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Demand Visibility: Effectiveness on Supply Chain Performance

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UNDERGRADUATE STUDENT POSTERS

A MENU RENEWING PROCESS IN A LOCAL RESTAURANT

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The purpose of this project was to analyze and assess the effectiveness of a local restaurant's menu selection and pricing in order to streamline their menu to include their most profitable and popular items. By researching different methods of menu planning and pricing, our team was able to forecast restaurant's menu items and determine suggested sale prices. In doing so, our team has hoped to make educated recommendations to the restaurant for potential menu revisions. In analyzing price versus costs of goods sold and the total contribution margin of each menu item, the team has attempted to determine whether or not each product is truly profitable for the company. In regards to menu items that were determined not profitable or were deemed to not be meeting their maximum profit potential, our team planned to suggest revisions. We were able to obtain information about non-food costs, total sales, and total revenues of the restaurant for the year 2016. We were also able to utilize this information in several models found from literature on menu analysis to determine the profitability and popularity of the menu items.

Keywords: menu planning, menu engineering

BANKRUPTCY PREDICTION USING MULTIPLE UNDER-SAMPLING: A STUDY OF NORTH AMERICAN COMPANIES

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Abstract

Bankruptcy prediction has been widely studied in the field of accounting, finance, and business. In dealing with the issue of imbalanced distribution between bankruptcy and non-bankruptcy cases that affects the predictive power of classification models, the dominant approach in the literature is to under-sample the non-bankruptcy observations. In this work, we develop a strategy to combine multiple under-sampling datasets to work with predictive models, including decision tree, random forest, and flexible discriminant analysis. Our computation on data of North American firms from 1997-2016 shows that this strategy works favorably against the traditional random under-sampling method.

Keyword: bankruptcy prediction, under-sampling, classification

BUILDING AN AUTOMATED TRADING SYSTEM

Jake Schurch, Bryant University, USA, jschurch@bryant.edu David Louton, Bryant University, USA, dlouton@bryant.edu Abstract

Keywords: Financial Services, Trading, Technology Applications

Overview

In lieu of taking a required finance course to fulfill his finance major, Bryant University senior, Jake Schurch, had the opportunity to pursue a directed study under the supervision with Finance Professor Dave Louton during this spring semester. Due to his interest and background in programming, Jake initiated an idea to develop a directed study to design and implement an automated trading system in the Go programming language. Jake believed that the Go programming language was an effective development environment to use due to its promising features like standard-library concurrency, as well as the ability to contribute code to a fairly new – but growing, community.

In order to complete the course, Professor Louton and Jake agreed that five main modules would need to be created. The approach to implement the final modules will allow other programmers the ability to re-utilize one or more of the modules for their own Go projects. It is believed that this implementation will provide the foundation for a sustainable and agile trading system framework.

Module	Overall Use
Portfolio/Security Construction	Design of Portfolio/Security classes and functions.
Research System	Measure trading signals of securities.
Portfolio Management Environment	Implement set compliance portfolio policies, such as max number of trades, as well as the ability to measure portfolio performance.
Backtesting Environment	Implement previously mentioned modules into sandbox- trading environment.
Execution System	Ability to take information from the portfolio management and research systems modules to process orders in the back-testing environment module.

Module Deliverables

Work Plan and Presentation

To date, Jake has just completed the Portfolio/Security Construction module. The current plan will be to complete all development activities and fully implement all modules to present at the NEDSI 2018 conference.

DEALING WITH BED BUGS IN HOSPITALITY INDUSTRY: A CASE STUDY ANALYSIS

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This project is an exploration of the beg bug issue in the hospitality industry. We explored a global management company's approach to this issue, including learning the root causes of a bed bug infestation, and reactionary costs to having a confirmed bed bug sighting. When bed bugs are spotted in a hotel room, the company has mapped out several courses of action that must be carried out in addition the removal of the bed bugs via a pest control service. This project also includes a preventative solution to the bed bug issue and associated costs. These costs and procedures impact the daily revenue of hotels, and create bottlenecks for their operations. The issue, causes and possible solutions are broken down in detail in the following sections.

Keywords: bed bug control, hospitality industry

DECREASING NONCONFORMITIES IN AN APPAREL DYING FIRM USING DMAIC PROCESS

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The main problem occurring in the firm was that a high percentage of shirts per batch were being ruined due to human error. The main problem area we were looking at involved how the dye was created and applied to each shirt. This was decreasing total business revenue and increasing number of nonconformities and expenses for completing the process. This research team aimed at reducing the errors and continuously improving the quality using certain Six Sigma processes. Finding the root cause of the problem was helpful with a fishbone diagram. Using Six Sigma methodology based on DMAIC process, the team was able to show key points on what was eventually leading to ruined shirts. The team also came up with a few solution ideas to minimize the number of nonconformities. Six Sigma-based problem solving process helped the firm recognize how much they could save on time and costs.

Keywords: Six Sigma, DMAIC

DESIGN OF MULT-PLAYER MULT-OBJECTIVE DECISION MAKING SUPPORT SYSTEM USING A LINEAR PHYSICAL PROGRAMMING APPROACH

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ABSTRACT

In many real-life situations, it is necessary to optimize two or more objects simultaneously. In these problems, objectives under consideration conflict with each other, and optimizing a particular solution with respect to a single objective can result in unacceptable results with respect to the other objectives. The technique of bringing two or more mutually opposite objective functions close to the desired value set up under the constraints which were able to be given as much as possible is called goal programming [1], [2]. The basic approach of goal programming is to establish a specific numeric goal for each of the objectives, formulate an objective function for each objective, and then seek a solution that minimizes the weighted sum of deviations of these objective functions from their respective goals. Goal programming, generally applied to linear problems, deals with the achievement of prescribed goals or targets. In other words, in general goal programming, the problem whose objective function and constraints are linear is solved. However, nonlinear objective functions and constraints may be handled in real-life problems (ex. [3]). The nonlinear goal programming can calculate a solution by solving goal programming successively, changing the weight factor given for every objective function. However, the changing method of the weight factor in nonlinear goal programming is not shown clearly.

On the other hand, one of the features of Japanese product development is a product development which can obtain a multi-objective satisfactory solution by "Suriawase" in Japanese: Japanese physical way for negotiation among several decision-makers [4]. However, decision-makers must search the optimal solution that satisfies a number of performance requirements by repeating analysis and modification of the models. Decision-makers need to change solution based on experience until it can obtain the better design solution. This method generates a ranged set of solutions that satisfy sets of performance requirements [5], [6]. By generating the set in which the

solution with which the set of demand performance is filled was put in order, the effective system for acquiring the satisfactory solution of a lot of people's multiplex object can be built.

The aim of this research is to design the decision-making model for solving multi-player nonlinear goal programming. This problem has a structure similar to Linear Physical Programming (LPP) [7]–[9]. LPP simplifies physical procedure since preference functions in LPP are piecewise linear, and solve nonlinear goal programming as general goal programming. In LPP procedure, range limit is defined as minimum and maximum values, and the range limit helps define the equality constraints. In order to provide the range limits by the decision-maker. Therefore, the set of solutions which fills set of demand performance within the same range is generated by LPP. In this research, based on the LPP procedure to solve the goal programming. In this research, the procedure for negotiation among several decision-makers was installed by using the concept of robust optimization [10], [11]. Finally, in order to clarify the meaning of multi-player nonlinear goal programming procedure, numerical experiments using production planning problem are performed.

Keywords: Goal programming, Nonlinear optimization, Suriawase, Robust optimization, Production Planning.

REFERENCES

- [1] Charnes, A., & Cooper, W.W., (1955). Optimal Estimation of Executive Compensation by Linear Programming. *Management Science*, 1(2), 138–444.
- [2] Charnes, A., & Cooper, W.W., (1977). Goal Programming and multiple objective optimizations: Part 1. *European Journal of Operational Research*, 1(1), 39–54.
- [3] McManus, B., (2007). Nonlinear pricing in an oligopoly market: the case of special coffee. *The RAND Journal of Economics*, 38(2), 512–532.
- [4] Inoue, M., Mogi, R., Nahm, Y.E., & Ishikawa, H., (2011). Design Support for "Suriawase": Japanese Way for Negotiation among Several Teams. *Improving Complex Systems Today*, Springer, 385–392.
- [5] Inoue, M., Nahm, Y.E., Tanaka, K., & Ishikawa, H., (2013). Collaborative engineering among designers with different preferences: Application of the preference set–based design to the design problem of an automotive front-side frame, Concurrent Engineering; Research and Applications, 21(4), 252–267.
- [6] Sobek, D.K., Ward, A.C., & Liker, J.K., (1999). Toyota's Principles of Set-Based Concurrent Engineering, Sloan Management Review, 40(2), 67–83.
- [7] Messac, A., Gupta, S.M., & Akbulut, B., (1996). Liner Physical Programming; A New Approach to Multiple Objective Optimization, *Transactions on Operational Research*, 8(2), 39–59.
- [8] Messac, A., (2015). Physical Programming for Multiobjective Optimization. *Optimization in Practice with MATLAB for Engineering Students and Professionals*, Cambridge University Press, 429–444.
- [9] Ilgin, M.A., & Gupta, S.M., (2005). Physical Programming: A Review of the State of the Art. Studies in Informatics and Control, 21(4), 349–366.
- [10] Ben-Tal, A., & Nemirovski, A., (2000). Robust solutions of Linear Programming problems contaminated with uncertain data. *Mathematical Programming*, 88(3), 411–424.
- [11] Bertsimas, D., & Sim, M., (2004). The Price of Robustness. Operations Research, 52(1), 35–53.

DYNAMIC STORAGE ASSIGNMENT IN LOGISTICS WAREHOUSE FOR MEAN CHANGE IN DEMAND

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ABSTRACT

In recent years, many companies need to deliver to customers many kinds of products with short delivery time due to diversification of customer needs or intensified market competition. In order to supply products to the customers in a short delivery time, increase in efficiency of operation in logistics warehouse is important. Moreover, since operation called order picking accounts for 55% of the operation time in the logistics warehouse, improvement of order picking operation is more effective [1]. In order to improve the efficiency of order picking operation, it is necessary to optimize four elements; warehouse layout, storage assignment, order batching and routing.

On the other hand, due to the shortening of the life cycle of products, companies need to develop decision-making systems that take account of demand fluctuations. There are many studies about changing order batching and routing under dynamic environments [2]–[5]. Changing warehouse layout or storage assignment require a lot of cost and time, so changing these methods depending on the demand fluctuation is not always effective. Some studies on warehouse layout and storage assignment suggest robust decision-making methods for steady demand fluctuations [6]–[8]. However, even if additional time for change storage assignment is taken into account, it may be more efficient to modifying storage assignment with unsteady demand fluctuation.

The aim of this study is to propose a method to dynamically modify storage assignment under unsteady demand fluctuation environment. First, a demand forecast value of future Tperiods is generated based on the past demands. Next, by using dynamic programming [9],[10], an optimal storage assignment schedule for the T periods based on the demand forecast value is generated. As a result, if the storage assignment for the next period has been changed, the storage assignment will be modified before starting the next period's order picking operations. Since this storage assignment modification method detects unsteady demand fluctuation which should be considered, the increase in efficiency of order picking work is obtained.

Keywords: Order picking, Storage assignment scheduling, Unsteady demand fluctuation, Demand forecast, Dynamic programming.

REFERENCES

- [1] Koster, R., Le-Duc, T., & Roodbergen, K. J. (2007). Design and control of warehouse order picking: A literature review. *European Journal of Operational Research*, 182(2), 481–501.
- [2] Gademann, N., & Van de Velde, S. (2005). Order Batching to minimize total travel time in a parallelaisle warehouse. *IIE Transactions*, 37(1), 63–75.
- [3] Petersen, C.G. (1997). An evaluation of order picking routing policies. *International Journal of Operations & Production Management*, 17(11), 098–1111.
- [4] Petersen, C.G., & Aase, G. (2004). A comparison of picking, storage, and routing policies in manual order picking. *Journal of Production Economics*, 92(1), 11–19.
- [5] Theys, C., Braysy, O., Dullaert, W., & Raa, B. (2010). Using a TSP heuristic for routing order pickers in warehouse, *European Journal of Operational Research*, 200(3), 755–763.
- [6] Pohl, L.M., Meller, R.D., & Gue, K.R. (2009). An analysis of dual-command operations in common warehouse designs, *Transportation Research Part E: Logistics and Transportation Review*, 45(3), 367– 379.
- [7] Hausman, W.H., Schwarz, L.B., & Graves, S. C. (1976). Optimal Storage Assignment in Automatic Warehousing Systems, *Management Science*, 22(6), 629–638.
- [8] Le-Duc, T., & De Koster, R. (2005). Travel distance estimation and storage zone optimization in a 2block class-based storage strategy warehouse, *International Journal of Production Research*, 43(17), 3561–3581.
- [9] Wagner, H.M., & Whitin, T.M. (1958). Dynamic version of the economic lot size model, *Management Science*, 5(1), 89–96.
- [10] Bellman, R. (1954). The theory of dynamic programming, Bulletin of the American Mathematical Society, 60(6), 503–515.

ECONOMIC DEVELOPMENT IN TURKEY: WHAT IS THE ROLE OF WOMEN?

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Abstract

This research examines the connections between the status of women and the economic development of Turkey and how the empowerment of women can lead to the economic development in Turkey. Turkey is considered a developing nation because many of its economic indicators lag developed nations. The economic indicators examined include GDP per capita, unemployment rate, poverty gap ratio, GINI Index, population rate, healthcare expenditure, and school enrollment rates. The research also includes an examination of the status of women in Turkey. The status of women is measured by the differences in the role of women in rural and urban areas, western influence, violence against women, economic standing of women, child marriages, and honor killings. It also aims to look at what cultural and legislative steps are necessary to empower women in Turkey. The research hopes to find that the empowerment of women has a positive impact on the economic development of Turkey.

Exploratory Data Analytics and Visualization of Characteristics of Sarcopenia Patients in South Carolina: A Data Science Lite Approach

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Introduction

Sarcopenia is characterized by progressive and generalized loss of skeletal muscle mass and strength and may lead to adverse health outcomes, such as physical disability, poor quality of life and death. Prevalence of sarcopenia is prevalent in most geriatric settings. (Cruz-Jentoft et.al, 2014). Its cause is widely regarded as multifactorial, including neurological decline, hormonal changes, inflammatory pathway activation, declines in activity, chronic illness, fatty infiltration, and poor nutrition (Alston, 2012). Compared with nonusers, Non-Steroidal Anti Inflammatory Drug users had a nearly 80% lower risk of being affected by sarcopenia (Landi F. et. al, 2013). In 2000, estimated healthcare costs associated with sarcopenia were \$18.5 billion. (Dodds et. al, 2014). Data science tools are generally intended for professionals and not accessible by broader audiences. Web application prototyping is a useful method for designing tools for making health data accessible by broader audiences. Web-based tools that visualize complex health data are in high demand for population health decision-making.

Objective

The objective of this study was to explore the prevalence of sarcopenia and develop a web-based prototype inclusive of website navigation and dashboards to visualize findings across sarcopenia patients in South Carolina.

Methods

- 1. **Data Query**: Select data based on pre-determined criteria from Health Sciences of South Carolina Clinical Data Warehouse.
- 2. **Statistical Analysis**: Conduct descriptive and inferential analyses using IMB SPSS Statistics software.
- 3. **Prototype Development**: Create website and user interface design for data visualization.
- 4. **Web Development:** Use PHP, JavaScript and other web design technologies to create the dashboard.
- 5. **Testing**: Conduct the web application testing and make required improvements or changes.

Results

The results show the comparison of the sarcopenia patients based on the number of doctor visits they had during the years 2010-2016.



Fig. Comparison of Prevalence of Sarcopenia based on age groups in South Carolina



Fig. Comparison of Prevalence of Sarcopenia based on race in South Carolina

The screenshots below show the layout of our prototype design.



Conclusion

We found that persons between 45 and 64 years old had higher number of sarcopenia diagnoses as compared to other age groups. In fact, diagnosis count increased significantly until age 64; it then decreased as people grew older. The graphs show that females had greater number of sarcopenia diagnoses that males. The results also demonstrate that more sarcopenia cases were found among White persons than among minority persons.

The project demonstrates the design and use of web-based data science tools using existing Internet, web development, data analytics and data visualization techniques. These tools make data accessible to and more user-friendly for a wider audience, thereby fostering broader impact of these data. These kinds of tools may be an essential component of effective education and awareness campaigns and of research.

Future Directions

- 1. Conduct comparative data analysis using a more comprehensive data science approach.
- 2. Identify risk factors, co-morbidities, and healthcare resource utilization costs associated with sarcopenia patients.
- 3. Create a robust web-based data analysis and visualization tool expanding the current prototype into a fully functional system.

References

- 1. Cruz-Jentoft, A. J., Landi, F., Schneider, S. M., Zuniga, C., Arai, H., Boirie, Y., ... Cederholm, T. (2014). Prevalence of and interventions for sarcopenia in ageing adults: A systematic review. Report of the International Sarcopenia Initiative (EWGSOP and IWGS). *Age and Ageing*, *43*(6), 748-759. doi:10.1093/ageing/afu115.
- 2. Alston, J. D. (2012). Sarcopenia in older adults. *Current Opinion in Rheumatology*, 24(6): 623–627. doi:10.1097/BOR.0b013e328358d59b.
- Landi, F., Marzetti, E., Liperoti, R., Pahor, M., Russo, A., Marotne, A. M., ..., & Bernabei, R. (2013). Nonsteroidal anti-inflammatory drau (NSAID) use and Sarcopenia in older people: Results from the ilSIRENTE study. *Journal of the American Medical Directors Association*, 14(8), 629. https://doi.org/10.1016/j.jamda.2013.04.012
- 4. Dodds R., & Sayer A.A. (2014). Sarcopenia. Arquivos Brasileiros De Endocrinologia E Metabologia, 58(5), 464-469.

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HOW DOES SOCIAL MEDIA ADVERTISING RELATE TO CASMAR SOCIAL COMMERCE FRAMEWORK IN HIGHER EDUCATION? A FOCUS ON SOCIAL MEDIA DRIVEN STUDENT-CENTERED LEARNING

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ABSTRACT

The research discusses the usage of social media in advertising with CASMAR, our theoretical Framework for Social Commerce. In the research, we focus on how social media positively affects advertising and how it relates to social commerce, as well as, increasing an organizational branding and exposure. We examine social media advertising through CASMAR social commerce framework, and how CASMAR affects consumers and businesses in branding and customer loyalty. In Higher Education (HE) sector, prior research has indicated that social media technologies and networks such as Twitter, Facebook, Instagram, and Google Docs has the potential to enhance primary and secondary learning. We review the importance of Word-of-Mouth (WOM), and the effects of personalized interactive advertising and its usage intensity on consumers and organizations, with a distinct focus on higher education. Furthermore, we investigate how social media sites are being used for e-commerce platforms and how they are integrated into educational (learning) needs of individual consumers and organizations. The research addresses questions of how social media advertising relate to CASMAR social commerce framework; how social media affect social commerce and WOM related interactive advertising for higher learning needs; and how are social networking sites (SNSs) being used as e-commerce platforms that can be integrated into Higher Education (HE) teaching practices to emphasize student centered pedagogy and learning. Finally, we offer recommendations to researchers, practitioners and policy makers regarding the usage of social media and social commerce driven CASMAR framework for organizational growth, learning and innovation.

Key words: Social Media, Social Commerce, CASMAR, Personalized Interactive Advertising, Higher Education, Student-Centered Learning

References

Adam C. Uzialko, B2B Staff Writer. (2017, October 10). Shopping on Social Media: The Future of Social Commerce. Retrieved 2017, from http://www.businessnewsdaily.com/6318-future-of-social-commerce.html

Aral, S., and Walker, D. (2011). "Creating social contagion through viral product design: A randomized trial of peer influence in networks." *Management Science*, 57(9), 1623-1639.

Bhayani, A. (2015). Social and peer influences in college choice. Retrieved from <u>http://ro.uow.edu.au/cgi/viewcontent.cgi?article=1742&context=dubaipapers</u>

Bilgicer, T., Jedidi, K., Lehmann, D. R., and Neslin, S. A. (2015). "Social Contagion and Customer Adoption of New Sales Channels." *Journal of Retailing*.

De Bruyn, A., and Lilien, G. L. (2008). "A multi-stage model of word-of-mouth influence through viral marketing." *International Journal of Research in Marketing*, 25(3), 151-163.

Holt, D., (March 2016). Branding in the Age of Social Media, 1-20. Retrieved October 14, 2017, from <u>https://hbr.org/2016/03/branding-in-the-age-of-social-media</u>

Iyengar, R., Van den Bulte, C., and Valente, T. W. (2011). "Opinion leadership and social contagion in new product diffusion." *Marketing Science*, 30(2), 195-212.

Libai, B., Bolton, R., Bügel, M. S., De Ruyter, K., Götz, O., Risselada, H., and Stephen, A. T. (2010). "Customer-to-customer interactions: broadening the scope of word of mouth research." *Journal of Service Research*, 13(3), 267-282.

Moran, M., Seaman, J., & Tinti-Kane, H. (april 2011). Teaching, Learning, and Sharing: How Today's Higher Education Faculty Use Social Media. Teaching, Learning, and Sharing: How Today's Higher Education Faculty Use Social Media , 1-26. Retrieved October 10, 2017, from https://eric.ed.gov/?id=ED535130.

Mehmood, S., & Taswir, T. (2013, January). The Effects of Social Networking Sites on the Academic Performance of. Retrieved from http://www.ijac.org.uk/images/frontImages/gallery/Vol.2_No._1/10.pdf

Risselada, H., Verhoef, P. C., and Bijmolt, T. H. (2014). "Dynamic effects of social influence and direct marketing on the adoption of high-technology products." *Journal of Marketing*, 78(2), 52-68.

INFLUENCING FACTORS ON BROOKLYN NETS MARKET DEMOGRAPHICS USING SPATIAL REGRESSION ANALYSIS

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Abstract:

The major sporting league, National Basketball Association (NBA), has experience various marketing transformations due to the increase of technology integration including customer relationship management (CRM) software to extend their market segmentation. There are different strategies created for sales-oriented types of customers known as potential, new, impulsive, discount, and loyal customers as well as brand ambassadors.

The study will create a spatial regression model using GIS that allows the spatial variability of different factors. Actual customer base was obtain and aggregated for the 2017-2018 season. Independent variables such as income level, zip code, and ticket type are included in the spatial model to analyze the factors generating sales.

The research results demonstrated a positive correlation between season ticket holders and higher income. While closer spatial proximity to Brooklyn Nets venue revealed higher season ticket holders. Limitations to the study include the accessibility to customer base in previous game seasons.

The results imply that the customer segmentation contributes to the marketing planning for the games. The major factors influencing sales will provide pointers on how marketing analytics department can continuously obtain a large customer base throughout the game season. Any impact made to the customer base will be redeveloped through strategic planning and incentives, without interfering with consumer value. In the results a spatial representation of the customer base for 2017-2018 season has been produced.

Keywords: spatial regression analysis, market segmentation, geographic information systems

DECISION SCIENCES INSTITUTE

Inventory Control in Supply Chain using Simulation

ABSTRACT

This study intends to investigate the effect of inventory policies on supply chain performance. Excessive inventory will result in higher costs and may lead to spoilage while little inventory may cause stock outs and lower customer service level. Thus, this study aims at finding near-optimal inventory control policies to lower supply chain cost and improve supply chain performance using simulation optimization.

Introduction

The importance of effective inventory control policies has been studied extensively in the manufacturing and distribution sectors. Recently, interest in supply chain management has further increased awareness of the importance of inventory control throughout various stages in a supply chain. More importantly, optimizing inventory control policies needs more attention since different firms at each stage of the supply chain can benefit from simulation optimization using Simio. This study demonstrates how simulation optimization can be used to lower supply chain cost and improve customer service level using Simio.

KEYWORDS: Inventory policy, Lead time, Supply Chain, Simio, Simulation Optimization
LEAD TIME REDUCTION THROUGH RAW MATERIAL PLANNING FOR A LARGE-SCALED MANUFACTURER

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The students Arthur Gifford,'19/BUS Kyle Bulmer,'19/BUIS and Ryan Vaillancourt,'20/ECON worked on Lead Time Reduction through Raw Material Planning for a large-scaled manufacturing firm in BUS 260 Operations Management course. The team analyzed a big data set including historical data collected from the business processes by the firm. ABC analysis (an inventory categorization technique) was simply implemented to categorize the raw material. Using ABC analysis, the team categorized more than 30 thousands items kept in the inventory. The results of the project were implemented in decision making processes.

Keywords: Material planning, lead time reduction, ABC analysis

MENU ENGINEERING IN RESTAURANT INDUSTRY: A CASE STUDY ANALYSIS

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In this undergraduate research project, the team aimed to improve a local restaurant's menu, considering several decision making criterions. In this process the team concentrated only on the food menu. The motivation to renew the food menu was to minimize the menu to only the most popular selling items and few staples that the restaurant is known for. Analyzing menu will allow them to highlight the most profitable items and increase the restaurant's bottom line. This could open up room for new possible items without adding too many options to their vast menu options. In this project, we focused on eight menu engineering models proposed in the literature. All models presented in this project can be very useful in evaluating existing menu items and reconstructing menu. With careful analysis of restaurant's food costs, menu item prices, contribution margins, item's profitability and popularity, the identification of items that contribute to more profit helped figure out how to renew the menu in this local restaurant.

Keywords: menu engineering and menu development

THE EFFECT OF RESAMPLING METHODS ON BANKRUPTCY PREDICTION MODELS: A COMPARATIVE STUDY ON NORTH AMERICAN FIRMS

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THE EFFECT OF RESAMPLING METHODS ON BANKRUPTCY PREDICTION MODELS: A COMPARATIVE STUDY ON NORTH AMERICAN FIRMS

Abstract

Bankruptcy prediction is a binary classification problem with imbalanced dataset where the number of observations belonging to one class (non-bankruptcy) is much larger than the number in the other class (bankruptcy). Resampling methods - balancing the data before fitting it to a traditional classification model - offer a simple solution to the imbalance issue. In this poster, we compare the effect on the performances of bankruptcy predictive models of ten resampling techniques, including Synthetic Minority Over-sampling Technique (SMOTE), Adaptive Synthetic (ADASYN) and cluster based under-sampling. Our computation on data of North American firms (1997-2016) shows that, despite its naive approach, random under-sampling technique still performs most effectively in term of both running time and accuracy.

Keyword: Resampling methods, bankruptcy prediction, SMOTE

ABSTRACTS

ABSORPTIVE CAPACITY IN ENTEPRISE SYSTEMS

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ABSORPTIVE CAPACITY IN ENTEPRISE SYSTEMS

In this study, we investigate the influence of absorptive capacity on the success of enterprise system implementations. We draw on innovation diffusion theory to frame our investigation and then test the model using data gathered from a sample of production firms. The results indicate that absorptive capacity moderates the relationship between enterprise system implementation and firm performance. The findings suggest that enterprise system modules impact firm performance differently, and that absorptive capacity plays a significant role in enhancing firm performance.

Keywords: Enterprise System, Absorptive Capacity, Firm Performance.

ANALYSIS OF THE FACTORS AFFECTING THE QUALITY PERCEPTION OF THE PATIENTS IN A HOSPITAL AND THE OVERALL QUALITY EVALUATION BASED ON THEM

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Abstract

In this study, a modified Servqual questionnaire is used to measure the quality that the patients perceive in a hospital in Turkey and also to determine the factors affecting it. After demonstrating the reliability of the questionnaire and the sufficiency of the samples number, the factors affecting the quality perception of the patients are identified using the stepwise regression. The results show that the patients of the hospital give more importance to the kindness and behavior of the employees than the physical facilities, equipment, and other tangible matters. In addition, the results of an ANOVA test show that the patients' characteristics such as their educational level affect their quality perceptions.

Keywords: Healthcare management, Servqual questionnaire, Quality perception

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APPLYING AN AUGMENTED REALITY SYSTEM FOR ENGAGING STUDENTS WITH DEVELOPMENTAL AND INTELLECTUAL DISABILITIES

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APPLYING AN AUGMENTED REALITY SYSTEM FOR ENGAGING STUDENTS WITH DEVELOPMENTAL AND INTELLECTUAL DISABILITIES

ABSTRACT

(PAPER PROPOSAL)

Cognitive disabilities are characterized by deficits in attention skills that adversely affect development in information processing and in learning progression. Computer systems are evolving however to help young adults with developmental and intellectual disabilities to improve attention, information processing and memory, in order for them to engage fruitfully in continued learning and in daily living like those without disabilities. The goal of this paper is to evaluate augmented reality applications that may enhance the attention control skills of a population of young adults with cognitive disabilities at mid-spectrum.

The author of this paper is attempting to determine the benefits (or non-benefits) of applications (apps) of augmented reality already customized for young students with cognitive disabilities. Chosen from the disability field, the applications are being evaluated by the author from the best-of-the-best current devices from HTC Vive, Oculus Rift and Samsung Gear VR for augmented immersive reality systems. The author is evaluating the applications on headsets on the features of ease, flexibility, functionality of immersion presence, individualization and performance, for impacting (or not impacting) learning and living outcomes of a pilot >24 <48 higher-functioning (i.e. less impaired) middle / high school students with developmental and intellectual disabilities (IDD). The evaluations are being formed from the perceptions of those with disabilities and the perceptions of related staff from a local non-profit organization. The author of this study is measuring the perceptions of the applications on the augmented reality device systems from Likert-like instruments of methodology already applied in other studies of those with disabilities.

Findings from this paper, anticipated for conference presentation, will be beneficial in helping general and special education instructors and others learn of the potential of augmented reality systems for young adults with cognitive disabilities. Such systems may improve noticeably the opportunities of students with developmental and intellectual disabilities at mid-spectrum, with increased learning skills in school and increased living skills in society. This study will be fascinating in investigation of the real relevance (or non-relevance) of a highly promising technology for a marginalized if not neglected niche population of young students.

ASSURANCE OF LEARNING: DEVELOPING INTERVENTIONS FOR CONTINUOUS IMPROVEMENT IN CURRICULUM

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ASSURANCE OF LEARNING: DEVELOPING INTERVENTIONS FOR CONTINUOUS IMPROVEMENT IN CURRICULUM

Business programs are a popular major for undergraduate students (358,000 in 2014) and graduate students (189,000 in 2014) in the U.S. (NCES, 2015). Accordingly, curricula development and improvement is a significant undertaking for the faculty at colleges and universities offering these programs. A mechanism for managing these processes at AACSB accredited business schools is the Assurance of Learning (AOL) process and the assessment practices that support it. The literature has explored various ways that AOL and assessment practices can be developed and implemented. A common theme underlying these processes is that they are geared toward the schools' missions and curricula (Kundu & Bairi, 2016; Marques & Garrett, 2012; Rexeisen & Garrison, 2013; Stivers & Phillips, 2009; Yeung, 2011). In this research, we investigate ways to enhance the AOL and assessment processes.

Assessment in an academic context refers to "a subset of evaluation processes focused on student achievement (Latucca & Stark, 2008, p. 231)." Assessment occurs at multiple levels in a university setting, from individual assignments within a course, to the evaluation of program learning goals, to university level assessment of a general education curriculum. As such, assessment is both data-laden, and complex, as there are interactions between these levels. No doubt, failure at one level affects another, as might be the case when a mis-specified math course affects students' abilities in a later quantitative course in the major. These interactions often complicate the improvement process, and at the same time, provide opportunities for process enhancement.

An important step in the AOL process is the development of interventions or treatments, which unfortunately, is a task that is not consistently accomplished: "Program goals and learning objectives get assessed, but improvements do not always make it back into program offerings" (Betters-Reed et al., 2008, p.224). Identifying and assuring effective implementation of such interventions is a prevalent problem in institutionalizing AOL assessment programs (Bacon & Stewart, 2017; Bennett, Smart, & Kumar, 2017), and certainly, a challenging task that merits further investigation into appropriate tools for support.

As an example, with the aim of continuous assessment and improvement, comprehensive item analyses of a common final exam was conducted in a core classes at our School of Business.

Exam questions related to five areas fell short of the threshold criteria for individual questions. Consequently, the department assessed the current syllabus and decided on an intervention. Specifically, a new textbook, providing a more relevant context was introduced the following semester. What was the underlying process of developing this intervention? Can we aim to provide a more formalized process for such intervention developments?

This is the challenge that we address in this research: the development of a process for identifying good interventions in the AOL process. One possible approach springs from the philosophies and practices of Six Sigma. The Define-Measure-Analyze-Improve-Control (DMAIC) cycle may provide a compatible framework for the development of methods for identifying interventions. Similarly, related tools may apply in the education realm, such as process flowcharts, cause-and-effect diagrams, Pareto analysis, histograms, scatter diagrams, and statistical quality control methods. We will investigate these principles and tools using an AOL lens and evaluate its usefulness in this curriculum context.

References available upon request.

Keywords: Assessment, AACSB, Assurance of Learning, Intervention, Six Sigma

AVOIDING COGNITIVE BIASES IN MANAGING WICKED PROBLEMS

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AVOIDING COGNITIVE BIASES IN MANAGING WICKED PROBLEMS

Technical issues simply require an answer, direction, or application of resources to solve a problem, which many leaders do in expediency to address conflict given the constant demands and issues they confront daily. On the other hand, wicked problems or adaptive challenges are typically grounded in the complexity of the values, beliefs, and loyalties rather than technical complexity and stir up intense emotions rather than dispassionate analysis (Heifetz, Grashow, & Linsky, 2009). Wicked problems in organizations that confront managers are unstructured, and not only is it difficult to predict the outcomes of possible solutions with precision, but the ideal set of alternatives that should be considered prior to making a strategic choice is also often unclear. Addressing adaptive challenges requires a deeper understanding of people's behaviors, motivations, loyalties, as well as organizational norms, attitudes, and processes to enact real and sustained change. This type of leadership and decision making cannot easily rely on past methods or actions. Instead, the leader must embrace the learning and risks that come with implementing tough changes that ultimately support the values and purposes of the individual and/or collective.

Managers do not make flawed decisions simply because they lack intelligence, expertise, or the correct motivations/incentives. Most often than not technical solutions are used in decisionmaking for adaptive challenges (Kahneman, Lovallo, & Sibony, 2011). In cases where wicked problems are recognized and also acknowledged that technical solutions will only address the symptoms, managers still make poor choices because they encounter systematic traps that impair their judgment. These cognitive biases are rooted in nature and are artifacts of wicked problems and adaptive challenges. Managers find themselves vulnerable to these biases no matter how capable and intelligent they are. It is important to understand that everyone is vulnerable to cognitive biases. Intelligence, experience, and/or expertise in a particular field does not shield people from these decision traps. They are rooted in human nature. What techniques can we use to combat cognitive biases in addressing adaptive challenges? Ability to diagnose and recognize a wicked problem or adaptive challenge from a tame problem or a teachnical challenge is the critical firststep, but recognizing an adaptive challenge alone will not prevent flawed choices because of cognitive biases (Yawson, 2015).

Key cognitive biases include the confirmation bias, the sunk cost trap, the anchoring bias, and the framing bias. How can organizational leaders avoid these decision traps in addressing wicked problems? How can decision making on complex systems – the so called wicked problems

or adaptive challenges - come to grips with irreducible, or deep, uncertainty without cognitive biases? This paper discusses, complex adaptive decision making in the context of four main cognitive biases: Confirmation Bias, Sunk Cost Trap, Anchoring Bias, and Framing Bias.

Keywords: Adaptive Challenges, Complex Systems, Cognitive Biases, Decision-Making, Wicked Problems.

References

- Heifetz, R., Grashow, A., & Linsky, M. (2009). The Practice of Adaptive Leadership: Tools and Tactics for Changing Your Organization and the World. Boston, MA: Harvard Business Press.
- Kahneman, D., Lovallo, D., & Sibony, O. (2011). Before you make that big desicion. *Harvard Business Review*, 89(6), 50–60.
- Yawson, R. M. (2015). The "wicked problem construct" for organisational leadership and development. *International Journal of Business and Systems Research*, 9(1), 67–85. https://doi.org/10.1504/IJBSR.2015.066812

Can an Investor Beat the Market in Foreign Exchange Markets

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Abstract

This paper uses an efficiency specification model of the spot and forward foreign exchange markets and tests the hypotheses for random walk (which cannot be rejected), general efficiency, and unbiasedness by using a regression estimation and various specification and diagnostic tests for the series and the error terms (residuals). Whereas the forward rate is usually viewed as an unbiased predictor of the future spot rate, the unbiased forward rate hypothesis has failed to be rejected for the Canadian dollar, although more research is needed in this particular area so that better statistical inferences can be drawn in the future.

BEHAVIORAL HEALTHCARE: A NEURAL NETWORK ANALYSIS OF SUBSTANCE ABUSE

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Behavioral Healthcare: A Neural Network Analysis of Substance Abuse

Abstract

We investigate the phenomenon of behavioral healthcare by analyzing the influence of demographic factors on substance abuse in the United States. Substance abuse categories include alcohol, depressants, stimulants, and hallucinogens. Demographic factors include age, gender, education, employment and marital status. The data are collected from the Substance Abuse and Mental Health Services Administration (SAMHSA) for the years 2009 to 2011 for the United States. Using Neural Networks to analyze the data, our findings indicate that certain substance problems are highly related to some specific demographics. The most important factors for predicting substance abuse are race, employment status, age, and marital status, while the least important demographic factor is gender. Our neural network model reveals that prediction of substance category is far more accurate than that of frequency of use. The most common abused substance categories are alcohol and depressants. Accuracies of predictions for depressants are very high in both training and testing partition (90%), while the accuracies of predictions of alcohol are relatively low (31%). Our results offer insight on budget allocation and quality of care for public and private sectors. High risk offenders can be identified and targeted by certain demographics such as race, employment status, age and marital status for both rehabilitative and preventive programs. Because depressants and alcohol are the most commonly abused substance categories, programs can be targeted and tailored to be effective. Preventive and treatment programs budget can be more reasonably allocated based on the demographics of population in certain regions. With a more optimized budget allocation, national healthcare costs can be reduced.

Keywords: Substance Abuse, Demographic Factors, SPSS Modeler, Neural Network, Bayesian Network, Association

BLOCKCHAIN TECHNOLOGY AND SUSTAINABLE SUPPLY CHAINS

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Blockchain technology is increasingly being used in supply chain networks and logistics. Adoption of blockchain technology will transform supply chain management and sustainability practices. Blockchain technology consists of decentralized ledgers, which keep the records of supply chain transactions on a reliable peer-to-peer network architecture. With the absence of a central authority, blockchain technology provides a transparent, immutable, and authenticated platform that has a potential to transform materials, information, and financial flows through supply chains and to provide traceability to manage sustainability practices and address economic, environmental, and social facets. However, as a disruptive technology, blockchain implementation would change supply chain cross-functional, cross-firm processes and require preparation. Blockchain technology is nascent and uncertainty about how this technology would revolutionize sustainable supply chain is a focus in this paper. We provide a comprehensive overview of various opportunities and challenges of adopting blockchain technology to manage sustainable supply chains. We explore various barriers, which stem from system limitations, different level of organizational activities through supply chain, and external authorities. This paper sets a foundation for study on blockchain technology and gives organizations an opportunity to take full advantage of successful implementation of blockchain technology and overcome the barriers.

KEYWORDS: Blockchain Technology, Sustainability, Supply Chain Management

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CAN FIRMS USE NATURAL IMAGERY TO IMPROVE FRONTLINE EMPLOYEE CREATIVITY AND SERVICE PERFORMANCE?

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CAN FIRMS USE NATURAL IMAGERY TO IMPROVE FRONTLINE EMPLOYEE CREATIVITY AND SERVICE PERFORMANCE?

Extended Abstract

Frontline employees (FLEs), or employees who act as points of contact – to promote, facilitate, or enable value exchange between an organization and its customers - are an important brand touchpoint with customers (Sirianni, Bitner, Brown and Mandel 2013; Singh, Brady, Arnold, and Brown 2017). Frontline employees are an important part of the exchange as they use creativity to identify needs, create connections, solve problems, and generate ideas. In fact, FLEs that can accurately read customer needs and creatively solve customer problems are a source of competitive advantage that can help increase customer loyalty (Donovan, Brown and Mowen 2004).

Due to the importance of FLEs, firms promote FLE creativity (Marinova, Ye, and Singh 2008; Homburg, Wiseke, and Bornemann 2009). FLE creativity is shaped by an individual's intrinsic (or internally driven) motivation to be curious, cognitively flexible, take risks, and to be persistent in the face of barriers (Utman, 1997; Zhou & Shalley, 2003). While FLE creativity is associated with individual factors like personality and cognitive style, it is also shaped by contextual characteristics of the work environment that are not part of the individual (Shalley, Zhou, and Oldham 2004). For example, firms try to adjust job characteristics like job autonomy, variety, feedback, and a sense of identity to promote FLE creativity (Coelho and Augusto 2010).

Firms attempt to find the right combination of individual and context factors to maximize intrinsic motivation and FLE creativity because they are linked to service performance, problem solving, and, in turn, overall service quality (Agnihotri, Rapp, and Gabler 2013). However, these efforts can be expensive, difficult, and unsuccessful because FLEs tend to be geographically dispersed, operate in different physical environments, and experience higher turnover than other roles, which increases the expense associated with training them (Ahmed and Rafiq 2003; Green, Walls, and Schrest 1994). Therefore, the current research project aims to investigate a low cost way firms may be able to increase FLE creativity and improve service interactions: exposing FLEs to natural imagery.

Previous research established that the physical setting can influence employee satisfaction, productivity, and motivation (Davis 1984; Countryman and Jang 2006). In other contexts, natural stimuli in the physical setting have been linked to emotional arousal, bonds, increased attention, fascination, and inspiration (Kaplan 1995; Wilson 1984; Han 2007; Berto 2005). Research also suggests that exposure to restorative stimuli - things like botanical gardens, mountains, lakes, grassy areas, and parks - can give people the sense that they can escape, and can result in fascination and inspiration (Han 2007). Restorative environments can reduce the mental fatigue that is often associated with challenging thinking (Berto 2005). Further, an individual does not need to go into the natural environment to gain these effects; pictures of plants, animals, and water have a similar effect to genuine objects (e.g. Hull and Stewmi 1992). Can exposure to natural images help FLEs think more creatively and solve consumer problems?

If natural imagery improves inspired thinking and/or intrinsic motivation among FLEs, it may increase the likelihood that FLEs engage in creative problem solving, pay attention to cues from customers, and respond to unique challenges. Thus, natural imagery may provide a low cost way to help FLEs respond to shifting role demands, increased ambiguity and conflicts, and the increased need for creativity, resulting in better service outcomes for customers.

References Available Upon Request

Keywords: Frontline employees, Employee Creativity, Retail, Service Quality, Context Factors, Natural Imagery

Cointegration Tests and Error Correction Techniques for Purchasing Power Parity

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Abstract

This paper examines the cointegration property of exchange rates and prices using techniques that have received limited attention in several studies on the validity of the Purchasing Power Parity (PPP) hypothesis. It provides comprehensive evidence on the PPP hypothesis using recent monthly data for 1971 through 2011 (i.e., 492 observations). The paper also explores the symmetry and proportionality conditions in PPP. In addition, estimates of the short-run dynamics are obtained for each country, utilizing the error-correction technique. Results from long-run cointegration analysis, short-run dynamics and half-lives, all provide evidence for long-run PPP. The symmetry condition is largely supported, and when imposed on prices, the proportionality condition is supported in a majority of cases.

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COMPARISON OF RETIREMENT WITHDRAWAL STRATEGIES

Abstract

Withdrawal strategy for retirement is an important consideration from a practical standpoint. The shift towards defined-contribution plans places the responsibility for asset management with retirees. For example, a retiree, working by oneself or an advisor, must decide how to invest the portfolio, how much to withdraw in each year, and whether to adjust withdrawal amounts or investment strategies depending on market and personal circumstances. Some factors are under the retiree's control, and many factors lie outside their control.

This is also a challenging problem from a technical viewpoint. With numerous decisions and uncertainties, it essentially becomes a stochastic sequential decision problem with a stochastic time horizon. Various withdrawal strategies are considered in the academic literature as well as practitioner publications.

This paper centers on the practical aspects of the problem. Many calculators are available online with a variety of assumptions and methodologies. It can be difficult to how one tool's results compare to another's. For this paper several different withdrawal strategies are compared using Monte-Carlo simulation. Well-known fixed-withdrawal strategies are compared to a number of dynamic strategies, with one strategy motivated by inventory control practice. Tradeoffs among the various strategies are articulated.

Key Words: Portfolio Management; Investment Management; Retirement Planning; Monte-Carlo Simulation

CONFIGURING SME ENTERPRISE SYSTEMS

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CONFIGURING SME ENTERPRISE SYSTEMS

In this research study we investigate the changes in operational performance that result from different configurations of enterprise system deployments in small and medium enterprises. A research model based on innovation diffusion theory was developed, and data were gathered through a field study from small and medium enterprises to test the hypothesized relationships. The model relationships were tested using factor analysis and multiple linear regression analysis. The findings suggest that different configurations of enterprise system modules impact operational performance differently, and that small and medium enterprises should parsimoniously deploy and focus on enterprise system module integration to derive maximum operational performance benefits.

Keywords: Enterprise System, Enterprise System Configuration, Operational Performance.

Conflict Resolution Style and Decision-making. An Historical Analysis Tom Anastasi, Ph.D. Southern New Hampshire University

There are five conflict resolution styles people have: Collaborate, Compete, Compromise, Avoid, and Accommodate. We all use each of the five styles; the only differences are the intensity and the order we use them Conflict resolution is learned and we tend to solve conflicts in a predicable manner based on our conflict resolution style.

Conflict resolution style is an important part of decision-making because the decisions we make while in in each style are dramatically different. In the competing mode, we make decisions that strongly favor our positon. In the accommodating mode, we tend to make decisions not in our best interest in hopes of preserving a relationship or ending the conflict. In the avoiding mode, we tend to not want to make a decision or even deal with the conflict, often hoping if we ignore the conflict it will go away. In the collaborative mode we want to make decisions that benefit all parties, and in the compromising mode, we tend to want to make decisions that are suboptimal in order to bring the conflict to and end with each party partially satisfied.

This paper looked at John F. Kennedy's conflict resolution style with the Joint Chiefs of Staff during the Bay of Pigs Crisis and the Cuban Missile Crisis. Based on evidence found in The Taylor Report, declassified meeting notes, and Presidential recordings, it is concluded Kennedy's style during the Bay of Pigs that occurred in April, 1961 was Avoid, Accommodate, Compete, Compromise, and Collaborate.

The Bay of Pigs Crisis is universally felt to have been a military and diplomatic failure. Kennedy felt his poor decision-making was a major factor in the failure. Afterwards, Kennedy asked General Maxwell Taylor do an analysis of Kennedy's own decision-making style and make recommendations to improve his Presidential decision-making. Taylor did so and presented his findings to Kennedy in a document titled "The Taylor Report." Kennedy had just taken office prior to the Bay of Pigs invasion, and Taylor concluded that the root cause of the failure was Kennedy's excessive accommodation to the Joint Chief's. This allowed the Bay of Pigs invasion to occur in an attempt to try to win their favor and respect, in spite of the fact that Kennedy expressed grave concern to Attorney General Robert Kennedy that the mission was foolhardy and had little chance of success.

Based on recommendations from The Taylor Report, when the Cuban Missile Crisis occurred a year an a half later in October of 1962, Kennedy, dealing with the very same people, changed his style to Compromise, Compete, Collaborate, Accommodate, and Avoid.

CONSIDERING UNCERTAINTIES AND PRODUCT SUBSTITUTION FOR PLANNING OF CLOSED-LOOP SUPPLY CHAIN

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CONSIDERING UNCERTAINTIES AND PRODUCT SUBSTITUTION FOR PLANNING OF CLOSED-LOOP SUPPLY CHAIN

Today, many products are disposed of while still functional; that is sometimes due to the customer's desire to upgrade to a newer technology, or it could be due to esthetic changes, e.g. wear and tear. In addition, some products can be regarded as end of life (EOL) as well, according to Gupta (2013), If a product is not functional after its leasing contract is expired, it is considered EOL. The same applies to products returned due to dissatisfaction or for finding a better deal. Other EOL products are the ones returned for repair services but found un-repairable.

According to Gungor & Gupta (1999) and Ilgin & Gupta (2010), environmentally conscious manufacturing and product recovery (ECMPRO) research, has become significant by achieving economic benefits for the overall supply chain in addition to minimizing the amount of waste sent to landfills. To solve ECMPRO problems, single objective models have been developed beside multi criteria decision making models which are able to solve conflicting objectives (Gupta & Ilgin, 2017). One of the categories covered by ECMPRO is closed loop supply chain (CLSC), which is a result of the integration of forward and reverse supply chains. The idea of a CLSC has successfully shown its capability of achieving financial and environmental benefits, and many industries are employing the concept of CLSC in their practices today, e.g. Xerox Corporation and Caterpillar Inc (Ferguson, 2009).

In CLSC, decision is divided into: strategic, tactical, and operational planning. Although there is considerable research on CLSC, which integrates strategic and tactical decision planning and tactical and operational decision planning, only a few studies have combined all the decision planning levels together. In addition, there is no study on CLSC planning that has taken into account all decision planning levels together with product demand substitution.

Product substitution, in general, is the process of fulfilling the demand of product B by product A. The substitution either takes place for assortment, inventory or pricing decisions. Product substitution can be beneficial in different ways; to reduce the probability of shortage occurrence, which would increase the service level. Second, it would decrease the holding cost, which would benefit origination financially. Last, setup, production time, and production costs are reduced when applying the concept of product substitution (Lang, J. C., 2010).

Due to uncertainties resulting from the integration of forward and reverse supply chains, and complexity of considering strategic, tactical and operational planning for CLSC, in this paper, I will propose a CLSC model that would consider uncertainties in new product demand, and remanufactured product demand when number of returned products is uncertain. In addition, the proposed model would integrate all the decision planning together when product substitution is allowed between new and remanufactured product as a one-way downward substitution. The strategic decision considered is selecting the optimal number of different facility types in the CLSC (manufacturers, remanufacturers and collectors). The tactical decision is selecting the transportation mode from a set of transportation mode candidates. Finally, the operational decisions taken into account are the quantity to produce from each facility, quantity of substitution, quantity of products transported between facilities. It is hoped that the insight provided by this research would be a tool that can supply chain decision makers in making the most efficient, effective and robust decisions.

Keywords: Closed Loop Supply Chain (CLSC), Product Substitution, Operational Decisions **References**

Ferguson, M. (2009). Strategic and Tactical Aspects of Closed-Loop Supply Chains. Foundations and Trends® in Technology, Information and Operations Management, 3(2), 101–200.

- Gungor, A., & Gupta, S. M. (1999). Issues in environmentally conscious manufacturing and product recovery: A survey. *Computers and Industrial Engineering*, *36*(4), 811–853.
- Gupta, S. M., & Ilgin, M. A. (2017). Multiple Criteria Decision Making Applications in Environmentally Conscious Manufacturing and Product Recovery. CRC Press.
- Gupta, S. M. (2013). *Reverse Supply Chains: Issues and Analysis. Reverse Supply Chains: Issues and Analysis.*
- Ilgin, M. A., & Gupta, S. M. (2010). Environmentally conscious manufacturing and product recovery (ECMPRO): A review of the state of the art. *Journal of Environmental Management*, 91(3), 563–591.
- Lang, J. C. (2010). Production and inventory management with substitutions. *Lecture Notes in Economics and Mathematical Systems*, 636, 1–258.

CORPORATE SOCIAL RESPONSIBILITY AND THE ROLE OF FAIRNESS HEURISTICS IN PROMOTING SUPPLY CHAIN COOPERATION

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ABSTRACT

Prior research has established the importance of mutually beneficial cooperation in optimizing supply chains. Cooperation within supply chains, however, largely relies upon trust and expectations of fair treatment among supply chain partners. In the absence of prior information regarding the trustworthiness of potential customers, suppliers are left to infer such information from publicly available signals. Corporate social responsibility has been shown to trigger a fairness heuristic such that individuals who observe companies engaging in socially responsible activities expect that those companies will be more likely to treat them fairly in the future. Thus, we propose that corporate social responsibility acts as a signal to potential supply chain partners that they will be treated fairly within the business relationship. We examine the extent to which downstream corporate social responsibility triggers suppliers to behave in ways which signal their relatively high perception of customer trustworthiness within the relationship. Specifically, we test whether suppliers invest more heavily in relationship-specific fixed cost investments, extend more favorable credit terms, and develop longer lasting relationships with customers exhibiting higher levels of socially responsible behavior. Our results provide insight into how suppliers establish initial expectations of customer trustworthiness upon developing a new business relationship.

KEYWORDS: Supply Chain Management; Corporate Social Responsibility; Fairness Heuristic.

COUNTRY-LEVEL ENTREPRENEURSHIP ANS ECONOMIC ENVIRONMENT: AN EMPIRICAL ANALYSIS

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Country-level Entrepreneurship and Economic Environment: An Empirical Analysis

ABSTRACT

There is a lot of research on the impact of institutional factors on entrepreneurship and on subsequent economic growth. However, there is not much empirical research on the environmental ecosystem for entrepreneurship and economic growth. The current research addresses this void and empirically explores cross-country differences in the economic environment of entrepreneurship. Specifically, we use the Economic Freedom Index from the heritage foundation database to study the effect on the country-level requirements of starting a business. The economic freedom variables are analyzed in four categories: Rule of law (Property rights, Freedom from corruption); Limited Government (Fiscal freedom, Government Spending); Regulatory Efficiency (Business freedom, Labor freedom, Monetary freedom); and Open Market (Trade freedom, Investment freedom, and Financial freedom). Our results highlight variances in the economic freedom indices by income-level of countries. There is generally a negative association between a country's economic freedom (overall score) and the requirements (time, cost and procedures) to start a business. The rule of law index is positively associated with time required to start business; while property rights and government environmental index are positively related to procedures to start a business. Freedom from corruption is negatively associated with procedures to start a business. Naturally, higher income countries that have a favorable freedom from corruption index show more potential for entrepreneurship. Therefore, governments of countries with lower income levels need to direct their strategic, and policy decisions to improving the economic freedom indices so as to encourage entrepreneurship and impact economic development. Our study highlights the necessity for government spending on areas that will create positive indicators aimed at encouraging the economic climate for entrepreneurship.

Keywords: economic freedom index, entrepreneurship, freedom from corruption, rule of law, regulatory efficiency, open market, limited government

CRITICAL SUCCESS FACTORS IN SME ENTERPRISE SYSTEMS

Anjana Arunkumar AU

Arun Madapusi LI
CRITICAL SUCCESS FACTORS IN SME ENTERPRISE SYSTEMS

The purpose of this research study was to investigate the influence of critical success factors on enterprise system implementations in small and medium enterprises. A research model based on organizational information processing theory was developed and a survey instrument constructed to gather data to test the hypothesized model relationships. Data were collected through a cross-sectional field study of small and medium enterprises. The model relationships were tested using factor analysis and multiple linear regression analysis. The findings suggest that enterprise system modules impact organizational performance differently, and that critical success factors influence the relationship between enterprise system implementation and organizational performance.

Keywords: Enterprise System, Critical Success Factors, Organizational Performance.

Decision Model that Links Employee Morale with Workforce Planning

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Abstract

When facing declining demand or financial predicament, companies often resort to layoffs to reduce operational costs. However, layoffs may dampen the morale of the survivors (those staying with a company after layoffs) and lead to lower productivity and higher costs instead. While a lot of empirical studies have confirmed the negative impact of layoffs on employee morale, few studies have modeled such an impact explicitly and incorporated it in workforce planning decisions. In this paper, we build a decision support model that a company can use to analyze the consequence of its layoff or hiring decisions and tradeoff with other alternatives, such as employee cross-training. We propose techniques to linearize the nonlinear relationship between workforce size and productivity so that the decision model can be effectively solved by a standard mixed integer programming software.

Key Words: Decision Model, Morale, Productivity, Workforce Planning, Mixed Integer Programming

DETECTING NON-INJURED PASSENGERS AND DRIVERS IN CAR ACCIDENTS: A NEW UNDER-RESAMPLING METHOD FOR IMBALANCED CLASSIFICATION

Son Nguyen, Gao Niu, John Quinn, Alan Olinsky, Jonathan Ormsbee and James Bishop

Abstract

In recent years, the problem of classification with imbalanced data has been growing in popularity in the data mining and machine learning communities due to the emergence of an abundance of imbalanced data in many fields. In this paper, we compare the performance of six classification methods on an imbalanced dataset under the influence of four resampling techniques. These classification methods are the decision tree, the random forest, logistic regression, k-nearest neighbor, support vector machine, and adaboost.

Our study has shown that all of the classification methods have difficulty when working with the imbalanced data, in which the k-nearest neighbor performing the worst, detecting only 27.4% of the minority class. However, with the help from resampling techniques, all of the classification methods experience improvement on overall performances. In particular, the random forest combining with the random oversampling technique performs the best, achieving 82.8% balanced accuracy (the average of the true positive rate and true negative rate).

We then propose a new procedure to resample the data. Our method is based on the idea of eliminating "easy" majority observations before under-sampling them. It has further improved the balanced accuracy of the random forest to 83.7%, making it the best approach for the imbalanced data.

Keyword: Imbalanced Data, Resampling, Under-sampling, Classification

DOES BLATANT BENEVOLENCE INCREASE SOCIAL CAPITAL?

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DOES BLATANT BENEVOLENCE INCREASE SOCIAL CAPITAL?

Research has discussed the effect of conspicuous consumption on social capital (e.g., Bagwell and Bernheim 1996, Becker et al. 2005). Hinz (2015) provided empirical evidence of the effect of conspicuous consumption on social capital. Based on the previous research, this study intends to focus on the effect of blatant benevolence (conspicuous altruism) on the attainment of social capital. Many studies have been done on the blatant benevolence (conspicuous altruism) and show that people who behave altruistically are more likely to be chosen as friends (Mark, 2009 & 2012; Vladas, 2007; McAndrew, 2012; Tore and Johannesson, 2011). Charlie and Mark (2006) propose that people strategically show their prosocial behaviors to signal their abilities to suffer the cost, and are more likely to gain more resources in the long term.

However, the previous research does not provide empirical evidence that showing off altruism increases people's social capital. The only related study was conducted by Oliver (2015), who shows that conspicuous consumption increases people's social capital, which is defined as the number of friends. Unlike conspicuous altruism, conspicuous consumption displays merely convey that people are wealthy. A public good contribution is a more powerful signal because it both conveys that people possess resources and are willing to share them (Mark, 2012). Therefore, the effect of blatant benevolence (conspicuous altruism) is also worth investigating.

We design a field experiment to test the effect of blatant benevolence in virtual communities. Before we conduct the experiment, we make an announcement on the community: "An *Altruist Symbol* is awarded to 100 community members who always share their kindness and help others". The "Altruist Symbol" is a conspicuous display. Members who are awarded the symbol show the symbol with their avatars. Therefore, every member of the community can quickly recognize the person who is awarded the symbol. Also, we conduct a test of member's belief about the source of the *Altruist Symbol*. If the majority of members believe people possessing the symbol are altruistic people, the signal would be credible. We randomly select 200 members from the online community. We divide the samples into two groups with equal number participants. We assign the treatment group the "Altruists symbol". The control group does not receive the symbol. We collect the

number of friends of these two groups before and after the "Altruists Symbol" is conferred. After we collect the data, we test the statistical significance of the difference of the number between the two groups.

Our research contributes to the literature of blatant benevolence and the attainment of social capital. We also adopt new ways to conduct the field experiment using virtual communities, which will provide more and more insights and research opportunities to researchers.

Key words: blatant benevolence, social capital, virtual community

Reference

Bagwell LS, Bernheim BD (1996) Veblen effects in a theory of conspicuous consumption. Amer. Econom. Rev. 86(3):349–373.

Becker GS, Murphy KM, Werning I (2005) The equilibrium distribution of income and the market for status. J. Political Econom. 113(2):282–310

Mark Van Vugt, C. L. (2009). Cooperation for reputation: Wasteful contributions as costly signals in public goods. Group Process and Intergroup Relations, 101-111.

Mark Van Vugt, W. I. (2012). Men behaving nicely: Public goods as peacock tails. British Journal of Psychology, 3-13.

McAndrew, F. T. (2012). Is Self-Sacrificial Competitive Altruism Primarily a Male Activity? Evolutionary Psychology, 50-65.

Vladas Griskevicious, J. M. (2007). Blatant Benevolence and Conspicuous Consumptio: When Romantic Motives Elicit Strategic Costly Signals. Journal of Personality and Social Psychology, 85-102.

Tore Ellingsen, M. J. (2011). Conspicuous generosity. Journal of Public Economics, 1131-1143.

Charlie L.Hardy, M. V. (2006). Nice Guys Finishe First: The Competitive ALtruism Hypothesis. *Society for Personality and Social Psychology*, 1402-1413.

Oliver Hinz, M. S.-H. (2015). Research Note-Can't Buy Me Love..Or Can I? SocialCapital Attainment Through Conspicuous Consumption in Virtual Environments. *Information Systems Research*, 859-870.

DOES THE IMPROVED STATUS OF WOMEN RESULT IN IMPROVED WELFARE OF CHILDREN?

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Does The Improved Status of Women Result In Improved Welfare Of Children?

The chronic inequalities in opportunities available for women compared to men in the developing world has been well documented in the development economics literature. The status of women, besides being vital on its own accord, also impacts the long-term development prospects of a country, primarily due to the fact that in most societies women are the primary care takers of children. The welfare of children has consequences for the long-term economic growth and development of a country. This paper studies the relationship between the welfare of women and the welfare of children for a group of developing countries. The status of women is measured by indicators of education, employment, health, fertility and life expectancy. The welfare of children is measured by infant mortality, child mortality, school enrollment, nutrition and health of children. We group countries in order to control for per capita income, geography, culture and religion.

DOING THE MATH FOR CONSUMERS TO BETTER MARKET AND PROMOTE GREEN PRODUCTS

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DOING THE MATH FOR CONSUMERS TO BETTER MARKET AND PROMOTE GREEN PRODUCTS

Abstract

Most successful companies are looking towards the future by considering the environmental and socio-economic impacts of their business. Green products, which often have a lower carbon footprint and minimize environmental impacts of consumption, have struggled to become mainstream. Part of the resistance towards green products is a perception issue that today's top companies should be able to overcome. Consumers would likely adopt green products at a higher rate if the advantages of these products were presented more effectively. However, consumers often see green products with higher prices with little explanation of quality and performance. Companies should be doing a better job helping us be green. In many cases, it is just of matter of telling a different story depending on the "Greenness" of the customer. This theoretical paper proposes strategies companies could use to educate and influence consumers on the cost advantages of purchasing green products.

Consumers caring about the impacts of their consumption behavior is not a new concept. All else equal...price and quality, consumers will choose a green product over a traditional one (Kinnear 1974). This makes sense as consumers want to feel good about their purchases. However, after 40+ years green products are not being adopted at higher rates.

Many companies who are promoting green products focus their messaging around emotional appeals when it comes to green products and services. This works well on green consumers who want to save the planet, but not so well on those consumers who do not selfidentify as green. The customer who would purchase a green product if they could see all of the advantages will require a different marketing approach.

Green products usually cannot compete on price, at least not the way most consumers view prices. Therefore, green companies need to look at the way they convey prices and overall costs. Most customers think the sticker on the product is the price. They often do not take the time to calculate total costs: Total Costs = Purchase Price + Use Costs + Disposal Costs. This is important as green product often save consumer money through use costs even though they

usually have a higher initial purchase price. The lower use costs along with disposal costs, to some extent, should make green products more appealing if companies did a better job educating consumers.

Time value of money also has implications. When considering solar panels, led lights, electric cars and consumer will also save additional money if energy costs increase. Companies could help consumers estimate these cost, which may influence their initial purchase decision.

We can all make a positive impact with our consumption behavior. Buying green products can make a difference and minimize environmental impacts. There can be clear cost savings and performance advantages that companies should be promoting to increase green product adoption.

Keywords: green marketing, sustainability, green product adoption

References

Kinnear, Thomas C., and Sadrudin A. Ahmed (1974), "Ecologically Concerned Consumers: Who Are They?" *Journal of Marketing*, 38 (2), 20–24.

Dynamics of Quality as a Strategic Variable in Complex Food Supply Chain Network Competition: The Case of Fresh Produce

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Abstract:

In this paper, we construct a competitive food supply chain network model in which the profit-maximizing producers decide not only as to the volume of fresh produced produced and distributed using various supply chain network pathways, but they also decide, with the associated costs, on the initial quality of the fresh produce. Consumers, in turn, respond to the various producers' product outputs through the prices that they are willing to pay, given also the average quality associated with each producer or brand at the retail outlets. The quality of the fresh produce is captured through explicit formulae that incorporate time and link characteristics with links corresponding to processing, shipment, storage, etc. Capacities on links are also incorporated as well as upper bounds on the initial product quality of the firms at their production/harvesting sites. The governing concept of the competitive supply chain network model is that of Nash Equilibrium, for which alternative variational inequality formulations are derived, along with existence results. An algorithmic procedure, which can be interpreted as a discrete-time tatonnement process, is then described and applied to compute the equilibrium produce flow patterns and accompanying link Lagrange multipliers in a realistic case study, focusing on fresh fruit, under best case and various disruption scenarios.

Key words: food supply chains, quality deterioration, fresh produce, oligopolistic competition, game theory, networks

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EFFECT OF DEMAND CHANGES FOR ASSEMBLY LINE COST BY MATRIX MODELING WITH BUSY RATE AND WORK-IN-PROCESS

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ABSTRACT

The demands of the assembly products fluctuate by the seasonal and product type variation. Therefore, it is necessary to change the assembly line according to these changes. As a result, the line balances change so that the busy rates and the numbers of work-in-process change. Then the total line cost also changes. Matrix modeling is to model the line costs from the busy rates and the numbers of work-in-process at each station by using a matrix representation, and it easily enables us to reevaluate the line costs when the production parameters are changed. This study evaluates the total line cost when demand is increased, thus the cycle time of a certain assembly line is decreased. Analysis results are quantitatively showed the influence of the total line cost when the cycle time is decreased.

Keywords: Corporate performance, Line changes, Improvement targets, Cycle time, Feedback

EFFECT OF LEAN PRACTICES ON EMPLOYEE RETENTION, SATISFACTION, AND PERFORMANCE

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EFFECT OF LEAN PRACTICES ON EMPLOYEE RETENTION, SATISFACTION, AND PERFORMANCE

Abstract: Employee retention and high turnover rates are among the highest sunk cost for organizations and it is estimated to cost between 6 to 9 months' salary on average to replace a salaried employee. This study empirically examines the impact of lean practices in an organization on employee retention, satisfaction and job performance. This paper investigates three research questions. First, determining what are the implications of implementing lean practices within an organization. Second, how does lean practices improve employee performance and employee satisfaction. Third, does employee performance and employee satisfaction have any impact on employee retention.

Data will be collected from 50 frontline employees in an organization in the United States and the empirical model will be tested using structural equation modelling.

Keyword: Lean Management; Employee Performance; Job Satisfaction; Employee Retention

EFFECTS OF DIFFERENT CARBON TAX AMONG ASIAN COUNTRIES ON LOW-CARBON AND ECONOMIC SUPPLIER SELECTION

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ABSTRACT

Materials and parts for assembly products are often procured by manufacturers on global supply chains across not only developed but also emerging countries with lower procurement costs. Additionally, to resolve global warming problems, the greenhouse gas (GHG) emissions [1] should be reduced in the global supply chains. When the materials for the assembly products are produced and transported on the supply chains, it is unavoidable to discharge GHG emissions. As solutions of reducing GHG emissions, carbon tax and emission trading system have been introduced in many countries [2]. Carbon tax is one of the environmental taxes and is paid depending on the volume of CO₂ emitted by economic activities [3]. It is expected that the carbon tax encourages manufacturers to reduce the GHG emissions efficiently. However, its rate differs by each country.

On the other hand, by using life cycle assessment (LCA) [1] and life cycle inventory (LCI) databases [4], the GHG emissions and the procurement costs for each material are estimated quantitatively. According to the LCI database with the Asian international input-output (I/O) tables, each material/part is produced by different GHG emissions depending on the country where it is manufactured [5]. One of the reasons is that each country has different GHG emission levels because of an energy mix of the electric power such as coals, national gases and nuclear. In general, materials are manufactured with lower GHG emissions but higher procurement costs in the developed countries. On the other hand, ones are manufactured with higher GHG emissions but lower procurement costs in the emerging countries [5]. For this reason, it is necessary to procure from the both developed and emerging countries on the global supply chain in order to reduce the GHG emissions and procurement costs simultaneously. Kuo et al. (2014) [6] and Kuo et al. (2017) [7] investigated a problem of supply chain network design for decreasing carbon footprints while ensuring cost effectiveness. Yoshizaki et al. (2016) [8] proposed a low-carbon and economic supplier selection method using the LCI database with Asian international I/O tables. However, they did not select suppliers by considering the carbon tax and the emissions in Asian assembly products. Kondo et al. (2017) [9] proposed a low-carbon and economic supplier selection method by introducing the carbon tax. However, the different carbon tax rates among the countries were not considered.

This study proposes a low-carbon and economic supplier selection method considering the multiple rates of the carbon tax among different countries, and analyzes effects of the different carbon tax among the countries on the supply chain. First, different carbon tax rates among different countries are addressed, and a bill of the materials which has the GHG emissions and the procurement costs for each part is constructed by using Asian international I/O tables. Next, the low-carbon and economic supplier selection with the multiple rates of the carbon tax among the countries is formulated. Thirdly, the suppliers for each part are selected by using integer programming with ε constraint method to be

satisfied for reducing both the GHG emissions and the procurement costs with the multiple rates of the carbon tax. Finally, results of the supplier selection with the carbon tax are shown, and effects by different rates of the carbon tax among the countries is discussed. (538 / 550 words)

Keywords: Global Warming, Global Supply Chain, Life Cycle Inventory Database, Bill of Materials, Carbon pricing

REFERENCES

- [1] Inaba, A., Itsubo, N., Kurishima, H., Kobayashi, K., Shibaike, N., Tabata, T., Tahara, K., Narita, N., & Yagita, H. (2014). Learning for LCA by drill. The Society of Non-Traditional Technology 1st ed., Tokyo (in Japanese).
- [2] Urata, T., Yamada, T., Itsubo, N., & Inoue, M. (2017). Global supply chain network design and Asian analysis with material-based carbon emissions and tax. *Computers & Industrial Engineering*, 113, 779-792
- [3] Adachi, J. (2004). Environmental tax. Tokyo, Tsukiji Shokan Publishing (in Japanese)
- [4] Sugiyama, H., Fukushima, Y., Hirao, M., Hellweg, S., & Hungerbuhler, M. (2012). Using standard statistics to consider uncertainty in industry- based life cycle inventory databases. *The International Journal of Life Cycle Assessment*, 10, 399-405
- [5] Kokubu, K., Itsubo, N., Nakajima, M., & Yamada, T. (2015). Low carbon supply chain management, Chuokeizai-sha, Inc., Tokyo (in Japanese).
- [6] Kuo, TC., Chen, HM., Liu, CY., Tu, J-C., & Yeh, T-C. (2014). Applying multi-objective planning in low-carbon product design. *International Journal of Precision Engineering and Manufacturing*, 15, 241-249
- [7] Kuo, TC,. Tseng, M-L., Chen, H-M., Chen, P-S., & Chang, P-C. (2017). Design and analysis of supply chain networks with low carbon emissions. *Computational Economics*, 1-22
- [8] Yoshizaki, Y., Yamada, T., Itsubo, N., & Inoue, M. (2016). Material based low-carbon and economic supplier selection with estimation of GHG emissions and affordable cost increment for parts production among multiple Asian countries, *Journal of Japan Industrial Management Association*, 66, 435-442
- [9] Kondo, R., Kinoshita, Y., Yamada, T., Itsubo, N., & Inoue, M. (2017). Effects of carbon tax on low-carbon and economic supplier selection for Asian assembly product. 10th International Symposium on Environmentally Conscious Design and Inverse Manufacturing, Tainan, Taiwan

EFFECTS OF HEALTH POLICY REFORMS ON EQUITABLE ACCESS OF HEALTH SYSTEM: A CASE STUDY OF TURKEY

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Effects of Health Policy Reforms on Equitable Access of Health System: A Case

Study of Turkey

Abstract:

This study aims to derive the effects of policy changes, especially the effects of health policy reforms on social, demographic and economic barriers of access in Turkey. The effects of predisposing, need, and enabling variables on health care utilization from specialist and hospitals are examined by using nationally representative 2008 and 2012 Turkey Health Survey data sets.

The results provide meaningful insights to judge how health care reforms improved the degree of equitable access of the Turkish health care system. According to the results, people with poorer health status and chronic disease were less likely to use specialists and hospital services. Increasing education, residing rural areas and working status were not significant barriers in front of delaying health care needs in Turkey. However, self-insured and low level of income continues to shape the choice of health care users in the direction of delaying their health needs. The findings indicate that income level and insurance status would be the main challenges in front of equitable Turkish Health Care System in coming years.

Turkish Health Care System have to encounter chronic financial problems of developed countries as it has already encountered chronic diseases that are major cause of deaths in developed countries for years. Preparing Turkish Health Care System for the future by making appropriate regulations to prevent poor or increasing efficiency within financing and providing health care may help Turkey to create more equitable health care system for its future. However, it must handle with two important and apparent problems in making appropriate regulations: Scarcity of financial resource, and treating people with cost-effective techniques at the appropriate level.

Key Words: Equitable access to health, Turkish Health Care System, Health Reforms, Health Systems

EFFECTS OF NATIONAL CULTURE ON MANAGEMENT STYLE

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Effects of National Culture on Management Style

Cultural beliefs and values impact many individuals on a day to day basis. Immigrants or ex-pats in supervisory positions may face challenges when adapting to new cultures and customs. One of these challenges is learning which management styles are effective in these different cultures.

While organizational theories are created in one culture, it can't be assumed that they will apply exactly the same way in other cultures. Often, people are unaware of their thought patterns that come naturally and assume others will respond and understand them. Triandis examined various dimensions of organizational theories to argue that assumptions on which they are based may not be accurate and that these views are developed because they are functional.

The learning of national culture results from socialization that occurs primarily within the family rather than in school or at the workplace. National culture, then, will likely be the most influential determinant of workplace behaviors, including managerial style.

According to the Globe cultural model developed by Ronen and Shenkar, national cultures may be identified according to their characteristics in areas such as leadership style, power distance, and uncertainty avoidance. This model identifies 11 distinct national culture clusters. In our study, we examine whether the preference for particular management styles varies according to cluster membership. We use data from the World Values Survey database wave six representing all 11 clusters to measure preferred management style.

Results will provide valuable insights for interacting with national cultures other than one's own. Having an understanding of management style differences will result in more effective organizational outcomes.

FACULTY PERCEPTIONS OF ONLINE TEACHING

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FACULTY PERCEPTIONS OF ONLINE TEACHING

The number of faculty who teach online courses is growing, but there continues to be some resistance to the effort. Recognizing that faculty represent a critical constituency in building quality online learning programs, we conducted a comprehensive survey of BSU faculty experiences, attitudes, and beliefs toward online learning. A previously validated survey was used (survey includes 30 items that parallel the information collected by Allen and Seaman (2008), Lloyd, Byrne, and McCoy (2012), and the SLOAN (2012) research studies on faculty perceptions about online education).

This information will assist BSU in furthering their online teaching practices. BSU will be able to identify and address faculty issues pertaining to online teaching in an effort to expand online offerings to students.

References

Allen, I. E. & Seaman, J. (2012a). Conflicted: Faculty and online education. Babson Survey Research Group and Quahog Research Group, LLC. Retrieved from http://www.insidehighered.com/sites/default/server_files/files/IHE-BSRG-Conflict.pdf.

Allen, I.E. & Seaman, J. (2008). Staying the course: Online education in the United States, 2008. United States: The Sloan Consortium.

Lloyd, S. A., Byrne, M. M., & McCoy, T. S. (2012). Faculty-perceived barriers of online education. *MERLOT Journal of Online Learning and Teaching*, 8(1), 1-12.

Keywords

Online teaching, online learning

FLOOR-LOADED OR PALLETIZATION PROBLEM

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ABSTRACT

This study considers a decision making process for shipping products from suppliers to destinations. To minimize total logistics cost, shippers determine either a palletized or floor-loaded container. Each product has different dimension and weight to be loaded onto a container. Last mile delivery should use pallet for utilization and speedy loading and unloading process. This study investigates an integer linear program to find a best scenario for each product. The study also provide a sensitivity analysis for each product considering the price of pallets at origins and destinations.

Keywords: palletization, Floor load, containerization, linear programming, logistics

FROM CORPORATE TO THE CLASSROOM: TOP TEN OBSERVATIONS FROM A PRACTITIONER'S PERSPECTIVE

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After working for 20 years in large corporate organizations I observed some startling differences when moving/instructing in the classroom. During the first 5 years in the classroom I was also working full time. Therefore, my experience in the classroom was limited to once per week with evening undergraduate students. Upon leaving the corporate world and for the past 5 years, I began teaching three finance courses and advising undergraduate finance students. This paper will examine those observations from the perspective of culture, organization, behaviors, and relationships.

GAINING LIFT IN CUSTOMER REVIEW HELPFULNESS THROUGH DUO-MINING

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ABSTRACT

Customer reviews in popular e-commerce sites are intended to provide new or potential customers with helpful information to assist in purchase decisions. These online customer reviews are typically composed of star ratings and review comments. However, helpfulness of such reviews suffers from the disconnect between the quantitative measures and the qualitative assessment. In this paper, we present a model that seeks to identify and enhance the degree of "lift" to enhance the predictability of helpfulness of online customer reviews by combining data mining and text mining techniques.

Keywords: Customer review, predictive modeling, lift, duo-mining, text analytics.

Global Entrepreneurship: Evidences from China and Implications for Education and Research

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China is transitioning from the "world's manufacturing center" to the "laboratory of innovation". Two recent phenomena are particularly noticeable, namely shared economy and integrated e-commerce ecosystem. In this research, we first describe China's shared economy, especially bike-sharing, and focus on ofo, a campus entrepreneurship based in Beijing successfully expanding to Western countries including the U.S. We then examine China's integrated e-commerce ecosystem spanning from social media for product finding, on-line shopping, e-payment, to express delivery, all of which is completed in a seamless and swift fashion at affordable cost. Finally, we summarize the Chinese characteristics of entrepreneurial spirit and explore the macro-economic environment that enables Chinese to pursue various innovations. Our ultimate goal is to discuss the similarities and differences of the entrepreneurships between the U.S. and China, as well as the implications of this comparison that lead to possible directions for new education and research.

GLOBAL EQUITIES PRICE REBOUND CAUSATION 2009 TO 2017

By

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Abstract

This paper investigates the causation of the global stock market boom since the last U.S. financial crisis and economic recession. Since the global stock market crash of 2008/2009, there has been enormous growth in global equities indexes prices. For example, the U.S. DOW Jones Industrial Average increased by about 243 percent since 2009; Germany's DAX 30, 215 percent; India SENSEX, 206 percent; Japan's NIKKEI 225, 188 percent; and the Australia ASX 200 by 100 percent.

Preliminary evidence suggests that actions taken by the U.S. Government during the financial crisis and economic recession have ignited the U.S. stock market growth. However, evidence also suggests that economic growth has not been the main driver for this observed stock market growth. If these situations prevail globally, will this precipitate another global stock market crash?

This study examines the following fourteen stock indexes from all the continents of the world: U.S. DOW Jones Industrial Average, Brazil iBovespa stock index, Mexico IPC stock market index, British FTSE 100, Germany DAX 30, Greece ASE, France CAC 40, Japan NIKKEI 225, China Shanghai, India SENSEX, Nigeria NSE All Share, Egypt EGX 30, South African JSE FTSE All Share, and the Australia ASX 200. We use data available from the United Nations, World Bank, The Bureau of Economic Analysis of the United States Department of Commerce, data bases of the Central Banks of the selected countries, Yahoo Finance, and Trading Economics data bases.

We apply the Pearson R test on Economic data such as Gross Domestic Product and the stock prices for the 14 stock indexes and interpret the observed results.

HOW BREXIT AFFECT THE CASUAL RELATIONSHIPS BETWEEN THE UK AND FOURTEEN OTHER DEVELOPED COUNTRIES IN THE EUROPEAN UNION?

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ABSTRACT

The goal of this research is to investigate the causal relationships among the Small-Cap stock market behaviors of the UK and the other fourteen developed countries in the European Union before and after the UK European Union membership referendum. The Granger causality test is used in this study by use of a leveraged bootstrap test developed by Hacker and Hatemi-J to examine the causalities. The data results show that six causalities are found before the referendum and the number of the casualties decrease to only three after the referendum. It suggested that the UK Small-Cap market is less affected and has less influence on the movement of the other fourteen developed countries in the European Union. This finding provides another prospect for the investor to take into consideration of the UK European Union membership referendum while building an investment portfolio.

KEYWORDS: Granger Causality, Bootstrap, MSCI, Small-Cap stocks

HYBRID FIX-AND-RELAX HEURISTIC AND SIMULATED ANNEALING APPROACH FOR THE NURSE ROSTERING PROBLEM

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Abstract

The workforce scheduling is an important task for many employers to achieve the cost reduction, the work balancing, and the workers' satisfaction. As the results of the scarce resources, this task becomes even more critical in the healthcare field. Healthcare facility managers must consider many requirements to effectively develop efficient rosters. One of the scarce resources is naturally nurses and there are many factors to remember in the scheduling effort. Daily number of nurse needs per a department or a facility, the day-off requests from nurses, the balancing of the workload between nurses, and considering the skills of nurses are some of the elements that need to be taken into account. The Nurse Rostering Problem (NRP) addresses the assignment of nurses to work shifts over a planning horizon considering the preferences of nurses as well as the medical staff needs of heath care facilities. The NRP is a combinatorial optimization problem and solving the problem to the optimality is a computationally intractable process.

In this study, we propose a hybrid approach of Mixed Integer Programming (MIP) based Fixand-Relax (F&R) heuristic and Simulated Annealing (SA). Overall, the algorithm works in such a way that F&R heuristic is used to generate an initial solution and SA is used to improve the initial solution utilizing many neighborhood structures. In the F&R initial solution generation step, the NRP is decomposed into a set of smaller problems and each sub-problem is solved to optimality until all the problems in the set are solved. Then, the solution generated in the F&R step is passed to the SA step for improvement. Starting from an initial temperature level; in the SA step, new schedules are generated by applying different neighborhood structures and the cost of the new schedule is compared to the previous one. While better cost values are automatically accepted by the SA algorithm, some of weak results are also considered to prevent falling into the local optima. This process is carried over in an iterative way until a certain stopping criterion is reached. The final result is reported at the minimum temperature level.

The software is written in Java using the IBM ILOG CPLEX Optimization Studio 12.6 Application Programming Interface and run in a Windows 7 PC with Intel Core i3 2.27 GHz processor and 3 GB of RAM. The algorithm is tested using publicly available instances. The computational results show that the algorithm generates optimum solutions for the first 8 problem instances in significantly faster processing times.

Keywords:

OR In Health Services, Timetabling, Nurse Rostering Problem, Fix-And-Relax, Simulated Annealing

References

Burke, E.K., & Curtois, T. (2014). New Approaches to Nurse Rostering Benchmark Instances. *European Journal of Operational Research*, 237(1), 71–81.

Rahimian, E., Akartunali, K., & Levine, J. (2017). A hybrid Integer Programming and Variable Neighbourhood Search algorithm to solve Nurse Rostering Problems. *European Journal of Operational Research*, 258, 411–423.

Employee Shift Scheduling Benchmark Data Sets (2014). 24 New instances. Retrieved from http://www.schedulingbenchmarks.org/

IDENTIFICATION AND PREVENTION OF FRAUD FOR REMANUFACTURED PRODUCTS IN REVERSE SUPPLY CHAIN

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IDENTIFICATION AND PREVENTION OF FRAUD FOR REMANUFACTURED PRODUCTS IN REVERSE SUPPLY CHAIN

The focus of most research is on traditionally manufactured goods and services and there is little interest in what happens to products once they reach their End of Life (EOL). Some of the strategies that arose in response to tackling EOL included design for disassembly, design for remanufacture and design for assembly. Some of the new techniques that incorporated design for disassembly, reuse and recycling were discussed by Veerakamolmal and Gupta (2000). Several sources, including Gupta and Ilgin (2018) and Xiong et al. (2008) have proposed methodological approaches for tackling the EOL product recovery problem. Of all the EOL processes, remanufacturing involves the most amount of work, and consequently remanufactured products have better quality and reliability compared to repaired and reused products. In terms of performance, a remanufactured product may perform as well as a new product; however the consumer may not perceive that as being the case. The fact that a consumer is frequently unsure about the quality of a remanufactured product that is to be purchased, and is therefore unsure of the extent to which the product will render services, might lead to a decision to opt out of buying it. Because of misconceptions held by consumers, manufacturers often search for market mechanisms, such as warranties, that might provide assurance about the reliability of remanufactured products (Algahtani and Gupta 2017). While warranties are sometimes performed by the remanufacturers themselves; they often outsource such services to third party service providers (Murthy and Jack 2017). With multiple parties, each with their own goals, motivations, and competing interests involved, the likelihood of fraud being committed by one or more parties is inevitable.

The warranty service agent isn't the only one that tries to defraud the manufacturer. Fraud in manufacturing can originate from many sources such as the workers in the assembly line, parts providers, the management and the customer. Many types of frauds can exist, such as counterfeiting, overbilling and false information (Chatterjee and Das 2007, Zhang, Hu and Zhou 2010). A number of methods of tackling manufacturing related frauds using emerging technology have been proposed. Not much work has been done to investigate issues in fraud detection and prevention in the remanufacturing sector. As with many problems, emerging

innovative technology may offer a way to tackle this issue in an effective way. The advent of sensor embedded products and the Internet of things (IoT) allows for constant monitoring that might yet offer unexplored avenues to tackle this issue. The trend of the majority of today's IoT research is around the building of conceptual models that address issues such as cost, revenue and break even analysis, which all highlight the potential usability of IoT. One aspect of IoT that is rarely discussed with respect to a supply chain scenario is that the ability of IoT framework to self regulate and to reconfigure itself in response to unusual changes in the work environment, which could be useful as a potential fraud deterrence mechanism.

This study aims to examine problems in the remanufacturing sector, by examining the relationships between the different interested parties and examines the best strategies with respect to each in dealing with fraud. Additionally, as fraud has a psychological element it, attention has been given to quantify how these feeling reflect a change to the rates of conducting or catching frauds.

Keywords: Remanufacturing, Fraud, End of Life, Internet of Things

REFERENCES

[1] Veerakamolmal, P., & Gupta, S. M. (2000).Design for Disassembly, Reuse and Recycling. *Green Electronics/ Green Bottom Line: Environmentally Responsible Engineering*, 5, 69-82.

[2] Gupta, S. M., & Ilgin, M. A. (2018). Multiple Criteria Decision Making Applications in Environmentally Conscious Manufacturing and Product Recovery. CRC Press, Boca Raton, Florida, ISBN: 978-1498700658.

[3] Xiong, Y., Lau, K., Zhou, X., & Schoenung, J. M. (2008). A Streamlined Life Cycle Assessment on the Fabrication of WC–Co Cermets. *Journal of Cleaner Production*, 16(10), 1118-1126.

[4] Alqahtani, A. Y., & Gupta, S. M. (2017). Warranty as a Marketing Strategy for Remanufactured Products. *Journal of Cleaner Production*. 161(1), 1294-1307.
[5] Murthy, D. N. P., & Jack, N. (2017). Game theoretic modelling of service agent warranty fraud. School of Mechanical and Mining Engineering, The University of Queensland, St Lucia, QLD 4072, Australia; and Springfield, Fife, Scotland KY15 5SA, UK. ISSN: 0160-5682

[6] Chatterjee, K., & Das, D. (2007). Semiconductor Manufacturers' Efforts to Improve Trust in the Electronic Part Supply Chain. *IEEE Transactions on Components and Packaging Technologies*, 30(3), 547-549.

[7] Zhang, H., Hu, Y., Zhou, Z., (2010). Prevention of resource trading fraud in manufacturing grid: a signalling games approach. *International Journal of Computer Integrated Manufacturing*, 23(5), 391-401.

IDENTIFYING KEY STUDENT SUCCESS FACTORS USING INTERACTIVE ONLINE LEARNING TECHNOLOGIES

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Abstract

IDENTIFYING KEY STUDENT SUCCESS FACTORS USING INTERACTIVE ONLINE LEARNING TECHNOLOGIES

Keywords: Learning Technologies, Interactive, Accounting, Statistics, Performance Data

Over the past ten years, universities have used online, interactive learning technologies to assist students in learning key subjects, such as mathematics, statistics, finance, and accounting, just to name a few disciplines. These tools have several advantages, in that they allow students to master course content and objectives based on their preferred learning style and pace. The ultimate goal of these tools is to improve student mastery of key concepts, and thus, enhance student success in courses.

These tools also gather a wealth of objective data about student interaction with online course materials and activities. This includes information such as the length of time the student spent on assignments, the number of times the student attempted an assessment and when the student started work on an assignment after it was assigned. The presence of this objective data gives us an opportunity to re-visit the age old question about behaviors that are related to the student's performance in a course. In this study, we use data from several sections of statistics and accounting courses to explore factors that are related to student success.

The class sections used for this research were taught by the researchers in 2016 and 2017 at a small university on the east coast.

IMPLEMENTING EARLY-WARNING DASHBOARDS USING AI TO IMPROVE SOFTWARE PROJECT OUTCOMES

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TITLE

Implementing Early-Warning Dashboards using AI to Improve Software Project Outcomes

KEY WORDS

Aritificial intellegence; Project management dashboards; Software metrics; Open source software (OSS); Predictive modeling; Early warning indicators (EWI)

ABSTRACT

Modern-day software project managers (PMs) are charged with a difficult task. Often times they obtain their inputs from highly technical leads who provide overly detailed inputs. When assessing software projects, PMs perform their role subject to their own time-constraints, capabilities, and core-competencies. PMs are constantly required to contend with the stresses of the business environment, the policies and procedures dictated by their organizations, and resource constraints. Robust assessment systems and tools, which are easy to use, that provide just-in-time (JIT) information, and are powered by real-time data, are of immense use to software PMs. These systems can be of invaluable help to the PMs who are trying their best to make good project decisions.

This paper focuses on how to improve software project management through the development and implementation of improved early-warning indicating systems and dashboards that rely on good and timely data. While researchers have studied software

project management for many years, they have openly acknowledged understandable challenges in obtaining reliable and unbiased project data from proprietary source software (PSS) development organizations. Open source software (OSS) communities have a wealth of data which researchers are able to leverage more easily and reliably. The external validity of OSS data for PSS related study has been long debated amongst researchers and practitioners. Even still, there have been numerous instances where the study of OSS data has undoubtedly provided valuable insights to researchers studying OSS development processes. In particular, this research will demonstrate how innovative PM dashboards can be powered by using publically available software data and artificial intelligence.

The primary purpose of this research is to determine how real-time dashboards can be built and leveraged to improve software project management outcomes. The paper will provide novel approaches to examining and applying software data to create earlywarning indicating dashboards. Use of machine-learning algorithms will be explored to develop data-models and resulting dashboards. The associated processes can be leveraged by web-based tools for improved project management and timely decision making. Preliminary findings, results, and implications will be shared. Opportunities for future research will be identified for further development and research.

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IMPROVING PATIENT OUTCOME WITH HEALTHCARE INFORMATION SYSTEMS

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ABSTRACT

The purpose of this paper is to review the existing literature on Health Information Technology (HIT), specifically Electronic Health Records (EHR) and life-long patient records, in order to provide a broad assessment of the current state of this technology in the United States. Relevant literature was reviewed to determine whether key hypotheses were validated. Areas for additional research and development were identified, and a potential path forward was proposed. HIT adoption is a worthwhile effort in the United States, and it is possible for us to enact an interoperable central records system within our current fee-for-service healthcare system. Wide scale adoption will require subsidies and regulatory involvement at the state level, but professional networks may be exploited to speed the rate of adoption. A four-tier architecture with autonomic security systems, properly validated, can provide the infrastructure necessary.

Keywords: health information systems, health information technology, electronic health records, personal health record, interoperability, knowledge dissemination, healthcare services

INNOVATION IN LINER SHIPPING COMPANIES

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INNOVATION IN LINER SHIPPING COMPANIES

Abstract

In the liner shipping industry, business conditions have become tougher in recent years in an already very competitive market. Over supply of vessels has existed for years and the situation is not getting much better in the near future (BIMCO, 2017). It is important for liner shipping companies to be innovative and create value to their customers (Lam and Wong, 2018). However, there is limited prior research addressing innovation in liner shipping and how companies deliver customer value. The limited literature available in this area merely proposes measurements for shipping companies to evaluate the customer value they delivered (Ding, 2009). This study attempts to narrow the literature gap and proposes innovative solutions for liner shipping companies to enhance customer value.

This study introduces 7 innovative solutions as design requirements (DRs) and examines to what extent these 7 solutions facilitate to enhance 5 proposed customer values (CVs) in liner shipping (see tables 1 and 2). CVs and DRs are identified based on literature analysis and then validated by interviewing academic and industry professionals.

Table 1 List of CVs

Notations	Customer Value
CV1 RS	Responsive Service
CV2 SC	Service Customization
CV3 SR	Service Reliability
CV4 CPC	Cost and Price Competitive
CV5 CB	Corporate Branding

Notations	Innovative Solutions
PI1 UESECT	Use of Eco Ship and Eco Container
	Technology
PI2 BDS-SIM	Big Data Solution for Ship Information
	Management
PI3 3DP	3D Printing in Maritime Industry
PI4 ADS	Automation and Digitalization of System
SI1 IEOSS	Integrated and Extensive Online Shipping
	Service
SI2 SCST	Specialized Cargo Services and Technology
SI3 CCFR	Customized Carbon Footprint Report

A case study of K Line is performed to examine the relationship between the CVs and DRs. A Fuzzy Quality Function Deployment QFD model is used to analyze the relative importance of each DR. The results reveal that "Use of Eco Ship and Eco Container Technology", "Big Data Solution for Ship Information Management" and "Automation and Digitalization of System" are the three most effective innovative solutions for enhancing customer value in liner shipping.

Keywords: Innovation; Customer Value; Liner Shipping; Container Shipping; Fuzzy Quality Function Deployment

References

BIMCO (2017). BIMCO's Reflections on Shipping Industry Issues, BIMCO Denmark.

DING, J. F. (2009). Evaluating customer value for liner shipping companies in Taiwan: An empirical study. *International journal of innovative computing, information & control*, 5, 2031-2042.

Birkinshaw, J., & Gupta, K. (2013). Clarifying the distinctive contribution of ambidexterity to the field of organization studies. *The Academy of Management Perspectives*, 27(4), 287-298.

Lam, J.S.L., & Wong, H.N. (2018). Analyzing Business Models of Liner Shipping Companies, *International Journal of Shipping and Transport Logistics*. DOI: 10.1504/IJSTL.2018.10008856

LEASING MODEL ANALYSIS FOR NEW AND REMANUFACTURED PRODUCTS ACROSS GENERATIONS

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LEASING MODEL ANALYSIS FOR NEW AND REMANUFACTURED PRODUCTS ACROSS GENERATIONS

Extended Abstract

As the e-waste problem explodes and people's awareness of environmental protection increases, environmentally conscious manufacturing and product recovery (ECMPRO) has come onto the center stage (Gupta & Ilgin, 2018). The manufacturer, as one of the players, is responsible for take-back legislations, customers' awareness of green products, and economics (Andrew-Munot, Ibrahim, & Junaidi, 2015). According to a survey, hot topics within ECMPRO include environmentally conscious design and production, material recycling and remanufacturing (Gungor & Gupta, 1999). Lately, research has been extended to reverse and closed-loop supply chains (Ilgin & Gupta, 2010; Gupta, 2013). Market-related issue is one of these areas (Alqahtani & Gupta. 2017). Marketing analysis and pricing decisions can transform a burden to recycle into a profitable business opportunity for manufacturers.

Nowadays, customers place high demand for high technology products such as laptops and smartphones. Some high-end fashion customers dispose of old products that still have much value remaining and purchase new products that incorporate the latest technology. From the manufacturer's perspective, new models are released frequently to improve product attractiveness and keep pace with competition. Therefore, both customer behavior and manufacturer's policy on innovation shortens the product life cycle. Remanufacturing and upgrading operations have intensified to adapt to the changes of the world. As the result, new and remanufactured products with multiple generations co-exist in the market. Moreover, the availability of remanufactured products is uncertain because of the dependence on the return of used products. How to make appropriate market policies and price decisions to deal with various types of products is the scope of this study.

Some scientists pointed out that leasing new products and selling remanufactured products is a good way to control the return rate of used cores, making the availability of remanufactured products more predictable. Agrawal, Ferguson, Toktay, and Thomas (2012) established multi-objective functions to analyze the difference between the selling model and the leasing models for

profit optimization and environmental impact. Robotis, Bhattacharya, and Van Wassenhove (2012) focused on the leasing option only. They determined the optimal rental price and contract duration by leasing the product bundled with maintenance service. Aras, Gullu, and Yurulmez (2011) built a dynamic model to determine the selling price for remanufactured products and payment structure for leasing new products with a third-party in the system. When the inventory of used cores is under shortage, used cores would be purchased from a third-party manufacturer. In this study, we expand the research problem into a multi-generation line, obtaining the optimal leasing rates and selling prices for new and remanufactured products belonging to different generations that maximizes the remanufacturer's profit. The optimal leasing duration is also discussed. The customers are classified into two segments: quality-conscious and technologysavvy. Each group has different perceived values on quality inferiority and technology obsolescence. The demand of new and remanufactured products in different generations is dependent on the time since the release of the product as well as customers' choices. The availability of remanufactured products is based on the number of leased new products with a fixed duration leasing contract. Numerical examples are considered to show the variation in results under different conditions of contract duration and customer segmentation ratio.

Key words: Remanufacturing, Pricing, Leasing, Generation

References

Alqahtani, A. Y. & Gupta, S. M. (2017). Warranty as a Marketing Strategy for Remanufactured Products. *Journal of Cleaner Production*. 161(1), 1294-1307.

Agrawal, V. V., Ferguson, M., Toktay, L. B., & Thomas, V. M. (2012). Is Leasing Greener than Selling. *Management Science*, 58(3), 523-533.

Andrew-Munot, M., Ibrahim, R., & Junaidi, E. (2015). An Overview of Used-Products Remanufacturing. *Mechanical Engineering Research*, 5(1), 12-23.

Aras, N., Gullu, R., & Yurulmez, S. (2011). Optimal Inventory and Pricing Policies for Remanufacturable Leased Products. *International Journal of Production Economics*, 133, 262-271.

Gungor, A., & Gupta, S. M. (1999). Issues in Environmentally Conscious Manufacturing and Product Recovery: A Survey. *Computers & Industrial Engineering*, 36, 811-853.

Gupta, S. M. (2013). *Reverse Supply Chains: Issues and Analysis*. CRC Press, Boca Raton, Florida, ISBN: 978-1439899021.

Gupta, S. M. & Ilgin, M. A. (2018). *Multiple Criteria Decision Making Applications in Environmentally Conscious Manufacturing and Product Recovery*. CRC Press, Boca Raton, Florida, ISBN: 978-1498700658.

Ilgin, M. A., & Gupta, S. M. (2010). Environmentally Conscious Manufacturing and Product Recovery (ECMPRO): A Review of the State of the Art. *Journal of Environmental Management*, 91, 563-591.

Robotis, A., Bhattacharya, S., & Van Wassenhove, L. (2012). Lifecycle Pricing for Installed Base Management with Constrained Capacity and Remanufacturing. *Production and Operations Management*, 21(2), 236-252.

LINKING THE STUDY OF BUSINESS ANALYTICS TO HISTORICAL DECISION SUPPORT SYSTEM RESEARCH

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ABSTRACT

In this talk, I propose a conceptual definition of business analytics (BA) that is intended to advance the empirical study of BA within organizations. To provide theoretical grounding, the proposed definition draws from decision support system (DSS) research studying the broad class of information systems whose shared purpose is to support managerial decision-making (Arnott and Pervan 2005; Clark et. al 2007). Rather than providing an expansive definition, this proposal seeks to circumscribe the definition of BA by identifying its constituting dimensions.

To begin, the following defining elements were inductively derived from literature: 1) analysis, 2) data and 3) decision-making. By way of a definition of "analysis," it is proposed that BA is essentially about abstractions of cause-effect relationships between parts and, borrowing from decision theory, parts are conceptualized as situations, actions and outcomes. Since abstractions are models, this conceptualization provides a linkage to model-based decision support systems (e.g. Power and Sharda 2007) and to the notion of mental models used in executive support systems research (e.g. Vandenbosch and Higgins 1995).

Following the early work of Alter (1977), DSS researchers have often distinguished model-driven DSS from data-driven DSS. Alter argued that DSS could be described "along a single dimension ranging from extremely data-oriented to extremely model-oriented" and which could be labeled as "the degree of action implication of system outputs." The categories of descriptive, predictive and prescriptive analytics described in more recent literature (e.g. Holsapple et. al. 2014) reflect increasing action implication. However, to admit the possibility of both high model and high data orientation, it is proposed that model-orientation and data-orientation are two *different* dimensions of BA:

- 1) *model orientation* the extent to which software represents all parts of a business situation and relationships between parts and
- 2) *data orientation* the extent to which electronic data is used to instantiate models.

To address the third core defining element, the following additional dimension of BA is proposed:

3) *decision process orientation* – the extent to which models are an integral component of an ongoing decision process.

This third dimension captures the extent to which models are embedded within an organization's decision-making activities. The presentation concludes with a discussion about the value of using decision processes as focal objects of investigation especially for bridging earlier DSS research with more recent business analytics research.

Management of Foreign Exchange Exposure:

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Abstract

In this study, we examine the principles of three forms of foreign exchange exposure. We narrate the essence of what each of those exposures is. Then, we ask numerous firms about their behavior toward the types of foreign exchange exposure they face. We report the results of their expressed behavior.

MANAGEMENT OF SUBSTITUTABLE PERISHABLE GOODS UNDER CUSTOMER CHOICE

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MANAGEMENT OF SUBSTITUTABLE PERISHABLE GOODS UNDER CUSTOMER CHOICE

In this study management of perishable goods with separate demand for products at different ages is analyzed. The product has two periods of shelf life, and substitution can take place between old and new products. Customer choice is incorporated into the model meaning customer does not always accept a substitution offer.

Keywords: perishable, inventory management, substitution

MATERIAL SELECTION FOR COST, DISPOSAL WEIGHT AND GHG EMISSIONS BY LINEAR PHYSICAL PROGRAMMING

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ABSTRACT

Assembly products consume natural resources and emit greenhouse gases at a virgin material manufacturing phase. For material circulation and reduction of additional GHG emissions, end-of-life products have to be collected for material recycling. The disposal weight at a recycling phase and GHG emissions at the virgin material manufacturing phase depend on material types. On the other hand, the costs including procurement, assembly and recycling processes also depend on the material types because different materials require each different operations. Thus, material should be selected environmentally friendly and economically for reducing cost, disposal weight and GHG emissions simultaneously. However, it is difficult for product designers to take into account the costs, disposal weight and GHG emissions determined by material selection because there are a lot of design functions to consider such as durability and reliability. The environmentally friendly and economical material selection is considered as a multi-criteria decision making problem. As one of the effective methods to solve these problems, linear physical programming (LPP) is adopted to express preferences by the designers for each goal.

This study proposes a material selection for cost, disposal weight and GHG emissions by using LPP. First, the multi-objective environmentally friendly and economical material selection is formulated by using LPP. Next, a case study is conducted by using a vacuum clear. Finally, the results are discussed from the viewpoints of the cost and environmental loads.

Keywords: Assembly Reliability Evaluation Method, Recyclability Evaluation Method, Sustainable Manufacturing, Assembly Product, Multi-Objective Decision Making Problem

OCCUPATIONAL FRAUD PREVENTION IN SMALL BUSINESSES: MULTIPLE CASE STUDY

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OCCUPATIONAL FRAUD PREVENTION IN SMALL BUSINESSES: MULTIPLE CASE STUDY

A recent *Association of Certified Fraud Examiners* report shows that organizations worldwide lose approximately 5% of annual revenue representing a potential annual occupational fraud loss of \$3.7 trillion. Occupational fraud can put the sustainability of small businesses at risk. The purpose of this study is to explore strategies used by selected managers and owners of small businesses to prevent occupational fraud. The conceptual framework for this qualitative multiple case study is grounded in Cressey's 1950 fraud triangle theory. Managers and owners of small businesses may benefit from the findings of this study by gaining awareness of the need to prevent occupational fraud. The knowledge and training of small business owners and managers on what constitutes occupational fraud and how to prevent it can play an important part in the success of a small business.

KEYWORDS: Occupational Fraud, Small Businesses, and Internal Control.

OPPORTUNITIES AND CHALLENGES OF VISUAL ANALYTIC COURSE

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OPPORTUNITIES AND CHALLENGES OF VISUAL ANALYTIC COURSE

ABSTRACT

As social network diffuses so does the data generated through them. This data contains text, videos, graphs, pictures and many other varieties. Data is generated at the speed of light and organizations must take advantage of it. Organizations are demanding graduates who can understand, manage and make sense of such data. Universities are obligated to provide such skills to their graduates. Visualization is becoming an important tool for exploring big data. Visualization typically has 2 parts. Exploration and Explanation. First part deals with data analysis and second part deals with data modeling and validation. These parts are not mutually exclusive. Both parts should be included in a course. This creates challenges for professors who need to either offer a new course in visualization or at a minimum include it in an existing course. It is important that our students understand this new phenomenon in addition to existing systems. This paper is an attempt in developing a new visualization course. We are in the process of developing the course and will share our insights at the conference.

Keywords: Visualization, analytics

OPTIMAL ALLOCATION OF PHARMACEUTICAL DETAILING AND SAMPLING BASED ON EMPIRICAL DATA

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ABSTRACT

Pharmaceutical industry devotes significant resources on marketing prescription drugs to physicians. The marketing efforts include personal visits to physicians (detailing), giving away samples of prescription drugs (sampling), consumer advertising, and journal advertising. Most of this expense is dedicated to detailing and sampling. Hence, numerous research efforts include models predicting the prescription behavior based on levels of detailing and sampling. However, the receptiveness to personal selling and the extent of its influence on the prescription decision vary among different physicians and drugs. Hence, we propose an optimization approach that accounts for the differences in the physician markets segments. The techniques include cluster analysis, neural networks and mathematical programming models.

Keywords: Pharmaceutical Marketing, Healthcare Industry, Resource Allocation, Sampling, Detailing.

PERCEPTIONS OF BIG DATA AMONG THE ACTORS OF DECISION MAKING

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The purpose of this research is to explore the perceptions of Big Data among the decision makers involved in various hierarchical levels of the decision making processes in business. The Big Data has emerged as a promising practice among both practitioners and academics to increase the value and quality of decision-making processes in a great variety of industry over the last decades (e.g. Sivarajah et al., 2017; Agarwal & Dhar, 2014).

After reviewing the relevant literature, a questionnaire was designed to reveal perceptional differences among academics, data analysts, and decision makers, such as managers, directors, coordinators, vice presidents, and presidents, in business organizations. The questions addressing perceptions were rated using 5-point Likert scale varying from 1=strongly disagree to 5=strongly agree. The questionnaire was initially examined by academicians who have both academic and professional experience in data analytics and their contributions were incorporated. The questionnaire was also pilot tested by 10 academics who have been working on data analytics and Big Data, 5 data analysts and 5 managers. Reliability and content validity of the questionnaire were deemed adequate. Given the significant nature and impact of Big Data, the data were collected through the questionnaire from several industries where Big Data has been considered an appropriate value creation tool for decision making processes.

Based on the data collected, the perceptions of the Big Data of the decision makers and sectoral perceptional differences were analyzed. Statistical differences among the respondents were explored. The challenges of Big Data identified by the respondents were categorized using factor analysis. The further analysis presented in this paper identified Big Data's potential challenges and issues, both conceptually and empirically, perceived by both practitioners and academicians. The outcomes and findings of this study are expected to shed light on improving and developing future advancements in Big Data.

Keywords: Big Data, perception, academician, data analysts, manager

References

Agarwal, R., & Dhar, V. (2014). Editorial – big data, data science, and analytics: the opportunity and challenge for is research. *Information Systems Research*, 25(3), 443–448.

Sivarajah, U., Kamal, M.M., Irani, Z., & Weerakkody, V. 2017. Critical analysis of Big Data challenges and analytical methods, *Journal of Business Research*, 70, 263-286.

POPULAR-PRESS BUSINESS SCHOOL RATINGS AND RESEARCH PRODUCTIVITY IN SELECT JOURNALS

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Abstract

In this research we explore the relationship between faculty publications in a select group of high quality journals and the popular-press ratings of the business schools of those faculty. This project was motivated by the ongoing relevance of such rankings to business schools, and the (perhaps related) movement of "middle-tier" business schools from primarily teaching institutions to those with an increasing emphasis on research. We examine the effect of a high-quality publication on institution ratings looking at all business schools, "tier one" research institutions, and middle-tier schools.

We considered the ratings provided by U.S News & World Report and Bloomberg Businessweek for both undergraduate and graduate business programs.

Keywords: business school ratings, research productivity

Post-Recession Jobs Recovery: A State-Level Spatial Analysis

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Abstract

Employment recovery performance across states - gauged as the level of employment in 2014 as a fraction of employment levels in 2008 - has varied considerably. The difference between the maximum (North Dakota) and the minimum (Nevada) States' amounted to approximately 7 standard deviations in 2014.

Several theoretical and empirical studies have set forth a diverse set of explanatory factors. The net effect of the inquiry has resulted in a large set of prospective explanatory variables. In this study I use Bayesian Model Averaging to address the resulting model uncertainty in identifying the variables associated with the variation in post-recession employment growth.

Accordingly, various economic and political state policy variables as well as quality-of-life variables are considered as possible explanatory variables for the observed differences in performance. Bayesian model averaging is used to select the variable set prior to further analysis.

Another consideration that may have a bearing on this inquiry is the regional agglomeration and dispersion forces that have increasingly led to employment clusters that often straddle several states. Thus, it is possible that employment recovery performance has a spatial spillover dimension to it. Again, a proper gauging of variables responsible for employment performance, should readily account for possible spatial spillovers.

We do not find evidence of neighboring states influence on employment performance. And we do find a reduced set of explanatory variables that account for the observed differences in employment recovery performance.

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PREDICTING THE SEVERITY OF FRACTURES TO ALLOCATE RESOURCES WITH HOSPITAL ADMINISTRATIVE DATA

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According to WHO, falls are the second leading cause of accidental or unintended injury deaths worldwide. In the United States alone, the medical costs and compensation for fall-related injuries are \$70 billion annually (National Safety Council). Adjusted for inflation, the direct medical costs for all fall injuries are \$31 billion annually. Hospital costs account for two-thirds of the total. The objective of this paper is to predict fall-related injuries that result in fractures that ultimately ends-up in hospital admission. We compare various modeling methods to predict the number of fractures and come up with the best modeling technique with the most accurate prediction percentage. The modeling methods from machine learning, artificial intelligence and statistics will be used to predict the number of fractures that lead to hospital admissions. By being able to predict the injuries that need an admission beforehand in real-time, hospitals will be able to allocate resources more efficiently when patients are admitted to the Emergency Department.

Key words: Fracture, Emergency department, Prediction, Machine learning, Hospital.

PROACTIVE STAKEHOLDER PRACTICES: CASE STUDY OF A MAJOR PHARMACEUTICAL COMPANY

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Proactive Stakeholder Practices: Case Study of a Major Pharmaceutical Company

Abstract

This paper is a qualitative inductive case study with the purpose to outlining features of proactive stakeholder organizations. The study argues that based on the normative nature of stakeholder theory only proactive stakeholder orientations qualify as stakeholder organizations. The study attempts to modify the RDAP (Reactive, Defensive, Accommodative, and Proactive) scale to improve the descriptive validity of stakeholder management. The findings suggest that proactive stakeholder organizations seek out external stakeholders and try to involve them in a dialogue to resolve issues of mutual concern, and internally they value and engage their stakeholders in organizational decision-making processes. The vital contribution of the paper is that it has delineated critical features of stakeholder organizations and established a basis for further descriptive work in the field of stakeholder management.

Key Words: Stakeholder Theory, Stakeholder Management, Proactive Stakeholder Management, Case Study

Introduction

There is theoretical and empirical support for the need of a proactive orientation to stakeholder management (Heckscher *et al.*, 2003; Fassin, 2012, Henisz *et al.*, 2014, Author, 2017). However, proactive stakeholder management, which a fairly common business practice, presents some definitional challenges. What features in an organization's management style can be considered as proactive? How to distinguish proactive stakeholder organizations from those that are not? The purpose of this paper is to outline the defining characteristics of proactive stakeholder organizations to improve stakeholder theory's descriptive validity and establish a basis for further inquiry.

This study argues that in a volatile and intrusive business environment the optimal benefit of stakeholder management may only come from having a proactive stakeholder orientation (Heckscher *et al.*, 2003; Fassin 2012; Author, 2017). It is further argued that in the last three decades scholars have recognized stakeholder management's normative underpinnings. These foundational principles require organizations to identify a broader range of intrinsically vital stakeholders and gain a competitive advantage by developing mutually beneficial, cooperative, and dialogue based relations with them (Phillips, 1997; Heckscher *et al.*, 2003; Jones *et al.*, 2007; Fassin, 2012; Author, 2017). Hence, just the fact that business firms interact with their stakeholders is not enough to classify them as stakeholder oriented forms. A bonafide stakeholder management strategy ought to represent the normative principles enumerated above; therefore, only proactive stakeholder orientation may be regarded as an authentic stakeholder management strategy.

This study is singular as it attempts to delineate the features of proactive stakeholder organizations by using a qualitative case study methodology. The study modifies Clarkson's (1995) Reactive Defensive Accommodative and Proactive (RDAP) stakeholder management scale. The study finds that the key ingredients that comprise stakeholder organizations are distinct and make them qualitatively and quantitatively different from non-proactive stakeholder organizations. The implications of the findings are crucial, i.e., there are cultural peculiarities in proactive organizations that may be appreciated regarding values, perspectives, morale, loyalty, and expectations, which, in turn, may affect more quantifiable measures such as organizational structures, productivity, growth, and profit.

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Why Proactive Stakeholder Orientation?

This study focuses on proactive stakeholder management for three reasons. First, Freeman (1984) discusses organizational reactions to environmental change and concludes that the organizational strategic response to the environment should be predicated on the level and intensity of change. Other scholars have argued that the business environment has become volatile, and intrusive (Freeman *et al.*, 2010; Tashman and Raelin, 2013; Mason and Simmons, 2014; Fassin *et al.*, 2017) and the relationship between organizations and their stakeholders have become increasingly interdependent (Fassin, 2012; Goettsche *et al.*, 2016). Therefore, organizations now need to be proactively involved with their stakeholders predicated on the principles of collaboration and mutual trust (Heckscher et al., 2003; Fassin 2012; Author 2017).

Second, as this author has argued elsewhere (Author, 2017), stakeholder theory is inherently a normative theory of management. It originates from a philosophic core that argues that all stakeholders have intrinsic value and organizations need to include all relevant stakeholders in their strategic planning (Freeman *et al.*, 2010). This philosophic underpinning would necessitate the development of distinctive policies towards organizational stakeholders supported by congruent organizational institutions and culture aimed at creating value for all stakeholders. Additionally, different from non-stakeholder firms, stakeholder organizations will develop relations with their respective stakeholders based on the long-term view of business, mutual dependence, dialogue, and collaboration (Phillps, 1997; Post *et al.*, 2002; Heckscher *et al.*, 2003; Fassin, 2012; Desai, 2017). Hence, there is a need to differentiate between stakeholder and non-stakeholder firms as all firms interact with organizational stakeholders at one time or another. However, stakeholder management represents "a particular normative attitude towards stakeholders and cannot be used as a portmanteau description of how organizations operate" (Author, 2017). In sum, it is argued that only proactive stakeholder or accommodative orientations institute a bonafide stakeholder orientation (Author, 2017).

Finally, there is ample evidence on the incidence of stakeholder management as practiced by organizations (Verschoor, 1998; Ogden and Watson, 1999; Berman *et al.*, 1999; Luoma and Goldstein, 1999; Pajunen, 2006; Henisz *et al.*, 2014). However, there is little work done that delves into describing the features of stakeholder firms and mechanics of stakeholder management. Whereas, future descriptive work in stakeholder theory would, "catapult stakeholder theory into the ranks of major theories of organization" (Jones and Wicks, 1999: 208). More recently, Freeman *et al.* (2010) point towards a definite direction by suggesting that

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stakeholder theory will be best served by works that might describe best practices of stakeholder organizations.

Who are Proactive Stakeholder Organizations?

Starting with Freeman (1984), proactive is a stance in which organizations predict changes and position themselves to cope with those changes. A proactive organization interacts and gets involved with forces of change, in other words, the stakeholders. Several scholars have discussed categories of organizational responses to changing the environment (Ackoff, 1974; Post, 1978; Sethi, 1979; Wood, 1991). However, for the purpose of this study more pertinent categorization comes from Carroll (1979 and 1991), who offers four categories of organizational responses to stakeholders: reactive, defensive, accommodative, and proactive. Later, Clarkson (1995) build on Wartick and Cochran (1985) and Carroll's (1979) models and develops the RDAP scale. Clarkson (1995) further operationalizes the categories and makes the scales more practicable by adding "posture or strategy" and "performance" to the existing scales (Table 1). Clarkson's (1995) nuanced RDAP scale defines proactive stakeholder management as organizations that lead the industry and deal with their stakeholders in a more comprehensive way than ordinarily required.

Table 1.	RDAP Scale	

Rating	Posture or Strategy	Performance
Reactive	Deny responsibility (Fight all the way)	Do less than required
Defensive	Admit responsibility but fight it (Do only what is required)	Doing the least, that is required
Accommodative	Accept responsibility (Be progressive)	Doing all that is required
Proactive	Anticipate Responsibility (Lead the industry)	Doing more than is required

Source: Clarkson (1995), Page 109

The RDAP scale is a significant development, but it does not provide specific features to differentiate proactive or accommodative from defensive or reactive organizations? This work presents a nuanced description of how and on what basis proactive stakeholder organizations are different from defensive or reactive organizations (Table 2). The study maintains the RDAP categories and argues that proactive organizations can be differentiated from other types based on their strategy towards internal and external stakeholders and level of engagement with their
stakeholders. Proactive stakeholder organizations constantly survey the environment to identify current, emerging, and potential stakeholders. Once recognized these stakeholders are engaged in dialogue to develop mutual understanding, shared goals, and solutions to areas of common interest. Internal stakeholders, in such organizations, have autonomy, voice, and are valued and engaged in the decision-making processes. Engagement in proactive organizations, with both internal and external stakeholders, means sharing of information and meaningful dialogues with stakeholders to reach solutions based on consensus.

Accommodative stakeholder organizations, on the other hand, treat internal stakeholders (employees) as assets and give them sufficient autonomy in their work situation but do not include employees in actual decision-making and share information with employees on a need to know basis. Externally, accommodative organizations do not proactively look for potential future stakeholders, but they keep an eye out for current and emerging stakeholders and try to understand their needs. Accommodative stakeholder organizations maintain limited contact with stakeholders. Their contact is mostly limited to collecting pertinent stakeholder information required for organizational decision-making. However, stakeholders are not engaged in a dialogue, and they are not a party in the organizational decision-making process.

Rating	Stra	Level of Engagement	
	Internal Stakeholders	External Stakeholders	
Reactive	Treating internal stakeholders as a liability	Ignoring external stakeholders and only react to them or recognize them when they start to affect the bottom line of the firm	Ignoring stakeholder interests and concerns and focusing only on organizations
Defensive	An instrumental relationship with internal stakeholders where adequate effort is made as needed or required	Keep an eye out only for narrowly defined strategic stakeholders and their needs	Limited interaction with stakeholders just for the purpose of knowing their interests
Accommodative	Considers core internal stakeholders (employees) as assets and give them adequate autonomy in their work situation but most employees do not have real voice and information is available to them on need basis	Not proactively looking for possible future stakeholders but keep an eye on current and emerging stakeholders and try to understand their needs	Having some contact with stakeholders to collect pertinent information to take decisions. However, stakeholders are not engaged in a dialogue, and they are not a part of the decision-making process
Proactive	Internal stakeholders (employees) have autonomy and voice, they are valued, seen as an asset, and treated fairly and humanely and there is availability of information and transparent management	Survey the environment to identify current, emerging, and possible future stakeholders. Once recognized then reach out to future and current stakeholders	Engages stakeholders in a meaningful dialogue to reach mutually beneficial decisions on matters of common concern

Table 2	Stakeholder	Orientation	Scale
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In sum, proactive stakeholder management is beyond actively assessing stakeholder interests. It is an approach to management in which internal and external stakeholders are engaged in decision-making processes at different levels. At an adequate level, engagement

could be engaging internal and external stakeholders and eliciting their opinion regarding firm's products, services, policies, management, and impact on the community. This type of engagement is usually done to align organizational policies with the expectations of important stakeholders. However, at the more advanced proactive level stakeholders are involved and invited in a discourse with the organization on matters of mutual interest. This dialogue, in other words, manifests a greater degree of stakeholder involvement in which there is an exchange of ideas to reach consensus and shared visions.

Methodology

This study is exploratory and evaluative in nature as it is attempting to discover features of proactive stakeholder firms. Keeping the stated end in mind, this is an inductive work designed as a case study (Schutt, 2006). Inductive case studies require the collection of rich, nuanced data with the aim to establish theoretical generalizations regarding the subject of interest. Resultantly, inductive case studies entail interpretation and complex analysis of large amounts of descriptive data from different sources. Therefore, to develop theory of a complex social phenomenon, i.e., stakeholder management, precepts of grounded theory were employed to collect, arrange, and analyze rich data obtained form varied sources (Strauss, 1990). Grounded theory method helps arrange and analyze data through techniques like memo writing, coding, and theoretical sampling (Strauss, 1990). It represents a flexible yet thorough non-linear process of collection and analysis of data in which each piece of data is analyzed as it is collected leading to the gathering of additional pertinent data (Gephart, 2004).

This work consists of one primary and one secondary case study: Johnson & Johnson (primary)-with a specific focus on one of its subsidiaries, i.e., Tibotec Therapeutics (secondary). Additionally, interviews were also conducted from two stakeholder organizations, i.e., Elizabeth Glaser Pediatric AIDS Foundation (EGPAF), and AIDS Treatment Activists Coalition (ATAC), to assess the validity data collected from the primary and secondary case studies.

Organization selection strategy underscores the main purpose of this work, i.e., highlight the practices of proactive stakeholder organizations. J&J was selected because of its stakeholderoriented Credo statement—that was established in the 1940s—and substantial secondary data available to establish its stakeholder orientation. TT was selected based on the argument that it would have been quite impossible to analyze J&J's interaction with its full range of stakeholders existing in so many different communities and countries. Therefore, data from J&J headquarter

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provides insights into J&J's overall stakeholder strategy, whereas data from TT substantiates J&J's overall stakeholder strategy by discussing in-depth how TT exhibits proactive stakeholder tendencies while interacting with its vital stakeholders. In sum, interviews and field notes from the secondary organization and other stakeholder organizations are used to enrich understanding of stakeholder processes in the primary firm.

The data consists of primary and secondary sources. The main sources of data include field notes—almost all interviews were conducted on organizational premises— and twenty-four face-to-face in-depth interviews (Appendix I). Interviews averaged 40 minutes, and several interviewees were interviewed more than once for supplementary questions via telephone or email for clarifications or to gather additional information. The interviews and field notes produced almost 300 pages of transcription and field observations. A list of additional documents, used as secondary data, is also produced (Appendix II).

Interviewee selection was based on theoretical sampling. A technique that allows researchers to analyze collected data from previous interviews, identify relevant themes, and gain access to interviewees that can shed better light on the noted theoretical categories (Charmaz, 2007). Data analysis in qualitative studies is an interactive cyclical process that begins with the collection and analysis of the first piece of data and continues until a complete picture of the studied phenomenon emerges. Therefore, to analyze the data techniques of data reduction, data display, and conclusion drawing or verification were used (Miles and Huberman, 1984). To facilitate the process of organizing and analyzing complex data NVIVO 10 software was used.

Finally, to ensure the validity of a qualitative case studies it is essential for the researcher to minimize the bias of the data points, i.e., the interviewees. Hence, several steps were taken. First, the interview procedure followed Human Subject Protection protocols. A consent agreement was signed between all interviewees and the interviewer to guarantee that information disclosed would remain anonymous in all quotes and analysis. Second, to assess the consistency of information, interview data were collected from interviewees belonging to different departments, managerial levels, and geographic areas, e.g., interview of a J&J manager from India, and two interviews from TT managers in Europe. Additionally, interview data were matched with data collected from secondary sources. Third, interviewees were selected by the researcher and approached either directly or through J&J management. No interview request was denied either by the interviewees or by the management. Fourth, data was collected from

organizations and individuals that represented stakeholders of the studied firms. This was done to assess the validity of the claims made by the interviewees from the primary and secondary firms. For internal stakeholders, employees from different departments were interviewed. For external stakeholders, interviews were conducted with EGPAF to assess J&J's philanthropic claims, and ATAC to analyze TT's efforts at stakeholder management in product development.

Proactive Stakeholder Practices

At this stage, it would be pertinent to clarify that this study does not claim that J&J represents the epitome of proactive stakeholder management. J&J is a large international organization operating through 250 subsidiaries in 57 countries. Whereas, the data was only collected from J&J headquarters and one subsidiary. The analysis, therefore, does not intend to be a paean for J&J but is aimed at developing theoretical generalizations regarding proactive stakeholder management based insights from the collected data.

J&J Corporate Proactive Stakeholder Strategy

J&J's policy of engaging its stakeholders is rooted in its Credo. General Robert W. Johnson created the Credo in 1943. The Credo, like a constitution, outlines broad principles by providing a list of important stakeholders and the core philosophy the company must follow to interact with them. The Credo lists four main categories of stakeholders by order of priority with customers at the top, followed by employees, community, and shareholders.

Internal Stakeholders. Employees are the most important internal stakeholders and on the overall list are second, after customers but above shareholders. J&J, as discussed below, justifies the above claim at two levels. First, J&J practices employee involvement as a proactive strategy. It engages employees in assessing and improving its value-based business policies and create consensus driven operations. Throughout all the interviews conducted with J&J management and employees, it has been consistently noted that J&J considers its employees to be vital and there is an overall culture of involvement and engagement in the company.

However, operationally, employee engagement exists in organizational structures and is used as a feedback mechanism to improve J&J values, and as a tool to improve management practices. Employee involvement in overall organizational policy-making is encouraged through a separate office of Employee Advocacy and Workplace Engagement (EAWE) within the HR department. The main purpose of this department underscores the proactive stakeholder principles of internal stakeholder engagement and valuing internal stakeholders and their views.

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The department achieves this in two ways. One, the department conducts several surveys throughout the year, some of these surveys are universal and some of specific departments or regions, however, the purpose of these surveys is to include employee opinion to see if the company and different offices are living up to employee expectations. Often, changes are made in policy by the management based on the positive or negative feedback from the employees. Hence, the administration constantly engages employees in a meaningful dialogue regarding matters of mutual concern. As commented by a senior manager,

"[Employees] express to management things we are doing well and areas of opportunit[ies for improvement], and to help provide tools, processes [and] insights for management to take [corrective] action, [through] those surveys."

Another senior manager commented,

"What the employees say could be a leading indicator ... We have a very talented workforce, and the role of the leaders is to make sure that our employees really feel valued and contribute to the success of the organization. And that is the beauty of our survey process because it does give the employee that voice."

Two, EAWE conducts surveys with J&J Credo as the core and uses insights from these surveys to express to management what it is doing well and where it needs to improve. A senior manager from this department explained that the function of this office,

"Truly understand how our employees are feeling, [measure] our ability to live [by] our Credo, and... assessing it from all vantages of our stakeholders, [and establishing if we] are... living up to [our] promises to our customers, or at least [to] the community."

For this purpose, "Credo Dialogue" is a vital instrument utilized to update, reevaluate, and improve the relevance of J&J's most important source of policy guidance that is the J&J Credo. It is conducted globally every two years to assess employees' views on individual work and understanding of strategic goals at the sectional level, immediate managers, and management in general, and J&J performance from a business and credo perspective. This employee engagement at J&J serves as a management tool in which employee opinion is solicited with the intention to make necessary improvements in processes and institutions. Furthermore, this tool also serves the purpose of assessing the J&J Credo. The Credo is considered as a living document and has the status of a constitution, a senior manager from Government Affairs Department commented that "it is [the Credo] like the US constitution, it gets amended very infrequently, but it does get updated." It was noted in several interviews that the Credo had been altered based on these surveys and dialogues. In fact, the original Credo did not include environmental concerns in it and a Credo survey done in the mid-80s led to adding environmental sustainability in the living constitution of J&J.

Second, evidence also shows that employees are authentically valued and treated fairly by the organization. The treatment is based on the principles of respect, dignity, and fairness. In all interviews with J&J employees, the employees felt and expressed that J&J appreciates its employees, as commented by an employee,

"I think that they fulfill that [Credo] commitment [to employees]...I feel that we are respected, we are listened to, [and] we are valued."

Another senior manager recently recruited at J&J office in India, who had extensive experience of working with several multinationals, and who was under training at J&J headquarters expressed his views on how J&J values its employees in these words,

"They [J&J] have much respect for ... human beings. [In J&J]... the most important thing, apart from ... customers and patients are the employees. In J&J, the moment you come in, you can see that great respect towards the individual: They help... people, and they [take] time to listen to you...In terms of a work/life balance, they meet that standard 100 percent."

Furthermore, all interviewed employees agreed that J&J invests in its employees by training them and helping them build careers within the company. They also agreed that J&J provides its employees with work-life balance. It was also observed that several interviewees at various managerial levels started their careers in J&J as interns and staff, but through the years J&J provided them with educational and promotional opportunities that resulted in their gradual ascent to the highest levels in J&J. An example underscoring the impact of treating employees as stakeholders was offered by a senior manager who herself had been with J&J for over 30 years. She at one point, due to personal reasons, had to apply for jobs at other companies. A manager at of one of these businesses that she was interviewing with agreed that she was the best candidate for the job, but that the firm avoids hiring people from J&J because they always go back.

Finally, it would be useful to discuss the example of layoffs to demonstrate the fairness of treatment of employees by J&J. Laying off employees is often an economic necessity, however, as a policy, layoffs have a negative relationship with the employee feelings of being a stakeholder (Mishra and Spreitzer, 1998; Allen *et al.*, 2010). In the last few years, J&J, like many other corporations, has laid off many employees. If employees are important stakeholders then

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why are these layoffs taking place and what is the difference between J&J or any other nonstakeholder oriented organization?

J&J's middle and upper management defends layoffs by arguing that, in a highly integrated world economy that is collectively facing upheavals brought on by a debilitating economic recession, it is not possible to avoid layoffs. However, while J&J cannot ensure the security of employment, it can guarantee the employability of their employees. For this, J&J stresses training and development of its employees at all levels. Educational loans and aid are available to employees. As mentioned earlier, J&J develops its employees and trains them for higher levels by providing them with training and educational opportunities. Coming back to the layoffs, the interviewed managers believe that J&J still maintains its stakeholder character based on how the layoffs are conducted. On a general level, one important aspect of the layoffs at J&J is the sensitive and empathetic treatment of laid-off employees. It is true that quantitatively humane treatment still means loss of jobs for the laid off employees. Nevertheless, the qualitative effect is profound, as one HR manager explained that most laid-off employees in their exit interviews strongly agree that they will recommend J&J for a place to work to their friends.

The layoff process is also quite transparent that adds to the above dimension of humane treatment. The employees not only know well in advance—often more than six months—that layoffs are going to occur, but the management also shares with them financial information to make them understand why layoffs are necessary. All interviewed employees also agree that J&J effectively communicates business imperatives and needs that underlay layoff decisions, and is transparent and candid.

Another important aspect of layoffs at J&J is the material and tangible support that it provides to the employees facing future layoffs. Every J&J employee gains two weeks per year of full benefits. The accumulated weeks can be availed by employees after they are laid off. There is also a very effective replacement center at J&J that provides employees with coaching, basic training, and other resources to find jobs within or outside of J&J. The work of the replacement center is made more efficient by the fact that usually, employees know about their layoffs six months in advance, which means that they have a reasonable time to avail the resources offered by the center. Finally, J&J also has a generous severance plan. One senior HR manager summed up in these words, "It is the benefits, [and] we have an outplacement center [right here] in New Brunswick that provides one-on-one outplacement support to employees...we try to make it as... supportive as we can."

The important point is that during layoffs employees are treated with dignity and respect, and this treatment makes J&J the employer of choice, as observed in all interviews of the J&J employees.

<u>External Stakeholders</u>. Keeping in view the impossibility of collecting data to assess J&J's relationship with all its stakeholders, in this section, J&J's external interactions in two important domains will be discussed: philanthropy (national and international) and product development. For product development, the example of a J&J subsidiary will be discussed.

J&J's philanthropic arm is led by a dedicated Corporate Contributions and Community Relations Department with the overall purpose to make long-term, life-changing differences in human health, academic excellence, art and culture, and environment at the community and global levels. In the state of New Jersey, the community relations department focuses on New Brunswick, which is the location of J&J headquarters, and the six New Jersey counties in which 80 percent of J&J employees reside.

The proactive aspect of the philanthropic policy becomes evident when J&J conceives, develops, and implements its many community programs. Unlike most large corporations that dole out money and resources to certain causes and organizations, J&J plans its philanthropy with full involvement of the local activists and other concerned actors. First, research is done to identify the gaps J&J can fill. After identifying the gaps, J&J philanthropy team identifies concerned stakeholders that represent the leadership of the community in healthcare issues. Finally, these leading individuals or organizations are contacted with the aim to create partnerships in achieving the philanthropic goals of J&J.

According to one manager in J&J's philanthropy division, "[these] relationships take a long time to develop... It may be over the course of a lot of time before something results from discussions." This manager gave an example of a recent internal discussion in J&J that lead to J&J's efforts to reach out to the main parties to give New Brunswick residents access to a farmers market, J&J initiated discussions with Rutgers University, which owns land and farms in New Jersey, on developing a plan for such a venue. As a result, J&J and Rutgers University not only launched a farmers market but also developed other ideas to help the community and community farming.

At the international level, J&J maintains a proactive strategy to involve and engage stakeholders. Most of the international philanthropic work is done through NGOs. However, J&J's philanthropy department is intimately involved in the process. J&J has prescribed precise quantitative standards for NGOs and selects its partner NGOs based on their reputation, competence, and capacity to deliver. Usually, the international philanthropic strategy would begin by identifying the intended target population and the intended intervention. In the overall strategy, participating stakeholders and specific inputs are outlined. In the output component, goals to be achieved at different stages of the program are laid down with specific standards to assess success. The important aspect of these activities is that charitable activities are conducted by J&J as a community partner with full involvement, which results in developing long-term relations with the target community.

To illustrate J&J's collaborative policy in its international philanthropy, J&J's philanthropic work through an international independent NGO, i.e., the Elizabeth Glaser Pediatric AIDS Foundation, will now be discussed. Each year, the Foundation submits proposals to J&J for various programs, for example, treatment of pregnant women with AIDS/HIV. The approval process is based on an intimate involvement of J&J's philanthropy team and open dialogue between the team and the Foundation. A high-level Foundation manager informed that a major challenge in donating AIDS medications is assessing and respecting the cultural imperatives and specific needs of the country and the target population. According to this manager, J&J, unlike most pharmaceutical companies, starts its projects from a needs assessment of the target countries, which primarily involves understanding the culture of the country. The managers compared J&J with other organizations that he had interacted with in these words,

"J&J does the opposite ... they look to understand the culture of the country with which they are working or providing donation [to] it is 180 degrees away from what I have seen in other companies."

This cultural assessment begins with collaborating with organizations and individuals who already have a presence in the field and who are aware of the particular cultural issues of the target country. Second, J&J philanthropy department managers frequently travel to these countries to understand the on-the-ground realities and to obtain first-hand data. According to a senior manager from the philanthropy department, "We have a strategic plan for our philanthropy... We have strategic focus areas and outlooks ... So if we were working with a new partner, we would be working with them because we believe that that organization can deliver."

A top-level manager from Elizabeth Glaser Foundation commented,

"I do not think many of the folks [involved in philanthropy] have actually worked in many of these countries. But most of the J&J philanthropy staff travel to the program country ... to see at the clinic level what's going on."

Besides traveling and understanding ground realities, J&J philanthropy department also involves major stakeholders in its decision-making process. The Foundation manger further added that "the Foundation gets involved with J&J decision making in philanthropic efforts from the senior level to lower levels of management." In sum, J&J's proactive tendencies are exhibited in the process of needs assessment and understanding the cultural peculiarities of target countries and communities, in creating beneficial partnerships with all concerned organizations and individuals, and by involving vital stakeholders in the decision-making process.

Finally, Tibotec (TT), as a J&J sunsidiary, demonstrates proactive stakeholder management in its product development process. TT was primarily created as a research organization in the 1990s, and J&J acquired it in 2002. TT specializes in virology and conducts research and develops medications for AIDS and Hepatitis C. Before acquiring TT, J&J was not a known name in the field of AIDS and HIV medication. Thus, TT provides an excellent example of how J&J was able to establish itself in a highly competitive yet trust deficient AIDS field with proactive stakeholder strategy.

TT reached out to stakeholders for their contributions in three main areas, i.e., drug development, creating awareness about the disease, and creating consensus among stakeholders. From the beginning, to build trust, TT followed the rules of transparency and open communication and invited activists and AIDS/HIV healthcare-related individuals for discussions and consultations. As one TT manager involved in drug development explained,

"[At] the earliest development stages of our (AIDS) drugs, [we] said look, here's what we are planning to do. Do you have input? [They reviewed] all of our clinical trials, they [saw] the protocols. They [recommended] doctors that we go to, [in order] to have them participate in [our] trial." Furthermore, the feedback was also acted upon as explained by a TT manager from the department of Drug Development,

"It is not saying come on ... give us your feedback, but then you do not act on it. [What] very early on...won us some... trust [was] not just them having them have a seat at the table, but ... listening, really listening and valuing the feedback that they provided."

In addition to coordinating efforts with AIDS activists groups, TT also maintains direct contact with AIDS patients to improve their awareness about the disease. Pharmaceutical company sales forces are legally not allowed to have direct contact with patients. Therefore, TT maintains contact not through sales representatives, but via ten community liaison managers who are not compensated based on sales but whose job is to interact with AIDS/HIV patients and increase their awareness about the disease and what they can do to improve their lives.

Based on the proactive stakeholder philosophy, TT managers—especially those that are charged with contacting and involving the AIDS activist community and other concerned stakeholders—are constantly endeavoring to bring together international, national, and local stakeholders. They are continuously returning to their key community stakeholders to keep them informed of healthcare reforms and changes in government policy. These efforts, in return, earn them useful feedback and trust of the community. Their main goal is to align the concerns of the activists with those of the company and other national and international governmental stakeholders.

To achieve the stated goals, TT has established a Department of Global Access and Partnering in Europe. The main purpose this department is to engage external stakeholders and inform J&J management of the views of the groups involved. As one senior manager in this office stated, "80 percent of my time, [is devoted to] outward looking...[to f]rankly using my relationships to understand what the concerns are, and then trying to apply those to the counsel and advice I give [to] senior management on where we go with issues, on how we make decisions." Also, an Advisory Board elicits opinions from a broad array of external stakeholders like very high-level prescribers, key opinion leaders, community physicians, high-level doctors, nurse practitioners, and a representative sampling of patients. The information thus collected from the practitioner group and patients is discussed and compared with the AIDS advocacy groups to assess if TT's conclusions match those of the advocacy groups that represent customers (patients).

The main purpose of all of the above is to bridge the gap between stakeholder requirements and company needs. However, essentially, this is a long and tedious process of building consensus over issues of mutual concern. According to one TT manager, "I think it is important to understand that 'consensus' does not mean that everybody agrees." He further explained that whenever there is disagreement on a major issue, TT always refers to the J&J Credo-based values that not only gives a priority list of stakeholders but also stresses developing a consensus.

At this point it must be noted that all of the interviewed managers resonated similar views. However, one manager at TT, with more than twenty years of national and international experience in the field of AIDS activism before joining TT, opined that J&J/TT has done a good job at managing its stakeholders but it needs to learn to be more aggressive in a very competitive and confrontational industry. According to this manager, "we don't not have the history, we don't have the bruises, of some of the other companies ... I think those bruises are important, because they demand a level of external engagement and flexibility in policy thinking that J&J, being a very consensus-driven company, may find hard to adapt to."

The above is impressive, but the most pertinent and corroborating evidence comes from the interviews conducted with an important TT stakeholder that was part of the dialogue process during drug development, i.e., AIDS Treatment Activists Coalition (ATAC) (an independent coalition of more than twenty AIDS activists groups), and the ATAC Pharma Report Card (2009).

One ATAC official described TT's proactive strategy in these words,

"The company (TT) proactively called together members of the activist community in both the United States and Europe at an early stage in the [drug] development process... They did not give in to everything that the [activist] community asked for, but ... they did a pretty good job of explaining why they [chose] not to accept, or incorporate [our requests] ... [and] that is important."

Further evidence of satisfied stakeholders comes from an ATAC Report Card. The ATAC report assesses companies on various parameters, for example, fair marketing practices, following FDA non-mandatory guidelines and warnings, cooperating with community requests for price setting, and including women and African Americans in their trials. TT, in this report,

earned an overall 'B,' the highest grade given to any company. As one ATAC official commented,

"I think that... even members [who] probably had some of the most adversarial feelings towards the industry, all of us, would have to agree that, on average, Tibotec gave us more of what we were asking for, than probably any [of the] other companies."

An important question could be that why exactly did TT not earn an 'A'? Unfortunately, there is no direct evidence reported that answers this puzzling question directly, so an explanation comes from employing deductive methods. First, as per ATAC's Report Card, TT and Merck in relative industry terms are leading the industry. Secondly, on the Report Card in all the categories, TT only received positive remarks with no criticisms and suggestions to improve any practice. Whereas, most other companies did receive negative comments in several categories. Thirdly, both interviewees from ATAC categorically placed TT in the highest rank based on its proactive approach to involve all stakeholders. Finally, as admitted by the respondents, the report lacks well thought out objective measures for the assessment categories, which might have resulted in the subjective evaluation of the companies, with an underlying approach that no company should get an 'A,' which could diminish the possibilities of any future improvements.

In addition to ATAC, J&J's outreach also extends to several other prominent activist groups and state and national bodies like Fair Pricing Coalition, National Alliance of State and Territorial AIDS Directors (NASTAD), and the AIDS Institute and the National Minority AIDS Council. Most importantly, if needed TT also reaches out to its competitors in the field. As one ATAC official explained,

"TT [set] a good example ... in Phase two of the trials ... they made their drug available to Merck ... So they allowed that drug into Merck's expanded access trial. You know, there was this collaboration, and they had data early on to show that the drugs were okay ... So that allowed them to form that kind of nice collaboration...moreover, I think that is to the credit of TT."

In essence, TT provides an excellent example of how J&J broke into a market in which J&J did not have the benefit of existing goodwill and reputation. TT proactively pursued the advice of important stakeholders, including its competitors, before launching its product. It involved NGOs and activists as permanent partners. In short, it is fair to conclude that TT's main

strategy is to create the best product by uniquely involving diverse stakeholders at different levels.

Conclusion

This paper has added to the much needed descriptive work on stakeholder management by attempting to improve understanding of proactive stakeholder management. The paper has established some basic features and strategies of stakeholder firms as illustrated in Table 3. The study argues that conceptually there is a need to differentiate between stakeholder and nonstakeholder firms. It further argues that based on the normative nature of stakeholder theory, only proactive firms should be considered as stakeholder organizations. The study finds that stakeholder/proactive firms support a specific philosophy that considers a broader range of stakeholders with intrinsic value. Based on this philosophy proactive firms develop values, structures, and institutions to maintain and execute their normative stance. These organizations not only have a more comprehensive *a priori* list of stakeholders but they also constantly survey their environment to identify additional stakeholders. Once recognized, these businesses, attempt to create long-term relationships with their stakeholders based on cooperation, collaboration, transparency, and communication. Finally, these companies engage their internal and external stakeholders in meaningful dialogues to reach consensual solutions to common issues of concern.

A major deficiency of this study is that due to its qualitative methodology its results are not statistically generalizable. Furthermore, there is no comparative data to see how much proactive firms differ from companies in the other three categories. Finally, even with all methodological techniques and precaution, there is a possibility that the self-reported interview based data may have some interviewee bias. However, this study lays an adequate theoretical foundation for future work on descriptive stakeholder management. Future research directions may include comparative studies in which data is collected from all types of firms on the RADP scale. Future work may also focus on the role of trust in stakeholder management, types of and forms of stakeholder engagement, institutions and cultures of stakeholder firms, processes of stakeholder recognition by stakeholder firms, and quantitative studies to test the model for statistical generalizability.

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Table 3. Proactive Stakeholder Characteristic

J&J's Philosophical Stance	Stra	Level of Engagement	
	Interal Stakeholders	External Stakeholders	
J&J's philosophical stance emerges from its Credo that was created in the early 1940s. The Credo sets out four main stakeholders in the following order: Customers, employees, Community, and Shareholders. The essential component of J&J philosophy is that J&J can serve shareholders better by serving all other stakeholders. The Credo, in essence, sets the parameters that are manifested in J&J's culture, and institutions. J&J sees itself as a component of the society in which it can do well by having collaborative relations with its many stakeholders.	Employees are the internal stakeholders. They are considered as valued resources. They have work autonomy and J&J has structures and procedures to involve employees in organizational and departmental decision- making. Employee engagement department elicits views and opinions of the employees. It also conducts Credo surveys and Credo Challenges to give employees an opportunity to assess J&J's performance and use the results as a tool to improve management. Finally, at departmental levels employees have autonomy in their particular work spheres.	J&J surveys its environment and recognizes and reaches out to potential stakeholders. Once identified J&J makes efforts to involve these stakeholders in its decision- making process individually or in larger gatherings in which all stakeholders are present. J&J and its studied subsidiary attempt to maintain long-term, mutually supportive, and collaborative relations with their stakeholders and try to reach consensus on shared issues. J&J also tries to maintain transparency in its stakeholder relationships.	J&J practices a very high level of enaggement with its stakeholders. The company believes in creating common forums with stakeholders. It also creates opportunities of dialogue with its stakeholders. These dialogues represent exchange of views and envisage that stakeholders are involved in the process of organizational decision-making. These dialogues with organizational stakeholders are based on transparency and sharing of information. The aim is to achieve consensus in decions.

Reference

Ackoff, R. (1974). Redesigning the Future. New York: John Wiley & Sons.

Allen, T. Freeman, D. Russell, J. Reizenstein, R. & Rentz, J. (2010). Survivor Reactions to Organizational Downsizing: Does Time Ease the Pain? *Journal of Occupational and Organizational Psychology*, 74(2).

Author (2017)

Berman, S., Wicks, A. & Jones, T. (1999). Does Stakeholder Orientation Matter? The Relationship between Stakeholder Management Models and Firm Financial Performance. *Academy of Management Journal*, 42(5), 488-506.

Carroll, A. B. (1991). The Pyramid of Corporate Social Responsibility: Towards the Moral Management of Organizational Stakeholders. *Business Horizons*, July-August.

Carroll, A. B. (1979). A Three Dimensional Conceptual Model of Corporate Performance. *Academy of Management Review*, 4(4), 497-505.

Charmaz, K. (2007). *Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis*. Los Angeles, CA: Sage Publications.

Clarkson, M. B. E. (1995). A Stakeholder Framework for Analyzing and Evaluating Corporate Social Performance. *Academy of Management Review*, 20(1), 92-117.

Desai, V. (2017). Collaborative Stakeholder Engagement: An Integration between Theories of Organizational Legitimacy and Learning. *Academy of Management Journal*, doi: 10.5465/amj.2016.0315.

Fassin, Y. (2012). Stakeholder Management, Reciprocity and Stakeholder Responsibility. *Journal of Business Ethics*, 109, 83-96.

Fassin, Y. De Colle, S. & Freeman, R. (2017). Intra-Stakeholder Alliances in Plant-Closing Decisions: A Stakeholder Theory Approach. *Business Ethics: A European Review*, 26(2), 97-111.

Freeman, R. (1984). *Strategic Management: A Stakeholder Approach*. Boston, MA: Pitman Publishing.

Freeman, R. Harrison, J. Wicks, A. Parmar, B. & De Colle, S. (2010). *Stakeholder Theory: The State of the Art*. Cambridge, MA: Cambridge University Press.

Gephart, R. P. (2004). Qualitative Research and the Academy of Management Journal. *Academy of Management Journa*, *l* 47(4), 454-462.

Goettsche, M. Steindl, T. & Gietl, S. (2016). Do Customers Affect the Value Relevance of Sustainability Reporting? Empirical evidence on stakeholder interdependence. *Business Strategy and the Environment*, *25*(3), 149-164.

Henisz, W. J. Dorobantu, S. & Nartey, L. (2014). Spinning Gold: The Financial Returns to Stakeholder Engagement. *Strategic Management Journal*, 35(12), 1727-1748.

Heckscher, C., Maccoby, M. Ramirez, R. & Tixier, P. (2003). Agents of Change: Crossing the Post-Industrial Divide. New York: Oxford University Press.

Henisz, W. J. Dorobantu, S. & Nartey, L. (2014). Spinning Gold: The Financial Returns to Stakeholder Engagement. *Strategic Management Journal*, 35(12), 1727-1748.

Jones, T. Felps, W. & Bigley, G. (2007). Ethical Theory and Stakeholder Related Decisions: The Role of Stakeholder Culture. *Academy of Management Review*, 32(1), 137–155.

Jones, T. & Wicks, A. (1999). Convergent Stakeholder Theory. *Academy of Management Review*, 24(2), 206-221.

Luoma, P. & Goldstein, L. (1999). Stakeholders and Corporate Boards: Institutional Influence on Board Compositions and Structure. *Academy Of Management Journal*, 42(5), 553-563.

Mason, C. & Simmons, J. (2014). Embedding Corporate Social Responsibility in Corporate Governance: A Stakeholder Systems Approach. *Journal of Business Ethics*, 119(1), 77-86.

Miles, M., & Huberman, M. (1984). *Qualitative Data Analysis: A Sourcebook of New Methods*. Sage Publications.

Mishra, A., & Spreitzer, G. (1998). Explaining How Survivors Respond to Downsizing: The Roles of Trust, Empowerment, Justice, and Work Design. *The Academy of Management Review*, 23(3), 567-588.

Ogden, S., & Watson, R. (1999). Corporate Performance and Stakeholder Management Balancing Shareholder and Customer Interest in the UK Privatized Water Industry. *Academy of Management Journal*, 42(5), 526-538.

Pajunen, K. (2006). Stakeholder Influence in Organizational Survival. *Journal of Management Studies*, 43(6), 1261-1288.

Phillips, R. (1997). Stakeholder Theory and the Principle of Fairness. *Business Ethics Quarterly*, 7(1), 51-66.

Post, J. (1978). Corporate Behavior and Social Change. Reston, VA: Reston Publishing Co.

Post, J. Preston, L. & Sachs, S. (2002). *Redefining the Corporation: Stakeholder Management and Organizational Wealth.* Stanford, CA: Stanford University Press.

Schutt, R. (2006). *Investigating the Social World: The Process and Practice of Research* (5th *Edition*). Los Angeles, CA: Sage Publications.

Sethi, P. (1979). A Conceptual Framework for Environmental Analysis of Social Issues and Evaluation of Business Response Patterns. *Academy of Management*, 4(1), 63-74.

Strauss, A. (1990). *Qualitative Analysis for Social Scientists*. New York, NY: Cambridge University Press.

Tashman, P. & Raelin, J. (2013). Who and What Really Matters to the Firm: Moving Stakeholder Salience Beyond Managerial Perception. *Business Ethics Quarterly*, 23(4), 591-616.

Verschoor, C. (1998). A Study of the Link between a Corporation's Financial Performance and its Commitment to Ethics. *Journal of Business Ethics*, 17(13), 1509-1516.

Wartick, S. L. Cochran, P. (1985). The Evolution of Corporate Social Performance Model. *Academy of Management Review*, 10(4), 758-769.

Wood, D. J. (1991). Corporate Social Performance Revisited. *Academy of Management Review*, 16(4), 691-718.

Appendix I: Case Study Database

Organization	Summary of Case Study	Site Visits	In-depth Interviews	Importance
Johnson & Johnson	Pharmaceutical industry; a large multinational with headquarters in New Brunswick (NJ)	Seven visits to the Corporate Headquarters between the Summer of 2009 and Fall 2011	A total of 14 interviews conducted including one interview of a manager from India	One of the main case studies. J&J represents a large proactive stakeholder organization with a long history of stakeholder orientation.
Tibotec Therapeutics	A J&J subsidiary that works in the field of AIDS and Hepatitis C research and medication manufacturing	Three visits to Tibotec Titusville, NJ Office from Fall 2009 to Fall 2010	A total of 7 in- depth interviews conducted including two interviews from regional office in London	As one of the subsidiaries, TT gave us some understanding of how J&J subsidiaries act upon the precepts of J&J Credo.
Elizabeth Glaser Pediatric AIDS Foundation	A leading U.S. national non- profit organization	Not visited	One interview conducted	This organization works with some large corporations regarding their philanthropic activities. It also works with J&J and gave a stakeholder's and partner's perspective to J&J's philanthropic activities
AIDS Treatment Activists Coalition	A national coalition of AIDS activists	Not visited	Two interviews conducted	These interviews gave a stakeholder's view on J&J's/TT's involvement with potential and current stakeholders

Appendix II: List of Important Documents

Details of Documents	Organization	Information Obtained
Global Leadership Profile	Johnson & Johnson	Explains the expectations from top management. It is linked with the Credo and is one of the tools to train and assess managers
Global Survey	Johnson & Johnson	Explains the link between J&J Credo and management practices and what is measured regarding J&J performance from the employee perspective
Customer Survey	Johnson & Johnson	This document is not just a customer satisfaction survey but assesses J&J performance as a value based organization
ATAC Report Card	Aids Treatment Activist Coalition	This is the Report Card that ATAC has published to assess the performance of pharmaceutical companies in the AIDS medication field. It was useful in understanding how J&J/TT's stakeholders assess its performance.
General Johnson Speeches and Quotes	Johnson & Johnson	Gave some idea about General Johnson's thoughts about a number of issues related to management, business practices, role of organizations in community, and importance of stakeholders.
Corporate Philanthropy Flyer	Johnson & Johnson	Gave some facts about J&J national and international philanthropic activities and volume
Logic Model for Community Programs	Johnson & Johnson	This document was an example of how J&J involves local partners in their philanthropic work. This document also clarified the process through which partners are chosen and how success in such programs is assessed.

QUALITY FAILURES AND CONSEQUENCES ON GLOBAL SUPPLY CHAIN PERFORMANCE

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QUALITY FAILURES AND CONSEQUENCES ON GLOBAL SUPPLY CHAIN PERFORMANCE

Abstract: Recent quality failures have led to global supply chain disruptions and performance. Quality controls in manufacturing have been in place beginning with formal controls introduced by Shewhart, Deming, and Juran. A review of how quality control was introduced by these pioneers in quality enhancement will be discussed. This paper will review recent product failures and the quality control issues faced by the companies who produced these products and the impacts on global supply chain disruptions and performance. Exploration into the possible reasons for these failures and recommendations for remedies to these failures will be offered.

RELATION BETWEEN GLOBALIZATION AND ECONOMIC GROWTH: EVIDENCE FROM NEW GLOBALIZATION INDICES MEASURED BY DEA

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Relation between Globalization and Economic Growth: Evidence from New Globalization Indices Measure by DEA

Compared with the known technique to assess the degree of globalization as "KOF Index of Globalization", we develop a set of DEA (data envelopment analysis) models to provide new indices with the same 23 variables covering three main dimensions: economic integration, social integration, and the political integration. Two innovations are introduced. First, DEA is a non-parametric method and can integrate every aspect of each unit under consideration, which proposes another fair choice of globalization index. Second, except for integrate three dimensions, we also examine the indices in each dimension. As the results show, this paper provides new empirical evidence on the relations between globalization and the economic growth from 1970 to 2016 for 126 countries.

Keywords: Globalization; economic growth; DEA; indices

RESEARCH ON IOT-BASED SUPPLY CHAIN RISK MANAGEMENT--WITH REPRESENTATIVE CASES IN COUNTRIES

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RESEARCH ON IOT-BASED SUPPLY CHAIN RISK MANAGEMENT --WITH REPRESENTATIVE CASES IN COUNTRIES

Keywords:

Food Supply Chain, Risk Management, IoT-based Traceability System, Blockchain, Case Studies

Abstract

In this paper, establishing an IoT-based traceability system across the supply chain is most essential for implementing resilient supply chain. In this paper, we will first discuss current status and problems of food supply chain, which has been attached more and more importance in supply chain research in recent years. After this, a review and analysis of the research on traceability systems for IoT-based food supply chains will be conducted. In the latter part of the paper, we will introduce and explain the establishment of food supply chains in Thailand and China and their respective traceability systems through examples. After this, we will conduct a systematic analysis regarding the changes and effects the blockchain, which has become widely known as a result of the focus on fictitious cryptocurrency - bitcoin made on supply chains and especially, food supply chains. In the end, through a case analysis of Japan, explicit speculation and forecast will be made on how blockchain affects the development of traceability systems of IoT-based food supply chain.

REWARD SYSTEMS FOR MOTIVATING KNOWLEDGE SHARING: EFFECTS ON LEARNING IN AN ENTERPRISE SOCIAL NETWORK

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Abstract

This paper presents and studies an analytical model of an enterprise social network (ESN) applied by organizations in facilitating knowledge sharing and learning. We explore the design of different types of reward systems that motivate workers to share knowledge and the effects of such systems on individuals' learning in an ESN. This research expects to provide valuable insights for practitioners to implement appropriate reward systems to promote knowledge sharing and learning in ESNs.

Keywords: Enterprise Social Network, Knowledge Sharing, Learning, Reward

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Introduction

Companies have recently recognized social media as an effective platform that facilitates their communications with stakeholders and applied it to achieve various business objectives, such as increasing annual growth rate, improving customer relationship, expanding customer base, promoting product marketing, initiating cost control plans, enhancing public relations, and strengthening employee retention and recruiting (Nordmeyer, n.d).

As a particular type of social media, an enterprise social network (ESN) is an online platform in organizations that allows employees to form online communities and streamline connections across different functional departments in large companies. Some popular ESNs on the market include Tibbr, Jive, Yammer, SocialCast, Convo, Kaltura, Chatter, Zyncro, Socialtext, and Connections (Fee, 2013).

Among many ESNs' applications such as problem solving, idea exchange, and task management (Mäntymäki & Riemer, 2016), knowledge sharing and learning have emerged as an important purpose for organizations. The success of applying ESNs in promoting knowledge sharing and learning among individuals highly depends on many different technological, organizational, social, and individual factors (Chin et al., 2015). Although many of these factors are identified and discussed in the literature (e.g, Kwahk & Park, 2016; Oostervink et al., 2016), very few studies have explored reward systems for knowledge sharing in ESNs, which is the focus of our research. In particular, we study how to design different types of sharing rewards and the indirect effects of such rewards on individual learning in an ESN.

The rest of the paper proceeds as follows. Next section outlines our analytic model and plan for analysis. The last section concludes the paper.

Outline of Model and Analysis

We consider an ESN used by a firm to facilitate knowledge sharing and learning among *N* knowledge workers. First, the firm announces a reward for sharing knowledge. Second, workers share knowledge and learn through the ESN. Third, the firm obtains the benefits from workers' knowledge, for instance, by applying it in a joint project among individuals. Finally, sharing rewards are allocated to knowledge providers in the network based on the pre-announced reward.

The ESN is modeled as a network with nodes and arcs in which nodes represent the workers and arcs represent connections between individual workers. Considering two types of knowledge workers in the ESN: workers with either high-knowledge k^H or low-knowledge k^L , we denote *i* as the index for the *m* high-knowledge workers ($i \in I = \{1, 2, ..., m\}$), *j* as the index for the *n* low-knowledge workers ($j \in J = \{1, 2, ..., n\}$), and δ_{ij} as the connection status between worker *i* and *j*, one being connected and zero disconnected. Hence, the number of followers (low-knowledge workers) for a high-knowledge worker *i* is $\phi_i = \sum_{i \in J} \delta_{ij}$.

In the ESN, a low-knowledge worker will learn and increase her knowledge level to k^{H} if at least one of her connected high-knowledge worker shares knowledge. Extending the model by Sundaresan and Zhang (2017), we assume that a low-knowledge worker's probability of learning is given by $p(\sum_{i \in I} \delta_{ij} \gamma_i)$ in which γ_i is a binary variable, indicating if a high-knowledge worker shares knowledge ($\gamma_j = 1$) or not ($\gamma_j = 0$). We assume that $p(\cdot)$ is a concavely increasing function and $p(\cdot) = 0$, which implies that a low-knowledge worker is more likely to learn if more high-knowledge workers she follows are willing to share knowledge.

Based on the sharing reward r_i announced by the firm, a high-knowledge worker will decide if she will share her knowledge in the ESN with her followers. We define β_L and β_H as the benefit factor for a low- and high-knowledge level to the firm, respectively. So, the firm's decision problem [P] can be shown as follows,

$$[\mathbf{P}] \qquad \max_{r_i, \gamma_i} \left\{ f\left(\sum_{i \in I} \beta_H k^H + \sum_{j \in J} \left[\beta_H k^H p(\sum_{i \in I} \delta_{ij} \gamma_i) + \beta_L k^L \left(1 - p(\sum_{i \in I} \delta_{ij} \gamma_i)\right) \right] \right) - \sum_{i \in I} r_i \right\}$$
(1)

subject to, $\forall i \in I$, and $\forall j \in J$,

$$r_i - \gamma_i C_i \ge 0, \tag{2}$$

$$\gamma_i$$
 binary variables. (3)

Following upon the analytical model, we will derive the firm's solutions and discuss their implications. In particular, we plan to (1) show how the firm can design different sharing rewards through quantitatively analysis and algorithm development, (2) compare the efficacy of different types of reward systems on individuals' learning in the ESN.

Conclusion

Prior research has recognized the important role of ESNs in knowledge sharing and learning, but very few studies have fully explored the design of reward systems in ESNs. Through developing and investigating an analytically model, we attempt to address the research gap by studying the design of sharing rewards for high-knowledge workers in an ESN and the effects of such reward systems on the learning of low-knowledge workers in the network. Our research expects to provide valuable insights for practitioners to implement appropriate reward systems to promote knowledge sharing and learning in ESNs.

Reference

- Chin, C. P. Y., Evans, N., & Choo, K. K. R. (2015). Exploring factors influencing the use of enterprise social networks in multinational professional service firms. *Journal of Organizational Computing and Electronic Commerce*, 25(3), 289-315.
- Fee, J. (2013). 10 Enterprise Networks to Improve Company Communication. Available at http://mashable.com/2013/06/14/enterprise-social-networks/#IFYKpJgl9qq9
- Kwahk, K. Y., & Park, D. H. (2016). The effects of network sharing on knowledge-sharing activities and job performance in enterprise social media environments. *Computers in Human Behavior*, 55, 826-839.
- Mäntymäki, M., & Riemer, K. (2016). Enterprise social networking: A knowledge management perspective. *International Journal of Information Management*, 36(6), 1042-1052.
- Nordmeyer, B. (n.d.). The High-Level Business Impact of Social Media. Available at http://smallbusiness.chron.com/highlevel-business-impact-social-media-38816.html

- Oostervink, N., Agterberg, M., & Huysman, M. (2016). Knowledge sharing on enterprise social media: Practices to cope with institutional complexity. *Journal of Computer-Mediated Communication*, 21(2), 156-176.
- Sundaresan, S. & Zhang, Z. (2017). Incentive Policies for Facilitating Knowledge Sharing in an Enterprise Social Network. *Journal of Information Technology Theory and Application*, forthcoming.

ROLE OF INSTRUCTORS IN THE AGE OF AUGMENTED LEARNING

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ROLE OF INSTRUCTORS IN THE AGE OF AUGMENTED LEARNING

Abstract: This study is an attempt to further our understanding of how teaching methods (e.g. instructor interactions and learning environments) impact the social emotional intelligence and eventually the academic performance of students in undergraduate programs. Given that our current students are mostly millennial and post-millennials, who have been raised or will be raised in an age of augmented learning, it is important to understand what kinds of teacher-student interaction influences student's motivation and more importantly, how does the learning environment moderate the relationship between student's motivation and their social emotional intelligence which then could lead to improved academic performances. Data for this study will be collected from students in various undergraduate business courses at a private college in the United States. The research model for this study will be tested using structural equation modeling.

Keyword: student-teacher interaction, student motivation, learning environment, social emotional intelligence, student performance

SATISFACTION WITH LIFE AND HEALTH STATUS: DO COUNTRY CHARACTERISTICS MATTER?

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SATISFACTION WITH LIFE AND HEALTH STATUS: DO COUNTRY CHARACTERISTICS MATTER?

Background: Culture can be defined simply as the way of living life, and it is bounded by many facts: value systems, beliefs, norm systems, and the way of interpreting the world. Culture and ethnicity is used sometimes synonymously. However, ethnicity is a more general terms and also includes culture (Sirkka-Liisa & Azita, 2007). It is expected that these values might be important in believing the role of modern health care services and the utilization, as well as overall the value of overall life and life satisfaction. It is also believed that health status is an important aspect of quality of life, and quality of life is related in a significant way with overall life satisfaction (Yildirim *et al.*, 2013; Anand & Arora, 2009). For this reason, it might be meaningful to expect that health system characteristics depending on country characteristics might be important in increasing life satisfaction via enabling/discouraging the citizens to use more health services that are more likely to increase their health status.

Purpose: This study tries to find out the determinants of state of subjective health and satisfaction with life. This study also investigates how health system type might be important in determining state of subjective health and satisfaction level with life. It is a fact that both state of health and life satisfaction are broad concepts and are more likely to be affected by various factors including individual and country level factors. Health system might also be a country level factor due to its close relationship between having better health status and higher level of life satisfaction.

Data: World Values Survey (WVS) is the data source used for study purposes. WVS collects data on different aspects varying from cultural diversity to aging for years in many countries. The variables that were thought to be significant to state of subjective health and satisfaction with life were selected from this data.

Material and Method: Turkey, China, Germany, Sweden, USA, and South Africa are the countries selected to see how cultural diversity and health system characteristics are significant in determining state of health and life satisfaction. The data on 12840 individual in six different countries were analyzed by using descriptive statistics and regression analysis to reach study purpose. Separate regression analyses investigating significant determinants of state of subjective health and life satisfaction were run for each selected country as well as all whole data coming from all countries.

Findings: The results showed that country characteristics might be an important factor in determining both state of health and satisfaction with life. Descriptive statistics revealed that South Africa was the country whose citizens had better subjective health status while China was found to be the country whose citizens rated their subjective health as the worse. The results of regression analysis also supported this

finding. Compared to those living in South Africa, those who were living in China, Germany, Sweden, Turkey, and USA were more likely to rate their subjective health status worse. According to the results of regression analysis on the state of subjective health, increasing satisfaction with household financial status, seeing himself/herself at relatively higher social class, being at relatively upper level of income, and increasing education level were found to be statistically significant variables for better subjective health status. In addition, increasing age was the significant variable for lower level subjective health status. Compared to full time workers, those who were retired, student, unemployed, and others were more likely to rate their subjective health status worse. However, it is interesting to see that those who were living in other countries rather than in South Africa were more likely to be satisfied with their life. As expected, increasing satisfaction with household financial status, seeing himself/herself at relatively higher social class, being at relatively upper level of income, and increasing education level were found to be statistically significant variables for increasing satisfaction with life. Single respondents stated that they had relatively lower level satisfaction with their lives compared to married respondents. Employment status also was found to be a significant factor for life satisfaction, and those who were housewife and student were more likely to be satisfied with their life while those were unemployed were more likely to be dissatisfied with their life compared to those full time worker respondents. The results also showed that having better health status was also statistically significant factor increasing satisfaction with their life in all selected countries. Separate regression analyses run for each selected country to see the effect of country level characteristics showed that cultural diversity might not be very important factor changing significant determinants of state of subjective health and satisfaction with life even if there were some differences in the effects of selected variables. Increasing satisfaction with household financial status and having better subjective health status were the statistically significant variables for satisfaction with life in all selected countries. It is interesting to find that increasing number of children was a significant factor for having higher life satisfaction in Germany while increasing age was found to be a significant factor for higher life satisfaction in China. Being at relatively upper level social class was a factor increasing life satisfaction in Germany and South Africa. Unemployment decreased the level of life satisfaction in a significant way in Turkey and Germany. The results of regression analyses run for state of subjective health at country level showed that decreasing level of satisfaction with household financial status and increasing age were found to be significant factors for lower level of state of subjective health status in all selected countries. The interesting finding was that having worse income status was related with worse health status in a significant way in a rich country like Germany. This variable was insignificant for state of subjective health in all other selected countries. It is also interesting to find that divorced respondents were more likely to state lower level health status in China, and the effect of marital status on state of

subjective health was not significant in other selected countries. The results also revealed that those who were not full time worker tended to rate their state of subjective health worse.

Conclusion: The findings on the effects of increasing age, marital status, and social class indicates that cultural diversity and country level characteristics might be important in determining state of subjective health status and satisfaction level with life. However, the findings of satisfaction level with household financial status and employment status recommend that being relatively wealthier might play more important role for better health status and satisfaction with life rather than cultural diversity.

REFERENCES

- Anand, M., & Arora, D. (2009). Burnout, life satisfaction and quality of life among executives of multi national companies. *Journal of the Indian Academy of applied Psychology*, *35*(1), 159-164.
- Sirkka-Liisa, E. R. N., & Azita, E. R. N. T. (2007). Cultural diversity in health care. *Scandinavian Journal* of Caring Sciences, 21(4), 417-418.
- Yildirim, Y., Kilic, S. P., & Akyol, A. D. (2013). Relationship between life satisfaction and quality of life in Turkish nursing school students. *Nursing & health sciences*, 15(4), 415-422.

SCALE FOR THE ASSESSMENT OF PERCEIVED PRODUCT ATTRIBUTE IMPORTANCE LEVELS

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"SCALE FOR THE ASSESSMENT OF PERCEIVED PRODUCT ATTRIBUTE IMPORTANCE LEVELS" ABSTRACT

One of the recent trends regarding ways of differentiating and improving existing products has been adding attributes/features to the base products. It has become a common route followed by product designers to offer all-in-one products (e.g. smart phones) that enclose multiple functions to cover diverse needs of consumers. However, whether all of the added attributes are equally and/or additively contribute to the overall evaluation of the base products has been an undeveloped research topic. Although investigating the *attribute importance* construct offers an explicatory role in the consumer behavior domain, specific efforts for its conceptualization, measurement and evaluation have been left immature in the past literature. Consequently, the main goal of this paper is to fill this gap by clearly defining the attribute importance construct and provide a reliable scale for its effective measurement. Our initial theory from which our original measurement model emerged was that the attribute importance construct is formed by 4 sub-dimensions which are need, value, interest and appeal. Our initial scale, including 94 items in total, was administered to a sample of 88 undergraduate students. In order to analyze specifics of our scale, an exploratory factor analysis and a confirmatory factor analysis were applied. Due to our analysis, our purified measurement model was consisted of 2 sub-dimension constructed by value and appeal. We expect that, by making use of this scale, researchers would take into account the potential importance differences between product attributes and their different levels of contributions to overall evaluations of specialized or all-in-one products.

Keywords: Scale development, Product attributes.

SEA CHANGE AT THE FASB: FROM A UNIVERSAL TO A STAKEHOLDER-ORIENTED APPROACH

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ABSTRACT

Sea Change at the FASB: From a Universal to a Stakeholder-Oriented Approach

Historically, the Financial Accounting Standards Board (FASB) have enacted accounting standards universally without sufficient consideration to the characteristics of the reporting entity. As such, standards were applied equally to public and private concerns, without regard to the size and needs of the reporting firms. We have identified a significant shift in the promulgation of recent accounting standards by the FASB, particularly after the establishment of the Private Company Council (PCC) in 2012. This paper will also review the background and history of the establishment of the PCC.

In general, many accounting standards address complex transactions that require significant compliance costs. Private companies who often have limited resources, experience enormous difficulty and significant costs in applying these standards. The PCC was established because the needs of their users of accounting standards differ from public companies. In general, there are fewer users of private companies' financial statements and these users generally have greater access to the company's management (Schofield, 2014). It is estimated that there are approximately 14,000 publicly traded companies that are regulated by the SEC and over 28 million private companies that require accounting services in preparing tax returns or securing loans from financial institutions (Buchholz, 2014).

Private companies have been critical of the standards promulgated by the FASB as primarily accommodating the needs of financial analysts representing large institutional investors, other equity and credit investors, regulators and major creditors within the banking industry (Lange, 2015). The Master Glossary of the FASB Accounting Standards Codification as amended by ASU 2013-12, does not directly define the characteristics of a private company. The Master Glossary lists various qualifying criteria for a public company, such as filing financial statements with Securities Exchange Commission, issuing debt or equity securities on an exchange, or on an over-the-counter market. Hence, a private company is any business entity other than a public company, a non-for-profit entity or an employee benefit plan (FASB 2013).

Prior to the establishment of the PCC, the Financial Accounting Foundation (FAF) conducted a round-table discussion in various regions throughout the United States regarding the specific issues concerning private companies. Various other organizations, such as the American Institute of Certified Accountants (AICPA), "the Financial Accounting Foundation (FAF), the parent organization of the Financial Accounting Standards Board (FASB), and the National Association of State Boards of Accountancy (NASBA) established a "blue-ribbon" panel (the Panel or BRP) to address how accounting standards can best meet the needs of users of U.S. private company financial statements" (FASB n.d.). The PCC was finally established in May 2012 by the FAF in order to address the impact future accounting standards have on private companies. In addition, the FASB would address any existing accounting standards that may require modification and even exceptions regarding its application for private companies.

One of the main responsibilities of the PCC is to serve in an advisory role to the FASB regarding the impact of both new and existing accounting standards have on private companies.

All modifications and proposed exceptions to accounting standards issued by the FASB requires a two-thirds vote by the members of the PCC. The FAF has a designated member that acts as a liaison to both the FASB and the PCC. The FASB also provides both staff and technical support in assisting the operations of the PCC. All modifications and exceptions to proposed standards must be endorsed by a simple majority of the members of the FASB (Financial Accounting Foundation Board of Trustees, 2012).

Research Design

Our research question for this study is: Is there a significant change in simplifying accounting standards by the Financial Accounting Standards Board since the establishment of the Private Company Council?

To answer this question, we examine the following hypotheses:

H1₀: There is no significant change in simplifying accounting standards by the Financial Accounting Standards Board since the establishment of the Private Company Council.

H1_A: There is a significant change in simplifying accounting standards by the Financial Accounting Standards Board since the establishment of the Private Company Council.

In order to test our hypotheses, we will analyze all the accounting standards issued by the FASB from 2007 to 2017 (five years before and five years after the establishment of the PCC in 2012) to determine how many standards are simplified. We are currently in the process of ascertaining the optimum method to operationalize these qualitative variables.

REFERENCES

- Buchholz, A. K., & Pilato, B. (2014). The private company council financial reporting standard setting for private companies. *Review of Business*, *35*(1), 35.
- Cosper, S., Groskopf, T., Daniel Noll, D., and Bielstein, M. (*July 2013*). GAAP For Private Companies: Debating Alternatives for Small and Medium-Sized Entities. CPA Journal., *Vol. 83 Issue 7, p42-45*.

Financial Accounting Standards Board. (n.d.). "History of Establishing the PCC," *Financial Accounting Standards*, Norwalk, CT. Available at: http://www.fasb.org/jsp/FASB/Page/SectionPage&cid=1351027243391

Financial Accounting Standards Board. (2001). "Business Combinations," *Financial Accounting Standards Board*, No. 141. FASB, Norwalk, CT.

Financial Accounting Standards Board. (2013). "Definition of a Public Entity: An Addition to the Master Glossary," *Accounting Standards Update*, No. 2013-12. FASB, Norwalk, CT.

Financial Accounting Foundation Board of Trustees. (May 30, 2012). "Final Report: Establishment of the

Private Company," *Financial Accounting Standards*, Norwalk, CT. Available at: http://www.accountingfoundation.org/cs/ContentServer?site=Foundation&c=Document_ C&pagename=Foundation%2FDocument_C%2FFAFDocumentPage&cid=11761600667 78

- Lange, C. D., Fornaro, J. M., & Buttermilch, R. J. (2015). A new era for private company accounting standards: changes in long-standing practices for goodwill. *The CPA Journal*, (1). 28.
- Schofield, K. (2014). Accounting Alternatives Offer Potential Relief For Private Companies In 2013 Year End Reporting. *Financial Executive*, *30*(1), 20-25.

SIMULATION-BASED ANALYTICS FOR INVENTORY SYSTEMS

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Simulation-based Analytics for Inventory Systems with Unknown Input Models

ABSTRACT

We consider the simulation of an inventory system subject to demand model uncertainty. We propose an algorithm that jointly estimates the unknown demand models and service levels without making any assumptions on the form of the demand models. We illustrate the benefits of our approach in a single-product inventory system.

<u>KEYWORDS</u>: Inventory, limited data, simulation, input-model uncertainty, service-level estimation

SKILL-BASED CALL CENTER AGENT ALLOCATION OPTIMIZATION

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Abstract

In this paper, we consider a call center optimal agent allocation with each agent having multiple skills and priorities. This is an extension of an earlier paper by the authors where we developed a call center optimal agent allocation model with agents having a homogeneous set of skills and priorities. We first introduce the structure of the model, then propose an efficient decision making process for distributing incoming calls to agents. The new decision making process converts a multi-level set of "if" statements into a one dimension decision making metric which significantly increases computational efficiency. In the end, an optimization algorithm is proposed and results are discussed.

1

Keywords: Call Center, Decision Making Process, Optimal Allocation, Skill-based, Computational Efficiency

SOCIAL MEDIA DRIVEN STUDENT-CENTERED LEARNING THROUGH SOCIAL COMMERCE IN HIGHER EDUCATION

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ABSTRACT

The research discusses the usage of social media in advertising with CASMAR, our theoretical Framework for Social Commerce. In the research, we focus on how social media positively affects advertising and how it relates to social commerce, as well as, increasing an organizational branding and exposure. We examine social media advertising through CASMAR social commerce framework, and how CASMAR affects consumers and businesses in branding and customer loyalty. In Higher Education (HE) sector, prior research has indicated that social media technologies and networks such as Twitter, Facebook, Instagram, and Google Docs has the potential to enhance primary and secondary learning. We review the importance of Word-of-Mouth (WOM), and the effects of personalized interactive advertising and its usage intensity on consumers and organizations, with a distinct focus on higher education. Furthermore, we investigate how social media sites are being used for e-commerce platforms and how they are integrated into educational (learning) needs of individual consumers and organizations. The research addresses questions of how social media advertising relate to CASMAR social commerce framework; how social media affect social commerce and WOM related interactive advertising for higher learning needs; and how are social networking sites (SNSs) being used as e-commerce platforms that can be integrated into Higher Education (HE) teaching practices to emphasize student centered pedagogy and learning. Finally, we offer recommendations to researchers, practitioners and policy makers regarding the usage of social media and social commerce driven CASMAR framework for organizational growth, learning and innovation.

Key words: Social Media, Social Commerce, CASMAR, Personalized Interactive Advertising, Higher Education, Student-Centered Learning

STUDENT TEAM BASED SEMESTER LONG COMPANY FINANCIAL ANALYSIS PROJECT IN A FOUNDATIONAL FINANCE COURSE

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This paper outlines one approach for instructors of basic corporate finance courses to deliver a semester long company financial analysis project. The majority of students who are enrolled in a foundational finance course are not finance majors but are required to complete a finance course as part of a core business curriculum. As an instructor, I found it challenging to keep them engaged in the course material. Over time I have developed a framework that promotes interest, teamwork, competition, while applying the basics of corporate financial analysis. This step by step approach breaks down a semester long project into eight straightforward parts. In my experience, the outcomes are improved accuracy and quality of the analysis, student engagement, peer involvement, an overall more positive experience for the students and myself.

SUPPLY CHAIN - MARKETING SHARK TANK EXPERIENTIAL LAB GAME IN INTERDISCIPLINARY BUSINESS EDUCATION

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'Supply Chain – Marketing Shark Tank' Experiential Lab Game in Interdisciplinary Business Education

ABSTRACT

Our business education system has been facing major challenges in matching its outcomes to the needs of industry, market, and society. In order to survive in the current business world, companies are competing for highly qualified manpower with knowledge in interdisciplinary business areas. However, the students in business colleges become 'experts' in individual areas of their 'major' business disciplines but experience difficulties working in interdisciplinary environments which requires varied skill sets. From a business perspective, there is a huge evidence of interactions between interdisciplinary areas of Supply Chain Management and Marketing. Strategic experiential gaming is an answer to teaching interdisciplinary areas of business and creating elaborate solutions for the issues of both individual behavioral control and collaborative strategy techniques. From the past examples of experiential and strategic games, the effectiveness of experiential games has only been measured qualitatively and their purview is only restricted to one area of business. The quantitative evidence of measuring effectiveness of experiential games is not found in the literature. In order to close these existent gaps in literature and strengthen the interdisciplinary business education, we introduced the Supply Chain – Marketing (SC-Mark) Shark Tank experiential lab game for our 161 undergraduate students in the 'Advertising and Promotion Management' course at a business school of a Historically Black College and University (HBCU) over two semesters; and measured its effectiveness both qualitatively and quantitatively. The SC-Mark Shark Tank experiential lab game is a real-life business environment simulation exploring complexities in the advertising and marketing supply chains. This experiential game was spread over two weeks. The qualitative analysis of the game feedback provided by students saw the emergence of Center for Occupational Research and Development's

(CORD) "applied, understanding, enactive, and cooperative" teaching styles of instructors involved in SC-Mark experiential lab game. We used structural equation modeling using LISREL to analyze the data collected over a two semester period after the completion of each game. The analysis provides statistical (quantitative) evidence that the emerged teaching styles have a positive effect on the teaching effectiveness. The other significant finding from statistical evidence suggests that learning styles of the learners (students) may not have any positive effect on the measured teaching effectiveness; while teaching styles elaborated through the SC-Mark game has a positive significant effect on teaching effectiveness of instructors.

In this article, we provide educators in business schools with a new interdisciplinary experiential lab game - Supply Chain – Marketing (SC-Mark) Shark Tank lab game, which can be implemented in both SCM and Marketing courses, thereby contributing positively to business education and real-life industry scenarios focused on exchanges between interdisciplinary areas of business.

Second, the outcome of this experiential lab game helps business students appreciate and understand the cross-functional nature of advertising and supply chain in the real business world and helps them develop a holistic mindset rather than a functional thinking of the corporate world. Third, our research provides statistical evidence that interdisciplinary and practitioner-oriented teaching styles may have a positive effect on the teaching effectiveness of educators which may ultimately lead to better academic performance by students in business schools and subsequently in their professional careers.

References

Available on Request

SUPPLY CHAIN NETWORK COMPETITION AMONG BLOOD SERVICE ORGANIZATIONS: A GENERALIZED NASH EQUILIBRIUM FRAMEWORK

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SUPPLY CHAIN NETWORK COMPETITION AMONG BLOOD SERVICE ORGANIZATIONS: A GENERALIZED NASH EQUILIBRIUM FRAMEWORK

Abstract

In this paper we present a Generalized Nash Equilibrium model of supply chain network competition among blood service organizations which compete not only for blood donors but also for business from hospitals and medical centers. The model incorporates not only link capacities and associated arc multipliers to capture perishability, but also bounds on the number of donors in regions as well as lower and upper bounds on the demands at the demand points in order to ensure needed amounts for surgeries, treatments, etc., while reducing wastage. The concept of a variational equilibrium is utilized to transform the problem into a variational inequality problem, and alternative formulations are given. A Lagrange analysis yields economic insights. The proposed algorithmic procedure is then applied to a series of numerical examples in order to illustrate the impacts of disruptions in the form of a reduction on the number of donors as well as that of decreases in capacities of critical links such as testing and processing on RBC prices, demands, net revenues of the blood service organizations, and their overall utilities.

Keywords: game theory, blood supply chains, supply chain competition, Generalized Nash Equilibrium, variational inequalities

SURVEY RESPONSE AND ITS RELATIONSHIP TO STUDENT RETENTION

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Jesus Montoya Salem State University Youqin Pan, Jesus Montoya Survey response and its relationship to student retention

DECISION SCIENCES INSTITUTE

Survey response and its relationship to student retention using data mining approach

ABSTRACT

This paper intends to investigate the relationship between student response and student retention among first -year college students. This study looks at the connections between survey response and college student characteristics. It also investigates whether survey response helps predict student retention.

Introduction

Student retention has been one of the top priorities for college administrators as colleges face increasing pressure from federal and state governments and accrediting agencies to demonstrate effective outcomes (such as student success). More importantly, colleges with high attrition rates have to deal with the substantial loss of tuition, fees, and potential alumni contributions (Deberard, Spielmans, & Julka, 2004). Survey research is widely used to examine college students in order to better understand what they think, what they perceive, and who they are. However, most surveys are subject to potential nonresponse error since there is only a subset of students who complete each survey. Student surveys suffer from increasing level of nonresponse. Low response rates not only reduce a study's statistical power because of small sample size, but also lessen its face validity (Rogelberg, 2006). This study fills the void by investigating both responders and non-responders. In this paper, we use MAP-Works survey data to perform the analysis. The findings will provide insights to policy making and program evaluation.

KEYWORDS:

Data Mining, Decision Trees, Student Retention, Survey Response, Higher Education

TEACHING BEHAVIORAL ASPECTS OF WAITING LINE MANAGEMENT

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Abstract:

Waiting line management is a central topic of nearly all introductory courses on operations management or service management. Typically textbooks place an emphasis on the application of quantitative queueing models for the determination of average waiting time and other aspects of waiting line performance. Behavioral approaches to waiting line management, however, merit equal attention and are readily appreciated by students. As set forth by Maister (1985) and other researchers, the customer's perception of the waiting line experience can be influenced by multiple factors besides the actual waiting time. This teaching brief reviews the related literature, and more importantly, introduces pedagogical resources for teaching behavioral aspects of waiting line management. These resources include a discussion exercise, as well as several popular movie scenes that can be used to inject humor and effectively illustrate the concepts and the application of behavioral approaches for managing the waiting line experience.

Keywords:

pedagogy; service operations; waiting line management; customer experience

TEACHING FINANCIAL LITERACY USING EMBODIED COGNITION AND SENSORY MARKETING

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Abstract

This paper describes and implements an innovative model for teaching financial literacy (FL). The model creates metaphors for various FL topics using popular music videos. The model is based upon the theory of embodied or grounded cognition which argues that all aspects of cognition, including decision making, are shaped by aspects of the body. Our model can also be considered a form of sensory marketing, which is also based upon embodied cognition, theories of neuroscience and the cognitive significance of metaphors. The model will be implemented and evaluated at a later time.

THE CLUSTER ANALYSIS APPROACH OF STRESS-FACTORS OF JAPANESE SOJOURNERS ELL AND THEIR PARENTS IN THE AMERICAN SCHOOL SYSTEM

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ABSTRACT

Sojourners stay is temporary residents, and their acculturation in a new country is therefore relatively stress-free and unproblematic for both the host communities and sojourners. However, there are many Japanese sojourners English Language Learners (ELLs) and their families who are struggling to adjust to U.S. schools and culture. Although the most critical issue is language, there are many other factors that preclude their adjustment.

The study aims to assess whether specific factors are associated with consistency in adjusting American life of ELLs and their parents. Supporting Japanese parents is necessary to support their ELL children. Although substantial studies have carried out on this theme and succeeded in detecting the cause of their stress factors, more suggestions are needed to support their adjustment. Consequently, this study's goal is to identify the factors that impacted on their adjustment in the U.S. Several studies indicated that multiple factors are related to their difficulties: their length of stay in the U.S., academic history, English proficiency levels, their occupation, family members, social status, family budget, the age of their ELL children, number of people they know, connection with local society, the frequency of volunteer work in American schools and their motivation when they arrive to the U.S. To clarify the relationship between the above listed factors and their stress or satisfaction level, we use cluster analysis. First, we will classify categorize several groups based on their adjustment levels. Using the cluster analysis, the biggest factors related to their adjustment will be also detected in each group. Second, the ELLs and their parents' stress factors are individually surveyed, and the relationship between them are analyzed. These factors seem to be tangled with each other and complicate the issues further. Reducing the cause of stress will be helpful to consider the practical solution for Japanese parents.

Keywords: Sojourners, adjustment, ELL (English Language Learners), stress, ICAPS (Intercultural Adjustment Potential Scale).

THE COGNITIVE ORIENTATION OF TOP MANAGERS INFLUENCES ADVERTISING SPENDING DECISION

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Title: The Cognitive Orientation of Top Managers Influences Advertising Spending Decision

Abstract: Long-termism is a newly emerging but age-old agenda in academia and practice alike. Security analysts, and corporate elites' behaviors with regard to the topic were intensively scrutinized in economics and sociology. However, previous efforts to understand their behaviors were focused on the external forces, neglecting the internal psychological forces. Grounded in construal level theory, I explore the less explored psychological factor behind the corporate short-termism (Barton and Wiseman, 2015). I propose that the top managers' cognitive orientations - whether they are abstract or concrete thinkers (Liberman, Sagristano, and Trope, 2002) - will influence the focal business enterprises' long-horizon advertising investment decisions. To measure top managers' cognitive orientation, we used 'management discussion and analysis (MD&A)' section of annual reports since they significantly reflect top management's attention (Park and Abrahamson, 1994) because they seek to persuade to multiple stakeholders on the legitimacy of results in operations and current or changing business strategies. The preliminary results of U.S. publicly-held companies in 2006-2010 show support. The top managers with abstract thinking style are more likely to invest in advertising spending. On the contrary, the top managers with concrete thinking style are less likely to pursue changes in advertising investment. This study contribute to provide a different lens to the cause of long-standing ill of modern capitalism, that is 'managerial myopia', although it is in a very preliminary stage.

References:

Abrahamson, E. and C. Park. (1994). Concealment of negative organizational outcomes: An agency theory perspective. *The Academy of Management Journal*, 37(5): 1302-1334.

Barton, D. and M. Wiseman. 2015 Perspectives on the long term. The McKinsey Quarterly.

Liberman, N., Sagristano, M., & Trope, Y. 2002. The effect of temporal distance on level of mental construal. *Journal of Experimental Social Psychology*, 38, 523-535.

THE IMPACT OF CRYPTOKITTIES ON THE ETHEREUM BLOCKCHAIN

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THE IMPACT OF CRYPTOKITTIES ON THE ETHEREUM BLOCKCHAIN

Keywords: Blockchain, Ethereum, Ether, Cryptokitties, Cryptocurrencies

Abstract

Advertised as one of the first virtual games based on blockchain technology, Cryptokitties (<u>www.cryptokitties.co</u>) launched on November 28th, 2017 and saw rapid adoption. This online game allows players to buy, breed, and sell unique virtual cats using the Ether digital currency. Ether is currently the number 2 cybercurrency based on market capitalization, second only to Bitcoin, with a value of over \$70B as of 12/31/2017. Based on the Ethereum blockchain technology, Ether is the only supported currency in this game. However, unlike Bitcoin, the Ethereum blockchain allows for smart contracts, or the ability to embed additional information along with the transaction. This allows ownership of these virtual cats to be transferred using the Ethereum blockchain.

This late-breaking research takes a look at the impact that Cryptokitties has had on the Ethereum blockchain. Shortly after the release of Cryptokitties, the backlog on the Ethereum blockchain grew significantly and Cryptokitties has been blamed for a slowdown in the blockchain. The open ledger aspect of the Ethereum blockchain allows us to examine each transaction, which in turn allows us to examine the impact that the Cryptokitties virtual game has had on the Ethereum blockchain. Using network analysis tools, we are able to show the participation in the Cryptokitties game and examine whether the game has brought new participants into the Ethereum community. We further explore whether virtual games, such as Cryptokitties, could serve as an educational platform by which students can learn about the blockchain technology.

THE IMPACT OF THIRD PARTY RESTAURANT DELIVERY PENETRATION ON THE QUICK SERVICE PIZZA INDUSTRY

Robert Goch Molloy College

THE IMPACT OF THIRD PARTY RESTAURANT DELIVERY PENETRATION ON THE QUICK SERVICE PIZZA INDUSTRY

Key Words: QSR Delivery

The fast food, or quick service restaurant (QSR) industry is defined as a specific kind of restaurant or restaurant chain that serves food that can be prepared in minimal time with limited (if any) table service. Within the QSR segments is a sub-sector of national multiunit national pizza chains, including Domino's, Pizza Hut and Papa John's. I will refer to these chains as quick service pizza or (QSP). Both QSR and QSP share many characteristics, including similar average checks (price points of approximately \$5-\$7 per person), target demographics (including age, income and gender) and speed of service. What separates the two is meal delivery capability. In general, QSR meals are not deliverable. If a customer wants a QSR meal, they need to drive to the restaurant. This contrasts with QSP, which has a very high delivery penetration (deliver sales as a percentage of total sales). With the advent of third party delivery (TPD) providers, such as Grub Hub/Seamless, Uber Eats, Door Dash, etc., the competitive landscape is rapidly changing. This may adversely affect QSP sales as there is significant customer overlap between QSR customers and QSP customers.

Third party restaurant delivery (TPRD) providers are service companies that deliver on behalf of restaurants. While the providers have been around since 2010, they only recently have entered into formal arrangements with QSR concepts, including Wendy, McDonald's, Jack in the Box, etc. If successful, and if the TPRD providers can make meaningful penetration into the QSR space, QSP sales may suffer.

The purpose of this research is fourfold. First, I will address the likelihood of TRPD providers making significant inroads into the QSR space. Second, through survey data, I will assess the impact of such a development on the QSP sector concept regarding lost customers. Third, I will translate the lost customer impact to lost delivery sales and market share within the QSP space. Fourth, I will analyze the financial impact on one of the biggest QSP players, namely, Domino's Pizza (DPZ).

RESEARCH DESIGN

I. TRPD PROVIDER PENETRATION TO THE QSR SPACE

I will do research review of academic publications and trade magazines. In addition, I will review SEC filings and conduct phone interviews with representatives of both the QSR industry and TPRD providers to access the prospects of successful TRPD penetration into the QSR space.

II. POTENTAIL LOSS OF QSP DELIVERY CUSTOMERS TO OTHER QSR CONCEPTS

I will conduct a demographic sensitive survey to assess the likelihood of a QSP delivery customer choosing delivery from an alternative QSR concept should QSR delivery become available. The survey questionnaire will be distributed via Survey Monkey.

III. ASSESS THE LOST MARKET SHARE AND SALES IMPACT ON THE QSP CONCEPT

This paper will attempt to estimate the potential sales and market share decline resulting from the aforementioned loss in QSP customers

IV. ASSESS THE FINANCIAL IMPACT ON DOMINO'S PIZZA (TICKER: DPZ)

I chose to analyze the QSR delivery penetration impact on Domino's because it us the second largest QSP player and has the greatest delivery penetration.

THE IMPORTANCE OF WORKPLACE PREDICTABILITY FOR WORK-FAMILY BALANCE

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THE IMPORTANCE OF WORKPLACE PREDICTABILITY FOR WORK-FAMILY BALANCE

Keywords: work-family balance, workplace predictability, work-family conflict

Abstract:

According to a recent study, there are about 43.5 million individuals in the United States providing unpaid care to at least one adult or child (National Alliance for Caregiving and AARP, 2015). Based on studies that have been conducted for several decades (e.g., Gozukara & Colakoglu, 2016; Madsen, Camerson, & Miller, 2005; Frone, Russel, & Cooper, 1992), it is well documented that employees with caregiving responsibilities often experience work family conflict. Work-family conflict can be defined as a form of interrole conflict in which the role pressures from work and family domains are incompatible, such that compliance with one would make it more difficult or render impossible compliance with the other (Kahn, Wolfe, Quinn, Snoek, & Rosenthal, 1964).

There have been many types of solutions that companies have instituted in order to help employees better balance their work and family responsibilities, thus decreasing the work-family conflict they experience. Many of these solutions are based on providing employees with more flexibility at work. The Center on Aging & Work defines workplace flexibility as a situation in which "employees and their supervisors have some choice and control over when, where, how work gets done, and what work tasks are assumed by which employees/work teams" (Boston College, 2017). One of the more popular types of workplace flexibility is flexible scheduling in which employees can vary the hours they start and end working depending on their individual needs.

Much of the research and practice that has been done to help workers to better balance work and family has been geared to white collar salaried workers. Yet in 2016, 79.9 million workers age 16 and older in the U.S. were paid at an hourly rate which represents 58.7% of the workforce

population (U.S. Bureau of Labor, 2016). For these hourly workers, predictability at work seems to be more important than flexibility. Workplace predictability refers to giving advance notice of work schedules and minimizing changes to assigned schedules (Miller, 2017). In fact, there have been new laws addressing this issue. For example, Oregon was the first state to enact a statewide predictable scheduling law for workers in 2017.

According to dictionary.com, the definition of predictability is the "consistent repetition of a state, course of action, behavior, or the like, making it possible to know in advance what to expect." Having predictable schedules is one way to help workers better achieve work-family balance. Knowing when they are scheduled to work allows employees to better plan for caregiving duties during work hours thus decreasing work-family conflict. Additionally, we propose that looking at predictability more broadly (beyond scheduling), can lead to companies developing additional techniques that will allow both salaried and hourly workers to better balance their work and family roles. Our presentation will address these techniques and outline the benefits for both workers and organizations.

References

Boston College. (2017). The Center on Aging & Work at Boston College. https://www.bc.edu/research/agingandwork/.

Frone, M.R., Russell, M., and Cooper, M.L. (1992). Antecedents and outcomes of work family conflict: Testing a model of work family interface. *Journal of Applied Psychology*, 77, 65-78.

Gozukara, I. and Colakoglu, N. (2016). Mediating effect of work family conflict on the relationship between job autonomy and job satisfaction. *Social and Behavioral Sciences*, 229, 253-266.

Kahn, R.L., Wolfe, D.M. Quinn, R.P., Snoek, J.D., and Rosenthal, R.A. (1964). *Organizational stress: Studies in role conflict and ambiguity*. New York: Wiley.

Madsen, S.R., Camerson, J.R., and Miller, D. (2005). Work family conflict and health: A study of workplace, psychological, and behavioral correlates. *Journal of Behavioral and Applied Management*, 6(3), 225 247.

Miller, B. (2017). What is predictable scheduling? *HR Daily Advisor*, http://hrdailyadvisor.blr.com/2017/01/24/what-is-predictable-scheduling/.

National Alliance for Caregiving and AARP. (2015). Caregiving in the U.S., Caregiving Report, June.

SHRM. (2017). Oregon enacts first statewide predictable scheduling law. www.shrm.org/resourcesandtools/legal-and-compliance/state-and-local-updates/pages/oregonenacts-first-statewide-predictable-scheduling-law.aspx. U.S. Bureau of Labor Statistics. (2016). Characteristics of minimum wage workers. BLS Reports, U.S. Bureau of Labor Statistics, www.bls.gov/opub/reports/minimum-wage/2016/home.htm.

THE SENSITIVITY OF THE HUMAN DEVELOPMENT INDEX TO ASSUMPTIONS ABOUT NATIONAL INCOME

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Charles Moyer Roger Williams University

Priniti Panday Roger Williams University The Sensitivity of the Human Development Index to Assumptions about National Income

The United Nations' Human Development Index (HDI) aims to present a more robust picture of a country's "development" status than what is suggested by simply considering national income per capita. The theoretical underpinning for the HDI is economist Amartya Sen's emphasis on the importance of the capabilities of individuals and their ability to make their own choices regarding consumption baskets and more generally on how to live one's life. The HDI aggregates country-level data on life expectancy, schooling and income per capita. Necessarily, assumptions are made regarding upper and lower bounds and the re-scaling of each of the three individual components and in their aggregation into a summary measure. This paper focuses on the strength of the theoretical underpinning of the current assumptions related to income per capita in the construction of the HDI and the sensitivity of the HDI to alternative assumptions regarding income per capita.

KEYWORD: Human Development Index (HDI)

USING DATA ANALYTICS ON TAX RETURN DATA TO IDENTIFY EFFECTS OF TAX REFORM: A TEACHING CASE

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USING DATA ANALYTICS ON TAX RETURN DATA TO IDENTIFY EFFECTS OF TAX REFORM: A TEACHING CASE

ABSTRACT

This proposal outlines our teaching case for students in the income tax accounting for individuals course. The case has students use data analytics software to analyze a large dataset of fictitious, but realistic, federal income tax returns to identify possible effects of tax reform on different categories of tax filers. Students will investigate several of at least ten policy reforms, some that potentially decrease taxes on individuals and some that may increase taxes.

A motivation behind our development of this teaching case is the recent revisions to the Association to Advance Collegiate Schools of Business (AACSB) International standards for accounting accreditation calling for "learning experiences that develop skills and knowledge related to the integration of information technology in accounting and business. Included in these learning experiences is the development of skills and knowledge related to data creation, data sharing, data analytics, data mining, data reporting, and storage within and across organizations." [1]. In a review of curriculum resources available for integrating Big Data and information technology into the accounting curriculum, Sledgianowski, Gomaa, and Tan [2] found limited curriculum resources available for the taxation courses.

This teaching case addresses important and relevant issues in accounting education, and will help to fill a void in the accounting curriculum by providing teaching resources for hands-on application of data analytics in the individual taxation course. This teaching case should be of interest to all instructors looking to better integrate data analytics and other technologies into their curriculum, as well as for instructors looking to assess students' knowledge of the impact of tax reform.

THE CASE

Software and Data

The case provides methods to instructors, to provide to the students, for how they can access Tableau software. Tableau provides free software for academic use and free Internet-based training videos on their website (www.tableau.com). The videos should be viewed before attempting to analyze the dataset. The dataset is provided by the authors and is available in both an Access database and an Excel spreadsheet format. The dataset is comprised of fictitious income tax return data based on a filing year of 2016. The data sample was designed to be a true representation of the actual populations of filers, based on the latest information available from the Internal Revenue Service's filing statistics (source: https://www.irs.gov/statistics at the time of the creation of our dataset.

Scenario

S & P Prep is a national franchise of tax preparation companies with locations throughout the United States of America. As a service to its franchises, corporate headquarters is providing them with information about the possible implications of recently passed income tax policies on the franchises' client base, based on their clients' tax return filings from the previous year. The executive office of S & P Prep has tasked you with analyzing the data and preparing a report of the implications based on your knowledge of the new tax policies and your ability to use data analytics to analyze Big Data. S & P Prep uses Tableau data visualization software to analyze data and Microsoft Excel spreadsheet software to store the tax return data. S & P Prep uses Tableau because it is easy for non-technical users to analyze

large datasets and create graphical visualizations of the analysis. Your instructor will provide instructions how to access the Excel dataset of client tax returns. Requirements

Assume you are Pat Lee, the director of tax analytics at S & P Prep, and are tasked with using Tableau visualization software to analyze S & P Prep's clients' previous year's income tax return filings. Your deliverables for this assignment include:

- 1. Prepare a report with at least three insights as to how the new tax reform policies may affect S & P Prep's client base. Your report should include visual outputs of your Tableau analysis. Each insight should include one or more visualizations as evidence to support your suggestions.
- 2. Deliver a presentation to S & P Prep's management team summarizing your insights. Your presentation should include outputs from Tableau.

In your analysis, you will examine prior year income tax return data for S & P Prep's clients, with the objective to see how proposed income tax policies may affect individual taxpayers, based on demographics such as filing status, number of dependents, and state of residence. You will investigate several of at least ten policy reforms (see below), some of which will decrease taxes on individuals and some of which will increase taxes, e.g.:

- 1) Reduced tax rates on individuals.
- 2) Increased standard deduction amount.
- 3) Enhanced Child Tax Credit.
- 4) New Dependent Care Credit.
- 5) Reduced home mortgage interest deduction.
- 6) Repealed home-equity loan interest deduction.
- 7) Reduction in state and local income and property tax deductions.
- 8) Increased exemption amounts for the AMT.
- 9) Repealed deductions for personal exemptions.

10) Deduction of 20% for "qualified business income" from a partnership, S corporation, or sole proprietorship.

REFERENCES

- [1] Association to Advance Collegiate Schools of Business. AACSB Accounting Accreditation Standards <u>http://aacsb.edu/accreditation/accounting/standards/2013/</u>
- [2] Sledgianowski, D. Gomaa, M. & Tan, C. Toward integration of Big Data, technology and information systems competencies into the accounting curriculum. *Journal of Accounting Education* 2017, <u>http://dx.doi.org/10.1016/j.jaccedu.2016.12.008</u>

USING MULTIPLE METHODS TO INVESTIGATE THE CURVILINEAR RELATIONSHIP BETWEEN EXPLORATION AND FIRM PERFORMANCE

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USING MULTIPLE METHODS TO INVESTIGATE THE CURVILINEAR RELATIONSHIP BETWEEN EXPLORATION AND FIRM PERFORMANCE

Exploratory activities are essential for firms' survival and growth. In order to explore, organizations need to depart from existing knowledge and try to meet the needs of emerging customers or markets through offering new designs, creating new markets, and developing new channels of distribution. Exploration and its impacts on firm performance have been examined in various research streams including technological innovation, organizational learning, strategic management, and organizational design. However, most existing literature only examined the first order direct impact of exploration on performance and showed inconsistent results. Some studies found a positive relation between exploration and performance, some studies found a negative relation, while some other studies failed to find any significant relationship between the two. The inconsistency of existing literature suggests us to investigate the performance impact of exploration from a different perspective: a curvilinear point of view. The findings and evidence from this study will advance the research on exploration and also help organizations better allocate their resources and gain more from their exploratory effort. Two research methods are suggested in this study: survey-based research and coding from companies' annual reports.

Key words: exploration, curvilinear

WHO IS THE RIGHT CUSTOMER FOR YOUR SERVICE? A COPRODUCTION FRAMEWORK

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WHO IS THE RIGHT CUSTOMER FOR YOUR SERVICE? A COPRODUCTION FRAMEWORK

In order to have successful service coproduction, organizations should match the type of customers participating in the coproduction with the type of service characteristics and capabilities in the organization. Some services receive more uniform customers while the others receive more diverse customers. Since coproduction requires active customer participation, the organization should have systems in place to handle diverse customers. We offer a framework to guide service managers to match their service systems with the type of customers.

Keywords: Services, coproduction, framework, flexibility

WHY IS RATIONAL SUBGROUPING ESSENTIAL FOR STATISTICAL PROCESS CONTROL? AN ACTIVE LEARNING EXERCISE

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Abstract:

A critical component of Walter Shewhart's original proposal of statistical process control charting is the use of rational subgroups as the sampling method for process performance data. Despite its importance for deriving control limits that distinguish between common cause and special cause variation, rational subgrouping is an underemphasized, even overlooked, topic in most textbooks and courses on quality management. This teaching brief outlines the concept of rational subgrouping and introduces a novel, hands-on classroom exercise that illustrates the effects of sampling method on the effectiveness of control charts. With random sampling, the control chart does not detect special cause variation, whereas the use of rational subgrouping leads to easy detection of a known process change.

Keywords:

pedagogy; statistical process control; quality management

WORK-LIF BALANCE AS A MEDIATING VARIABLE ON TELECOMMUTING INTENSITY AND PERCEIVED EMPLOYEE ORGANIZATIONAL COMMITMENT – AN EMPIRICAL ANALYSIS

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ABSTRACT

Over the last three or so decades, a growing body of research has suggested that telecommuting enhances employees' organizational commitment. While the literature supports the premise that telecommuting whose time has come and in fact, is here to stay because it enhances telecommuters' ability to balance work and life, there is an overarching need to validate the role of perceived work-life balance and its mediating effect on the relationship between telecommuting intensity and perceived organizational commitment. The conceptual research model incorporated covariates (Control variables) to test their effects if any in the hypothesized outcomes. This study was specifically undertaken to empirically investigate the role of perceived work-life balance as a mediating variable in the hypothesized relationship and outcome. Data was collected from a large government agency that had implemented telecommuting on voluntary and non-voluntary basis while others were contractually required to. Using linear and hierarchical regression analyses on a sample of 1,412 telecommuting employees, the findings showed that the relationship between telecommuting intensity and work-life balance was positive. On the other hand, telecommuting intensity has a curvilinear (inverted u-shaped) relationship with perceived work-life balance meaning that the results of the regression curve fitting did not significantly predict improved work-life balance, thus not supporting the alternative hypothesis. In addition, improved work-life balance was positively related to higher levels of organizational commitment, thus hypothesis was supported. It is important to note that the failure of telecommuting intensity to predict improved work-life balance in this study is a direct departure from the literature findings.

Keywords: Telecommuting Intensity, Organizational Commitment, Mediating Effect, and Covariates, Work-life,

YOU'RE HIRED! RE-IMAGINING PROJECT TEAM FORMATION INTO A MORE REALISTIC EMPLOYMENT EXERCISE

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YOU'RE HIRED! RE-IMAGINING PROJECT TEAM FORMATION INTO A MORE REALISTIC EMPLOYMENT EXERCISE

Group project are a core component to many undergraduate business courses, however the formation of the project teams is burdensome. Random selection, student selection and faculty selection all have notable downsides in terms of implementation, outcomes and satisfaction. For years I have employed a hiring exercise for team formation in both Systems Analysis and Design and Project Management courses. The exercise requires that all classmates submit resumes which have been stripped of identifying information such as name, email and phone number. Students are asked to assume the role of hiring managers where they have to review and evaluate resumes to select team members. The rankings of who the students would like to hire for their project team is used by the instructor to form the groups.

While the evaluation of resumes is done anonymously as an out of class written exercise, there is a debriefing discussion that occurs in class prior to the announcement of project teams. Discussion centers around the skills and attributes that were most in demand for selecting team mates, the importance of soft skills and how they are gleaned from resumes and the role of resume screens vs. interviews in hiring decisions.

While incorporating student input into the formation of project teams takes more time, the benefits are great. Teams are less homogeneous (i.e. all group members are in the same fraternity) and perform at a higher level. This exercise has eliminated the complaint that team performance was a result of the team students were "stuck" with. By putting students in the role of reviewing other resumes, they become self-reflective about the way they are presenting their own skills and attributes. Students unanimously report that after this exercise they have more insight into the hiring process and have made changes to strengthen their own resume.

Adding realism to the formation of the project teams offers a number of learning opportunities. The details of the exercise, specific learning objectives, de-briefing questions and other practical concerns will be presented.

1

PAPERS

A FRAMEWORK FOR STRATEGIES IN EMPLOYEE MOTIVATION

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ABSTRACT

Employee motivation can be defined as the energy an individual worker brings to their job. In contrast, practicing employee motivation is much less simple and incorporates individual and holistic elements of work - spanning components of the individual job to the behavior of the entire organization. The researchers will address the evolving definition of employee motivation over the past century. Historical practices in employee motivation have been based on equitable pay, recognition, reinforcement and outcome-based specifications of performance. More contemporary practices include a shift toward autonomy, or project-based specifications of performance, purpose and flexibility. The authors propose a framework that outlines a shift in the employee motivation strategies. As time progresses, the breadth of strategies in employee motivation increases.

KEYWORDS: Human Resources, Organizational Behavior, Employee Motivation

INTRODUCTION: DEFINING EMPLOYEE MOTIVATION

Employee motivation can be defined as the energy an individual worker brings to their job. In contrast, practicing employee motivation is much less simple and can be addressed in even more ways (Terpstra, 1979). Through a comprehensive literature review, the researchers developed a list of commonly occurring themes or strategies in employee motivation that can be categories into five areas: individual, position, the supervisor, organization, and policies. The list of practices that correspond to *individual* strategies refer to intrinsic motivators of the individual worker. *Position* refers to the finite details of the job itself. The next motivating factor is the *supervisor* and their direct impact on the employee. The *organization* refers to influencing elements surrounding the employee. *Policies* outline rules, regulations, and practices in the workplace.

The following sections discuss the themes in employee motivation across three time periods: (1) the historical period: 1900-1979, which is considered to be the original frame for motivation research, (2) the traditional period: 1980 - 1999, which covers the and growth in the service industries, and (3) the contemporary period: 2000-present, which spans the 21st century. The discussion ensues into a summary of the practices in employee motivation over time, a discussion of challenges and opportunities of the various strategies in employee motivation, and finally, a discussion of future impact and future research.

Historical Perspectives in Employee Motivation (1900-1979)

In this time period, individual employees were motivated through the stimulation of internal drivers such as self-efficacy, self-actualization and challenging work. The most common premise for motivation was based on Maslow's theory of the hierarchy of needs (1943). Although five basic needs are introduced in this theory, the needs that pertain to the individual employee, specifically, are esteem and self-actualization (Maslow, 1943). During this time, another key theory based on the individual employee is Vroom's expectancy theory (1970) or self-efficacy. Self-efficacy can be defined as one's belief to succeed and is related to Maslow's basic need of esteem. The main premise of expectancy theory is that motivation is a function of effort and performance (Terpstra, 1979). Terpstra summarizes expectancy theory as follows: "for an individual to be motivated, he or she must believe that additional effort will result in higher performance" (p. 281). In addition, individuals are also driven by challenging work. In a

time period rooted in mass production and standardization, opportunities for improvement lie in offering challenging work opportunities to keep employees engaged and exceeding expectations (Hammerton, 1970).

Employees can also be motivated through a well-defined, yet interesting job (Herzberg, 1968) with specific goals (Locke, 1968; Locke, 1975) or targets for performance. In the days of Frederick Taylor and the boom of scientific management, and increased incorporation of assembly lines and standardized work meant a within job emphasis on small tasks allocated to workers for optimal efficiency. Throughout this time period, the simple, repetitive task focus evolved to a goal setting approach. It has also been shown that with an increased use of *specific hard goals*, increased job interest, performance and motivation can be achieved (Bryan & Locke, 1967; Herzberg, 1968). This focus on outcome based performance had a critical impact on the design of jobs and direction for supervisors (Locke, 1978).

Supervisors also play a key role in motivating employees. As discussed in the previous section, an adequately designed job is of critical importance in terms of keeping the employee motivated to do their job. Of equal importance is a supervisor or manager that is responsive, communicative, and encouraging. One of the critical ways that supervisors can impact the motivation of their direct reports is providing appropriate guidance and structure as it relates to their performance. This guidance comes in the form of assistance in goal as outcome based performance (Herzberg, 1968). Supervisors also deliver performance evaluations, and should have good communication skills and effective and delivering both positive and negative feedback. Good communication and feedback from the supervisor is shown to have a positive impact on individual employee output and motivation (Swanson, 1969). Through this time period, of growing importance is the aspect of individual employee recognition. Recognition of accomplishment is repeatedly demonstrated to have a positive impact on employee drive and motivation, as seen in total quality management philosophies (Herzberg, 1968; Swanson & Corbin, 1969).

The organization also plays a role in motivating employees, as organizations must provide a structure and community for sustaining good work practices. During this time period, most of the workforce is in large industrial organizations. This means that most of the work is structured in such a way that employees work near and with one another. Maslow's theory of the basic needs also includes those at the organizational level: belongingness, or the need to belong, and safety or job security (Maslow, 1943). Organizations can support the need to belong by supporting efforts in professional development and training, and encouraging interactive work environments through a sense of community (Homan & Borst, 1962). In addition, an organizational commitment to continuous improvement is shown to increase employee motivation by supporting strategies relating to the supervisor and individual employee (Swanson & Corbin, 1969).

Finally, a structure and community of good work practices can also be enforced through workplace policies. These workplace policies typically center around a traditional reward system and equitable pay.

Traditional Perspectives in Employee Motivation (1980 - 1999)

In an era where technology had made huge strides, such as: the personal computer industry, which really started taking off; additive manufacturing, where 3D printing was invented; stealth planes, that made aircrafts radar-resistant; the World Wide Web, or better known as the internet; and much more, jobs were being created. New and improved methods had been shaped and restructured that ranged from keeping an employee motivated by providing challenging work that focused on keeping the job interesting, to receiving recognition and feedback for the work they did. Wiley sums up the importance of motivation very well in her research, stating, "The ability to motivate subordinates is critical to every manager's job...and...a motivated workforce can make powerful contributions to the profits of a firm (1995)."

Self-efficacy and challenging work continue to dominate the themes within individual strategies. The definition of self-efficacy has evolved, and now incorporates ability, adaptability, creativity and capacity to perform (Frayne & Latham, 1987; Locke, Frederick, Lee & Bobko, 1984). This theme plays an important role in an individual's self-motivation because it brings about self-control and responsibility. When one sets personal goals for their work or performance, they will hold themselves responsible for attaining that goal which is directly correlated to self-efficacy (Gully & Phillips, 1997). Individuals with high learning goals are more likely to have high self-efficacy and also perform at a higher level (Gully & Phillips, 1997). Challenging individuals with their work and setting difficult goals motivate the employee to achieve and have a sense of self-fulfillment (Wiley, 1995). When an employee is competent and

able to learn, experiences responsibility, and cares about their work, they will be most motivated (Hackman & Oldham, 1974; Becherer, Morgan, & Lawrence, 1982).

Strategies relating to the position include variety of tasks, goals and interesting work. The position an employee holds can be broken into a variety of tasks, which constructs their daily responsibilities. When an individual is task involved, they set goals in order to master their task or to improve on their personal best (Nicholls, 1984), which relates to the above category of self-efficacy. Performance can be directly correlated to setting goals related to the variety of tasks one is allocated (Latham & Locke, 1990). Studies from Latham and Locke's goal setting theory (1984, 1990) show that more difficult goals lead to higher performance, rather than specific, easy, and vague goals. In order to retain and motivate employees, the position should keep work interesting through the changing of job tasks, or giving a variety of tasks to provide meaning to the employee's work (Wiley, 1995).

Performance, appreciation, supervision, and feedback strategies outline the supervisor area in employee motivation. An employee's belief that effort will lead to performance, performance will lead to rewards, and value will arise from the rewards or outcome of the performance (Locke & Latham, 1990) make up an outcome-based performance. According to Bandura (1982), performance can be tied to expectation through research from the Expectancy Theory, developed by Vroom in 1964. Efficacy expectancy was said to be, "how well one can execute courses of action required to deal with prospective situations (Bandura, 1982)." Once that goal is reached, there is a meaningfulness behind positive reinforcement or appreciation from the supervisor, which in turn creates motivation (Becherer, Morgan, & Lawrence, 1982). Positive reinforcement will only enhance one's belief in their performance and the feeling of being appreciated for work will go far for any employee.

Several studies have been conducted on styles of supervision and how they can satisfy and motivate their employees. A particular piece of research conducted by Paul Spector (1982) on behavior in organizations, identified that employees responded positively to two styles: participative and directive. The participative style consists of input from all employees, as to where directive style is when the supervisor sets clear objectives and rules for the employees. Another form of supervision is consultative management, which is similar to a participative style. Consultative management is defined as an active effort to consult with employees on problems, and decisions, and to share information about the results (Ginnodo, 1985). Supervisors that have no hidden agendas and keep an open door for their employees garner more input about the job. With proper supervision, employees can feel a sense of job satisfaction, which is linked to motivation.

After completion of a goal or task, employees will seek a form of feedback, whether it be positive or negative to get a sense of how they are performing. Feedback can be continuous, intermittent, or only after a task is completed depending on the supervisor. How the feedback is processed is the important detail to remember because of the recipients anticipations (Howard, 1989; Taylor, Fisher, & Ilgen, 1984). Feedback refers to the degree to which carrying out work activities results in the individual obtaining direct and clear information about the effectiveness of their performance (Becherer, Morgan, & Lawrence, 1982). Being recognized for a job well done was among the top motivators by employees according to Wiley (1995).

Employee motivation strategies pertaining to the organization are summarized by three areas: belongingness, promotion, and job security. Belongingness refers to the drive to maintain lasting, positive, and significant relationships (Baumeister & Leary, 1995). Baumerister's and Leary's study concluded that humans are motivated by a need to belong by form and maintain interpersonal attachments (1995). A feeling of satisfaction comes over individuals when they feel they are a part of something, which in turn creates less intent to leave the organization. Employees who are taught and are able to learn, through proper socialization with their supervisors will tend to stay committed to the workplace (Caldwell, Chatman, & O'Reilly, 1990). Creating a sense of happiness and community allow employees to gain a sense of expression, innovation, and pride which produce motivation (Steininger, 1994).

Research shows there is a link between proper training and promotion within organizations that deliver motivation to their employees. A promotion can provide an employee with the feeling of self-fulfillment which builds a motivated workforce (Steininger, 1994). Organizations that recruit well and maintain commitment within, will often outline the specific job duties of employees, as well as provide information on advancement opportunities (Caldwell, Chatman, & O'Reilly, 1990). This practice is considered to be a realistic job preview.

An organization with a strong culture will have strong role models to lead and emphasize strong management actions. Employers that outline their mission, vision, and values in order for their employees to understand what they are doing, why they are doing it, and where they are heading provide a sense of direction. Steininger's (1994) study suggests that job security is set

in place by organizations for employees to have a sense of control over their environment. Employee commitment comes from having vested interest in the in the organization, meaning employers provide security of employment through pension rights, vacation credits, and so on (Pfeffer & Lawler, 1980). Also, legal systems have made major strides to confine employers who fail to understand the need for job security.

Good pay and rewards are two themes that represent policy. According to Pfeffer and Lawler (1980), good pay set in place by the company's policies for the individual's job, plays a significant role in their satisfaction and motivation within the workplace. A study conducted on what motivated employees over 40 years from 1946 to 1992 by Carolyn Wiley (1995) presented that good pay played a pretty significant role in one's motivation. Although it did not always rank at the top of the most important factors of motivation, good pay did settle in the middle and even peaked in 1992 according to the research. A quote from Daniel Steininger (1994) read, "…wages help employees gain control of their world," meaning they work in order to live.

Rewards come in many different forms for individuals and are broken down into two types: extrinsic and intrinsic rewards. Extrinsic rewards can be in forms of a monetary bonus for hitting a sales quota, making employee of the month, stock options or an education subsidy for growth. These rewards are set in place to help motivate an employee to do something they are not presumed to want to do (Steininger, 1994). Intrinsic rewards are intangible and can come in forms such as social interactions and services to others that employees can thrive from (Pearce, 1983). Both forms of rewards are intended to encourage and maintain productivity.

Contemporary Perspectives in Employee Motivation (2000-present)

The 21st century introduced a variety of societal factors that impacted the workplace, including stress, false hopes, and insecurities. Computers become more integrated into the business world around the globe; the World Wide Web brought with it more and more correspondence via electronic mail; and more information was becoming readily accessible. This transitioned into the average 40 hour work week for individuals becoming more stressful having acquired more assumed responsibilities. Bringing work home was and is becoming more of the standard even today. Employees are being worked to the maximum on many occasions more frequently. Without time off being actual time off away from the workplace, more individuals are reported to experience burnout. Esteem continues to impact workplace individual motivation practices. Lazaroui states that workers look for a sense of community and acceptance within the workplace while pursuing the consent and recognition of their fellows and overseers (2015). Managers supply staff in feeling associated to the organization and its assignment through internal esteem, or the demand for self-respect, trust, accomplishment, and self-determination, and external esteem, attaining the recognition of others, gratitude, and appreciation. When managers step in and supply their staff with ways to improve their competence levels, this will impel employees, giving them opportunities for thought-provoking and relevant work, thus proving strong incentives for employees.

During this time period, a new theme in the individual strategies in employee motivation emerges: purpose. According to Seppala, studies show that people who have a sense of purpose are more focused, creative, and resilient (2016). Research has shown that even unsatisfied employees feel better about their jobs while having a greater sense of purpose when devoting time to good causes, and that workplace support programs are effective not only because people get help, but also because these same employees can give help to other organizations.

Goals are a mainstay in practices in employee motivation relating to position. Financial incentives might cause employees to set more spontaneous goals that otherwise would not be set without monetary incentives (Hokroh, 2014). Although performance management is often a source of great frustration for employees who do not clearly understand their goals or what is expected of them at work (Harter & Adkins, 2015). Great managers frequently talk with employees about their responsibilities and progress rather than waiting to save critical conversations about goal-setting for once-a-year Engaged and motivated employees are more likely to hold discussions with their managers frequently to help them set work priorities and performance goals. Recognition also plays a significant role for supervisors since extraordinary low levels of engagement in the United States workforce has recently been shown according to a recent Gallup poll indicating that 70% of employees are not engaged or actively disengaged at work (Seppala, 2016).

Outcome-based performance, feedback, promotion, and recognition, make up the supervisor. Outcome-based performance is more often than not, assumed appropriate skills and competencies that should exist within the workplace. These assumed skills consist of proper and effective communication, decision making, strategic planning, and other forms of decision

making that do not acknowledge differences such as age, color, religion, gender or sexual identities (Ramall, 2004). Eisele, Grohnert, Beausaert, & Segers discuss ways to stimulate employees such as undertaking learning and development activities (2013). These can be personal development plans, a strategic development tool used by Human Resource departments to stimulate employee formal and informal learning which in turn is assumed to improve occupational expertise-growth and performance.

Strategies pertaining to the organization are centered around promotion, job security, belongingness, organizational culture, fun, autonomy, supportive work environment, 'the little things', and training. Companies recognize promotion is a sensitive element in the career ladder. They have concluded that their system of evaluating their employees drives the promotion process but actually has a reverse effect on the employees since it increases emotional and economic pressures (McGregor & Doshi, 2015). As a result, it reduces motivation and thus performance. Because of this, many companies are moving away from performance review systems as it fosters unhealthy competition amongst employees.

Milicevic, Cvetkovski, & Tomasevic discuss the significance of *job security* and its motivating influences on employees during the global economic crisis (2014). Companies that are able to provide employees with job security will achieve long-term commitment through compensation due to the global crisis surrounding them at this point in time. However, if employees get the sense they are potentially replaceable within the organization, the company is not promoting a sense of commitment and is discouraging loyalty throughout its employees.

Belongingness is a broad theme that is generated from what is known as Corporate Social Responsibility (CSR). Skudiene & Auruskeviciene studied the CSR Concept finding that it positively impacts employee motivation within an organization. Corporate social responsibility refers to the firm's consideration of and response to, issues beyond the narrow economic, technical, and legal requirements of a firm (2009). In other words, CSR is meant when a firm has to evaluate its decisions considering the effects on the rest of society, as for every economic gain, there is also a benefit to society.

Organizational culture fosters mutual reliance and friendship among coworkers, encourages the sharing of best practices, and values collaboration and teamwork (Nohria, Groysberg & Lee, 2008). To engender a strong sense of camaraderie is to create a culture that promotes teamwork, collaboration, openness, and friendship. When employees routinely report that management cares about them and that they care about one another, there is clear evidence of a sense of teamwork, belongingness, and most importantly culture, all while successfully motivating their employees. A comparing aspect to organizational culture is having fun within your association. According to Blasingame, ensuring your organization finds ways to have fun at work generally create the most successful and happiest of employees who take their work seriously, but do not take themselves too seriously (2015).

The ability to influence decisions, also called decentralization or autonomy, improves performance through employee commitment to the organization. There appears to be a loss of motivation if the employed do not have open communication and dialogue with managers (Milicevic, Cvetkovski, & Tomasevic, 2014). As a consequence of minimal to non-existent autonomy, insecurities and discontinuities develop resulting in a collapse of organizational structure and motivation within a company.

Providing an employee with training to develop their skills works hand in hand with a supportive work environment. If an employee has high motivation for learning and development, they will notice and respond more to work environment cues encouraging participation than an employee low in motivation (Tharenou, 2001).

'*The little things*' refer to what boosts inner work life with the most important as making progress in meaningful work (Ambile & Kramer, 2011). Ambile and Kramer discovered what they call the progress principle. The progress principle states that of all the things that can boost emotions, motivation, and perceptions during a workday, the single most important is making progress in meaningful work. The events that generated the progress principle, an employee's best and worst days, and making progress in meaningful work consist of the following: minor milestones, supporting progress through catalysts (actions that support work) and nourishers (acts of interpersonal support), the progress loop (enhancement of inner work life), and using a daily progress checklist to review the current day and plan for the next day.

Under policy there are four primary strategies: benefits, good pay, equitable pay, and rewards. Vern Hicks and Orvill Adams defines an incentive as "all the rewards and punishments that providers face as a consequence of the organizations in which they work, the institution under which they operate and the specific interventions they provide," (2003). An incentive refers to one particular form of payment that is intended to achieve a specific change in the behavior of the working individual. Hicks and Adams generated a chart of the typology of

incentives, breaking out both financial and non-financial incentives and benefits that motivate employees. Financial incentives typically consist of pay, pensions, illness, health, accident, and life insurance, and travel and childcare allowance. Strategies aligning with pay can be further discussed as good pay and equitable pay. Ramlall explains fairness and *equitable pay* is the motivating factor to treat and reward employees in a fair and equitable manner regardless of age, gender, ethnicity, disability, sexual orientation, geographic location, or other similarly defined categories (2004). The non-financial incentives listed were holiday and vacation time, flexible working hours, access to/support for training and education, sabbatical leave, planned career breaks, occupational health counselling and recreational facilities; all benefits that motivate employees. Nohria, Groysberg, and Lee discuss that utilizing a *reward system* will sharply differentiate good performers from average and poor performers, giving the best people opportunities for advancement all while tying rewards clearly to performance motivating employees more often than not (2008).

Discussion

The earliest time period discussed uniformly spans the five themes, with a slight emphasis practices in employee motivation relating to the individual. Toward the most recent time period, the emphasis centers around organization-based strategies.

Based on the findings within our research of the contemporary era, it has been concluded that what used to be a 40-hour work week has slowly transitioned into longer working hours away from the office environment. This is as a result of many continually transitioning variables (themes), some of which have been alluded to in this literature review. The largest contributing factor has been the invention of the World Wide Web. This is due to the development of the digital age which has been keeping the average employee on the clock for longer amounts of time than what is considered necessary. More is expected out of employees as a result of instant gratification. Now that everything is in the "palm of our hands", no matter the ranking of employees, everyone expects a response almost immediately to satisfy this need of instant gratification. Because of this, employees and employers do not know when to stop working. They essentially never stop because the virtual world brings their work home with them when it used to be paper and books, leaving everything at the office at the end of each day. Ultimately, we must continue to motivate employees through the themes discussed within this literature

review. In a world that never stops moving, day or night, we must remember that our critical infrastructure is the backbone of the working individual.

The various themes in employee motivation have been discussed in the following order: the individual, the position, the supervisor, the (set of people in the) organization, followed the by the workplace policies. Table 1 summarizes the strategies and practices by time period. It can be seen that as time progresses, the breadth of strategies in employee motivation increases. This means that, consistent with the increasing variety of consumer needs across industries over time, the variety in the breadth of employee needs is also increasing.

This order was intentionally chosen to illustrate increasing impact of the focus of the practices in employee motivation on the organization as a whole. The individual employee has a singular impression on the organization; at the other end of this spectrum are the policies, which have a more global impact on the organization. It can also be seen that as time and the level of impact on the organization increases (moving down the diagonal in the table), the breadth of strategies in employee motivation increases. This means that current practices are grounded in strategies that stem from organization-level practices, as opposed to individual-level practices. Organizations must be more proactive in outlining a comprehensive strategy for employee motivation.

	HISTORICAL	TRADITIONAL	CONTEMPORARY
Individual	Challenging Work Self-efficacy Self-actualization	Challenging Work Self-efficacy	
	Esteem		Esteem
			Purpose
Position	Goals Interesting Work	Goals Interesting Work	Goals
			Job Description
Supervisor	Outcome-based	Outcome-based	Outcome-based
	Performance	Performance Appreciation	Performance
	Recognition		Recognition
		Feedback	Feedback
	Communication		

 Table 1. Summarizing Strategies in Employee Motivation

Organization	Training Belongingness Job Security	Promotion Belongingness Job Security	Promotion Training Belongingness Job Security Organizational Culture Fun Autonomy Supportive Work Environment The Little Things
Policy	Rewards Equitable Pay	Rewards Good Pay	Rewards Equitable Pay Good Pay Bonofits

Challenges in Employee Motivation

While it may seem to be an easy task for organizations, supervisors, and managers, motivating employees in the workplace has proven to be far more challenging. Models and theories have been developed throughout time and continue to be researched for knowledge. The challenges faced throughout the three time periods discussed in this literature range from the individual to the supervisor.

All five themes within the context can simply relate to the following question, what happens when there is no longer a drive or desire to work? This question may drive employers to re-evaluate the job duties, pay scales, the work environment, or feedback given. Challenges that supervisors need to overcome is thinking only about their wants and needs. The challenge here is what can motivate the supervisor, does not necessarily motive the employee. There are times where the supervisors act on their own without the thought of others, when in reality they need to take a step back to reassess their own motivation. Not only does this issue affect the employee, but it can also prove to be a critical challenge for the supervisor.

Rewarding individuals with monetary funds, vacations, and more can help motivate an employee, but there is also a need for the value of the work. The issue here lies within the value employees place on the impact that their work has on consumers. Providing employees with positive feedback or reviews from customers can lead to feeling valued. Positive feedback can reinforce an individual to maintain or strengthen their performance, but focusing too much on one strength or being too critical and demanding can demotivate them.

Lastly, retention can be challenging for the organization. Retaining qualified and high performing employees deals with all five themes: the individual believing their abilities; the position with setting goals; the supervisor by providing feedback; the organization by giving the feeling of belongingness; the policies set in place to reward individuals. In order to retain employees there needs to be forms of motivation developed and practice.

Job duties, work environments, coworkers, jobs skills, and so on are bound to change due to the ever changing strides of technology. Challenges within the workplace, specifically dealing with employee motivation and how the affect the five themes discussed in this research, are inevitable. From the days of working solely with your hands and handwriting message to your consumer, to the now where cell phone are in everyone's hands, the way in which one responds to motivation is very different. Our research explains how important it was and still continues to be to provide employees through an organizational standpoint with a sense of belongingness. In the historical time period, workers worked with or near one another, and with time the structure of work changed. With that change brought about different approaches to keep that sense of belongingness, which started by supporting efforts with training, to then providing a feeling of interpersonal relationships, and finally focusing more towards corporate social responsibility.

Opportunities In Employee Motivation

Within the workplace many opportunities exist regarding employee motivation but they are not always highlighted. If every individual employee has the willpower to think "outside the box" then their organization may get ahead of their competitors at a much quicker pace. This would also mean individual employees would have the drive to do well and please others. Although in order for this to be the case, the positions within the business need to be establishing goals based on performance to keep assigned tasks interesting and fresh for their employees. The supervisor in charge needs to clearly demonstrate mastery of management techniques such as proper and effective communication, leading by example and most of all, creating a positive work environment which will ultimately transcend and lead to success within the entire business itself. By doing so, the structure of the organization will consist of more comradery motivating the employees to be much more effective at completing their work. This will result in higher retention rates within the workforce. Another major help would be current policies in place.

the little things in life that will assist the employees, manager, and businesses to continue to be successful; not only to overcome any obstacle but outcompete present rivals as well.

CONCLUSION

The future will consist of many challenges forcing the workforce to be more adaptive and more resilient than ever before. The frequency of natural disasters is rapidly increasing, along with our reliance on the electrical grid combined with our dependence on the digital world. This significant challenge is only going to become more complex, one wrong decision or a series of uneducated/misinformed decisions could send a business into a quick downward spiral. Now factor in the challenge of our global population continuing to increase at exponential rates along with competition rising each and every day. With all of this in mind, the current and future workforce could be in dire jeopardy unless the proper mitigation measures are taken. Currently, many other challenges existing in the workforce comprise of individuals working longer hours, many continuing to obtain more responsibilities, and those that are simply overworked. Many employees are becoming discouraged as a result since it has become extremely difficult to find a beneficial job that suits their expectations, and also stay with the job for many years. With more education required to even gain stability in the current workforce, a strong workforce is not going to be maintained well into the future based on its current path as it is too structured and rigid. The willingness for change is a must towards success and enhancement of the workforce in the future. If managers have not already started to take this different approach then they need to start as soon as possible. The main challenge to tackle first is regarding how much employees are burnt out, overworked, and often times not able to see their significance within the workplace. It should be considered to allow more flexible working options with employees and letting families come first as long as the work or project is completed. With these ideas and more forward thinking ingrained into a company, it will surely be on the right path towards success by establishing a stronger and more resilient workforce.

REFERENCES

- 1. Amaile, T. & Kramer, S. J. (2011). The Power of Small Wins. *Watertown: Harvard Business School Publishing Corporation*.
- Bandura, A. (1982).Self-efficacy mechanism in human agency. *American Psychologist*, Vol. 37, 122-147.
- Baumeister, R. F. & Leary, M. R. (1995). The Need to Belong: Desire for Interpersonal Attachments as a Fundamental Human Motivation. *Psychological Bulletin*, Vol. 117, No. 3, 497-529.
- Becherer, R. C., Morgan, F. W., & Richard, L. M. (1982). The Job Characteristics of Industrial Salespersons: Relationship to Motivation and Satisfaction. *Journal of Marketing*, Vol. 46, 125-135.
- Benson, T. (2016). Motivating Millennials Takes More than Flexible Work Policies. Watertown: Harvard Business School Publishing Corporation.
- Blasingame, J. (2015, August 7). Motivating Employees Is Good Business. Retrieved from <u>https://www.forbes.com/sites/jimblasingame/2015/08/07/motivating-employees-is-</u> good-business/#5cb63d995ab0
- Bryan, J. F., & Locke, E. A. (1967). Goal Setting as a Means of Increasing Motivation. Journal of Applied Psychology, 51(3), 274-277
- Caldwell, D. F., Chatman, J. A., & O'Reilly, C. A. (1990). Building organizational commitment: A multifirm study. *Journal of Occupational Psychology*, Vol. 63, 245-261.
- O'Reilly, C. A., Chatman, J. A., & Caldwell, D. F. (1990). People, jobs and organizational culture: A q-sort approach to assessing fit. Working paper, University of California, Berkeley.
- Eisele, L., Grohnert, T., Beausaert, S., & Segers, M. (2013). Employee motivation for personal development plan effectiveness. *Department of Educational Research and Development, School of Business and Economics, Maastricht University*. Vol. 37, 527-543.
- 11. Frayne, C. A., & Latham, G. P. (1987). Application of social learning theory to employee self management of attendance. *Journal of Applied Psychology*, Vol. 69, 79-84.

- Ginnodo, W. L. (1985, December, 1). Consultative Management: A Fresh Look at Employee Motivation. *National Productivity Review*, Vol.5, No. 1, 78.
- Hackman, R. J., & Oldham, G. R. (1974). *The Job Diagnostic Survey; An Instrument for diagnosing the Motivational Potential of Jobs*, New Haven, CT: Yale University, Department of Administrative Sciences, Technical Report No. 6.
- 14. Hammerton, J. C. (1970). Management and motivation. *California Management Review* (*Pre-1986*), *13*(000002), 51.
- 15. Harter, J. & Adkins, A. (2015). What Great Managers Do to Engage Employees. Watertown: Harvard Business School Publishing Corporation.
- 16. Herzberg, F. (1968). One more time: How do you motivate employees? Watertown: Harvard Business School Publishing Corporation.
- Hicks, V. & Adams, O. (2003). Pay and Non-pay Incentives, Performance and Motivation. *Studies in HSO&P*. Vol. 21, 257-274.
- Hokroh, M. A. (2014). A Touch on Employees Motivation. *International Journal of Human Resource Studies*. Vol. 4 No. 1, 1-4.
- Homan, H. L., & Borst, D. (1962). A new approach to employee motivation. *Personnel Journal*, 41(10), 508.
- 20. Klein, H, J. (1989). An Integrated Control Theory Model of Work Motivation. *The Academy of Management Review*, Vol. 14, No. 2, 150.
- 21. Latham, G. P., & Locke, E. A. (July, 1990). Work Motivation and Satisfaction: Light at the End of the Tunnel. *Psychological Science*, Vol. 1, No. 4, 240-246.
- 22. Lazaroui, G. (2015). Employee Motivation and Job Performance. *Linguistic and Philosophical Investigations*, Vol. 14, 97-102.
- 23. Locke, E. A. (1978). The ubiquity of the technique of goal setting in theories of and approaches to employee motivation. *The Academy of Management Review*, *3*(3), 594-601
- Locke, E. A, Frederick, E., Lee, C., & Bobko, P. (1984). Effect of self-efficacy, goals, and task strategies on task performance. *Journal of Applied Psychology*, Vol.69, 241-251.
- Locke, E. A., & Latham, G. P. (1984). *Goal-setting: A motivational technique that works*. Englewood Cliffs, NJ: Prentice Hall.
- Maslow, A. H. (1943). A theory of human motivation. *Psychological Review*, 50(4), 370-396.

- 27. McGregor, L. & Doshi, N. (2015). How Company Culture Shapes Employee Motivation. Watertown: Harvard Business School Publishing Corporation.
- Milicevic, A. L., Cvetkovski, T. & Tomasevic, V. (2014). Employee Motivation During The Global Economic Crisis. *Actual Problems of Economics*, Vol. 10 (160), 291-301.
- 29. Morin, A. (2015). CEOs Reveal The Secrets to Motivating Employees To Perform At Their Peak. Retrieved from https://www.forbes.com/sites/amymorin/2015/07/07/ceosreveal-the-secrets-to-motivating-employees-to-perform-at-their-peak/#2cb5572e2936
- Nicholls, J. G. (1984). Achievement Motivation: Conceptions of Ability, Subjective Experience, Task Choice, and Performance. *Psychological Review*, Vol. 91, No. 3, 328-346.
- Nohria, N., Groysberg, B., & Lee, L. E. (2008). Employee Motivation: A Powerful New Model. *Harvard Business Review*, July-August 2008, 1-8.
- Pearce, J. L. (1983). Job Attitude and motivation Differences Between Volunteers and Employees From Comparable Organizations. *Journal of Applied Psychology*, Vol. 68, No. 4, 646-652.
- 33. Pfeffer, J. & Lawler, J. (1980, March). Effects of Job Alternatives, Extrinsic Rewards, and Behavioral Commitment on Attitude Toward the Organization: A Field Test Of the Insufficient Justification Paradigm. *Administrative Science Quarterly*, Vol. 25, No.1, 38-56.
- 34. Phillips, J. M, & Gully, S. M. (1997). Role of Goal Orientation, Ability, Need for Achievement, and Locus of Control in the Self-Efficacy and Goal-Setting Process. *Journal of Applied Psychology*, Vol. 82, No. 5, 792-802.
- 35. Ramlall, Ph.D., S. (2004). A Review of Employee Motivation Theories and their Implications for Employee Retention within Organizations. *The Journal of American Academy of Business, Cambridge*, 58-63.
- Seppala, E. (2016). To Motivate Employees, Do 3 Things Well. Watertown: Harvard Business School Publishing Corporation.
- 37. Skudiene, V. & Auruskeviciene, V. (2009). The Contribution of corporate social responsibility to internal employee motivation. *ISM University of Management and Economics*, Vol. 7 No. 1, 49-67.

- Spector, P. E. (1982). Behavior in Organizations as a Function of Employee's Locus of Control. *Psychological Bulletin*, Vol. 91, No. 3, 482-497.
- 39. Steininger, D. J. (1994). Why Quality Initiatives Are Failing: The Need to Address the Foundation of Human Motivation. *Human Resource Management*, Vol. 33, No. 4, 601.
- 40. Swanson, L. A., & Corbin, D. (1969). Employee motivation programs: A change in philosophy? *Personnel Journal*, *48*(11), 895.
- 41. Taylor, M. S., Fisher, C. D., & Ilgen, D. R. (1984). Individuals' reactions to performance feedback in organizations: A control theory perspective. *Research in Personnel and Human Resources Management*, Vol. 2, 81-124.
- 42. Terpstra, D. E. (1979). Theories of motivation--borrowing the best. *Personnel Journal* (*Pre-1986*), *58*(000006), 376.
- Tharenou, P. (2001). The relationship of training motivation to participation in training and development. *Journal of Occupational and Organizational Psychology*, Vol. 74, 599-621.
- 44. Valencia, C. (1998). Motivation and Productivity in the Workplace.
- 45. Wiley, C. (1995). What motivates employees according to over 40 years of motivation surveys. *International Journal of Manpower*, Vol. 18, No. 3, 263-289.

A MULTIPLE CASE STUDY APPROACH TO ANALYZE THE DYNAMIC PROCESS OF STAKEHOLDER RECOGNITION AND PRIORITIZATION BY STAKEHOLDER FIRMS

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A MULTIPLE CASE STUDY APPROACH TO ANALYZE THE DYNAMIC PROCESS OF STAKEHOLDER RECOGNITION AND PRIORITIZATION BY STAKEHOLDER FIRMS

Abstract

This study empirically tests and adds to a recently suggested stakeholder recognition model for stakeholder oriented, i.e., proactive and accommodative, organizations. Owing to the complexity of the stakeholder recognition process, this qualitative case study aims at providing a nuanced understanding of stakeholder recognition model. The study finds that the stakeholder recognition is a socially constructed phenomenon in which the actual process of stakeholder recognition is composed of two interconnected procedures, i.e., long-term and short-term. The long-term process represents organizational stakeholder orientation as instituted by the top management. The short-term process represents an interaction between managers and focal stakeholders within a social context. Finally, the study finds that the process of stakeholder recognition is a complex multidimensional process in which organizations, stakeholders, and the social context influence each other.

Keywords: Stakeholder Theory, Stakeholder Recognition, Case Study, Stakeholder Salience

Introduction

A growing body of scholarship suggests that organizations engage in stakeholder management (Clarkson, 1995; Greenely and Foxall, 1997; Kassins and Vafeas, 1997; Ogden and Watson, 1999; Pajunen, 2006; Freeman et al., 2010; Henisz et al., 2014). In recent years, several US states have passed stakeholder laws that provide legal protection to managers who consider stakeholder concerns in organizational strategy and decision-making (Hiller, 2013; Brown, 2016).

With stakeholders now becoming a vital part of the organizational strategy, one crucial concern for managers could be the question of how to identify and prioritize stakeholders. In the past two decades, several important contributions have attempted to provide managers with guidelines for stakeholder recognition (Mitchell et al., 1997; Eesley and Lenox, 2006; Neville et al., 2011; Tasman and Raelin, 2013). Building on these seminal works, Author (2015) offered a theoretical model of stakeholder identification and prioritization for organizations with accommodative and proactive stakeholder orientations¹.

This study empirically examines and builds on the stakeholder recognition model for stakeholder-oriented organizations suggested by Author (2015). With the purpose of building theoretical generalizations, one singular aspect of this work is that this is a qualitative study designed to understand an inherently complex and dynamic social process. The study adds to the model discussed by Author (2015) in three ways. One, stakeholder recognition is composed of two distinct but interlinked processes, i.e., long-term and short-term. Two, the social context not only affects stakeholder recognition process but is also affected by organizations and their stakeholders. Three, stakeholder recognition is a complex multidimensional process and not a linear one, as suggested by the Author (2015).

Model and Theory

Figure 1 about here

Author (2015) sets the parameters of the stakeholder recognition model (Figure 1) for stakeholder-oriented firms, i.e., proactive and accommodative, by arguing that in the last 30 years academic literature has established the inherent normative nature of stakeholder theory.

¹ As defined by Clarkson (1995).

This literature differentiates stakeholder management from other theories of management, by suggesting that it assumes balanced, long-term, collaborative, dialogue-based, and mutually beneficial relations with stakeholders (Freeman, 1984; Philips, 1997; Post et al., 2002; Heckscher et al., 2003; Fassin, 2012). The crucial distinction that needs to be considered is that all organizations deal with stakeholders at some point in their operations, however, stakeholder management expects "a particular normative attitude towards stakeholders and cannot be used as a portmanteau description of how organizations operate" (Author, 2015). Hence, there is a possibility that stakeholder-oriented firms will define their organizational stakeholders more broadly and interact with them more inclusively as opposed to managers from reactive or defensive firms (Henriques and Sardosky, 1999; Buysse and Verbeke, 2003).

After setting the parameters of the model, Author (2015) suggested three salient stakeholder features. Considering the normative nature of stakeholder theory, Author (2015) defined *legitimacy* as moral legitimacy, which represents a prosocial logic that is inherently broader than narrow self-interest and is defined as, "beliefs about whether the activity effectively promotes societal welfare, as defined by the audience's socially constructed value system (Suchman 1995, p.579)." It is further argued that legitimacy is an indispensable feature without which an entity could not be considered as a stakeholder.

Power has three sources—coercive, utilitarian, and normative², and is defined as existing "where one social actor, A, can get another social actor, B, to do something that B would not have otherwise done (Agle et al. 1999, p.508)." Power alone without legitimacy does not make a stakeholder. Additionally, power is a dynamic feature and types of power can exist in combinations or separately. For the third stakeholder feature, Author (2015) rejected "*urgency*", as defined by Mitchell et al. (1997)³, and introduced a new stakeholder feature of *organization*. Organization represents stakeholder agency, is not considered as a potential but an achieved state of being, and is defined as "a body of persons organized for some specific purpose, as a club, union, or society." Finally, Author (2015) argues that the absence or presence and the varying levels of the three stakeholder salient features are codetermined by an interaction between managerial perceptions that are guided by the long-term organizational stakeholder orientation,

 $^{^2}$ As defined by Etzioni (1964) also used by Mitchell et al. (1997).

³ For a detailed discussion read Neville et al. (2011).

and "important stakeholders within the boundaries of moral, institutional, cultural, legal, and political norms."

The present study takes the discussed model (Figure 1) as the basis and attempts to provide a more nuanced understanding of a complex social phenomenon. First, it is argued, that the process of stakeholder recognition may be composed of two interlinked yet distinct processes. The first process represents the long-term organizational orientation towards stakeholders. This orientation is a result of organizational strategies and appropriate cultures that create implied and categorical guiding principles for managerial behavior vis-à-vis stakeholders (Jones et al., 2007). This long-term guidance is instituted and perpetuated by organizational leadership (Kunda, 1992; Kotter and Heskett, 1992), and manifested in organizational vision and mission statements. The second process is affected by the long-term stakeholder strategy; however, it represents the constant interaction between managers and focal stakeholders in a social context. Hence, in the short-term, managers identify stakeholders based on the absence and presence of specific stakeholder features, i.e., legitimacy, power, organization, which are determined through the process of codetermination.

Second, this study attempts to develop a nuanced understanding of the process of codetermination. This study argues that the process of codetermination not only represents the interaction of perceptions and strategies of the management and focal stakeholders; but it also underlines the importance of the social context, which is composed of a broad range of sociopolitico-economic variables that collectively constitute societal hypernorms. These societal hypernorms influence the process of codetermination by imposing the parameters within which the management and its stakeholders have their myriad interactions.

Furthermore, it is argued that stakeholders or organizations may also influence the social context. In this regard, the concept of *social acceptance* is crucial, which means the overall acceptance or opposition of any idea, norm, principle, individual, or a group in the society. A group may not have widespread legitimacy in a society, however, at some point, this group might be able to organize itself, create alliances, achieve political support, and eventually attain wider social acceptance, and subsequently modify the social hypernorms (Heckscher et al., 2003). Hence, improving its influence over the target organization.

Finally, the stakeholder salience model presented by Author (2015) either eschewed the complexity of the process or assumed that the process is unidimensional. Therefore, this study

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argues that the process of stakeholder salience, as a social phenomenon, is extremely complex and multidimensional as depicted in Figure 2.

Figure 2 about here

Methodology

The study intends to look at stakeholder recognition as a systemic phenomenon in which numerous interactions, perceptions, and interests within a specific societal context influence the process of stakeholder recognition. The complexity of the studied phenomenon requires the collection and nuanced analysis of in-depth data, hence, this study has been designed as a qualitative inductive multiple case study (Miles and Huberman, 1994; Yin, 2002; Schutt, 2006). Additionally, to comprehend the complex interactions of variables in the short-term process of stakeholder recognition, a qualitative event study method is used (Savage et al., 1991). In his method, instead of looking at overall general trends and policies, we discuss specific incidents that are instructive in understanding the dynamic process of stakeholder recognition.

Qualitative research is appropriate for social construction of reality and is designed as it is conducted (Gephart and Robert, 2004; Suddaby, 2006; Eisenhardt and Graebner, 2007). Hence, to achieve flexibility of the research process and maintain its robustness grounded theory techniques like data collection from multiple sources, constant comparison between data from different sources, theoretical sampling, data saturation, coding, and memo writing have been utilized (Strauss, 1990; Suddaby, 2006). Finally, case study approach was used to sharpen existing theory and use cases as comprehensive descriptions of specific occurrences of the studied phenomenon (Siggelkow, 2007; Eisenhardt and Graebner, 2007).

This work consists of the following five (primary and secondary) case studies (Appendix A): Primary (Johnson & Johnson (J&J), Give Something Back, and King Arthur Flour; Secondary (Tibotec Therapeutics (TT) and B-Lab). The secondary case studies provide supporting evidence for the primary cases. J&J is a large multinational; therefore, to get an overall idea of J&J's corporate culture data was collected from its headquarters in New Brunswick. However, data from TT gives us a better understanding of these policies at an operational level. All mid-sized firms are members of the B-Lab that represents a distinctive effort by these firms to become effective societal stakeholders. Organization sampling strategy was based on the logic of literal replication in which several case studies with similar underlying features are conducted to predict comparable results (Yin, 2002). The underlying characteristic of all studied organization was their purported stakeholder orientations. The theoretically guided approach to select cases improved the external validity and the theoretical generalizability of the findings (Yin, 2002; Gibbert et al., 2008). The stakeholder propensities of the studied firms were ascertained from analyzing their websites and other available secondary data like news reports, journal articles, and case studies.

A total of 38 interviews were conducted. Except for one organization, Give Something Back, all other organizations were visited and site notes were written. Interviews averaged 40 minutes and ranged from 20 minutes to an hour. Several interviewees were also asked supplementary questions via telephone or email to clarify points or to gather additional information. The interviews produced almost 400 pages of transcription. Other sources of data included field notes taken during site visits and secondary data sources. A list of important company documents used to obtain additional information on the firms is also produced (Appendix B). The use of multiple sources of data increased reliability and internal validity of research findings (Yin, 2002).

Preliminary descriptive data about the organizations and their policies determined the appropriate levels and number of managers for initial interviews. These initial interviews provided the starting point for subsequent theoretical sampling and identification of additional theoretical themes and categories (Charmaz, 2007). The interviews were relatively unstructured, while enough structure was maintained to delve into areas of interest. A master interview guide based on my research objectives was created, but additional rigorous individualized interview guides for most interviewees were also created.

To facilitate the analysis while keeping close to the data, techniques of coding and memo writing were used (Miles and Huberman, 1994). Each data set was immediately analyzed to guide the collection of the next piece of data. Data were coded in several stages leading to the drafting of memos. Memo writing served as a "pivotal intermediate step between data collection and writing drafts of papers (Charmaz, 2007)." Hence, memo writing allowed summarizing of large quantities of coded data, developing emergent analytical and theoretical categories, clarifying theoretical propositions, identifying new areas of inquiry, and facilitating attempts to

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link theoretical constructs. This interactive and iterative process was followed until a comprehensive picture of the studied phenomenon emerged.

Leadership, Organizational Orientation, and Long-Term Guidance

Johnson & Johnson (J&J)

J&J as a major pharmaceutical multinational⁴ is committed to its Credo (Fulmer, 2001: Genest, 2005). Like any other business, J&J seeks to produce high-quality products that best meet the needs of its customers. However, it has strived, since the Great Depression, to achieve this goal within the parameters of its Credo⁵. The Credo constitutes J&J's basic philosophy, which envisions J&J as a stakeholder-oriented organization. According to the Credo, the first priority of a business is its customers; second, its employees; third, its community and environment; and fourth, its shareholders. The company's responsibility to its shareholders was put fourth because, as General Johnson (1947) explained, "only if the other three have been met, or plainly can be met, it is worthwhile to consider the future of any business enterprise (p.81)."

By all accounts, J&J leadership takes quite seriously its role of preserving the continuity of the Credo's stakeholder values and of imbuing the next line of leadership with its spirit. The communication of J&J's stakeholder values is procedurally achieved when J&J CEOs travel abroad to meet with newly promoted vice presidents and discuss with them the importance of the Credo and how it should inform them in their business decision-making. This and similar dialogues constitute a crucial step in leadership training and development and continued success at J&J, so much so, that candidates for promotion at middle and top managerial levels are assessed on twelve areas of competence, including the understanding and adherence to stakeholder values outlined in the Credo.

In the case of employees, all employees are trained in Credo values and are annually evaluated based on their understanding and application of Credo values in their daily work. However, the Workplace Advocacy and Engagement Office takes the Credo's guidance in stakeholder management to a new level by instituting the "Credo Dialogue." The "Credo Dialogue", which started as a practice in the 1970s, is a vital instrument utilized to update and reevaluate the Credo, and assess J&J's overall adherence to the Credo values. The Dialogue typically focuses on ethical dilemmas where managers have a conflict between the four primary

⁴ Employing more than 120,000 employees in 250 subsidiaries operating in 57 countries.

⁵ J&J's "Our Credo" was created by General Robert Wood Johnson in 1943 and was amply described in his book titled *People Must Live and Work Together, or Forfeit Freedom (1947).*

stakeholders. The Dialogue, through discussion and exchange of views, provides guidance as to how to understand and address such conflicts appropriately. In sum, the Credo values have been institutionalized to the point where they have become a sort of "organizational DNA." As commented by a senior J&J manager:

"The Credo . . . acts as a guiding principle . . . It reminds us where . . . stakeholders may fall [in] terms of priorities or importance."

The Credo principles are adhered to when there is a conflict of interest between different stakeholder interests. As a manager noted, the Credo is both a conscious and a subconscious guide. He further added that the subconscious guidance often manifests when they sometimes struggle with the alignment of certain decisions with the values of the Credo or when they are faced with conflicting interests of different stakeholders. In this context, a senior manager in the J&J Foundation⁶ relayed an instructive example. The manager confronted a J&J executive, when she was a line manager, over a decision she felt was not in keeping with J&J's Credo. As she explained, the Foundation had been distributing Resperol, a drug for schizophrenics, free of charge in the New Brunswick area of New Jersey. The company president responsible for the manufacture of Resperol, to save the cost of production, proposed a withdrawal of Resperol from the Foundation's program because a generic alternative was already available. The Foundation manager countered that it was Foundation policy that drugs under J&J patent, even with generic alternatives, are marketed in the U.S. for philanthropic programs. She reminded the body that,

"Patients were using these drugs because they could get it free through our foundation. Do you think that they will get a generic drug that . . . may be 10 percent or 15 percent less in cost? They will not be able to afford it. We made a commitment we need to keep."

In the end, the drug was not taken off the Foundation list and there was no retaliation against this manager.

Finally, as a large multinational, J&J does not have a strong corporate center. Though decentralized, the subsidiaries are closely linked with the main corporate J&J through its Credo and mission-based strategy (Genest, 2005). There is a long and tedious process of acquiring subsidiaries at J&J. A detailed discussion of this process is beyond the purview of this paper; however, the process lays heavy emphasis on the matching of the values of the two firms and

⁶ Janssen-Ortho Patient Assistance Foundation is an independent entity involved exclusively with J&J philanthropic work.

post-acquisition inculcation of Credo values in the management and employees of the acquired company.

In sum, a stakeholder-oriented business model created by the owner, more than 70 years ago, remains relevant at J&J and provides guidance to managerial in their interactions with stakeholders.

Mid-sized firms

GSB is a flourishing office supplier business that operates nationally and represents a new model of social entrepreneurship. At GSB, stakeholder culture has originated from the founders of the organization and is manifested in the company's value statement. The statement enumerates values like integrity and honesty; teamwork and collaboration; understanding and accepting diversity; passion for work; and environmental stewardship, and lists organizational purpose like serving the customer, give to the community, grow employee potential, and inspire others to give. The owners believe that the company is accountable to all of its business and community stakeholders. GSB's sincerity to social entrepreneurship is evident from the fact that, since its inception, GSB has donated almost 75% of its net earnings to non-profit organizations, while the national average is about 1.1%. The owners believe that giving back to the community is not, "an act of generosity" but a responsibility of business.

As an organization, GSB maintains a stakeholder culture by ensuring that it involves relevant stakeholders in discourse and decision-making processes. For example, in 2010, the company involved employees in determining the mission statement of the firm. The resulting mission statement clearly supported the owners' views, and identifies and ranks three main stakeholders: community, customers, and employees. Another example is the elaborate process of donating to NGOs, in which recipients are nominated and voted upon by all relevant constituents, i.e., employees, customers, and management.

King Arthur Flour (KAF) is America's oldest flour company. It is an expanding, 100% employee-owned organization with about 170 employees. The organizational philosophy, as assessed from the interviews, mission statement, and the stated purpose of the organization⁷ states that creation of wealth is a byproduct of doing business well. The concept of "doing business well" brings us to the stakeholder features of the company. Externally, KAF believes in serving its customers well by giving them the best product, cultivating long-term mutually

⁷ <u>http://www.kingarthurflour.com/about/</u> Retrieved on May^{1st}, 2017.

beneficial relations with suppliers and vendor. The company also believes in developing the community through local giving, promoting food-based education, and supporting sustainability, environmental protection, and other social issues that the company feels strongly about. Internally, KAF prides itself on being a 100% employee-owned firm with highly inclusive management where information is shared with the employees who are encouraged to participate in the decision-making of the organization.

It is pertinent to point out that there is a lack of direct data from KAF's owners. Nevertheless, a case can be made, by looking at KAF's recent history, that the founding owners still set the tone and culture of KAF. The company was recreated in the 1970s when the owners sold off all of its assets and started the business anew without any of its previous employees. The company began to grow and by the 1990s became a medium-size firm. At this point, the owners, who were set to retire, did not want to sell their company to proprietors who would disregard the firm's social values and family-style culture. Instead, they decided to make the company an employee-owned business. To this day, that decision has dominated KAF's culture and as one employee remarked, "they [KAF] are very conscious of that [social responsibility]; they always have been."

Finally, both KAF and GSB are B-Corporations and early pioneers of B-Lab. The reasons for creating B-Lab, which reflect the owners' understanding of a holistic relationship between business and society, were twofold. One, to provide customers with verifiable standards of sustainability and organizational responsibility. Second, as discussed later in detail, to change corporate laws to allow managers to consider stakeholder interests with those of shareholders in business decisions. In sum, both medium-sized organizations have an avowed stakeholder orientation created by their respective owners and maintained through the adherence to mission-based principles by the top management.

Codetermined Short-Term Dynamic Stakeholder Salience

In this section, I will discuss the relevance of organization, legitimacy, and power as crucial stakeholder characteristics and make three arguments. One, long-term stakeholder orientations influence how organizations recognize, and interact with stakeholders on a quotidian basis. The short-term strategy is often an extension of the long-term normative principles of stakeholder management that include building trust, emphasis on mutual benefits, proactive acceptance of the plurality of stakeholders, and collaboration with stakeholders. Two,

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stakeholder salience is codetermined through stakeholder-management interactions within a social context. Three, the stakeholders and organizations may influence the social context through increasing social acceptance of their causes and goals. The last two arguments are linked as attempts at altering the context to improve salience underscores the importance of the context in which stakeholder-organization interactions occur. As a methodological choice, owing to the complexity of stakeholder-management interactions, the stated arguments are highlighted through the analysis of certain expository incidents.

Organization

It takes a sustained effort to gather momentum and to concentrate sufficient influence to have a lasting effect for one's cause. The study has found *organization* to be a key characteristic when organizational stakeholders want to exert influence on organizations and when organizations intend to influence the social context. In this section, I will discuss three examples to support the stated arguments.

Before acquiring TT, J&J did not have a foothold in the field of AIDS/HIV medication. Thus, without being able to use immediate advantage of J&J's overall good reputation, TT was able to become an important stakeholder in the HIV/AIDS area through organization. However, efforts to organize and achieve relevance in the HIV/AIDS area were predicated on the stakeholder values outlined by the Credo, i.e., accepting the multiplicity of stakeholders, proactive networking with important stakeholders, and building trust.

Entering a new market was even more difficult for TT, as many AIDS activists did not think too highly of existing pharmaceutical companies. TT began its efforts to improve its standing in the AIDS/HIV field by organizing and creating a network with relevant stakeholders. The main goal was to establish communication, emphasizing the commonality of interest between TT and the AIDS community, and build trust. The stated goals were achieved through open communication, transparency, and networking with like-minded organizations and groups in the area. TT, at an early stage, reached out to the community and invited activists and AIDS/HIV-healthcare-related individuals to discuss the development of drug trials. The AIDS activist community helped TT develop a network with doctors and healthcare professionals in the field of AIDS, which led to the formation of a forum that consisted of representatives from different stakeholders like patients, activists, and healthcare professionals, to discuss and develop drug trials. As one TT manager commented: "When we got into the area of AIDS and Hepatitis C, we didn't know any of the stakeholders, so we start[ed] by asking, who you know? Then, who[m] does the next person know? Now . . . we have a fairly good network, but it's [done] by meeting with one organization, and determining that we have common interests."

Finally, TT's main goal remains to be an important stakeholder in the AIDS community. For this purpose, TT managers—especially from the Department of Global Access and Partnering (DGAP) and the Advisory Board—constantly strives to remain relevant in the industrial context by interacting with national and local stakeholders. The DGAP constantly engages external stakeholders, apprises J&J management of the views of these groups, and maintains a voice in the AIDS community. The Advisory Board institutes a consultative process, which consists of a representative sample of TT's key stakeholders, i.e., high-level prescribers, key opinion leaders, community physicians, nurse practitioners, and a representative sampling of patients. Once the Board's consultative processes are concluded, TT staff then meets with community advocate groups to see if TT's conclusions placate their concerns.

The second example illustrates the importance of organization as a vital stakeholder characteristic from the point of view of organizational stakeholders. The example also underscores the importance of stakeholder-management interaction in a specific social context. The context may influence stakeholder to need to organize and attempt to alter it to achieve greater relevance vis-à-vis their target organizations.

The passage of the Ryan White Care Act in 1990⁸ sets the context for the organization of AIDS activists. More precisely Parts A, B, and C of the Act provide structured government funding for different levels of social service organizations⁹. A key point to grasp from the Act's many details is that AIDS activist groups that seek funding need to organize themselves to approach and get assistance from already existing government funding structures.

With this understanding of how the Ryan Care Act encourages AIDS activists' organization, we can turn to how and why AIDS Treatment Activist Coalition (ATAC)¹⁰ was organized, and how its relationship with TT developed.

⁸ The Act created a federally funded program, at this point the largest federally funded program, aimed at improving availability of AIDS medication to low income and uninsured HIV/AIDS patients.

⁹ Part A (direct government funding to city entities); Part B (Federal funding to the states, to subsidize organizations that mostly operate above the city level); and Part C (funding of community health centers).

¹⁰ ATAC is a center that coordinates the varying efforts of major activist groups. It has a core membership of twelve to fifteen individual activists and another twenty educators.

In the late 1980s to early 1990s, there were several activist groups and individuals who seek to have an impact on the process of AIDS research. The multiplicity of these groups brought with it the divergence of interests. Some wanted quick results and faster drug approval. Others were more concerned about diversity in drug trials. Such discord among activists made it possible for pharmaceutical firms to choose which groups to engage in discussions regarding drug-testing protocols and which groups to ignore, while claiming that, "we talked to the community, the community supports our efforts." In that setting, the pharmaceutical companies controlled the meeting agenda and divided activists by pitting one group against the other.

It was in response to these circumstances that ATAC was formed. The main purpose of ATAC was to give activists an organized voice and increased control of the agenda while dealing with pharmaceutical companies. Resultantly, the achieved consensus of AIDS activists provided a united front against the pharmaceutical industry and changed the context for the interaction with these companies. It allowed the activists to be heard and to become powerful stakeholders with the pharmaceutical industry. As commented by an AIDS activist:

"I think that the reason that the companies deal with ATAC is because the majority of the activists involved in HIV advocacy joined ATAC. So I think there was a realization that they needed to play ball with this group of people."

Such is the viewpoint of the activists. However, corroborating evidence comes from TT/J&J as TT managers involved in drug development explained that TT was involved from the beginning with ATAC because it represented the consolidated voice of the AIDS activists.

The final example is of B-Lab¹¹ that illustrates how firms, through organizations, may attempt to alter the social context in their favor. B-Lab is a non-profit NGO that believes that business power should be utilized to resolve social and environmental issues¹². The stated objectives of B-Lab reflect the stakeholder values of its member firms who intend to organize like-minded businesses to alter the legal and social context by changing corporate laws to accommodate stakeholder concerns in business decision-making. As explained by a B-Lab official that in sales of businesses or mergers, the managers have to sell to the investment firm

¹¹ B-Lab has more than 6,000 users. It has 407 members called B-Corporations that belong to 28 states and 54 different industries with a total revenue of \$1.91 billion and total investment assets worth \$6.8billion. <u>https://www.bcorporation.net/what-are-b-corps/about-b-lab</u> Retrieved on May 1st, 2017.

¹² <u>https://www.bcorporation.net/what-are-b-corps/the-b-corp-declaration</u> Retrieved on May 1st, 2017.

that makes the highest offer and this often excludes organizations that intend to buy the firm without affecting its social mission. Therefore, B-Lab intends to get legal support through organizing thousands of small to mid-sized businesses to create stakeholder laws that, in such situations, would allow these firms to retain their stakeholder orientation.

B-Corporations, as social enterprises, combine the social missions or values of nongovernmental organizations with a profit-based approach to business (Hiller, 2013; Brown, 2016). They represent a specific type of social entrepreneurship that does not follow the Business Judgement Rule in which the sole purpose of a business is to maximize shareholder value (Brown, 2016). This corporate model is also different from the constituency laws that allow the consideration of stakeholder interests by directors while making business decisions (Collart, 2014). B-Corporations are companies that are legally instituted as stakeholder firms, therefore, they are legally able "to stay mission driven through succession, capital raises, and even changes in ownership, by institutionalizing the values, culture, processes, and high standards put in place by founding entrepreneurs."¹³ One GSB owner explained that:

"A legal status that would allow stakeholders, other than investors and financial stakeholders, to [be] recognize[d] within the corporate charter . . . so that companies like ours, [which] have a commitment to donating our profits to non-profit organizations . . . wouldn't be subject to legal restrictions."

In sum, for the stated purposes, B-lab organizes like-minded businesses, interacts and cooperates with business associations, policy makers, and the media to create powerful networks. B-Lab also guides and provides legal help to organizations that want to be B-Corporations to create acceptance for a legal framework that is different from the existing corporate law and thinking. B-Lab is trying to create a new type of market, which would help redefine what is good in terms of social responsibility and change the context by creating lasting legal infrastructures and political support to help perpetuate this model.

Legitimacy

Legitimacy, as defined by Author (2015), in its simplest interpretation, implies that stakeholders represent socially acceptable interests that benefit the society. For all case studies in this work, none of the reviewed firms supported nor engaged stakeholders with illegitimate or socially harmful interests.

¹³ Taken from Rawhouser et al. (2015), who retrieved it from B-Lab," Patagonia, <www.patagonia.com/us/patagonia.go?assetid=68413.

Beginning with societal hypernorms and their influence on the managerial interpretation of long-term and short-term legitimacy. The J&J Credo reflected the interaction between topmanagement/owner values and the socio-politico-economic imperatives of its time. General Johnson elucidated the Credo to establish a value-based organization predicated on the idea that the middle class needs economic resuscitation. These views had wide social acceptance, especially, after the Great Depression as evident from the enactment of laws like the National Labor Relations Act (1935) and economic policies that concentrated on providing the middle class with jobs and workplace rights.

The Credo was formulated over 65 years ago; hence, it is not possible that socially acceptable goals have not changed in more than six decades. Recognition and acceptance of new societal goals and stakeholder expectations and making them a part of the Credo could be considered as valid evidence that J&J's stakeholder policy, which recognizes a wider range of organizational stakeholders allows J&J to recognize and adjust to the normative changes in the society and. In this regard, "Credo Dialogue," a universal survey to assess employee views on updating and re-evaluating J&J's Credo, was introduced in the 1980s to assess if environmentalism should be a part of J&J's values system. As expressed by a senior manager at J&J:

"In the original formulation of 65 years ago, they did not have this huge focus on environmental sustainability which as you know, the green movement has become much more prominent and come to the forefront in recent years and now the Credo talks about our responsibility to the environment."

Among mid-sized organizations, we find similar trends. All of the espoused causes are legitimate and have social acceptance in the current socio-politico-economic milieu. GSB believes that businesses should give back to the community. To achieve this goal they have created an elaborate system, which includes nominations and voting from employees, customers, ad management, of donating a large percentage of their profits to local causes and local NGOs. KAF is an employee-owned organization and supports legitimate causes such as sustainability and environmental protection. In sum, in all the studied firms, long-term stakeholder strategy is influenced by the social hypermorms. This influence subsequently influences the short-term interpretations of legitimacy by the studied firms as depicted by their acceptance of prosocial goals and approach to stakeholder interaction.

Legitimacy in terms of interactions between organizations and focal stakeholders can be illustrated from the case of AIDS/HIV patients. As discussed in the previous section, there is now a history of AIDS activism spanning more than four decades. The right of the patients to have a say in the drug development process of a deadly disease like AIDS may be inherent, however, it was recognized by the pharmaceutical industry only when AIDS activist groups were organized and created a broader acceptance in the society of their right to be part of the discussion. As one ATAC activist remarked:

"So there's this long history of this kind of involvement [of the AIDS community], and it's just [now] that the community has a pivotal role in research I think that they [TT] would say this group ATAC is well respected, and [is] legitimate—they have stature, and they're all volunteers, they have no vested [interest] and [this] stuff matters."

Furthermore, in terms of stakeholder-management interaction, if legitimacy can be gained, it can also be lost or curtailed. This may happen when organizations do not meet stakeholder expectations. One example that illustrates this argument is the recent J&J (McNeil— a J&J subsidiary) Tylenol scandal.

The incident, which arose in 2009, led to J&J being accused of a cover-up, lies, kickbacks, misinformation, and mismanagement (Anisfeld, 2011). J&J announced a voluntary recall of liquid pediatric Tylenol, Motrin, Benadryl, and Zyrtec, products that were manufactured in McNeil's Pennsylvania plants. The recall occurred due to the detection of metal particles in these products that did not meet FDA standards. These recalls led to a Congressional investigation, which found that J&J and McNeil were guilty of obstructing the process of investigation by the FDA and other government agencies, lying to Congress regarding recalls of the unsuitable drugs, and hiding the fact that the J&J and McNeil management knew of the quality issues and tried to cover up the issue through "phantom recalls".¹⁴ A detailed discussion of the causes of this stakeholder debacle by J&J is beyond the purview of this paper; however, it is germane to add here that J&J's lack of concern for its most important stakeholders, i.e., customers, led to a serious impact on J&J's goodwill and legitimacy in the society (Anisfeld, 2011).

¹⁴ "Phantom recall" refers to J&J's alleged recall through hired contractors in 2009, which was considered by the Congressional Committee as a covert attempt to recall without making a general announcement.

Finally, organizations and stakeholders may also influence societal norms by increasing social acceptability through an organization or other means to increase or create legitimacy for their interests and causes. For example, KAF sends its representatives to the Vermont Employee Ownership Center (VEOC) to promote and gain greater social acceptance and legitimacy for employee ownership in the region. Another good example of an attempt to change the social context comes from the mid-sized firms who as B-Corporations and members of B-Lab, through collective action, are attempting to gain legitimacy for a novel corporate structure. The whole campaign aims to create social acceptance of an idea that goes against the established norms of corporate law in the US. So far, B-Corporations have influenced lawmakers in 32 states that have passed benefit corporation legislation.

Power

The study finds that the stakeholder salient feature of power is a business reality and persists for stakeholder-oriented firms. However, it has also been found that the three types of power, i.e., coercive, instrumental, and normative, are influenced by long-term stakeholder strategy and are socially constructed, hence, may be gained through influencing the context.

TT involved ATAC in its process of developing AIDS/HIV drug trials. However, how and what influenced TT? An important tool by which ATAC can exert power and influence over TT is its Report Card¹⁵, which grades all pharmaceutical companies working in the field of AIDS/HIV¹⁶. The main intent of the report card, as explained by one ATAC official, is to encourage and establish good practices in pharmaceutical companies through social pressure by making public the fact that some companies are operating in a manner that is beneficial for the HIV/AIDS community. As a result, some companies with low scores have disagreed with their grading in the report but they have also expressed their intentions that they want to do better next time. Hence, ATAC was exerting normative pressure by highlighting the good practices of some of the pharmaceutical companies and they were applying coercive pressure by publically naming and shaming the companies that were not doing a great job at satisfying the AIDS activists. One ATAC official's comment highlights the normative pressure exerted by ATAC:

"So I can tell you that the intent of the report card was to make very public the fact that some companies were operating in a manner that was good for people with HIV. And I

¹⁵ The companies graded are assessed on various criteria like community involvement; ethical marketing practices; access to products; drug development portfolio; and pricing. These parameters include both qualitative and quantitative data. The first Report Card came out in 2009. ¹⁶ TT received a "B" in ATAC's Report Card—the highest grade.

think our hope was that if we could shine a spotlight on the companies that were doing better . . . [than] other companies who we were less pleased with, would start to adjust their behaviors that we felt were desirable."

However, could ATAC influence pharmaceutical companies by affecting its bottom line or otherwise compelling it to improve? The answer is a qualified "yes." This means that ATAC could create coercive pressure against unsatisfactory pharmaceutical companies by criticizing them publically and swaying the societal opinion in general and the AIDS community's opinion, in particular, against such companies. Hence, pressuring them to improve their performance. According to ATAC officials:

"We don't have a leverage in any traditional ways . . . probably the biggest leverage is our ability to speak publicly."

It must be noted here that TT, based on its Credo based practices, approached ATAC and other relevant stakeholders before the ATAC report came out. This shows the impact of organizational strategy over the dynamic recognition of stakeholders, however, TT also felt it necessary to pay attention to ATAC and the AIDS community based on their socially constructed coercive and normative power. The interviewed senior TT officials believed that AIDS community meetings were a formidable challenge as the AIDS community, under ATAC, had acquired a high level of effective influence. Based on its ability to rally opinion of the AIDS community ATAC had been able to bring changes in government policies. Hence, J&J had to consider ATAC as it could affect its reputation in the AIDS community. Another TT official, who had experience in other pharmaceutical companies, commented that:

"They [activists] can really make you look terrible, because they will protest, they will write to their peer journals . . . and those sorts of things do have an impact because that colors the perception of the prescriber [patient]."

Finally, AIDS activists also exerted instrumental power over TT. In the beginning of AIDS activism, most pharmaceutical companies were reluctant to deal with the community, as they thought that the activists were non-scientific people who could not understand complex scientific research. However, as described by the TT official, as the company understood the AIDS/HIV industrial context better it realized that the best way to reach the AIDS activist community and to get TT's perspective across to the community would be to work closely with organizations like ATAC.

The above comment also underscores the impact of J&J's long-term stakeholder strategy on short-term stakeholder interactions. TT, based on a stakeholder orientation, recognized and accepted a broad range of stakeholders. It approached ATAC and involved it in drug related decision-making processes based on J&J's Credo values of mutual trust, and cooperation and collaboration based on transparency with stakeholders. Eventually, this stakeholder engagement strategy resulted in several practical benefits. It earned the trust of the activist community, which created opportunities for TT to improve their networking in the field. Two, as explained by a senior TT manager, the robustness of any drug-related research depends on the validity of its drug trials. The advocacy groups helped develop trials that were more representative of the intended end users of the drug. They also helped develop the right conditions for trials by making the researchers aware of the needs and concerns of the end users.

Three, the engagement of ATAC activists benefited the company by an accelerated process of FDA approval. As one TT manager explained, if the drug trials are robust and all concerned stakeholders, including the activists, are already part of the drug development process then there will be minimal resistance for drug approval by the FDA. Finally, the support of AIDS activists and practitioners resulted in pre-approval marketing. Once the activists were part of the process of developing the drug trials they felt confident to push for the Early Access Program, which meant that after Phase 3 studies the drug will be made available to patients that were not part of the clinical trials. From a company's perspective, as explained by a TT manager, this amounts to free advertising and the creation of a market for the drug even before it is approved by the FDA.

In the case of the mid-sized firms, as discussed earlier, B-Lab intends to exert collective pressure to promote stakeholder thinking and legislation at local and state levels. This collective action utilizes two types of power, i.e., coercive and normative, against governmental authorities. It is coercive as collectively these B-Corporations represent a consortium of more than 1,000 companies in more than 30 countries representing 60 industries (B-Corp, 2014). The collective financial impact of these companies runs into several billion dollars (B-Corp, 2014). Hence, they have a certain amount of pressure on the legislators in terms of votes and money. On the other hand, these companies, through B-Lab, are also trying to gain normative power by increasing the social acceptance of a new form of corporate structure. The wider social acceptance of

stakeholder views has created pressure on governments—local and state—and has led to the emergence of B-Corporations as a leading form of social enterprise in the US (Brown, 2016).

Multidimentionality of the Stakeholder Recognition Process

It is argued that a vital finding of this study is that the process of stakeholder recognition is multidimensional in which management, stakeholders, and the social context may exert mutual influence. This finding is important on two accounts. One, it underscores the codetermined nature of the stakeholder recognition process and gives credence to the argument that stakeholder agency and the social context play a role in this process. Two, it illustrates that managers though important decision-makers in the stakeholder salience models may be influenced by organizational stakeholders or the societal context.

The study finds several interactions between different components of the model as depicted in Figure 2. One, the top management affects the long-term and short-term stakeholder salience processes. The overall organizational stakeholder strategy and culture is created and perpetuated by the owners and top management. This long-term orientation sets the parameters for managerial recognition, prioritization, and engagement of stakeholders in the short-term. We have discussed several examples of how the studied stakeholder firms, based on their stakeholder values, recognize a broader set of stakeholders and develop collaborative and mutually beneficial relations with their stakeholders. Additionally, these organizational orientations are consulted to seek guidance regarding stakeholder conflicts in daily operations, e.g., The J&J Foundation incident.

Two, the study also finds support for the argument that stakeholders, who are part of the short-term interactional process, can also influence management and gain the status of a useful partner in the eyes of the management through organization and gaining social acceptance, legitimacy, and power. For example, ATAC got its place at the negotiating table not because the pharmaceutical industry naturally recognized them as a worthy stakeholder. They gained their spot by organizing all other prominent AIDS activist organizations and by creating a united voice. In fact, they got their stakeholder status despite the attempts of the pharmaceutical industry to keep the activists divided.

Three, this study has found that the social context has a vital role in the stakeholder recognition model. It influences managerial decision-making and setting of the long-term parameters for stakeholder recognition. For example, the formation of J&J's Credo by General

Johnson under the socio-politico-economic realities of the period and changing of the Credo in the 1980s to add environmental concerns reflects the burgeoning interest of the society in environmental protection. The context also influences the short-term interaction process as the interaction occurs within specific socio-politico-economic parameters.

Finally, the study finds that whenever the organizations or stakeholders believe that the social context does not fully support their interests they may influence the context through creating greater social acceptance for their goals. This interaction gives further credence to the fact that social context is a crucial element of the stakeholder recognition scheme. Therefore, managers and focal organizational stakeholders by changing the context in their favor attempt to achieve greater influence on the other party. We have discussed several examples to illustrate this argument, i.e., B-Lab attempting to gain legitimacy for a new form of corporate governance, and AIDS activists creating ATAC and compiling the Report Card for pharmaceutical companies. Hence, stakeholder legitimacy may be a function of how far and wide an idea, a right, or an institution is acceptable in the society and social acceptance may be an antecedent for change in the social context and stakeholder configurations.

Conclusion

This study has attempted to give a more nuanced understanding of the process of stakeholder recognition. This research finds that owners and top management create and perpetuate organizational philosophies and strategies, which define organizational orientation towards stakeholders and provide long-term guidance to managers and employees regarding stakeholder recognition, prioritization, and engagement.

This process gives the organization long-term stability and continuity of policy. However, today organizations exist in a volatile ever-changing environment, which necessitates organizations to go beyond *a priori* rigid long-term list of stakeholders. The data supports the finding that in the short-term, stakeholder recognition depends on the absence and presence of three stakeholder salient features, i.e., legitimacy, organization, and power, which are codetermined between organizations and focal stakeholders in a social context.

Second, the study gives a much more nuanced understanding of the process of codetermination and finds that this process represents the interaction of organizations and their focal stakeholders within the parameters created by the socio-politico-economic context. Furthermore, the study finds that the concept of social acceptance in this interaction is also an

important ingredient. Finally, the study finds that the process of stakeholder recognition within the social context is a much more complex and multidimensional phenomenon than envisaged by the original model.

REFERENCES

Agle, B. Mitchell, R. & Sonnenfeld, J. (1999). Who matters to CEOs? An investigation of stakeholder attributes and salience, corporate performance, and CEO value. *Academy of Management Journal*, 42(5), 507–525.

Anisfeld, M. H. (2011). When do we get to BMPs? (and which BMPs do we have in mind?). *Journal of GXP Compliance*, 15(1), 79.

Author (2015).

B-Corp Report. 2014. 2014 B-Corp Update: Together B-Corps form a diverse, global community, https://www.bcorporation.net/sites/all/themes/adaptivetheme/bcorp/pdfs/BcorpAP2014_WebVer sion.pdf (Accessed 2 May 2017).

Brown, S. (2016). Benefit corporations: A case study in the issues of implementation and adoption of the fastest growing business form in the United States. *Business and Professional Ethics Journal*, 35(2-3), 199-216.

Charmaz, K. (2007). *Constructing grounded theory: A practical guide through qualitative analysis.* Los Angeles: Sage Publications.

Clarkson, M.B.E. (1995). A stakeholder framework for analyzing and evaluating corporate social performance. *Academy of Management Review*, 20(1), 92-117.

Collart, A. (2015). Benefit Corporations: A corporation structure to align corporate personhood with social responsibility. *Seton Hall Law Review*, 44(i).

Eesley, C. & Lenox, M. (2006). Firm responses to secondary stakeholder action'. *Strategic Management Journal*. 27(8), 765–781.

Eisenhardt, K. & Graebner, M. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal*, 50(1), 25-32.

Etzioni, A. (1964) Modern organizations. Englewood Cliffs: Prentice Hall.

Fassin, Y. (2012). Stakeholder management, reciprocity and stakeholder responsibility. *Journal of Business Ethics*, 109(1), 83–96.

Freeman, E. (1984). Strategic management: A stakeholder approach. Boston: Pitman Publishing.

Freeman, R.E. Harrison, J.S. Wicks, A.C. Parmar, B.L. and De Colle, S. 2010. *Stakeholder theory: The state of the art*, Cambridge: University Press.

Fulmer, R. (2001). Johnson and Johnson: Frameworks for leadership. *Organizational Dynamics*, 29(3), 211-220.

Genest, C. (2005). Cultures, organizations, and philanthropy. *Corporate Communications*, 10(4), 315-327.

Gephart, R.P. (2004). Qualitative research and the Academy of Management Journal. *Academy of Management Journal*, 47(4), 454-462.

Gibbert, M. Ruigrok, W. & Wicki, B. (2008). What Passes as a Rigorous Case Study?. *Strategic Management Journal*, 29(13), 1465–1474.

Heckscher, C. Maccoby, M. Ramirez, R. & Tixier, P.E. (2003). *Agents of change: Crossing the post-industrial divide*. New York, Oxford University Press.

Henisz, W.J. Dorobantu, S. & Nartey, L.J. (2014). Spinning gold: The financial returns to stakeholder engagement. *Strategic Management Journal*, 35(12), 1727-1748.

Hiller, J. (2013). The benefit corporation and corporate social responsibility. *Journal of Business Ethics*, 118(2), 287-301.

Jones, T. Felps, W. & Bigley, G. (2007). Ethical theory and stakeholder related decisions: The role of stakeholder culture. *Academy of Management Review*, 32(1), 137–155.

Kassins, G. & Vafeas, N. (2002). Corporate boards and outside stakeholder as determinants of environmental litigation. *Strategic Management Journal*, 23(5), 399-415.

Kotter, J. & Heskett, J. (1992). *Corporate culture and performance*, New York: The Free Press. Kunda, G. 1992. '*Engineering culture: Control and commitment in a high-tech corporation*, Philadelphia: Temple University Press.

Miles, M.B. & Huberman. M. (1994). *Qualitative data analysis: An expanded sourcebook*. Thousand Oaks, California: Sage Publications.

Mitchell, R. Agle, B. & Wood, D. (1997). Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts. *Academy of Management Review*, 22(4), 853–886.

Neville, B. Bell, S. & Whitwell, G. (2011). Stakeholder salience revisited: Refining, redefining, and refueling an underdeveloped conceptual tool. *Journal of Business Ethics*, 102(3), 357–378.

Ogden, S. & Watson, R. (1999). Corporate performance and stakeholder management balancing shareholder and customer interest in the UK privatized water industry. *Academy of Management Journal*, 42(5), 526-538.

Pajunen, K. (2006). Stakeholder influence in organizational survival. *Journal of Management Studies*, 43(6), 1261-1288.

Post, J., Preston, L. & Sachs, S. (2002). *Redefining the corporation: Stakeholder management and organizational wealth*. California: Stanford University Press.

Rawhouser, H. Cummings M. & Crane, A. (2015). Benefit corporation legislation and the emergence of a social hybrid category. *California Management Review*, 57(3), 13-35.

Schutt, R. (2006). *Investigating the Social World: The Process and Practice of Research*, 5th ed. Los Angeles: Sage Publications.

Siggelkow, N. (2007). Persuasion with case studies. *Academy of Management Journal*, 50(1), 20-24.

Strauss, A. (1990). *Qualitative analysis for social scientists*. New York: Cambridge University Press.

Suddaby, R. (2006). From the editors: What grounded theory is not. *Academy of Management Journal*, 49(4), 633-642.

Tashman, P. & Raelin, J. (2013). Who and what really matters to the firm: Moving stakeholder salience beyond managerial perception. *Business Ethics Quarterly*, 23(4), 591–616.

Yin, R.K. (2002). *Case study research: Design and methods (3rd Edition)*, Vol. 5. Thousand Oaks, California: Sage Publications.

Figure 1: A Unidimensional Stakeholder Recognition Model



Figure 2: A Multidimensional Stakeholder Recognition Model



Appendix A: Case Study Database of Interviews and Site Visits

Organization	Summary of Case Study	Site Visits	In-depth Interviews	Importance
Johnson & Johnson	Pharmaceutical industry; large multinational headquartered in New Brunswick (NJ)	Seven visits to the corporate headquarters between the summer of 2009 and fall of 2011	14	One of the main case studies.
Tibotec Therapeutics	A J&J subsidiary in the field of AIDS and Hepatitis C medication	Three visits to Tibotec Titusville, NJ office from fall 2009 to fall 2010	7	As a subsidiary, TT provided an understanding of how J&J subsidiaries act upon the precepts of the J&J Credo.
Give Something Back	A mid-sized firm of office supplies in Oakland, California	Not visited	7 interviews and exchange of several emails with important interviewees	One of the mid-sized main case studies
King Arthur Flour	A mid-sized flour & baking goods manufacturing company in Norwich, Vermont	Visited in spring 2010	7	One of the main mid-sized case studies
Elizabeth Glaser Pediatric AIDS Foundation	A leading U.S. national non-profit organization	Not visited	1	As an organization working with J&J's philanthropy department, it gave a stakeholder's and partner's perspective to J&J's philanthropic activities.
AIDS Treatment Activists Coalition	A national coalition of AIDS activists	Not visited	2	These interviews gave a stakeholder's view on J&J's/TT's involvement with potential and current stakeholders.
B-Lab	A coalition of mid- and small-sized organizations aiming to give voice to stakeholder firms	Visited in spring 2010	1	B-Lab gave an additional understanding of how its member organizations operate individually and collectively.

Appendix B: List of Important Documents

Details of Documents	Organization	Information Obtained	
Global Leadership Profile	Johnson & Johnson	Explains the expectations from top management. It is linked with the Credo and is one of the tools to train and assess managers.	
Global Survey	Johnson & Johnson	Explains the link between the J&J Credo and management practices and what is measured in terms of J&J performance from the employed perspective.	
Customer Survey	Johnson & Johnson	This document is not just a customer satisfaction survey, but actually assesses J&J performance as a value-based organization.	
ATAC Report Card	AIDS Treatment Activist Coalition	This is the report card that ATAC has published to assess the performance of pharmaceutical companies in the AIDS medication field.	
General Johnson Speeches and Quotes	Johnson & Johnson	Gave an idea about General Johnson's thoughts about a number of issues related to management, business practices, the role of organizations in the community, and the importance of stakeholders.	
Corporate Philanthropy Flyer	Johnson & Johnson	Gave facts about J&J national and international philanthropic activities and volume.	
Logic Model for Community Programs	Johnson & Johnson	This document was an example of how J&J involves local partners in their philanthropic work. This document also clarified the process through which partners are chosen and how success in such programs is assessed.	
Conflict Resolution Guide	King Arthur Flour	Showed the process of conflict resolution among employees and in general, the workplace.	
Company Booklet	King Arthur Flour	Gave details about the company history and other facts.	
Culture Booklet	King Arthur Flour	Gave details about the type of culture KAF intends to create in the company.	
2010 Goals	King Arthur Flour	Gave information on the company goals for the coming years that included a number of financial and qualitative goals.	
Employee Handbook	King Arthur Flour	Important employee policies	
King Arthur Business & Ethics Award Report	King Arthur Flour	Gave details about KAF's philanthropic works.	
B-Lab Annual Reports (2009, 2010, 2011, 2012, 2013, 2014)	B-Lab	Gave details about the B-lab achievements in the last three years.	
GSB Green Office Guide	Give Something Back	Gave details about the GSB Green Audit and how they can help businesses become environmentally friendly.	

A PROPOSED MODEL TO IMPROVE QUANTITATIVE REASONING: THE PROBLEM SOLVING MAPS

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Keywords

Math education, graphic organizers, problem solving, critical thinking, quantitative reasoning

Abstract

The thesis of this paper is that by focusing on developing key thinking processes, students will improve their quantitative reasoning skills. The proposed thinking skills are inductive thinking, deductive thinking, and analysis. Three graphic organizers designed to enhance those skills will be shown with examples. Testable propositions to test the effectiveness of the model are presented.

Introduction

The need for a better math education is clear. With the ever-increasing advancement in technology and the tighter integration of the global economy, relevant social and business problems have become more complex. Industries which require technology and science-based solutions are becoming the engine fueling countries growth. Math offers a rigorous and systematic process to improve problem-solving skills, which are useful not only for the highly complex but also for many daily life decisions.

Mastering math requires learning a set of interrelated building blocks which form a math hierarchy. First, students must master basic, information such as definitions and terminology. Once this basic information is known, students learn basic *math rules* which then form the base to the next level of learning: *multi-rule problems*. During this phase, students learn to solve more complex problems which require the application of appropriate rules from a menu of possibility. Applying a rule moves the initial problem to a new situation where another rule is to be selected and so on until the problem is solved. Finally, students learn *application problems*; these can be structured or semi-structured. To solve this type of problems, students apply single rules as well as several multi-rule procedures.

In trying to exploit the natural connectedness of math, I am proposing a model to teach math referred to as Problem Solving Maps (PSM).

The Problem Solving Maps.

The PSM model proposes a set of graphic organizers, referred to as maps, to represent critical thinking processes to solve math problems. Graphic organizers are "visual displays teachers use to organize information in a manner that makes the information easier to understand and learn" (Meyen, Vergason, & Whelan, 1996, p. 132). Educational theories agree that knowledge must be organized to be retained and accessed from long-term memory (Anderson, 1995; Farnham-Diggory, 1992). Graphic organizers are one of the theoretical foundations for the PSM model.

The maps are 1) Example-Conclusion Map, 2) the Multi-Rule Map and 3) the Math-Breaker Map. There is a one-to-one relationship between the math hierarchy introduced above and the Problem Solving Maps (see Table 1). The objectives of these maps are 1) to provide support in learning a specific topic and 2) to map out problem-solving strategies that are generic enough to be used on a large variety of math content.

Math hierarchy	Problem Solving Map
Rules	Example-Conclusion Map
Multi-rule problems	Multi-Rule Map
Application problems	Math-Breaker Map

Table 1 Math hierarchy and Problem Solving Maps

Example-Conclusion Map. Depicted in Figure 1, with an example, the Example-Conclusion Map is used to learn basic rules. The idea is for the instructor to develop or provide three examples of the application of a math rule (without giving the specific rule to students) and add them to each box marked "example." Students are asked to try to find a pattern based on the examples, and write the rule in their own words. To finish the exercise, students prepare their own example to verify their findings. At the beginning, students have difficulty finding the

rules, but eventually, they will learn how to think more inductively. The importance of inductive thinking is very well established in the literature (Christou, et al. 2007).



The Multi-Rule Map. Once students have learned the basic rules related to a specific topic, teachers can use the Multi-Rule Map (see figure 2 with an example) to attack multi-rule problems. The problem is written in the initial point and then a rule (learned with the previous step) is used to move the problem to the next step. The rule is written in the cloud next to the box. The process is repeated by picking a new rule until the problem is completed.



The Multi-Rule Map can be used in four different ways. First, a teacher can provide the problem already solved without providing the rules. The assignment for students would be to provide the rules that were used at each step. Second, teachers can provide the initial problem with all the

rules needed to solve it—students would need to solve each step by applying the rules given by the teacher. A third way to use the Multi-Rule Map is to just give students the initial problem and ask students to provide both the steps and the rules. Finally, a teacher can provide a completed problem, including the rules, but with some mistakes on it; students would have to go through the problem and find the mistakes.

The purpose of the Multi-Rule Map is to strengthen students' knowledge of the math rules and apply them to solve problems by thinking deductively. When students provide the rules to explain the steps, they deepen the understanding of the material. After students have done several problems, they may not need to present the problems using the Multi-Rule Map. The Multi-Rule Map prepares students to think deductively, a skill which is considered as the foundation of mathematical thinking (Ayalon & Even, 2008).

The Math-Breaker Map. The last PSM is the Math-Breaker Map. There is not a specific template for this tool because it depends on the problem being solved but the basic idea is depicted in figure 3 with an example. The map breaks down problems into smaller steps. Each step is given in a box that contains some instructions and a blank space for the student to do that step. The arrows represent prerequisites, a box with an arrow pointing to it means that all previous steps must be completed first. The first application of this tool was to teach business statistics (Sirias, 2002).



Teachers can use this map in three different ways. One is to just provide the template with all the steps with just the spaces in blank for students to solve a problem. This serves as a scaffolding device so students can later do the problem without the aid of the tool. A second possibility is for teachers to provide the steps but not how they fit together. Students are then asked to find the right sequence to solve the problem. Finally, teachers can ask students to do everything, the steps, and the right sequence. The skill of analyzing a problem by breaking down into smaller components and then sequencing these steps into a logical sequence is useful not only for math problems but also for successfully completing projects.

Problem Solving Maps and students' performance.

Since PSM break down math problems into manageable parts, students can focus on solving portions of a procedure, rather than getting overwhelmed with the whole problem. With the Example-Conclusion Map, students put all their efforts in trying to figure out the pattern related to one specific rule. As they do that more and more, their ability to think inductively improves. Both the Multi-Rule Map and the Math-Breaker Map divide the problem into manageable elements. Being able to solve a small portion of the problem can give students self-confidence to go to the next step and so on which can lead to better performance.

Research proposition 1: PSM increases student self-efficacy.

Teachers can also use PSM to diagnose students' weaknesses. Since problems are broken down into steps, teachers can pinpoint where students are having difficulties understanding the material. Homework problems and activities can be assigned to overcome those specific trouble spots. Teachers using the Maps have reported that they can see patterns in the type of mistakes students tend to make. This information not only allows a teacher to help individual students but offer opportunities for feedback to other instructors teaching prerequisite courses. Providing timely feedback can help students improve understanding of the material.

Research proposition 2: PSM can be used to diagnose student's weaknesses

Students can work in groups and verify their work as they go through the problems in the classroom, comparing their results with their neighbors'. By continuously referring to the steps in the maps, students can self-monitor their learning and progress. Self-regulated learning strategies have been associated with several cognitive and behavioral benefits (Lan, et al., 1993). The theoretical background underlying learning in teams is captured under the cooperative learning model (Johnson, et al. 1998). By providing a graphical framework, PSM can enhance cooperative work among students which can lead to better performance (Sirias, 2005).

Research proposition 3: PSM facilitates cooperative learning

An important benefit that could also result in better performance is that students have much better notes. Graphical organizers provide a very practical way to take clear and precise notes. After completing one diagram, students have a clear example of how a problem is to be worked and can easily refer to it. This happens regardless of how disorganized an instructor may be in writing a problem on the board. If they are aware of which step is being worked on, students will have clear notes depicting all the steps for a given procedure. Enhanced note-taking can lead to better performance (Katayama & Robinson, 2000).

Research proposition 4: PSM allows students to have better notes.

Finally, the hypothesis is that by learning a large variety of math topics with the same type of maps, students will eventually see the pattern and use the same process to learn and solve other math problems. As they become more efficient, students will develop important thinking processes. With the Example-Conclusion Map, students will develop inductive thinking abilities which will allow them to eventually see generic patterns in how to solve complete problems. The Multi-Rule Map promotes deductive thinking by looking at how to apply generic rules to specific problems. The Math-Breaker Map teaches students to systematically analyze a problem by breaking it down into steps, a skill that is important for math and for any projects students embark on their life.

Research proposition 5: PSM makes students better thinkers Research proposition 6: PSM leads to better performance

Conclusion

In this paper, a proposed model to improve quantitative reasoning was presented. The model consists of three graphic organizers that map out three thinking process: inductive, deductive and analysis. PSM has been used by teachers in different countries and anecdotal evidence suggests that there are some benefits to this method. Further research is needed to test the propositions presented in this paper.

References

Anderson, J.R. (1995). Learning and Memory: An Integrated Approach. New York: John Wiley.

- Ayalon, M., & Even, R. (2008). Deductive reasoning: In the eye of the beholder. *Educational Studies in Mathematics*, 69(3), 235-247.
- Christou, C., & Papageorgiou, E. (2007). A framework of mathematics inductive reasoning. *Learning and Instruction*, *17*(1), 55-66.
- Farnham-Diggory, S. (1992). *Cognitive Process in Education* (2nd Ed.). New York: HarperCollins.
- Johnson, D., Roger T. Johnson and Karl A. Smith [1998], "Cooperative Learning Returns to College: What Evidence is there that it Works?" Change, Vol. 30, No. 4, July/August, pp. 26-35.
- Katayama, A.D. and Robinson, D.H. (Winter 2000). Getting students 'partially' involved in note-taking using graphic organizers. *The Journal of Experimental Education*, 68(2), 119-133.
- Lan, W.Y., Bradley, L. and Parr, G. (1993). The Effects of a Self-Monitoring Process on College Students' Learning in an Introductory Statistics Course. *Journal of Experimental Education*, 62(1), 26-40.
- Meyen, E.L., Vergason, G.A. and Whelan, R.J. (1996). *Strategies for teaching exceptional children in inclusive settings*. Denver, CO: Love
- Sirias, D. (2002). Using graphic organizers to improve the teaching of business statistics. *The Journal of Education for Business*, 78(1), 33-37.
- Sirias, D. (2005). Combining cooperative learning and conflict resolution techniques to teach information systems. *Journal of Education for Business*, 80(3), 153-158.

ALTERNATIVE METHODS FOR CHECKING THE STABILITY OF THE UNIVARIATE AND MULTIVARIATE PROCESS DATA PRIOR TO MORE ADVANCED APPLICATIONS

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Abstract

The objective of this paper is to revisit the issue of checking the stability of process data (in both univariate and multivariate cases) before applying more advanced statistical models. This is a critical phase that needs to be performed prior to more advanced statistical analysis (using both univariate and the multivariate process data), since making a projection of the future based on an unstable process data will not be reliable. The methods described in the paper were based on an alternative approach for estimating the variance (for univariate data) and covariance matrix (for the multivariate data); and then testing the equality of regular and alternative variance and covariance matrix estimators for univariate and multivariate cases, respectively. The mean square successive differences (MSSD) concept was utilized to generate an alternative estimate for variance and also for covariance matrix.

Key words: Univariate and multivariate process data, stability, variance, covariance matrix, mean square successive differences.

Introduction

In order to come up with a reliable and accurate inference for the future behavior of a process using univariate or multivariate approaches, process data used in analysis should be statistically stable; i.e., no sign of non-random variation in the process. The stability of the process data should be checked first before any statistical analysis is done. Unfortunately, this natural step is commonly ignored in practice. Failure to do so may lead to an erroneous conclusion about both present and future process behavior. For example, as it is reported by Holmes and Mergen (2005), failure to check the stability of the data prior to estimating the variance/covariance matrix may lead to distortion in the results of the principal component analysis (PCA). In addition, Balestracci (2002, part 2, page 16-17) in his two-part paper talks about the importance of checking the stability of data before doing any other statistical tests.

As is known, a typical process may display two types of variations: random (common cause variations) and non-random (assignable, special cause of variations). If the process does not display any sign of non-random variation, the process is said to be in statistical control; i.e., stable. In other words, the process is repeating itself consistently. Keep in mind that a stable process may or may not meet expectations, which is a different issue. As was stated before, the future performance of the stable process is predictable, and planning operations and control is easier.

There are several ways to test the stability of the processes. In this paper, we will describe alternative methods for checking stability, both for univariate and multivariate process data. The approach is based on using the concept of mean square successive differences (MSSD) to estimate an alternative variance for the univariate data and covariance matrix for multivariate data. These alternative variance measures are then compared with the conventional estimates and tested for equality.

Methods

Univariate Case:

The conventional estimate of the variance (s^2) gives the total estimate of the variation that currently exists in the process, i.e.,

$$s^{2} = \frac{\sum_{i=1}^{n} (X_{i} - \overline{X})^{2}}{n-1}$$
(1)

where X_i are the individual observations, \overline{X} is the average and n is the number of observations. This estimate will include both random and non-random variation (if non-random variation exists) in the process. If we can come up with another variance estimate that excludes nonrandom variation, then we can compare the two estimates for equality. If there is no non-random variation in the process, then these two estimates would be very close to each other; otherwise, they will differ. One such estimate, i.e., the one that excludes the non-random variations, is the one computed using mean square successive differences (MSSD) – see, for example, Neumann, et al. (1941), Hald (1952), Holmes and Mergen (2007). The MSSD is defined as

$$MSSD = \frac{1}{(n-1)} \sum_{i=1}^{n-1} (X_{i+1} - X_i)^2$$
(2)

Using these differences an unbiased estimate for the process variance is given by Hald (1952) as

$$q^{2} = \frac{1}{2(n-1)} \sum_{i=1}^{n-1} (X_{i+1} - X_{i})^{2}$$
(3)

The significance of the difference between the conventional and MSSD variance estimates can be tested using the test given in Dixon and Massey (1969).

$$z = \frac{1 - \frac{q^2}{s^2}}{\sqrt{\frac{n - 2}{(n - 1)(n + 1)}}}$$
(4)

Since z is N(0,1), then, for example, the use of z values between ± 3 , gives about 99.7% critical region for the test (note: one could use other values beside ± 3 and the critical region would therefore be different). Values of z between ± 3 indicate that the difference between the two estimates is not significant, i.e., the process data seems to be stable. In other words, it is operating under common causes only. Z values bigger than +3 and less than -3 indicate that the two estimates are significantly different, and the process data is not stable. (Values bigger than +3 imply a trend and long-term cycles in the process and values less than -3 imply short term cycles in the process.)

Example 1:

The data set that is used is on viscosity. (All data sets are available from authors upon request). Relevant descriptive statistics are given below:

Median Mean = 9.1 93 _ Std. Dev. (SD) =0.6 Range 3.0 = MSSD SD 0.2No. of observ.= 310 _ Normal z to compare two variances = 15.1

The regular standard deviation is much bigger than the MSSD estimate of standard deviation (0.6 vs. 0.2); and the significance test has a z value of 15.1, indicating that two variance estimators are significantly different. This in turn implies that data may have a trend and/or long-term cycles. In other words, the process does not seem to be stable during the period the data was gathered. It also indicates that the process variation could potentially be reduced to 0.2 and the process capability could be improved.

Multivariate Case:

The method that we will describe for the multivariate case is a multivariate extension of testing the equality of two variance estimators, i.e., the regular variance estimator and the MSSD variance estimator, which is discussed under the univariate case above. Holmes and Mergen (1993) developed the mean square successive difference covariance matrix as the multivariate equivalent to the mean square successive difference variance. The equation below shows the MSSD covariance matrix:

$$\operatorname{Cov}(X_{j}, X_{k}) = \frac{\sum_{i=2}^{n} (X_{j,i} - X_{j,i-1})(X_{k,i} - X_{k,i-1})}{2(n-1)}$$
(5)

The covariance matrix obtained using the MSSD approach and the regular covariance matrix can be tested for equality using the test proposed by Kramer and Jensen (1969). The test that they proposed is as follows:

$$M = (n_1 + n_2 - 2)\log|S| - (n_1 - 1)\log|S_1| - (n_2 - 1)\log|S_2|$$
(6)

where S_1 and S_2 are the covariance matrices for using the regular and the MSSD approach, and n_1 and n_2 are the observations in samples used to determine the two dispersion matrices respectively, (we assume $n_1 = n_2$) and

$$S = \frac{(n_1 - 1)S_1 + (n_2 - 1)S_2}{(n_1 + n_2 - 2)}$$
(7)

and the logarithms are to the base 10.

The constant m is defined as

$$m = 1 - \left[\frac{1}{(n_1 - 1)} + \frac{1}{(n_2 - 1)} - \frac{1}{(n_1 + n_2 - 2)}\right] \left[\frac{2p^2 + 3p - 1}{6(p + 1)}\right]$$
(8)

where p is the number of variables in the process.

Then, equality of two covariance matrices is checked using the statistic G:

$$G=2.3026(m)(M)$$
 (9)

which is approximately distributed as Chi-Square with p(p + 1)/2 degrees of freedom. This value of G can then be compared to a table value of Chi-Square for a given confidence level. If the G statistic is less than the chosen table value of Chi-Square, it means that the covariance matrices are statistically equal, i.e., the multivariate process data has no sign of non-random variations. In other words, the process data is stable. Otherwise, the process data is said to be not stable.

Example 2:

The example data is from Holmes and Mergen (1998). This data dealt with the percentage by weight of a series of five screens (A through E) in a particle size determination. The results of the proposed multivariate test are summarized below. Since the G statistic is bigger than the chosen table value of the Chi-Square, this indicates that the data set collected during the period was not stable.

Variance-Covariance Matrix - Regular Way (S1)

	А	В	С	D	E
А	1.538	0.909	1.207	1.132	0.336
В	0.909	6.863	0.389	2.373	-4.065
С	1.207	0.389	4.960	3.824	1.777
D	1.132	2.373	3.824	5.468	-0.012
E	0.336	-4.065	1.777	-0.012	5.467

Variance-Covariance Matrix - MSSD Approach (S2)

	А	В	С	D	Е
А	1.516	0.292	1.471	1.328	0.944
В	0.292	1.144	0.612	1.132	0.280
С	1.471	0.612	3.827	3.240	1.078
D	1.328	1.132	3.240	4.852	0.638
E	0.944	0.280	1.078	0.638	2.228

Determinant of the regular covariance matrix $(S_1) = 151.415$ Determinant of the MSSD covariance matrix $(S_2) = 10.244$ Determinant of the combination of S_1 and S_2 (S) = 72.323M value = 17.949 m value = 0.921 G = 2.3026(0.921)(17.949 = 38.064 (with 15 degrees of freedom) Table value of Chi-Square (99.5%) = 32.80

Conclusion

Changes in process technology, increased product features, etc., may disrupt the stability of the data collected from processes. Thus, we recommend that initial tests for stability, like the ones described in this paper, should be part of any statistical modeling to improve the reliability of the results. Failure to check the stability of the data prior to more advanced analysis may lead to erroneous conclusions.
References

Balestracci, D. (2002). Statistics and reality – Part II. ASQ Statistics Division Newsletter, 21(1), 15-20.

Dixon, W.J., & Massey, F.J. (1969). *Introduction to statistical analysis*, New York, NY: McGraw-Hill, 353-354.

Hald, A. (1952). *Statistical theory with engineering applications*. New York, NY: Wiley, 357-360.

Holmes, D.S., & Mergen, A.E. (1993). Improving the performance of T-square control chart. *Quality Engineering*, *5*(4), 619-625.

Holmes, D.S., & Mergen, A.E. (1998). Multivariate test for randomness. *Quality Engineering*, 10(3), 505-508.

Holmes, D.S., & Mergen, A.E. (2005). Effect of multivariate process instability on principal component analysis: A case study. *The AAPS Journal*, 7(1), 106-117.

Holmes, D.S., & Mergen, A.E. (2007). Using descriptive statistics in statistical process control. *The 2007 Northeast Decision Sciences Institute Meeting Proceedings*, Baltimore, Maryland, March, 566-571.

Kramer, C.Y., & Jensen, D.R. (1969). Fundamentals of multivariate analysis - Part II: Inference about two treatments. *Journal of Quality Technology*, 1(3), 189-204.

Neumann, J.V., Kent, R.H., Bellinson, H.R. & Hart, B.I. (1941). The mean square successive difference. *Annals of Mathematical Statistics*, 12(2), 153-162.

AN EMPIRICAL INVESTIGATION OF INFORMATION TECHNOLOGY MEDIATED CUSTOMER SERVICES IN CHINA

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Abstract

Information technology mediated customer service is a reality of the 21st century. More and more companies have moved their customer services from in store and in person to online through computer or mobile devices. Using 208 respondents collected from two Chinese universities, this paper investigates customer preference over two service delivery model (either in store or online) on five type of purchasing (retail, eating-out, banking, travel and entertainment) and their perception difference in customer service quality between those two delivery model. Results show that a majority of Chinese students prefer in store and in person for eating out. For ordering tickets for travel and entertainment, they prefer computer/mobile device. For retail purchasing and banking, less than half of the students prefer in person services. In general, the results show that ordering through computer/mobile devices has become more popular in China and has received higher rating for most of customer service quality except security compared to ordering in store. In addition, it is found that there exist a gender difference in purchasing preference and perception in service delivery quality in China.

Keywords Customer service technology, customer service quality metrics, gender comparison, China

Introduction

Organizations continue to face competitive challenges from both home and overseas, and meeting these challenges often impacts customer brand loyalty and product profitability. Spending more for improved customer service may lead to lower profitability. When product differentiation cannot be achieved, there are two general strategies that can be employed to remain competitive: price differentiation and service differentiation. The focus of this study is limited to investigating service differentiation. Service can be defined as customer care and customer support. Most organizations have some form of customer service, as there will always be times when a customer has a need, a problem, or needs information.

With the growing deployment of self-service technologies, businesses need to determine their most favorable mix of traditional human service with IT mediated service. [5] Many companies are cultivating Customer Service by structuring the business model to meet and satisfy customer requirements. [4] For example: McDonalds has extended the breakfast menu to be served the entire day rather than just in the morning. Kentucky Fried Chicken has "bundled" menu offerings, and no longer sells certain items individually. McDonald's customer service strategy may lead to a

positive outcome, more sales; KFC may lead to a negative outcome, the customer does not want the bundle of items, only a single item. In any case, the ultimate objective of customer service is to assist customers in solving a problem or meeting a need.

Many see information technology as the modern driving force for customer service innovation. More than twenty five years ago, Clarke and Murray [2] argued that the greatest unrealized potential of IT is in the area of customer service. Recent research by Pulach and Wunderlich [9] studying B2B customers, however, found that despite their potential, gaining acceptance of technology based services presents significant management challenges. [3] The study also found that customers perceived technology based services as high risk. A recent study of the value of self- service [11] reported that while self-service may increase productivity and reduce the cost of service delivery, technology-based self-service may not always lead to desired results and may harm customer retention. Efforts in the area of chatter bots [1] underscore the difficulties in both typed and oral customer interface with automated systems. In spite of these obstacles, deployment of digital technologies is resulting in utilizing Information technology to replace humans in meeting service demands.

Moore's Law states that the number of transistors in a dense integrated circuit will double every two years, [8] therefore overall processing capabilities will double, while the cost stays about the same. Substituting technology for humans to provide customer service makes economic sense for organizations, because the price of technology continues to drop per unit of processing, while the price of human labor stays the same or continues to rise. This has led to such things as human-less automated telephone attendant systems to respond to telephone inquiries, internet driven service request systems, self-checkout stations at grocery retailers (such as Stop and Shop and Publix) [6], [7] and home improvement retailers (such as Home Depot and Lowes), self-ordering and paying devices at food retailers such as Chili's, and of course automated teller machines (ATMs) at banks and kiosks.

A study by Accenture [10] found that 83% of U.S. consumers prefer dealing with human beings rather than digital channels, and that human interaction is vital to customer satisfaction. Humans generally prefer not interacting with technology or machines when they require service. Human interaction, therefore, continues to be a vital element in successfully meeting customer service expectations. When economics come into play and service is outsourced off shore, even when humans are utilized, language may become a problem. Example: Many foreign countries may provide lower cost service representatives, but can these representatives communicate effectively, solve problems, and meet U.S. customer expectations? The Accenture study [10] found that cultural differences and language issues influence customer ratings.

Virtually all organizations claim to strive for superior customer service, but they also must live with finite budgets. In almost all situations great customer service is expected, but when delivered may not build customer loyalty. It is expected, and those expectations are met. Poor customer

service is generally unacceptable, and may drive customers to seek alternative providers, and will often negatively affect customer loyalty.

How does an organization verify that they are providing excellent customer service? One way is to measure customer satisfaction. Measurement of customer satisfaction often includes asking the customer to complete a brief survey, either at the time of service or after the fact. The survey provides a window to view those utilizing the service. Customer service quality begins with the business decisions establishing customer service response systems; customer satisfaction is how customers react to these systems when they have a problem that needs to be addressed. Whatever the process, measuring customer service effectiveness is vitally important [2]. Measuring service quality generally involves measuring both objective and subjective outcomes: were your needs met, and were they met in a manner that was acceptable to you.

Few studies have been done on customer service satisfaction in China. Our objective is to determine if today's Chinese customers are satisfied with customer service systems that are currently in place.

Methodology

In order to evaluate customer service satisfaction with IT mediated service we first identified five types of retail purchasing commonly done by potential survey respondents. These are one retail, two eating out, three banking, four travel and five entertainment. Next we identified two dominant means or modes by which purchasing can be done, either in store and in person, or through a computer or mobile device. For each type of purchasing, we developed seven items to measure how people perceive the relative value of each mode within each type of purchasing experience.

The survey was developed in English first, then translated into Chinese and finally verified by two researchers that are fluent in Chinese. The survey was tested with a few Chinese students and college professors for the validity and readability of the survey. The survey was modified accordingly. The final version of the survey was distributed through weChat to the students at two large Chinese universities in Beijing with 208 valid respondents. Table 1 shows demographic Information about the survey population, 91% of the students are in the age of 20-29. Among the respondents, 38 % are male and the rest of the respondents (62%) are female.

		Percent (Number)
Gondor	Male	37.5% (78)
Gender	Female	62.5% (130)
	Below 20	1.0% (2)
A @2	20-29	90.9%% (189)
Age	30-39	6.3% (13)
	Above39	1.9% (4)

 Table 1. Demographics Information

Table 2 shows the types of hardware devices owned by respondents and their inclination toward technology adoption as described in technology adoption modeling (TAM) [3]. It is interesting to note the high availability of owned hardware devices for Chinese students. Nearly 100% have laptops and web-enabled smart phones, and about 55% have tablet computers, hence many have three personal electronic devices. About one third (36%) of the respondents consider themselves as early adopter of new technology and gadgets. It can be seen that Chinese young generation has incorporated technology into their daily life and has more favorable attitude toward technology compared to old generation.

Devices I Own	Percent (Number)
Laptop/Computer	98.1%% (204)
Smart Phone	98.1% (204)
Tablet (iPad, Samsung Note,	
etc.)	54.8% (114)
E-Reader (Kinder Fire, Nook,	
etc.)	23.6% (49)
Apple Watch	3.4% (7)
I am always among the first to	
adopt new technology and	
gadgets	
Strongly Agree (Eagle	9.1% (19)
Beaver)	
Agree (Early Adopter)	26.9% (56)
Neither Agree nor Disagree	51.4% (107)
(Early Majority)	
Disagree (Late Majority)	10.1% (21)
Strongly Disagree	2.4% (5)
(Technically Adverse)	

Given the age, hardware availability and pro-technology bias associated with this population it was anticipated that survey results would be more friendly toward the use of IT mediated service than that of the Chinese purchasing population as a whole.

Data Analysis

This section will discuss the student purchasing preference (in store or online) by five type of purchasing (Retail, Eating-Out, Banking, Travel and Entertainment). Paired samples t-tested will then be used to test whether there exist significant difference between in-store and online purchasing for each metric of customer service quality. Additional analysis will be conducted to see whether there is a gender difference in purchasing preferences and customer service quality between in store and online purchasing.

Purchasing Preference by Type of Purchasing

Table 3 shows that a majority of Chinese students prefer in store and in person for eating out. For ordering tickets for travel and entertainment, they prefer computer/mobile device. For retail purchasing and banking, about 40% of the students prefer in person services, and the rest (60%) prefer computer and mobile devices.

Table 3a further divides student preference for each type of purchasing by gender. For retail purchasing, a higher percentage of female respondents (45%) prefer in store and in person than males (35%), however, for banking, a lower percentage of females (40%) prefer in store and in person than males (45%). Chi-square tests are used to see whether there is any gender difference in student preferences for each type of purchasing. The results how that retail purchasing is significant at 0.10 level (chi-square=2.33, df=1, p=0.08). More female students prefer to do retail purchasing in store than male students. There is no significant difference by gender in purchasing preferences for each gout, banking, travel and entertainment.

In addition, we classified the respondents based on their number of online purchasing preferences. For example, if the respondents prefer online for all five types of purchasing (retail, eat-outing, banking, travel and entertainment), they receive a 5; and if the respondents prefer in store for all purchasing types, they receive a 0. The results are listed in Table 3b. It can be seen that 8% of the respondents prefer online for all purchasing types, 34% of them prefer online for 4 out of 5 purchasing types, and 37% of them prefer online for 3 out of 5 purchasing types. In sum, the majority of the respondents prefer online for at least 3 types of purchasing.

Table 3b also show that males prefer online than females in China. For example, about 46% of the males prefer online for at least 4 types of purchasing, and this number is reduced to 40% for females.

	Respondent Preferences			
	In Store and in	Through		
	Person Computer/Mobile			
Type of Purchasing		Device		
Retail	41.3%(86)	58.7%(122)		
Eating Out	84.6% (176)	15.4% (32)		
Banking	41.8%(87)	58.2%(121)		
Travel	3.8%(8)	96.2%(200)		
Entertainment	3.8% (8)	96.2% (200)		

		Respondent Preferences				
Type of		In Store and in	Through Computer/Mobile			
Purchasing		Person	Device			
Retail	Male	34.6% (27)	65.4% (51)			
	Female	45.4% (59)	54.6% (71)			
Eating Out	Male	83.3% (65)	16.7% (13)			
	Female	85.4% (111)	14.6% (19)			
Banking	Male	44.9% (35)	55.1% (43)			
	Female	40.0% (52)	60.0% (78)			
Travel	Male	5.1%(4)	94.9% (74)			
	Female	3.1% (4)	96.9% (126)			
Entertainment	Male	5.1%(4)	94.9% (74)			
	Female	3.1% (4)	96.9% (126)			

Table 3a. Student Preferences by Type of Purchasing by Gender

Table 3b. Number of Online Preferences by Gender.

Gender	Number of Online Purchasing Preferences						
	0	1	2	3	4	5	
Male			19.2%	30.8%	35.9%		
	2.6%(2)	1.3% (1)	(15)	(24)	(28)	10.3% (8)	
Female			16.9%	40.0%	33.1%		
	0.8% (1)	2.3% (3)	(22)	(52)	(43)	6.9% (9)	
Total				36.5%	34.1%		
	1.4% (3)	1.9% (4)	17.8%(37)	(76)	(71)	8.2% (17)	

Customer Services Quality Comparison

For each of the five purchasing category (Retail, Eating Out, Banking, Travel, and Entertainment), 7 items for measuring customer services quality (see table 4) were developed and students were asked to rate each service quality (on a scale of 1-5) based on where purchasing was conducted (in store and in person, or computer/mobile). Paired sample t-tests were then used to test whether there is a significant perception difference in customer service quality between two modes of purchasing (in-store and in person, or computer/mobile device). In addition, paired sample t-tests were used to test whether there is a significant perception difference for male and female students separately.

The results show that there exists significant difference between in store or online purchasing for each category of purchasing (See Tables 4-8 and Charts 1-5).

<u>Retail Purchasing</u>

Table 4 shows that for retail purchasing, there exist significant difference between in-store and online purchasing for each metric of customer service quality except the last item (customer service met your expectation). Online purchasing received higher mean for all service quality measures except item 4 (you felt secure in doing your transaction) where in store and in person received higher mean.

Table 4a and Table 4b show the results of paired sample t-tests for males and females groups respectively. For males students, online purchasing have significantly higher mean for all service quality measures except item 4 and last item (You felt secure in doing your transaction; and Customer Service met your expectations). For female students, online purchasing have significantly higher mean for all service quality measures except item 4 and last two items. Again, both males and females feel more secure conducting transaction in store. However, males students considered total time to complete transaction for online purchasing is more reasonable than in store. However, this measurement is not significant for female students.

Chart 1 shows that there is a bigger perception difference between in store and online in most of the service quality measures for males students than for females students, indicating males students have a more favorable attitude toward online purchasing in retail.

	Mean for Each		Paired Samples t-	
	Mode of			test
	Purc	hasing		
	In Store	Computer	t-	Significance
	and In	/Mobile	value	
	Person	Device		
You felt welcome to the store/ websit	3.56	3.81	-4.68	.000
You were able to locate what you wanted	3.48	3.88	-5.35	.000
Checkout and payment was quick enough	3.54	4.11	-8.64	.000
You felt secure in doing your transactions	3.91	3.59	5.47	.000
Total waiting time is reasonable	3.30	3.92	-8.66	.000
Total time to complete transaction was reasonable	3.42	3.67	-3.17	.002
Customer Service met your expectations	3.43	3.52	-1.41	.161

Table 4. Retail Purchasing

	Mean for Each		Paired Samples t-	
	Мо	de of	test	
	Purc	hasing		1
	In Store	Computer	t-	Significance
	and In	/Mobile	value	
	Person	Device		
You felt welcome to the store/ website	3.51	3.78	-2.97	.004
You were able to locate what you wanted	3.38	4.00	-5.25	.000
Checkout and payment was quick enough	3.53	4.19	-6.12	.000
You felt secure in doing your transactions	3.92	3.68	2.66	.010
Total waiting time is reasonable	3.29	3.94	-5.56	.000
Total time to complete transaction was reasonable	3.35	3.81	-3.59	.001
Customer Service met your expectations	3.37	3.54	-1.71	.091

Table 4a. Retail Purchasing (Male Students)

Table 4b. Retail Purchasing (Female Students)

	Mean for Each		Paired Samples t-	
	Mode of		test	
	Purc	hasing		
	In Store	Computer	t-	Significance
	and In	/Mobile	value	
	Person	Device		
You felt welcome to the store/ website	3.58	3.82	-3.60	.000
You were able to locate what you wanted	3.54	3.81	-2.83	.005
Checkout and payment was quick enough	3.55	4.06	-6.18	.000
You felt secure in doing your transactions	3.90	3.53	4.82	.000
Total waiting time is reasonable	3.31	3.92	-6.63	.000
Total time to complete transaction was reasonable	3.46	3.58	-1.25	.213
Customer Service met your expectations	3.47	3.52	-0.54	.592



Eating-Out

Table 5 shows that for eating out, there exist significant difference between in store and online for 4 out of 7 items. In store purchasing received significant higher mean for the three items (You felt welcome to the restaurant/ website/phone; You felt secure in doing your transactions; and Customer Service met your expectations). In contrast, online ordering eating-out received a higher mean for the item (Checkout and payment was quick enough). The findings is consistent with previous section since the students chose in store and in person as their most preferred method of ordering eating out. They also consider in-store ordering as having better customer service quality.

Table 5a shows for male students, there is a significant difference between in store and online for 3 service quality measures. Ordering food in store has a higher mean in two items (Checkout and payment was quick enough; Customer Service met your expectations), while ordering online has a higher mean for the item Checkout and payment was quick enough. For females students, 4 out of 7 services are significant between in store and online. Besides the three items same to males, ordering food in store also received a higher mean for the first item (You felt welcome to the restaurant/ website/phone) than ordering online. In addition, Chart 2 shows that there is a similar perception difference in most of the service quality measures between in store and online for males and females students.

Table 5. Eating Out

	Mean for Each Mode of Eating		Mean for Each Paired Mode of Eating	
	In Store and In Person	Computer /Mobile Device	t- value	Significance
You felt welcome to the restaurant/ website	3.67	3.53	2.25	.026
You could find what you wanted on menu	3.71	3.65	0.98	.327
Checkout and payment was quick enough	3.73	4.05	-6.12	.000
You felt secure in doing your transactions	3.90	3.64	4.66	.000
Total waiting time is reasonable	3.25	3.28	-0.38	.704
Total time to complete transaction was reasonable	3.60	3.47	1.92	.057
Customer Service met your expectations	3.63	3.38	3.87	.000

Table 5a. Eating Out (Male Students)

	Mean for Each		Paired Samples t-	
	Mode of Eating			test
	C	ut		
	In Store	Computer	t-	Significance
	and In	/Mobile	value	
	Person	Device		
You felt welcome to the	3 68	3 56	1 22	227
restaurant/ website	5.00	5.50	1.22	.221
You could find what you	3 68	3 71	-0.26	798
wanted on menu	5.00	5.71	-0.20	.770
Checkout and payment was	3 71	4.06	-4 02	000
quick enough	5.71	7.00	-4.02	.000
You felt secure in doing	3.96	3 72	2 97	004
your transactions	5.70	5.72	2.71	.004
Total waiting time is	3 32	3 24	0.65	516
reasonable	5.52	5.24	0.05	.510
Total time to complete	3 58	3 40	1 45	150
transaction was reasonable	5.50	5.40	1.45	.130
Customer Service met your	3.64	3 11	2 1 1	038
expectations	5.04	5.44	2.11	.030

	Mean f	or Each	Paired Samples t-		
	Mode o	of Eating	test		
	0	ut			
	In Store	Computer	t-	Significance	
	and In	/Mobile	value		
	Person	Device			
You felt welcome to the restaurant/ website	3.67	3.51	1.88	.052	
You could find what you wanted on menu	3.73	3.62	1.40	.163	
Checkout and payment was quick enough	3.75	4.05	-4.60	.000	
You felt secure in doing your transactions	3.87	3.59	3.62	.000	
Total waiting time is reasonable	3.22	3.31	-0.94	.351	
Total time to complete transaction was reasonable	3.62	3.51	1.27	.206	
Customer Service met your expectations	3.62	3.35	3.24	.002	

Table 5b. Eating Out (Female Students)



<u>Banking</u>

Table 6 shows that for banking, 3 service quality measures are significant between in store and online. Among those three items, banking in store received higher mean for one item (You felt secure in doing your transactions), and online banking received higher mean for two items (Total waiting time is reasonable; Total time to complete transaction was reasonable). Previous result show that more than half (68%) of the respondents prefer online banking than in store. It seems that transaction time is more important than security in choosing preferred method for banking.

Table 6a and 6b shows that the above three items are also significant for males and females group. For females students, online banking has a higher mean for item 1 (You felt welcome to the bank/ website/phone) than banking in store. This item is not significant for male students.

Chart 3 shows that there is a big perception difference between in store and online for both males and females. In addition, males has a higher mean for online banking than females for most service quality measures.

	Mean f	for Each	Paired Samples t-	
	Mode of	f Banking	test	
	In Store	Computer	t-value	Significance
	and In	/Mobile		
	Person	Device		
You felt welcome to the bank/ website	3.53	3.66	-1.89	.060
You could complete those		• • •	0 - 11	
transactions you wished to	3.73	3.69	0.61	.545
You felt secure in doing your transactions	4.04	3.61	7.59	.000
Total waiting time is reasonable	2.67	3.89	-14.74	.000
Total time to complete transaction was reasonable	2.99	3.83	-10.19	.000
Customer Service met your expectations	3.50	3.58	-1.17	.242

Table 6. Banking

Table 6a. Banking (Male Students)

	Mean f	for Each	Paired Samples t-		
	Mode of	f Banking	test		
	In Store	Computer	t-value	Significance	
	and In	/Mobile			
	Person	Device			
You felt welcome to the	3.49	3.73	-2.13	.036	
bank/ website					
transactions you wished to	3.76	3.68	0.80	.426	
do					
You felt secure in doing your transactions	4.12	3.71	3.83	.000	
Total waiting time is reasonable	2.69	3.96	-8.00	.000	
Total time to complete transaction was reasonable	2.91	3.92	-6.81	.000	
Customer Service met your expectations	3.49	3.59	-0.77	.445	

Table 6b. Banking (Female Students)

	Mean for Each		Paired Samples t-	
	Mode of	f Banking	test	
	In Store	Computer	t-value	Significance
	and In	/Mobile		
	Person	Device		
You felt welcome to the	2 55	3 67	70	175
bank/ website/phone	5.55	5.02	12	.475
You could complete those				
transactions you wished to	3.71	3.69	.18	.855
do				
You felt secure in doing	2.00	2 55	6.80	000
your transactions	5.99	5.55	0.89	.000
Total waiting time is	266	3.85	12.80	000
reasonable	2.00	5.85	-12.09	.000
Total time to complete	2.02	2 77	7.62	000
transaction was reasonable	5.05	5.77	-7.03	.000
Customer Service met your	3 50	3 58	00	370
expectations	5.50	5.50	00	.379



<u>Travel</u>

Table 7 shows that for travel, there exist significant difference between in store and online except item 4 (You felt secure in doing your transactions). The similar findings are observed for males and females as shown in Table 7a and 7b. Purchasing online received higher mean for all service quality measures except security question than in store purchasing. Those are consistent with our earlier findings, showing students chose computer/mobile device as their most preferred way of purchasing travelling tickets. Chart 4 shows that both males and females rated online purchasing higher in all items except security. There is no significant difference regarding the security question between in store and online purchasing. This is surprising considering ordering in store is perceived more secure compare to ordering through computer/mobile device for retail, eating-out and banking.

<u>Entertainment</u>

Table 8 shows that for entertainment, there exists significant differences for all service quality measures between in store and online. Online purchasing has a higher mean for all measurement including the item (you felt secure in doing your transaction). This is unexpected as online is usually viewed as less secure than in store. This pattern is the same for females. For male respondents, the security question is not significant between in store and online. Chart 5 shows that both males and females rated online purchasing higher in all items than in store.

	Mean	for Each	Paired Samples t-test		
	Mode of	of Travel			
	In Store	Computer	t-value	Significance	
	and In	/Mobile			
	Person	Device			
You felt welcome at the counter or at the website/phone	3.12	3.85	-10.44	.000	
You could complete those transactions you wished to do	3.51	4.09	-9.52	.000	
Checkout and payment was quick enough	3.26	4.16	-12.44	.000	
You felt secure in doing your transactions	3.75	3.83	-1.36	.175	
Total waiting time is reasonable	2.75	4.08	-15.69	.000	
Total time to complete transaction was reasonable	2.88	4.09	-14.69	.000	
Customer Service met your expectations	3.31	4.00	-9.92	.000	

Table 7. Travel

Table 7a. Travel (for Male Students)

	Mean for Each Mode of Travel		Paired Samples t-test	
	In Store and In Person	Computer /Mobile Device	t-value	Significance
You felt welcome at the counter or at the website	3.09	3.81	-6.01	.000
You could complete those transactions you wished to do	3.46	4.14	-6.74	.000
Checkout and payment was quick enough	3.27	4.21	-7.70	.000
You felt secure in doing your transactions	3.77	3.86	-0.85	.396
Total waiting time is reasonable	2.69	4.06	-9.11	.000
Total time to complete transaction was reasonable	2.81	4.10	-8.66	.000
Customer Service met your expectations	3.35	4.04	-5.64	.000

Table 7b.	Travel	(for F	emale	Students)
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	Mean for Each Mode of Travel		Paired Sa	amples t-test
	In Store and In Person	Computer /Mobile Device	t-value	Significance
You felt welcome at the counter or at the website	3.13	3.87	-8.55	.000
You could complete those transactions you wished to do	3.54	4.06	-6.83	.000
Checkout and payment was quick enough	3.26	4.14	-9.74	.000
You felt secure in doing your transactions	3.73	3.82	-1.05	.294
Total waiting time is reasonable	2.78	4.08	-12.85	.000
Total time to complete transaction was reasonable	2.92	4.08	-11.96	.000
Customer Service met your expectations	3.29	3.98	-8.23	.000



	Mean for E Entert	Each Mode of tainment	Pair	ed Samples t-test
	In Store and	Computer	t-	Significance
	In Person	/Mobile Device	value	
You felt welcome at the counter or at the website	3.35	3.90	-8.16	.000
You could complete those transactions you wished to do	3.56	4.10	-9.07	.000
Checkout and payment was quick enough	3.45	4.18	- 11.60	.000
You felt secure in doing your transactions	3.68	3.88	-2.92	.004
Total waiting time is reasonable	2.86	4.12	- 16.58	.000
Total time to complete transaction was reasonable	3.06	4.11	- 13.81	.000
Customer Service met your expectations	3.38	3.98	-9.30	.000

Table 8a. Entertainment (Male Students)

	Mean for F Entert	Each Mode of ainment	Pair	ed Samples t-test
	In Store and In Person	Computer /Mobile Device	t- value	Significance
You felt welcome at the counter or at the website	3.33	3.85	-3.83	.000
You could complete those transactions you wished to do	3.59	4.08	-4.35	.000
Checkout and payment was quick enough	3.44	4.17	-6.20	.000
You felt secure in doing your transactions	3.69	3.92	-1.85	.069
Total waiting time is reasonable	2.78	4.10	-8.94	.000
Total time to complete transaction was reasonable	3.01	4.08	-6.90	.000
Customer Service met your expectations	3.36	4.00	-5.18	.000

Table 8b. Entertainment (Fe	male Students)
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	Mean for Each		Paired Samples t-test	
	Mode of Entertainment			
	In Store and In Person	Computer /Mobile Device	t-value	Significance
You felt welcome at the counter or at the website	3.35	3.94	-7.83	.000
You could complete those transactions you wished to do	3.54	4.11	-8.46	.000
Checkout and payment was quick enough	3.45	4.18	-10.11	.000
You felt secure in doing your transactions	3.68	3.85	-2.28	.024
Total waiting time is reasonable	2.90	4.13	-14.61	.000
Total time to complete transaction was reasonable	3.08	4.13	-13.05	.000
Customer Service met your expectations	3.39	3.97	-7.98	.000



Conclusion and Future Research

This paper investigates Chinese customer preference over two service delivery model (either in store or online) on five type of purchasing (retail, eating-out, banking, travel and entertainment) and their perception difference in customer service quality between those two delivery model. Results show that a majority of Chinese students prefer in store and in person for eating out. For ordering tickets for travel and entertainment, they prefer computer/mobile device. For retail purchasing and banking, less than half of the students prefer in person services. In general, the results show that ordering through computer/mobile devices has become more popular and has received higher rating for most of customer service quality except security compared to ordering in store. In addition, it is found that there exist a gender difference in purchasing and consider online purchasing as having higher service quality than female students.

Customer service strategy is in play and is becoming progressively more technology mediated. The checkout process is becoming a more time consuming part of the "bricks" shopping experience, which may be an unintended contributor to the significant worldwide increase in "clicks" sales. An increase in the ratio of self service to full service checkout in retail results in empty self-checkout and unnecessarily longer lines at full service. Companies should review their strategies for customer service and adjust their rate of IT mediated customer service to more closely match customer willingness to embrace these changes.

Areas of future research for information technology mediated customer service should include development of a model that links current customer adaptation realities to profit motivated changes in customer service, before such changes are implemented on a broad scale.

REFERENCES

1. Chakrabarti, C. and Luger, G. (2015). Artificial conversations for customer service chatter bots: Architecture, algorithms, and evaluation metrics, *Expert Systems with Applications*, 42, (2015), 6878–6897.

2. Clarke, P. and Murray, D., (1990). Information Technology in Customer Service, *Business Quarterly*, 54, (4), 91.

3. Davis, F., (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology, *MIS Quarterly*, 13 (3), 319-340.

4. Domegan, C. and Donaldson, B., (1992). Customer Service and Information Technology, *Journal of Information Technology*, (1992), 7, 203-212.

5. Israeli, A. and Brown, R., (2015). An Approach for Determining the Mix between Human and Automated Service Providers, *JOURNAL OF MULTI-CRITERIA DECISION ANALYSIS, online* 22, (2015), 75–88.

6. Lee, Hyun-Joo and Lyu, Jewon, (2016). Personal values as determinants of intentions to use self-service, *Computers in Human Behavior*, 60, (2016), 322-332.

7. McWilliams, A. and Anistal, M., (2016). Customer Versus Employee Perceptions: A Review of Self-Service Technology Options as Illustrated in Self-Checkouts in U.S. Retail Industry, *Academy of Marketing Studies Journal*, 20, (1), 79.

8. Moore, G., (1965). Cramming More Components onto Integrated Circuits, *Electronics*, 114-117.

9. Pulach, S. and Wunderlich, N., (2016). Contrasting risk perceptions of technology-based service innovations in inter-organizational settings, *Journal of Business Research* 69, (7), 2424–2431.

10. K. Quiring, F. DeAngelis & E. Gasull, (2016) Digital disconnection in customer engagements. Found at <u>www.accenture.com/us-en/insight-digital-disconnect.</u>

11. Scherer, A., Wünderlich, N., von Wangenheim, F., (2015). The Value of Self-service: Long-term Effects of Technology-based Self-Service Usage on Customer Retention, *MIS Quarterly*, 39, (1), pp. 177-200.

AN EXPLORATORY STUDY OF SMEs CEO CHARATERSTICS AND LEARNING ORIENTATION FOR SMEs: RBV, LEARNING THEORY, and CULTURE DIMENSION THEORY PERSPECTIVES

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AN EXPLORATORY STUDY OF SMEs CEO CHARATERSTICS AND LEARNING ORIENTATION FOR SMEs: RBV, LEARNING THEORY, and CULTURE DIMENSION THEORY PERSPECTIVES

1. Introduction

Small-Medium Enterprises (SMEs) play an essential role in most countries' production. SMEs have a positive impact on entrepreneurship, gross domestic product, and employment (Bygrave, 1994; Timmons, 1999). Lin (1998) finds that SMEs account for significant employment, innovation, social, and economic growth in both developed and developing countries. CEOs characteristics and firm learning orientations are vital components of SMEs strategy. Only a handful of research has identified the importance of SMEs' CEO characteristics and its impact on the firms' strategic decisions (Skerlavaj, 2007). Watkins and Marsick (2003) find that SMEs that have prioritized learning from external suppliers, customers, and competitors increased in productivity and performance.

However, relatively little empirical research has been done on the SMEs CEO characteristics of a particular culture that are reflected in an organization. The founders of an organization impose a certain cultural value on an organization from its inception. Therefore, members of an organization or organization strategies behave in a manner consistent with the values of CEO. We adopt Hofstede's theory of cultural dimension, providing valuable insight as to how CEOs in collectivist culture and individual culture influence organizational strategies and deployment of firm resources such as R&D capacity, technology, supply chain network, and globalization. There is a gap in the literature regarding how cultural differences impact on CEOs decision making in firm resources. Therefore, this study addresses this gap by using case study to find a better measurement items for the following research question: Do cultural differences in collectivism culture and individualism culture affect SMEs CEO's decision-making in firm resources?

Many researchers assert that SMEs struggle with an increasingly turbulent and uncertain environment, emphasizing on the importance of organizational learning. SMEs need to be creative, innovative, and quick enough to learn new things to stay on top of their fast-paced environment. Therefore, it is best to create a learning orientation where employees put their learning into practice. In this study, we further develop several components of learning orientation through the lens of learning theory, a conceptual model describing how knowledge is absorbed, processed, and retained during learning. We further categorize learning orientation into three different groups. We label these clusters as the three learning groups; *enthusiast*, *traditionalist*, and *inactivist*. Our study investigates which learning groups may lead to more favorable outcomes and contributes to firm performance. However, conventional components (e.g. commitment to learning, shared vision, open-mindedness, knowledge sharing) does not reflect the true nature of SMEs learning orientation. Even though learning orientation of SMEs is viewed as being different to that of large organizations, (Wyer et al., 2000; Keskin, 2006), little research has been done about the learning organization of these special types of organizations. This study, therefore, addresses this gap by exploring the different components of learning orientation, using a case study method to enrich the definition of learning orientation.

Finally, We hypothesize all variables including SMEs CEO Characteristics, information technology, R&D capacity, supply chain networks, globalization, and learning orientation, which affect SMEs' firm performance. A structure equation modeling is used to analyze the structural relationships. Our findings provide a guideline to cultivate a company learning culture and to foster the specific types of learning groups in the firm.

2. Literature Review

2.1 SME CEO characteristics

Many strategy research proposes that a firm's CEO has a profound impact on the performance and strategic decision of the firm (Hambrick & Mason, 1984; Peterson et al., 2003). Finkelstein and Hambrick (1996) assert that CEO has the overall responsibility for the firm's management and the CEO's characteristics are of critical consequence to the firm. Demographic variables such as age, education, and experience allow researchers to effectively capture CEOs characteristics such as talent and expertise, which are relevant to how CEOs make decisions (Hambrick & Mason, 1984).

However, the use of demographic characteristics as measurements for CEOs' characteristics does not truly reflect the true nature of CEOs' characteristics since other factors may drive CEOs' behavior (Carpenter et al., 2004). It undermines the robustness of theories regarding the relationships between CEO characteristics and firm outcomes, and increases the likelihood of an

incorrect interpretation of results (Lawrence, 1997). Although the CEO is considered a key player in a firms' decision strategy (Calori et al., 1994), the CEO's impact on SMEs has not been extensively explored.

2.2 Culture dimension (moderator)

Hofstede (2001) study suggests significant relationships between cultural dimensions and the certain attitudes, behaviors, and values of an individual. To better understand cultural differences, many researchers have specified dimensions along which cultures differ (Hofstede, 1980; Inkeles and Levinson, 1997). Individualism/collectivism is considered to be one of the major components in which cultures have influenced the members of a certain society (Hofstede, 1980; Schwartz, 1994). Much research has demonstrated its impact on the values, norms, and self for behavior (Markus and Kitayama, 1991; Schwartz, 1994).

Individualist culture describes an open group society. People regard themselves independent of others, pursue individual goals over group goals. Norms emphasize assertiveness and confrontation in interdependent situations (Leung, 1997; Markus and Kitayama, 1991; Triandis, 1995). Collectivist represents a closed group society. In such a society, individual believes their destiny is strongly tied to others, avoid their individual goals for collective goals, and rarely move in and out of groups. Norms favor harmony and cooperation in interdependent situations (Van De Vijver and Leung, 1997; Triandis, 1995).

We assert that a society's level of individualism/collectivism influences the relative importance of SME's CEO characteristics and his/her decisions on R&D investment, technology investment, supply chain network development, and globalization strategy. This influence is accomplished through cultural norms and values that determine the critical decision-making capability of CEO.

The Individualism VS Collectivism Dimension				
Low	High			
Japan, Korea, Greece,	U.S., Canada, Britain			
Organization as a family	Organization is impersonal			
Organization defends employee interest	Employees defend their own-interest			
Practices are based on loyalty, sense of duty, group participation	Practice encourage individual initiative			

Table 1: Culture Dimension

2.3 R&D investment

SMEs are significant drivers of innovation domestically and internationally. Acs and Audretsch (2003) find the difference between innovations made by SMEs compared to large counterparts. Among the findings, SMEs contribute nearly three times more innovations than do large counterparts. Further, SMEs tend to produce more inventions or radical innovations compared to their large counterparts (Baumol, 2006). Considering SMEs have an innovation advantage compared to larger firms, R&D investment may be valuable to domestic/international SME performance.

2.4 Technology investment

Information technology utilization is an important aspect of study in numerous fields including SMEs. IT reduces labors, production costs and adds value to products, which increase competitive advantages (Corso et al., 2003). Many studies have proven that IT is a method to enhance the business process (Acar et al., 2005). Many studies assert that there are a large number of unsuccessful IT implementations in SMEs and the adoption rate is slow despite the significance of IT adoption in most firms (Southern and Tiley, 2000) for the following reasons. First, upper managers are unclear of why and how their firms should adopt IT in the first place (Southern and Tilley, 2000). Second, there is a misunderstanding toward the IT adoption process because upper managers do not understand the relationship between IT and the firm performance (Carson and Gilmore, 2000). Third, firms do not have capabilities to expand their IT resources (Claessen, 2005).

2.5 Globalization

Research in globalization concedes the neglect of the SMEs globalization implementation (Sassen, 2007). Contemporary SME research lacks a proper framework of analysis to interpret the recent global activities of these firms. Many SME research cannot fill this theoretical framework with an appropriate approach which focuses on the size of the firms. Only a handful of globalization theories have been utilized by the research on large-scale enterprises (Borghoff, 2005). SMEs are defined as a business organization that, from inception, pursues to gain significant competitive advantages by using resources and selling their products in multiple countries (Oviatt and McDougall, 1994). Such firms are mostly founded in knowledge-intensive

industries and tend to be highly specialized. The specialization of SMEs is necessary for the expansion of business in global markets to take advantage of the skills developed in the domestic market, as well as to finance their significant R&D investments. Much of the learning associated with this process results from being connected to international networks, both at home and abroad (Knight and Cavusgil, 1996).

2.6 Supply Chain Network

SMEs that engage in low supply chain networks tend to lag behind among multiple possible competitors. On the other hand, SMEs that have a high position in the supply chain networks possess dominant value propositions (e.g., brand, reputation, management leadership, relationship strengths) (Kalafatis et al., 2000). However, most SMEs are falling behind in the adoption of integrated supply chain networks that affects the performance of the firms. In the context of SME, an effective supply chain network is crucial for its growth and survival as purchasing cost takes up the biggest portion of total revenue generated by the firm. The potential benefits associated with having good suppliers include minimized risk, increased flexibility, reduced lead time, and accurate forecasting.

2.7 Learning Orientation

Many researches have concentrated on a wide range of topics that might determine the success of SMEs including; the entrepreneur, entrepreneurial innovativeness, learning orientations, and motivation (Jasra et. al., 2011; Storey, 1994). Prior researches on learning orientation depends on three factors which underscore the adaptation and generation of learning in organization (Wang, 2008): (1) commitment to learning and the emphasis this is given (Wang 2008); (2) open-mindedness including proactive questioning of long-held assumptions and beliefs (Sinkula et al., 1997); and (3) shared organizational vision (Baker and Sinkula, 1999). However, for SMEs to expand business opportunities they have to change established assumptions about its mission, customers, capabilities, strategies and engage with higher generative learning. However, prior researches that relied on three components of learning orientation cannot capture the true contexts of SMEs learning orientation.

3. Methodology

3.1 Qualitative Approach

A qualitative approach is utilized to explore the unknown variables. It is used to gain an understanding of underlying opinions, reasons, and motivations. It provides insights into the problem or helps to develop hypotheses for potential quantitative research.

3.1.1. Scale Development

Two central variables in this study are the SMEs' CEO characteristics and learning orientation. To capture the most current and relevant issues within this context, we conduct several case studies, interviewing both CEOs in collectivism culture (China, Korea) and CEOs in individualistic culture (US, Canada) regarding the importance of CEO characteristics and learning orientations. We develop our own measurements for the CEO characteristics and learning orientation since appropriate measurement scales are not available. To generate measurement items for SMEs' CEO characteristics and learning orientation, several approaches are taken to generate initial items. First, previous literature on CEO characteristics and learning orientation are reviewed because literature review is an excellent source for descriptions of CEO characteristics and learning orientation. The second approach is to utilize qualitative approach in the form of a semi-structured interview. A semi-structured set of questions is used due to time constraints in open-ended questions.

Experts (CEO/director in our case) are asked to provide descriptions of their feelings about the importance of CEO characteristics and to describe multiple aspects of learning orientation. We contact approximately 50 organizations by telephone. The goal is to conduct eight case studies. In our sample, the call begins with a high-level management such as director or CEO. All eight case studies are conducted on-site visits. Participants who agree to involve in our study receives a copy of interview guide so that they know what types of questions to expect.

We interview eight SME executives regarding the importance of characteristics and learning orientation. In order to succeed in today's fast environment, SME's CEO characteristics cannot be treated the same as CEOs in bigger firms. Rather, conventional measurements for CEO

characteristics (e.g. education, ownership, innovativeness, self-efficacy, gender) need to be reconstructed using different components including (1) willingness to learn, (2) build a culture, (3) adapt to change, and (4) willingness to share. By conducting interviews prior to large surveys, key information from participants in small-medium enterprises circumstances may enrich the quality of the research. The interviews are transcribed and analyzed by using qualitative data analysis software.

As for the learning orientation, conventional components (e.g. commitment to learning, shared vision, open-mindedness, knowledge sharing) does not reflect the true nature of SMEs learning orientation. Even though learning orientation of SMEs is viewed as being different to that of large organizations, (e.g. Wyer, Mason, and Theodorakopoulos, 2000; Keskin, 2006), little research has been done about the learning organization of these special types of organizations, albeit organizational learning processes significantly differ with respect to organizational size (Spicer and Sadler-Smith, 2006; Michna, 2009). This study identifies learning orientation as different dimensions, a set of different components that are derived from the case study.

Purposive sampling is utilized because groups can be preselected relevant to a particular research questions.

3.1.2 Content Validity (Academic/Industry Expert Panel)

Experts evaluate content, validity, clarity of items which is an integral part of generating new item measurements. We use expert panels (academic and industry) who are asked to review the survey for content validity. We use an online survey to provide two constructs we developed and the definition of each construct. The scaling is used (1=does not explain definition at all, 7=does explain definition well). Open-ended text boxes are provided so that experts can write comments and provide thorough feedbacks. The scale is then distributed to the industry experts who have in-depth knowledge in SCM field.

We then conduct a few more interviews with CEOs in an effort to find if any new concepts or ideas could be generated from additional interviews. Finally, a point of saturation is reached when no new properties, dimensions, and other information contributed to the interviews (Strauss and Corbin, 1998).

Based on the literature review/case study, we then modify the primary questionnaires by pretesting with ten practitioners and three professors. As a final refinement, the revised questionnaire is reviewed by three professors, all specialized in SMEs in the field of supply chain management.

3.2 Quantitative Approach

Our goal in conducting quantitative research methodology is to determine the relationship between independent variables and outcome variables within our sample populations. It is used to quantify CEO characteristics, R&D, IT, supply chain network, globalization, learning orientation, and firm performance.

3.2.1 Research Hypotheses Development

Fig. 1 shows the research framework of SMEs in the present study, in which the relationships between SMEs CEO characteristic through the lens of cultural dimensions, R&D, technology, supply network, globalization, learning orientation, and performance are discussed and hypotheses relating variables are developed.



Figure 1: Research Model

SME CEO Characteristics and Firm Resources (Culture Dimension Theory and RBV Theory)

Collectivist cultural value has a context of employee engagement, commitment, and cooperative development which leads to firm success (Cameron et al., 2007). The organization expects leadership styles that are supportive and reliable. Researchers suggest that CEO in collectivist culture are likely to be tied to such values. CEOs with collectivistic value tend to have higher levels of supportiveness, cooperative, and concern about interrelationship skills (Hogan and Hogan, 1995). Moreover, higher levels of collectivism among team members have been linked to positive firm performance. CEO who has high levels of collectivism is likely to facilitate an environment of cooperation and concern about the employee's well-being.

Individualistic culture put emphasis on flexibility to strengthen the firm's competitiveness and gear towards creativeness that contributes to innovations (Zammuto and O'Connor 1992). Employees are encouraged to go beyond the norm and break the rules to build future success. CEO who has higher levels of individualism tend to be independent, unconventional, and unfettered which encourages creativity and innovation (Costa and McCrae, 1992). For example, Judge and Cable (1997) assert that individualistic character of CEO was highly related to the innovative cultures.

H1a: CEOs personality in collectivism culture is positively related to the higher adoption of R&D capacity.

H1b: CEOs personality in individualism culture is positively related to the higher adoption of R&D capacity.

H2a: CEOs personality in collectivism culture is positively related to the higher adoption of technology capacity.

H2b: CEOs personality in individualism culture is positively related to the higher adoption of technology capacity.

H3a: CEOs personality in collectivism culture is positively related to the higher adoption of supply chain network.

H3b: CEOs personality in individualism culture is positively related to the higher adoption of supply chain network.

H4a: CEOs personality in collectivism culture is positively related to the higher adoption of globalization.

H4b: CEOs personality in individualism culture is positively related to the higher adoption of globalization.

Information Technology and Learning Orientation

We define information technology as the application of the computer to store and share information within the organizations. The impact of information technology has tested on the firm's performance (Bharadwaj et al., 1999). From the RBV perspective, the information technology infrastructure provides the resources that make feasible innovation and continuous improvement of products. (Duncan, 1995; Bharadwaj, 2000). Technology policy, such as product line breadth, is positively related to the firm performance (Zahra, 1993). Ulrich (1993) states that one kind of learning orientation is the ability to move the lessons learned from technology experience and experiments across boundaries. Because information technology provides employees within SMEs an opportunity to get access and share information, the degree to which SMEs are involved in information technology will affect the firm's learning orientation. Therefore, we provide the following hypothesis:

H5. The degree to which SMEs are involved in information technology leads to greater enthusiastic learning orientation.

R&D Capacity and Learning orientation

R&D intensity is strongly associated with improvements in market share, controlling for firm size, and increase market share of enterprise (Ettlie, 1998). Cohen and Levinthal (1990) develop a model of a firm's accumulated R&D knowledge and concludes that R&D can generate innovation, facilitate learning. Henard and McFadyen (2006) further advance the perspective that consistent investment in knowledge-enhancing firm activities contribute to a firm's cumulative knowledge, which ultimately improves its overall absorptive capacity. Unlike large companies,

SMEs invest a large amount of money on R&D activities and implement R&D activities require high levels of learning orientation. We, therefore, hypothesize the following:

H6. The degree to which SMEs is involved in R&D activity leads to greater enthusiastic learning orientation.

Supply Chain Network and Learning Orientation

The design of the supply chain network is important. Many researchers focus on modeling the supply chain network (Nagurney et al., 2004; Sha and Che, 2006). Supply chain network is extremely important for the SMEs since SMEs need to depend on the external alliances to reduce costs and improve product quality in current business operations. A well-designed supply chain network includes good suppliers and customers. During the interactions with well-selected suppliers and customers, learning orientation of the firm will be maximized. We, therefore, hypothesize the following:

H7. A well-designed supply chain network leads to greater enthusiastic learning orientation

Globalization and Learning Orientation

Globalization has an impact on the SMEs' performance (Knight, 2017). Knight (2017) shows that the higher the degree of the SME's response to globalization, the better it performs. Relationships develop gradually when the firms learn by interacting with each other and committing themselves to the stronger relationship (Anderson and Weitz, 1992; Holm et al., 1999). During this process, the alliance partners gradually learn about mutual needs, resources, strategies, and business contexts (Johanson and Vahlne, 2003). Learning opportunities along the globalization path provide the firm with cumulative knowledge, preparing it for further successful expansion.

The resource-based view predicts that gaining and preserving sustainable competitive advantages is a function of the firm's core resources and capabilities. Consequently, an international expansion by a firm is to exploit valuable intangible resources, such as technological capabilities, well-established brand names, or management know-how. Therefore, the fundamental driver of internationalization is the stock of resources accumulated by the firm (Hsu and Pereira, 2008). We, therefore, hypothesize the following:

H8. The degree to which SMEs is involved in Globalization activity leads to greater enthusiastic learning orientation.

The impact of Learning Orientation on SMEs' Performance

It is obvious that a learning orientation is closely related to organizational innovation. Many scholars put emphasis on the importance of learning orientation to enhance innovation performance. Learning occurs largely through organizational interaction with and observation of the environment (Cahill, 1998). Therefore, an organization committed to learning can enhance its innovation capability in many ways. Research has recognized the importance of learning orientation to overall firms' performance (Slater and Narver, 1994; Wang, 2008). A firm with a strong learning orientation is not a mere storage of knowledge but a center for processing knowledge. Feedback from customers, channels, and competitors must be used to develop core competence. A learning orientation influences the degree to which firms are likely to engage in generating learning as a long-lasting core competency (Sinkula et al., 1997). Therefore, we hypothesize the following:

H9. An enthusiastic learning orientation is associated with better SMEs' performance.

3.2.2 Sample and Data Collection

The following section delineates the research method for large-scale data collection. Our unit of analysis is the small-medium manufacturing companies where a small-sized enterprise is a company with fewer than 50 employees, while a medium-sized enterprise is a company with fewer than 250 employees. Data are collected via a large-scale mail/online survey created and administered according to design methodology. To facilitate a large-scale survey, we focus on the manufacturing industry (SIC codes manufacturers) to make the research more reliable and manageable. Choosing pertinent target firms that have a deep comprehension of CEO characteristics and learning orientation are the primary concerns for this research. The key

success in a large-scale study is respondent quality, as this research's respondents represented different manufacturing industries, firm sizes, and geographical areas. Our study focuses on SME manufacturing firms including IT, automobiles, computer, electronic, medial/optical, machinery, and metal processing. We attain adequate samples and increase our response rate by incorporating Frohlich's (2002) strategy. During the survey, a follow-up phone-call is made to help clarify the questionnaires and to encourage participation. Non-response bias is assessed from the comparison between the first and last 200 respondents.

Profile	Category	Frequency	(%)
Industry	Auto		
	Electronics		
	Metal Processing		
	Medial/Optical		
	Machinery		
	Electrical		
	10>		
The Number	50>		
of Employees	100>		
	250>		
Department	Production		
	SCM		
	Management		
	Planning		
Position	General Manager		
	Director/CEO		

Table 2. Descriptive Statistics

3.2.3 Data Analysis

Data analysis employ several methodologies. First, the key SME CEO characteristics and learning orientation are identified via exploratory factor analysis, followed by cluster analysis for three groups (enthusiast, traditionalist, inactivist) of learning orientation. An EFA approach is selected since the measure for two variables are newly developed for the multi-item context. It is commonly used when developing a measurement to identify a set of latent constructs. EFA procedure must be preceded before moving on to confirmatory factor analysis.

CFA is utilized to assess the properties of R&D capacity, technology, supply chain networks, and globalization, and firm performance. We examine existing questionnaire items to evaluate

the construct validity of these instruments using CFA. A structural equation model is used to test the hypothesized measurement model. Using structural equation model is common in supply chain management since it has the ability to find relationships between latent variables and observable variables. For example, CEO characteristics cannot be measured directly. Therefore, we develop a hypothesis of CEO characteristics and design measurement items to measure characteristics according to our hypothesis. With SEM, CEO characteristics would be the latent variable and the test items (willingness to learn, build a culture, adapt to change, and willingness to share) are assessed.

The goodness of fit of the measures is evaluated, using various fit indices. In a model with both the independent variable and mediator predicting the outcomes, it should be validated that the mediator is associated with the outcome as well. Though the Bootstrapping method is widely used in AMOS, we adopt the SOBEL method since it is more accurate than the Bootstrapping method to determine the significance indirect effect of the mediator by testing the hypothesis. The full structural equation model is tested using AMOS. Based on full SEM model, we estimate coefficients for each hypothesis.

Items (1:Strongly Disagree, 4: Neutral, 7:Strongly Agree)									
Construct	Item	Factor Loading							
	1								
CEO Characteristics	2								
CEO Characterístics	3								
	4								
	1								
Culture Dimension	2								
Culture Dimension	3								
	4								
	1								
R&D	2								
	3								
	1								
Technology	2								
	3								
	1								
Supply Network	2								
	3								
	1								
Globalization	2								
	3								
	1								
	2								
Learning Orientation	3								
	4								
	5								
	1								
Performance	2								
	3								
Correlation Coefficient									
-------------------------	---------------------	----	-----	------	-----	-----	----	-----	----------
	CEO Characteristics	CD	R&D	Tech	SCN	Glo	LO	Per	Cronbach
CEO Characteristics	1								
CD		1							
R&D			1						
Tech				1					
SCN					1				
Glo						1			
LO							1		
Per								1	

Table 3. Measurement: Survey Items, Loading

Table 4. Correlation / Discriminant Validity

Construct	Composite Reliability	AVE*
CEO Characteristics		
CD		
R&D		
Tech		
SCN		
Glo		
LO		
Per		

Table 5. Measurement Model Statistics (AVE*=Average Variance Extracted)

4. Discussion

This study uses Hofstede's cultural dimension theory, resource-based view, and learning theory to develop a hypothesis. Our unique contribution lies in the development of new measurement items that explains the true nature of CEO characteristics and learning orientation in SME context. Furthermore, we explore the characteristics of SMEs CEO from different cultural dimensions and how each culture impacts on decision-making in firm resources. Additionally, we confirm that a higher adoption rate of firm resources leads to positive learning orientation. This study addresses two gaps mentioned in the introduction: Do cultural differences in collectivism culture and individualism culture affect SMEs CEO decision-making in firm resources? Does the SME learning orientation context different from larger counterparts?

4.1 Academic implication

There are academic implications from the development of the SEMs CEO characteristics and learning orientation scales. The development of these scales allows academic researchers to

assess the characteristics of SMEs CEO and learning orientation from the SME context. Our construct measurements are developed based on case study and possess favorable psychometric that could be able to capture the true nature of the construct dimensions. They provide insights into the problem or help to develop hypotheses for potential quantitative research. Our quantitative approach is, therefore, to prove whether our new constructs can be tested with existing constructs.

4.2 Managerial implication

This research is to prove that different cultural dimension is a valid way to explain the differences in CEOs decision-making. Cultural differences play a critical role in making right decisions, which in turn affect the decisions of investing, forecasting, production, and scheduling. In fact, CEOs in SME manage their resources in a manner that reflects the culture of their own country. This implies that a firm's success or failure relies heavily on cultural differences. CEOs should realize that operations decisions are made differently in different regions or countries. Especially, they should understand what dimensions of national culture affect operations decisions. Such understanding may help SMEs to more efficiently manage their firm.

As for the learning orientation, managers/CEOs must realize that continuous learning between organizations will be a key to success in small-medium enterprises. Our study suggests that interfirm learning can yield beneficial effects. Our findings may reveal that SMEs are more likely to become learning-oriented when making continuous efforts to learn from their competitors, supply chain networks, and customers. This, in turn, leads to firm innovativeness.

Reference

Acar, E., Kocak, I., Sey, Y., & Arditi, D. (2005). Use of information and communication technologies by small and medium-sized enterprises (SMEs) in building construction. *Construction Management and Economics*, 23(7), 713-722.

Acs, Z. J., & Audretsch, D. B. (2003). Innovation and technological change. In *Handbook of entrepreneurship research* (pp. 55-79). Springer US.

Alegre, J., & Chiva, R. (2008). Assessing the impact of organizational learning capability on product innovation performance: An empirical test. *Technovation*, 28(6), 315-326.

Anderson, E., & Weitz, B. (1992). The use of pledges to build and sustain commitment in distribution channels. *Journal of marketing research*, 18-34.

Baumol, W. J. (2006, January). Return of the invisible men: The microeconomic value theory of inventors and entrepreneurs. In *annual meeting of the American Economic Association, Boston*.

Bharadwaj, A. S., Sambamurthy, V., & Zmud, R. W. (1999). IT capabilities: theoretical perspectives and empirical operationalization. In *Proceedings of the 20th international conference on Information Systems* (pp. 378-385). Association for Information Systems.

Borghoff, T. (2005). Evolutionary theory of the globalisation of firms. Gabler Verlag.

Bygrave, W. D., Hay, M. G., & Peeters, J. B. (1994). Realizing investment value. Pitman.

Cahill, D. J. (1998). Key account management: Using key accounts as partners to get to the learning organization. *International Marketing Review*, *15*(3), 205-214.

Calantone, R. J., Cavusgil, S. T., & Zhao, Y. (2002). Learning orientation, firm innovation capability, and firm performance. *Industrial marketing management*, *31*(6), 515-524.

Calori, R., Johnson, G., & Sarnin, P. (1994). CEOs' cognitive maps and the scope of the organization. *Strategic Management Journal*, *15*(6), 437-457.

Cameron, C. A., Fu, G., Xu, F., Heyman, G., & Lee, K. (2007). Cross-cultural differences in children's choices, categorizations, and evaluations of truths and lies. *Developmental psychology*, *43*(2), 278.

Carpenter, M. A., Geletkanycz, M. A., & Sanders, W. G. (2004). Upper echelons research revisited: Antecedents, elements, and consequences of top management team composition. *Journal of management*, *30*(6), 749-778.

Carson, D., & Gilmore, A. (2000). SME marketing management competencies. *International Business Review*, 9(3), 363-382.

Claessen, E. (2005). Strategic use of IC reporting in small and medium-sized IT companies: a progress report from a Nordic project. *Journal of Intellectual Capital*, 6(4), 558-569.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative science*.

Corso, M., Ronchi, S., & Chapman, R. (2003). Knowledge management in continuous product innovation: a contingent approach. *International journal of technology management*, *26*(8), 871-886.

Costa, P. T., & McCrae, R. R. (1992). Four ways five factors are basic. *Personality and individual differences*, 13(6), 653-665.

Duncan, N. B. (1995). Capturing flexibility of information technology infrastructure: A study of resource characteristics and their measure. *Journal of Management Information Systems*, *12*(2), 37-57.

Ettlie, J. E. (1998). R&D and global manufacturing performance. *Management Science*, 44(1), 1-11.

Finkelstein, S., & Hambrick, D. C. (1996). *Strategic leadership: Top executives and their effects on organizations*. West Publishing Company.

Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of management review*, *9*(2), 193-206.

Henard, D. H., & McFadyen, M. A. (2006). R&D knowledge is power. *Research-Technology Management*, 49(3), 41-47.

Hofstede, G. (1980). Motivation, leadership, and organization: do American theories apply abroad?. *Organizational dynamics*, *9*(1), 42-63.

Hofstede, G. (2001). Culture's consequences: Comparing values, behaviors, institutions, and organizations across cultures.

Hogan, R. (1995). Hogan personality inventory. Hogan Assessment Systems.

Holm, D. B., Eriksson, K., & Johanson, J. (1999). Creating value through mutual commitment to business network relationships. *Strategic management journal*, 467-486.

Hsu, C. C., & Pereira, A. (2008). Internationalization and performance: The moderating effects of organizational learning. *Omega*, *36*(2), 188-205.

Inkeles, A., & Levinson, D. J. (1997). National character: A psycho-social perspective. New Brunswick, NJ: Transaction.

Johanson, J., & Vahlne, J. E. (2003). Business relationship learning and commitment in the internationalization process. *Journal of international entrepreneurship*, *1*(1), 83-101.

Judge, T. A., & Cable, D. M. (1997). Applicant personality, organizational culture, and organization attraction. *Personnel psychology*, *50*(2), 359-394.

Kalafatis, S. P., Tsogas, M. H., & Blankson, C. (2000). Positioning strategies in business markets. *Journal of Business & Industrial Marketing*, *15*(6), 416-437.

Keskin, H. (2006). Market orientation, learning orientation, and innovation capabilities in SMEs: An extended model. *European Journal of innovation management*, *9*(4), 396-417.

Knight, G. A., & Cavusgil, S. T. (2004). Innovation, organizational capabilities, and the bornglobal firm. *Journal of international business studies*, *35*(2), 124-141.

Lawrence, B. S. (1997). Perspective—The black box of organizational demography. *Organization Science*, 8(1), 1-22.

Leung, K. (1997). Negotiation and reward allocations across cultures.

Lin, C. Y. Y. (1998). Success factors of small-and medium-sized enterprises in Taiwan: An analysis of cases. *Journal of small business management*, *36*(4), 43.

Markus, H. R., & Kitayama, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation. *Psychological review*, *98*(2), 224.

Michna, A. (2009). The relationship between organizational learning and SME performance in Poland. *Journal of European industrial training*, *33*(4), 356-370.

Nagurney, A., Dong, J., & Zhang, D. (2002). A supply chain network equilibrium model. *Transportation Research Part E: Logistics and Transportation Review*, *38*(5), 281-303.

Oviatt, B. M., & McDougall, P. P. (1994). Toward a theory of international new ventures. *Journal of international business studies*, 45-64.

Peterson, R. S., Smith, D. B., Martorana, P. V., & Owens, P. D. (2003). The impact of chief executive officer personality on top management team dynamics: one mechanism by which leadership affects organizational performance. *Journal of Applied Psychology*, 88(5), 795.

Sassen, S. (2007). A sociology of globalization. Análisis político, 20(61), 3-27.

Schwartz, S. H. (1994). *Beyond individualism/collectivism: New cultural dimensions of values*. Sage Publications, Inc.

Sha, D. Y., & Che, Z. H. (2006). Supply chain network design: partner selection and production/distribution planning using a systematic model. *Journal of the operational research society*, *57*(1), 52-62.

Sinkula, J. M., Baker, W. E., & Noordewier, T. (1997). A framework for market-based organizational learning: Linking values, knowledge, and behavior. *Journal of the academy of Marketing Science*, 25(4), 305-318.

Škerlavaj, M., Štemberger, M. I., & Dimovski, V. (2007). Organizational learning culture—the missing link between business process change and organizational performance. *International journal of production economics*, *106*(2), 346-367.

Slater, S. F., & Narver, J. C. (1994). Does competitive environment moderate the market orientation-performance relationship?. *The Journal of Marketing*, 46-55.

Southern, A., & Tilley, F. (2000). Small firms and information and communication technologies (ICTs): toward a typology of ICTs usage. *New technology, work and employment*, *15*(2), 138-154.

Spicer, D. P., & Sadler-Smith, E. (2006). Organizational learning in smaller manufacturing firms. *International Small Business Journal*, 24(2), 133-158.

Storey, D. J. (1994). New firm growth and bank financing. *Small Business Economics*, 6(2), 139-150.

Strauss, A., & Corbin, J. (1998). Basics of qualitative research techniques. Sage publications.

Timmons, J.A. (1999), New Venture Creation, 5th. ed., Irwin McGraw-Hill, Burr Ridge, IL.

Triandis, H. C. (1995). Individualism & collectivism. Westview press.

Ulrich, D., Jick, T., & Von Glinow, M. A. (1993). High-impact learning: Building and diffusing learning capability. *Organizational dynamics*, 22(2), 52-66.

Van de Vijver, F. J., & Leung, K. (1997). Methods and data analysis for cross-cultural research (Vol. 1). Sage.

Wang, C. L. (2008). Entrepreneurial orientation, learning orientation, and firm performance. *Entrepreneurship theory and practice*, *32*(4), 635-657.

Watkins, K. E., & Marsick, V. J. (2003). Summing up: Demonstrating the value of an organization's learning culture.

Wyer, P., Mason, J., & Theodorakopoulos, N. (2000). Small business development and the "learning organisation". *International Journal of Entrepreneurial Behavior & Research*, 6(4), 239-259.

Zahra, S. A. (1993). A conceptual model of entrepreneurship as firm behavior: A critique and extension. *Entrepreneurship: Theory and practice*, *17*(4), 5-22.

Zammuto, R. F., & O'Connor, E. J. (1992). Gaining advanced manufacturing technologies' benefits: The roles of organization design and culture. *Academy of Management Review*, *17*(4), 701-728.

AN INTEGRATED MULTI-DIMENSIONAL FRAMEWORK FOR OPTIMIZING SOCIAL COMMERCE

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ABSTRACT

This research discusses social commerce in relation to the consumer decision-making process, and how this process is crucial in harnessing the commercial potential of social media resulting in customer value and improved organizational performance. Social commerce involves exchange activities that occur as a result of social interactions that correspond to consumer behavior across all stages of the decision-making process. In this research, we propose a framework on how social commerce integrates firm and consumer perspectives of pre-purchase, purchase and post-purchase behavior. We conceptualize an integrated multi-dimensional social commerce framework targeting firms and consumers as a basis for enhancing commercial activities on social media platforms. Finally, we examine our comprehensive framework through the lens of social commerce activities and offer implications for researchers, marketers, and policy makers.

Keywords: Social Commerce, Integrated Multi-dimensional Framework, Consumer decisionmaking process, Social Commerce Optimization

INTRODUCTION

The exponential rise in the use of social media has resulted in issues on how it can be

exploited for increased firm and customer value. Social commerce has been defined as

exchange related activities that occur in an individual's computer mediated social

environment, and these activities correspond to consumer decision making phases of need

recognition, pre-purchase, purchase, and post purchase stages of the transaction (Yadav et al.,

2013). Today, consumers engage in numerous brands via many channels, one of those channels is social media. As a result, businesses have had to adjust to this revolution by changing the way in which they engage with consumers online (Heinonen, 2011). Hence, a multi-dimensional framework that gives a clear guidance on how to effectively optimize social media for commercial activities is needed to understand consumer behavior in social media and create value for both firms and consumers.

There is a dearth of research on consumer social media behavior, the stages of consumer decision making, and motivating factors for customer engagement in social media (Heinonen, 2011; Lee, 2010). Yadav et al. (2013) provided a contingency framework of social media commerce for assessing the marketing potential that social media has to offer to firms; while considering the various phases of consumer behavior as key factors in effectively enhancing firm's social commerce initiatives. Extant research has focused on the 'Awareness, Interest, Desire, and Action (AIDA)' consumer behavior model which is a well-known 100-year-old four stage model for consumer behavior (Edelman, 2010). However, past research have failed to provide an in-depth investigation on consumer decision-making phases, and thus we need to develop a comprehensive framework that incorporates the post-purchase phase of consumer decision making behavior in its entirety.

The post purchase phase (which is absent in the AIDA model) has become an important touchpoint in social commerce. Consumers now have the power to post reviews of products and services online after purchase. These reviews could be negative or positive, and negative reviews greatly influence the firm's reputation compared to positive reviews. Up to fifty percent of consumers report problems with their transactions with suppliers, and more than four fifth of consumers communicate these negative issues to friends and peers (Lowenstein,

2011). Hence, this study contributes to the research on consumer behavior, and bridges the research gap by emphasizing the post-purchase phase of consumer decision-making process. We conceptualize an integrated multi-dimensional framework for social commerce optimization by describing the steps in the consumer decision-making process; examining how companies can build on the insights proposed in our integrated multidimensional framework for effective social media commercialization; and finally, highlighting the significance of pre-purchase, purchase and post-purchase stages/activities in social commerce optimization, thus harnessing social commerce potential for both consumers and firms.

In what follows, we provide a brief overview of the consumer behavior, consumer decision making process, and how this process is crucial in harnessing the commercial potential of social media. We then review previous research on the AIDA consumer behavior model, as well as, research on the domain of social commerce and optimization. Based on the literature review, we develop an integrated multidimensional social commerce optimization framework regarding how social commerce works with pre-purchase, purchase and postpurchase stages of consumer decision making process related to an organization's social commerce activities. Recommendations and implications to researchers, marketers, and policy makers are also discussed.

THEORETICAL BACKGROUND

Social Commerce

With the increasing popularity in the use of social media for commercial activities, there has been a lot of research and efforts towards defining social commerce. Yadav et al. (2013) proposed a definition of social commerce and its domain. They defined 'social commerce' as

any online or offline commercial activity that occurs as a result of a person's interaction and/or engagement in social networks. Social commerce encompasses the consumer perspective as well as the firm's. Social commerce is the concept in which consumers utilize social media technologies for online community interactions and collaborations which lead to acquisition of products and services (Liang & Turban, 2011). Stephen and Toubia (2010) noted that social commerce is a means by which people are actively involved in marketing and selling of goods and services through online-based social media platforms. Ickler et al. (2009) defined social commerce as a tool which "focuses on interpersonal relations (recommendations, feedbacks, information, etc.) that are influencing a business transaction before, while or after it happens" (p. 52).

Consumer Behavior Model and Decision Making Process

AIDA Consumer Behavior Model

The consumer decision-making process is crucial for firm's exploitation of social media for increased firm value. The understanding of this process presents an opportunity in influencing consumer decisions during the different phases of the process (Yadav et al., 2013). In 1906, Elmo Lewis proposed the AIDA model. AIDA represents 'Awareness, Interest, Desire, and Action'. This model provides insights into consumer behavior stages resulting in customer engagement and ultimately leading to purchase decisions. In marketing (based on the AIDA consumer behavior model), the first goal is to make consumers aware of a product or brand and get their attention. The next stage is to acquire consumers' interest. The interest is then transformed into a strong desire for the product or service, and ultimately taking action by purchasing the product (Rawal, 2013). Table 1 highlights the evolution of consumer decision making processes spanned over years and decades.

Insert Table 1 about here

Modifications of the AIDA Consumer Behavior Model

There have been a lot of modifications of the AIDA consumer behavior model. Some researchers have included more stages while others have renamed and redefined the stages of the AIDA model. One of such researchers, Edelman (2010) proposed that the consumer decision making-process involves four stages: Consider, Evaluate, Buy, and Enjoy-Advocate-and Bond. In the first stage, which is known as "consider", the customer starts with awareness of products or brands from various sources, in-store, traditional media advertising, and online (social /digital media) advertising. This is the stage with the widest number of products and brands. It is also known as 'top of the sales funnel' (Edelman, 2010). Stage two is "evaluate'. At this stage, consumers seek more information. In the internet age, they not only seek information from traditional sources, such as, consumer reports, word of mouth, or a prior experience, but online sources such as, blogs, and social networking sites like Facebook, Twitter, YouTube, etc. This stage has, therefore, been expanded when compared to the pre-internet era. Ickler et al. (2009) argues that stage two has expanded due to new functionalities that have been incorporated into new digital and social media platforms.

Stage three is "buy'. Consumers delay purchasing until they have physical interaction with the product often in a store (Edelman, 2010). According to Skrovan (2017), 55% of consumers still want to see, touch and feel products before buying them online, however that percentage reverses for consumers aged 18-24 years of age. Consumers are still quite susceptible to changing their choice at this stage. On the other hand, stage four consists of all post purchase activities of consumers, and this stage is characterized as "Enjoy, Advocate,

and Bond" stage. At this stage, the consumer already interacted with the product or brand and they are in the final stages of their decision making processes. This stage includes online feedbacks and reviews from consumers after the usage of the products and/or services (Edelman, 2010).

In the similar vein, Wijaya (2012) advocated the multi stage AISDALSLove model. As shown in Table 1, the post purchase 'L' stands for *Like/Dislike*, whereby the consumer either likes or dislikes the product enough to precipitate a further action. Post purchase 'S' stands for *Share*, as a continuation of *Like/Dislike*, whereby the consumer shares his or her experience with the social networks. It was noted that this sharing has a profound impact as consumers obey "the law of small numbers". This means that consumers think that the experiences of a small group of people, typically their social circle and friends are representative of the entire population. Finally, if the consumer has a long term feeling of satisfaction or dissatisfaction with a product, it influences future purchase (or non-purchase) of the product. This last stage is termed 'Love', also known as the *Love/Hate* stage.

Consumer Decision-Making Process and Influence on Social Commerce

Pagani and Mirabello (2012) conducted a study on the influence of personal and social engagements on consumers' passive or active usage of social networking sites. They found that both personal and social engagements have significant positive effect on the usage of social network sites, and if such engagements are enhanced and utilized effectively, there are great opportunities for social commerce. Ketter and Avraham (2012) argued about three types of consumer actions in social media context: (i) consumers as 'audience'; (ii) consumers as 'distributors'; and (iii) consumers as 'message creators'.

Liang et al. (2012) stressed the importance of social network members' interactions in social commerce. A website with a supportive climate allows for convenient consumer interactions during and after the decision making process. Information shared by consumers during their decision-making phases, especially the post-purchase phase, has a huge effect on the firm's social commerce initiatives and reputation. If the product or service was satisfactory, the consumer gives positive reviews and could become an advocate for the product or service through word of mouth and social media. In contrast, if a consumer is disappointed by the product or brand, s/he will often discard it or in worse case, disparage it and become an alienated customer (Edelman, 2010).

Social Commerce Models and Frameworks

Extant research have proposed contingency frameworks and models for evaluating the commercial potential of social media. Ickler et al. (2009) focused on understanding how changes in technology (specifically, social media and electronic commerce) influence the customer-company relationships, consumer behavior, and various stages of consumer decision making process. They proposed frameworks which align with the approach of many businesses to customer service management. Customer service management and customer engagement focuses on looking at everything from the viewpoint of the customer. The major weakness of these customer-centric models was that the impact of product and subsequent organizational performance was ignored. For instance, the requirements (and rules) of social commerce for an iPhone X will be different from that of a new iMovie. The model also assumes that organizations react to social commerce in two ways: "do nothing", which was termed a free rider strategy, or "be proactive and try to influence social commerce", which was dubbed as the shaping strategy (Ickler et al. 2009).

Yadav et al. (2013) proposed a contingency framework for evaluating the commercial potentials of social media. The contingency framework was built upon the argument that social network environment create value for consumers, and the firms can influence the consumer's decision-making process. The framework links the firm's social media initiatives and presence to the outcomes related to different stages of the consumer's decision-making process, while considering the product characteristics, platform characteristics and other firm-and consumer-related control variables. Yadav et al (2013)'s framework categorizes product characteristics into ten categories, despite following a simplified four step purchase process. In the next section, we propose a multidimensional framework for social commerce optimization emphasizing the impact of the firm and the nature of the product, while considering consumer behavior stages of decision making, and the important 'post-purchase' stage.

DEVELOPING AN INTEGRATED MULTI-DIMENSIONAL SOCIAL COMMERCE OPTIMIZATION FRAMEWORK

Figure 3 illustrates our conceptualized model of an integrated multidimensional social commerce framework. The framework is based on the integration of multiple research findings. This is a multi-dimensional framework for social commerce optimization which considers the consumer's perspective, the firm's perspective as well as the effect of moderating characteristics. At the heart of our framework is the expansion of AIDA to include the post purchase behaviors, "Enjoy and Broadcast". Enjoy incorporates the consumption of the product or service and also includes affinity for the product. Broadcast refers to the multi-way communication from the consumer to the organization, the organization to consumer, and consumer to consumer. Broadcast is also considered more appropriate to describe today's

aggressive post purchase communication, rather than the more sedate terms, such as, communicate or share used by previous researchers (Elgin, 2007). Broadcast also reminds us of the past where advertising communication was one way. Today, advertising communication is more complex and multi-dimensional.

Insert Figure 1 here

For social media optimization, the firm must gain an understanding of the consumer's decision making process. The firm must find ways of influencing the consumer behavior at the different phases of their decision-making process. This influence could be through the enhancement of the moderating characteristics to create enjoyable experiences for the customers. Hence, the firm gets good reviews from the consumers which in turn increases customer loyalty and brand broadcasting through consumer to consumer interaction. The interplay of the consumer decision-making process AIDAEB and the firm's social commerce strategy of doing nothing or being active on social media platforms, will ultimately impact the brand and the firm's value.

In this study, we define moderating characteristics as characteristics that affect the strength of the relationship between the consumer decision-making process and the firm's influence. We classify the moderating characteristics into four categories. Our classification is similar to that suggested by Yadav et al (2013). The social media platform characteristics refers to the different functionalities, interfaces, and contents of social media platforms. The product characteristics refers to the different categories of products based on necessity or luxury, public or private purchase and consumption, and the product value and associated

risks. The different types of consumers based on their values, attitudes, lifestyle, and finances is considered the consumer characteristics. The environmental characteristics encompasses the social influence, regulatory environment, political stability, infrastructures, and other influencing factors in the consumer's environment (Alrawabdeh, 2014). Following the above discussion, we offer the following propositions:

Proposition 1: Consumer online reviews and interactions have significant impact on brand and firm value.

Proposition 2: The firm's understanding and influence of the consumer decisionmaking process will result in increased customer loyalty and effective business commercialization through social media.

Proposition 3: The moderating factors can either strengthen or weaken the firm's facilitative effort to optimize social commerce.

CASE STUDIES

In this section, we explore our integrated multi-dimensional framework and concepts through the lens of two real-life companies with social media presence. To conduct the research, several case studies were engaged, which is generally considered more robust than single case studies (Yin, 1994). The cases were deliberately selected and the case methodology presented here is consistent with the objectives of qualitative research (Glaser and Strauss, 1965; Silverman, 2000). The research methodology follows closely to qualitative works including Karjalainen and Snelders (2010), Brockman et al. (2010), and Mabert et al. (1992) that utilize case research to drive new framework or theory. We examine the consumer decision-making processes, consumer interaction, and the firm's influence on social media. The two cases, L'Oréal Group and Apple Inc., were purposely chosen in consistency with the objectives of this research and our proposed multi-dimensional framework. We therefore explain how our framework applies to these companies and prove our propositions.

L'Oréal: Strategy for Social Listening Success

L'Oréal is a French cosmetics company headquartered in Clichy, France. L'Oréal was founded in 1909 and is currently the world leader in beauty with over 35 international brands and presence in 140 countries and five continents. L'Oréal group has an active presence on social media platforms such as; Facebook, Twitter, Instagram, LinkedIn, Google+, and YouTube with a lot of followers and engaged consumers (L'Oréal Group, 2017). This company has established social media platforms for their various locations and the main headquarters. To remain the best in the industry with high value, brand and consumer loyalty, L'Oréal continues to be innovative. The key ingredient in L'Oréal's innovation strategy is following consumer reviews and interactions on social media platforms. This is called "Social Listening (Wadhera, 2015).

This global beauty group recognizes the effect of consumer interactions, reviews and feedbacks on social media and how it influences the firm's performance. In 2011, when the company was at a crossroad on how to innovate within the hair color market, the company decided to venture into understanding consumer behavior and beliefs on the internet, to aid in the company's creation of innovative and profitable hair color products. By partnering with google to obtain analytics and scouring YouTube for consumer generated contents, the company was able to identify trends and better understand the issues faced by consumers, their behavior, decision-making process and interactions with other customers. The company was also able to identify ways of influencing the consumer decision-making process to

provide excellent consumer experience and promote brand loyalty (Wadhera, 2015). In this case, the consumer online reviews and interactions served as an innovation strategy for the company. The company's understanding of the consumer behavior and decision-making process led to increased value for the firm as well as insights on innovative strategies for their products and brands. Hence, this case study is consistent with the framework proposed in this study and proves the three propositions.

Apple Inc: Stealth Strategy for Social Media

Apple Inc. is an American multinational technology company headquartered in Cupertino, California. This company designs, manufactures and markets consumer electronics, computer software, and online services (Apple Inc., 2017). Some of the company's well known products include: iPhone, iPad, Apple watch and iTunes. Apple was founded by Steve Jobs, Steve Wozniak, and Ronald Wayne in April 1976. With a market capitalization of over \$896 billion in 2017, Apple is one of the largest companies in the world (Bloomberg L.P., 2017). Surprisingly, Apple does not appear at first sight to focus on its key public social media accounts. Apple Inc. as a corporation only embraced social media in 2016, when it opened its first official Twitter account. During that year, Apple also opened a twitter account to promote the iPhone 7. The company also ran a Facebook page in the same year (Leswing, 2016). However, the corporate Apple Facebook page has no activity but has over 10.5 million followers.

Insert Figure 4 here

On the Apple.com corporate website page, there are no icons that would link the consumer to Apple's Facebook, Twitter page or other social media pages. Apple's iPhone Facebook page has over 5 million followers and irregular postings, while Apple's official twitter page has 1.5 million followers and is yet to tweet. Apple therefore, does not have an active or visible social media strategy on its corporate sites. Instead, Apple uses a "dark social" media strategy. This is the use of social media sites as channels for buying social media advertising and redirecting advertising on the social media platforms for its products (Leswing, 2016). For example, when consumers visit the Apple website on the iPhone, they would see adverts on iPhone on their Facebook site at a later date. Apple gains insights on consumer visits on its social media page and the ability to reach the consumers via social media platforms, while not participating in social media messaging. This strategy aligns with Apple's view on authenticity and personal contact with the consumer.

The company believes that sales of its innovative and differentiated products and services are enhanced by knowledgeable salespersons who can convey the value of the hardware and software integration, and demonstrate the unique solutions that are available on its products. Providing high-quality sales and after-sales support experience is critical to attracting new and retaining existing customer. Hence, the company believes it offers superior innovation and integration of the entire solution, including hardware, software, online services and distribution of digital content and applications (Apple Inc., 2017). In conclusion, Apple does not appear to have an active social commerce strategy. However, Apple utilizes social media for commercial purposes in a way aligned with the company's philosophy. The recommendation for other organizations is to ensure that their social commerce strategy is authentic and aligns with their company values and marketing strategy.

DISCUSSIONS AND IMPLICATIONS

Theoretical Implications

This study provides important insights on the optimization of social media for commercial activities, which is a topic that has been attracting increasing attention among marketers, researchers, policy makers and the general public. This research contributes to the research on consumer behavior and bridges the research gap by proposing a clear and comprehensive framework which considers consumer behavior at the different stages of the decision-making process, especially the key post-purchase stage, and the impact of the firm. The characteristics of the products, social media platforms, consumers and environment are also considered in the framework. This paper is the first to offer an in-depth integration of past research on social commerce, consumer behavior, and a multi-dimensional framework that explores the commercial potential of social media.

Managerial Implications

While building on our propositions, we identify some implications of our study to marketers, firms, and providers of social network sites (SNS). How can they build on the insights developed in this research in their respective roles in harnessing the potentials of social commerce?

Marketers can use social commerce to understand the optimal ways of influencing consumer behavior across all the different phases of the consumer decision-making process. They should craft creative ways of engaging consumers on social media while considering the differences in consumer and product characteristics, so as to target the right audience. Firms should take advantage of the consumer power of online reviews to create value and excellent consumer experience. For instance; positive reviews are good for the firm but, it doesn't mean that negative reviews are entirely bad. The firm should respond effectively and positively to consumers' negative reviews. They should incorporate the negative reviews in redesigning their products, process, customer service and overall firm performance and reputation. Even if the firm decides to employ a passive strategy of not promoting their social media sites, it should consider following Apple's strategy of setting up social media platforms as efficient advertising channels. Given that platform characteristics influence the relationship quality between the customer decision-making process and the firm's influence, providers of social network sites (SNS) should make their sites highly functional and their interfaces user friendly. They should also provide analytics as guidance for consumers and the firms.

Limitations and Future Research Directions

This study focuses on the post-purchase of the consumer decision-making process. All the stages of the consumer decision-making process are important to firms. But, the importance of the specific stages may depend on the size and developmental stage of the firm. For instance; a start-up company may pay more attention to the pre-purchase stage of creating awareness for its brand. We emphasize the post-purchase stage as it is the stage least studied and yet, has a highly significant impact on social commerce, particularly for large firms with established brands and reputation in their respective industries.

Social commerce is growing exponentially as well as the consumer's power through reviews, product likes and dislikes, and consumer interactions. Hence, more research is required in this area. We hope this research stimulates an in-depth investigation and empirical analysis of our multi-dimensional framework. The optimal use of social commerce for firms of different sizes and development stages is another research area. The study of the potential

differences and effects of positive or negative consumer reviews and how firms can manage consumers' negative reviews effectively should also be examined in future research.

CONCLUSION

The research paper presents an integrated and multi-dimensional framework as a basis for enhancing commercial activities on social media platforms. It discusses consumer decisionmaking process and how this process is crucial in harnessing the commercial potential of social media. The proposed framework, research concepts, and propositions are explored and proved using real life companies. The theoretical and managerial implications of the proposed framework are also addressed. The framework provides a useful tool and perspective for researchers to understand the current state of social commerce from the perspective of the consumer, firm, and social media platforms. Empirical analysis and testing of the proposed framework should be considered in future research.

REFERENCES

- Alrawabdeh, W. (2014). Environmental factors affecting mobile commerce adoption: An exploratory study on the telecommunication firms in Jordan. *International Journal of Business and Social Science*, 5(8).
- Apple Inc. (2017). Form 10-K 2017, accessed November 8, 2017, available at http://www.sec.gov/edgar.shtml
- Barry, T. E., & Howard, D. J. (1990). A review and critique of the hierarchy of effects in advertising. *International Journal of Advertising*, 9(2), 121-135.
- Bloomberg L.P. (2006). Market capitalization, accessed November 8, 2017, available at https://www.bloomberg.com/quote/AAPL:US

- Brockman, B. K., M. E. Rawlston, M. A. Jones, and D. Halstead. 2010. An exploratory model of interpersonal cohesiveness in new product development teams. Journal of Product Innovation Management 27: 201–19.
 - Edelman, D. (2010). Branding in the digital age: You're spending your money in all the wrong places. *Harvard Business Review*, 88(12), 62-69.

Elgin, J. (2007). Marketing Communications. London, United Kingdom: Thompson.

- Heinonen, K. (2011). Consumer activity in social media: Managerial approaches to consumers' social media behavior. *Journal of Consumer Behavior*, *10*(6), 356-364.
- Ickler, H., Schülke, S., Wilfling, S., & Baumöl, U. (2009). New challenges in e-commerce:
 How social commerce influences the customer process. In *Proceedings of the 5th National Conference on Computing and Information Technology, NCCIT*, 51-57.
- Ketter, E., & Avraham, E. (2012). The social revolution of place marketing: The growing power of users in social media campaigns. *Place Branding and Public Diplomacy*, 8(4), 285–294
- Karjalainen, T., and D. Snelders. 2010. Designing visual recognition for the brand. The Journal of Product Innovation Management 27: 6–22.
- L'Oréal Group (2017). Group, accessed November 9, 2017, available at http://www.loreal.com/group
- Lee, S. D. (2010). Analysis of relationships e-commerce on consumer decision making motivation for buying goods online, accessed September 30, 2017, available at http://dx.doi.org/10.2139/ssrn.1918328

- Leswing, K. (2016). Apple needs to hire some teens to help with its social media strategy, accessed November 7, 2017, available at http://www.businessinsider.com/apple-has-no-social-media-strategy-2016-12
- Lowenstein, M. (2011). The other side of advocacy: Impact of negative word-of-mouth, and customer alienation and sabotage, accessed October 21, 2017, available at http://customerthink.com/negative_word_of_mouth_customer_alienation_and_sabotage
- Liang, T., & Turban, E. (2011). Introduction to the special issue social commerce: A research framework for social commerce. *International Journal of Electronic Commerce*, 16, 5-13.
- Liang, T. P., Ho, Y. T., Li, Y. W., & Turban, E. (2012). What drives social commerce? The role of social support and relationship quality. *International Journal of Electronic Commerce*, 16(2), 69-90.
- Mabert, V. A., J. F. Muth, and R. W. Schmenner. 1992. Collapsing new product development times: Six case studies. Journal of Product Innovation Management 9: 200–12.
- Pagani, M., & Mirabello, A. (2011). The influence of personal and social-interactive engagement in social TV web sites. *International Journal of Electronic Commerce*, 16(2), 41-68.
- Rawal, P. (2013). AIDA marketing communication model: Stimulating a purchase decision in the minds of the consumers through a linear progression of steps. *International Journal of Multidisciplinary Research in Social & Management Sciences*, 1(1), 37-44.

- Skrovan, S. (2017). Why many shoppers go to stores before buying online, accessed October 21, 2017, available at http://www.retaildive.com/news/why-many-shoppers-go-tostores-before-buying-online/441112/
- Stephen, T., & Toubia. O. (2010). Deriving value from social commerce networks. *Journal of Marketing Research*, 47(2), 215–28.
- Wadhera, P. (2015). L'Oréal's strategy of social listening success, accessed November 6, 2017, available at http://www.incite-group.com/customer-experience/loreals-strategysocial-listening-success
- Wijaya, B. S. (2015). The development of hierarchy of effects model in advertising. International Research Journal of Business Studies, 5(1), 73-85.
- Yadav, M. S., Valck, K. D., Hennig-Thurau, T., Hoffman, D. L., & Spann, M. (2013). Social commerce: A contingency framework for assessing marketing potential. *Journal of Interactive Marketing*, 27(4), 311-323.
- Yin, R. K. 1994. Case study research: Design and methods. Thousand Oaks, CA: Sage Publications.

TABLES

Table 1: Evolution of	buyer behavior r	models (1898 - 2017)
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Year	Acronym	Model	Developer/
1000		Attention Interest Desire	Researcher/Adapter
1090	AID	Attention, Interest, Desire	E. St Elmo Lewis
1900	AIDA	Attention, Interest, Desire, Action	E. St Elmo Lewis
1910	AICA	Attention, Interest, Conviction, Action	Printer's Ink Editorial
1911	AIDAS	Attention, Interest, Desire, Action, Satisfaction	Arthur F. Sheldon
1915	AICCA	Attention, Interest, Confidence, Conviction, Action	Samuel R. Hall
1921	AIDCA	Attention, Interest, Desire, Caution, Action	Robert E. Ramsay
1921	AIDCA	Attention, Interest, Desire, Conviction, Action	Harry D. Kitson
1922	AIJA	Attention, Interest, Judgement, Action	Alexander Osborn
1940	AIDCA	Attention, Interest, Desire, Conviction, Action	Clyde Bedell
1956	AIDMA	Attention, Interest, Desire, Memory, Action	Merrill Devoe
1961	ACCA	Awareness, Comprehension, Conviction, Action	Russell H. Colley
1961	EPCCA	Exposure, Perception, Communication, Communication, Action	Advertising Research Foundation
1962	AAPIS	Awareness, Acceptance, Preference, Intention, Sale	Wolfe et al.
1962	AIETA	Awareness, Interest, Evaluation, Trial, Adoption	Everett M. Rogers
1969	PACYRB	Presentation, Attention, Comprehension, Yielding, Retention, Behavior	William J. McGuire
1971	ACALTA	Awareness, Comprehension, Attitude, Legitimation, Trial, Adoption	Thomas S. Robertson
1982-1984	The Association model and expanded association model		Ivan L. Preston, & Esther Thorson
2009	Consumer Process	Goal definition, Information, Selection, Buying, After sales	Ickler et al.
2010	CEBEAB	Consider, Evaluate, Buy, Enjoy, Advocate, Bond	David C. Edelman
2012	AIDALSILOVE	Attention, Interest, Desire, Action, Like or Dislike, Share, Love or Hate	Wijaya B. Sukma
2013	Classic AIDA	Awareness, Interest, Desire, Action	Priyanka Rawal

2013	Consumer decision	Need recognition, pre-purchase,	Yadav et al.
	process	purchase, post-purchase	
2017	Integrated	Awareness, Interest, Desire, Action,	This research
	Contingency	Enjoy, Broadcast	
	Framework		

* Adapted from Barry and Howard, 1990.

FIGURES

Figure 1: Model of the customer-company relationship in social commerce (Adapted from





Figure 2: A contingency framework for assessing marketing potential in computer-mediated

social environments (CSMEs) (Yadav et al, 2013).



Figure 3: Integrated Multi-dimensional Framework for Social Commerce Optimization



C Secure https	://www.facebook.com/apple/							
; 🖮 Product Support De	Support Dell US 🗋 onlinestatbook.com/	🛃 General Electric Co. (🛛 🖗 Patent (Counts By Cla	Nonprovisiona	ו (Utilit ד	₩ HP 10BI	l Tutorial -
f Apple		Q	Brian	Home 20+	Find Friends	21 (ې 📢	0
_			_	_				
Apple ⊘				-	-	_	_	•
@apple							_	
Home								
Posts								
Photos	🖬 Like 🔊 Follow 🏕 Share							
Locations								
About	Photos			P	roduct/Service			
Community				C	ommunity			See All
Create a Page				2,	L Invite your frien	ds to like t	this Page	
					10,458,486 peop	le like this		
				3	10,543,993 peop	le follow th	nis	

Figure 4: Apple Facebook page

AN IT SOLUTION FOR ANTIBIOTICS PROPHYLAXIS DELIVERY

---A HEALTHCARE MANAGEMENT PROJECT---

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Key Words: Antibiotics, Medications

Abstract

This paper discusses antibiotic delivery prior to surgical procedures which is beneficial to patients and helps to prevent infections after surgery. What seems like such a simple concept and process has many moving parts and crosses many departments. There are many tools and short cuts that can be developed by IT to help streamline the information to providers for efficient and effective healthcare. A better antibiotic delivery procedure would provide higher reimbursements, less penalties and increases revenue to the hospital.

I. Introduction

A surgical site infection is an infection that develops at or near the surgical site within 30 days of a procedure. Surgical site infections (SSIs) occur in approximately 500,000 patients annually. SSIs are the most common hospital acquired infection that account for almost 2 billion dollars annually in increased health care costs. In addition to cost and reduced quality of life, the patients that develop an infection are 5 times more likely to be readmitted to the hospital, and are 60% more likely to spend time in the ICU. In an effort to reduce the incidence of SSIs, there was collaboration between the Center for Disease Control (CDC) and the Centers for Medicare and Medicaid Services (CMS) in 2002 to create guidelines for antibiotic administration during the surgical period. These evidence based guidelines known as The Surgical Care Improvement Project (SCIP) provided performance measures to reduce infections in surgical patients (Salkind, 2011). The first three include the core infection prevention measures.

- Prophylactic antibiotics should be given within 1-2 hours before the surgical incision to ensure the medication reaches the blood stream and tissues to reduce the risk of bacterial contamination.
- 2. The appropriate selection of antibiotic should be given specific to the type of surgical procedure performed.
- 3. The prophylactic antibiotic should be discontinued within 24 hours of the end of the surgery (Salkind, 2011).

The goal of SCIP was to reduce SSIs by 25%. However, surveys had found that the hospitals were not following the recommendations. Only 55% of the patients undergoing surgery received the antibiotics in a timely manner and only 40% of the antibiotics were discontinued within the recommended time frame. Another study showed that the correct selection of antibiotics occurred in only 25-50% of patients. In order to provide an incentive to hospital organizations to provide better patient care, CMS decided to reduce reimbursements based on failure to meet metrics. Essentially, CMS is penalizing hospitals who do not show adherence to the guidelines in an effort to decrease the surgical infection rates (Salkind, 2011).

Hospital organizations are developing processes to adhere to these guidelines to ensure maximum reimbursement and to avoid penalties, in addition to the cost savings in patient days spent in the hospital and quality patient outcomes. Hospitals should standardize care, develop processes to maximize the effective delivery of prophylactic antibiotics, and educate staff. Hospitals must also implement documentation and auditing processes to ensure compliance of antibiotic delivery.

II. Problem

In a recent audit at the hospital in this study, it was identified that 30% of surgical patients did not receive the correct antibiotic dose prior to surgery. Also, in 37% of the patient who received antibiotics, the timing of the dose was incorrect. It was identified that the information needed to make a clinical decision was not readily available for the providers on the day of surgery. The guidelines for antibiotic delivery were outdated and

not easily accessible. Many times, the order from the surgeon for the antibiotic was incorrect.

III. Background

All medications must be prescribed by a physician prior to being dispensed by the pharmacy in a hospital. Historically in the hospital of the study, the surgeon has been responsible for ordering the antibiotics for delivery by Anesthesia personnel on the day of the procedure. When ordering the antibiotic, the surgeon takes into account the type of procedure, the patient's weight and allergies, and any other medical conditions the patient may have. Typically the surgeon is ordering the antibiotic weeks and sometime months prior to the procedure date. The problem with this is that the patient's condition may change and the medication order may need to be updated or changed. Many times, this change occurs on the day of the surgery. This can create delays and improper dosing or timing of antibiotic delivery. It has been proposed that the Anesthesia provider should be the ordering physician instead of the surgeon since they are also delivering the medication. The antibiotic protocols that had been previously developed were out dated and not current with the latest guidelines. These would need to be updated so the Anesthesia provider could have a reference tool for proper ordering.

Another problem was that the patient information flow to the Anesthesiologist was disjointed. The patient health records were partly electronic and part paper documentation. In order for the Anesthesiologist to make the proper decision for antibiotic ordering and delivery they needed to review the information. The operating room and surrounding departments are very timely and fast-paced. Any delay in care can create back ups to the schedule. It is necessary for the Anesthesiologist to have the information readily available in order to make a decision in a timely fashion.

The organization recognized that the electronic health record (EHR) needed to include all aspects patient care including the perioperative phase, which was on paper. Senior leadership agreed to hire consultants to assist with the integration project to develop a 100% electronic health record for every patient who visited the hospital. This was a 2 year project with many projects, processes, and tools to meet the goals for the

organization. A team was created to work specifically on the flow of information prior to surgery through surgical procedure and post operative phase. It has been identified as the "Perioperative Project". One aspect of this perioperative project was to develop a process for the electronic flow of information in regards to the identification and proper delivery of prophylactic antibiotics.

IV. Key Stakeholders

The team identified to work on antibiotic prophylaxis delivery included the Chief of Surgery, Director of Anesthesia, Pharmacy Leaders, Infection Prevention team, Clinical Informatics, IT build team, OR Director, Nursing Leadership. Leadership from departments that may have impacted the project were included as well such as, Pre-Admission testing, Same Day Surgery and Surgical Offices. This team was governed by the Chief Medical Informatics Officer and the Assistant Vice President of Surgical Services.

V. Dilemma

The biggest dilemma in this project was establishing ownership of the medication order. In the past the surgeon was responsible for the order. The proposed process required the anesthesia personnel to be responsible for the order. This created a lot of discussion between the surgeon and anesthesia as well as the IT department. The new process was a very different work flow that required more steps in a shorter timeframe than the old process. This challenge was thoughtfully discussed and ultimately we came to the final decision that Anesthesia would "own" the ordering and delivering of the medication because it was the best process for the patient's benefit.

VI. Objectives and Goals

The objective of this project is to provide a summary of the detailed patient information to the anesthesia personnel in the EHR for the proper delivery of antibiotics prior to surgical procedures.

The goal of this project is to provide quality patient care by the guidelines provided by CMS in regards to antibiotic prophylaxis. Another goal is to have the ability
to monitor compliance of the guidelines through auditing from the EHR. Other impacts expected from this goal would be to properly manage usage of the medications and provide efficient ordering and preparation of the medication which can provide a cost savings by reducing waste of expired medications. Another impact would be to provide a "time stamp" in the electronic record for the initial dose of the medication that can then be automated to generate the next dose for the nursing staff post operatively to deliver and discontinue within 24 hours. This was the original measure number 3 in the SCIP project. Ultimately by adhering to guidelines and providing quality patient care, the result of this project would be to reduce surgical site infections and maximize reimbursements to the hospital organization.

VII. Process Overview



VIII. Process Development

The team developed a process plan first by mapping out current state, future state and a gap analysis. All stakeholders were involved and each department's impact was taken into consideration. The IT set out to build the Anesthesia summary page to include all of the integral pieces of information that would provide an "at a glance" summary of the patient's condition (see Table 1).

Inpatient Summary					- /=-
Patient Information	≣∙⊗	Vital Signs 🔻	≣∙⊗	Unlock PowerNotes	≣∗⊙
ACO	≡-⊗	Measurements and Weights (0)	≡∙⊗	Quality Measures (5)	≡∗⊙
Patient is currently not enrolled in ACO.		Labs	≣∗⊗	Allergies (1) 🔶	≣∗⊘
Evidence-Based Care Model Enrollment	≣∗⊗	Pathology (1)	≣∙⊗	Medications	≣∗⊗
Readmission Risk Score (2)	≣∙⊘	Microbiology (0)	≣∙⊗	Diagnostics (1)	≣∗⊘
Activity Documentation (4)	≣∙⊘	Lines, Tubes & Drains/iView (2)	≣∙⊗	Documents (12) 📥	≣∗⊘
Problems & Diagnoses	≡• ∾	Intake and Output	≣∙⊗	New Order Entry 💠	≡∗∾
Procedure History (12)	≣∙⊗			Active Orders (43)	≣∗ إ
				Social History (5)	≣∗⊘
				Family History (2)	≡∙⊗

Table 1

This summary page pulls information that is documented in other areas of the EHR and places it in one location that is easily accessible. Each tab in this view can be opened to provide more information to the provider. This provides the "at a glance" view of the patient's status to allow the anesthesia provider to order the medication appropriately.

IX. Implementation

After build, there were many aspects of testing that included the departments related to the project. During testing, other opportunities were identified and addressed. Education sessions and training was completed by the IT customer service department for the anesthesia providers. Other providers were also educated and trained including Nursing, Pharmacy and Physicians. A go-live date was set up and IT support was assigned to the project. The system wide roll out was completed with minor adjustments made as necessary. Overall the implementation of the project went smooth. The length of the project from start to finish was about 9 months. In the next few months, there will be a check cycle to review any barriers or challenges to the new work flow. The process will be continually monitored on a quarterly basis by auditing for performance measures to achieve the goal of 100% compliance of the 3 measures for antibiotic prophylaxis.

X. Conclusion

Antibiotic delivery prior to surgical procedures is beneficial to patients and helps to prevent infections after surgery. What seems like such a simple concept and process has many moving parts and crosses many departments. In order to make this process seamless, the IT department is beneficial to create virtual connections and links between the providers and departments. It is imperative to have all of the information necessary to order the medication for the patient. The electronic health record is a way to compile all of the patient's information in an organized way. The electronic records tend to be overwhelmed with information which can make it difficult to complete simple decisions or processes. There are many tools and short cuts that can be developed by IT to help streamline the information to providers for efficient and effective healthcare. The EHR can facilitate better reporting, better process flow which can ultimately provide better patient outcomes. These better outcomes provide higher reimbursements, less penalties and increases revenue to the hospital.

Reference

Salkind, A.R & Rao, K. C. (2011). Antibiotic Prophylaxis to Prevent Surgical Site Infections. *American Family Physician, Volume 83(5), 23-28*

Baltzan, Paige, (2017). Business Driven Technology. McGraw-Hill Irwin, 7th edition.

Applying Business Innovation Value Model to Enhance Innovation: Examples Observed in the U.S. and China

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Abstract

Lots of large companies use different business model to make more profit and achieve big business success. Business innovation value model can be applied to either demand side or supply side and even both sides, depending on the company strategies to use its competitive advantages to create new additional customer value among four categories: price, preference fit, transactional efficiency and quality. In this paper, we discuss this model in details and demonstrate the model with the application of the model to famous companies such as Airbnb in the U.S. and Waimai Meituan in China; and to a small Chinese new startup- Guangzhou Water Color Ocean Technology Co. The business innovation models they adopted create significant value for customers, which further adds their competitive advantages.

Keywords: Business model innovation, customer value

Introduction

How can the traditional business discover their new value increasing opportunity? What shall a company change regard to their business model to grasp the profit growth chance? Business model innovation always is the useful theory to analyze the demand and supply sides and identify the opportunity which focuses on creating new customer value or increasing additional value. Business model innovation can happen on market demand side, or on product/service supply side, or on both sides.

Innovation and Value creation

A new business model creates more value for customer from two aspects: Demand and Supply. These two aspects of all transactions affect the utility of goods/service and the price. Demand is relevant to the utility, while supply is relevant to the price. A new business model can create new service or discover new goods to create new demand or meet customers' need which haven't been satisfied before. And it also can change the supply manners to decrease the cost of goods/services and save the time of delivery goods/service.

Cachon & Terwiesch (2012) used the Customer Value Curve to describe how the business model innovation changed the customers value in four categories of attributes: Price, Preference fit, Transactional efficiency and Quality.

From value proposition-combining capabilities, assets, and cultural DNA, companies could distinguish themselves in three categories: price-value leaders, relational-value players, and performance-value leaders. Day (2004) suggested that Price players need to identify growth segment through the markets they already serve; Relational players focus on solving latent customer needs while performance players need to emphasis technological discontinuities.

Innovative example form demand side: Airbnb

Some business model innovation can be applied on demand side, which creates new goods or new service (Figure 1). Airbnb is not only an online platform to collect housing information, but it creates a new kind of lodging service and discovers new products. Airbnb supplied opportunities to landlords and tenants to satisfy their needs. On one hand, when people travel to a new place, they may be tired with the traditional travel methods: booking hotel rooms which lack of local life factors. More and more people would like a deep tour which including daily chat, living, cooking and eating with local people. Some would like to live a special house which may be mystery or rural. And some also want to have a reasonable price or bargaining. It is difficult to meet these demands because the customers never have a way to find their ideal rooms. On the other hand, people can make money to rent their extra rooms or houses. As landlord, they also can meet different people from any other place and exchange their thoughts which could bring new knowledge from other places, different cultures background and new languages. So the landlords and tenants are the customers of Airbnb who simply registered online and uploaded their needs which are rooms or finding rooms. Airbnb's new business model found the new and unsatisfied demand, supplied its service to meet its customers' needs and achieved a fabulous triumphant. From 2010 to 2014, its speed of increased revenue was dramatically: 7.2 million dollars in year 2010, 112 millions in year 2011 and 10 billions of year 2014. (Wikipedia, 2017) And its users are up to 150 million. Airbnb's new business model drove the landlords and tenants to share their information on its platform where it didn't create a new goods and it did create a new service. And by its way, it brought new value to its customers which also brought its business success.



Figure 1: Airbnb business-operating



Figure 2: Value Curve for Airbnb v.s. Traditional hotel

Compared to traditional business model hotel, Airbnb has very high preference fit because its services make the customers to communicate, match their need directly and receive the feedback quickly. For the prices on Airbnb are scattered, but also have much cost advantages compared to the tradition hotels which have a big amount expenses on marketing, maintenances, labors and sunk cost. For transactional efficiency, Airbnb is the online platform where the landlords and the tenants can easily make transaction and match their resources. For quality, Airbnb's services are very high relevant to the customers' needs. But the poor rooms or lodging also make Airbnb losing the reputation which it is difficult to separate the poor rooms with Airbnb. In conclusion of above four categories, Airbnb brought more value to the customer on preference fir and transactional efficiency. (Figure 2)

Innovative example form supply side: Waimai Meituan in China

Like Groupon in the U.S., Waimai Meituan is a group buying website which focus on foodordering. The powerful APP on smart phones gained popularity widely in China. The functions include ordering, payment and tracking.

1) Price: customers could compare the price among different restaurants and also should pay a certain delivery fee which was acceptable considering the convenience.

2) Preferences: customers could know about the style of dishes, other customers' comments on the food and the pictures of food which made the customers easy to order the right food.

3) Transactional efficiency: via the APP, customer also could know the expected waiting time and delivery time since they could track their order.

4) reliable quality: customers could comment their order directly by the APP concerning on taste, price, style and even delivery on time or not.

Actually, it also depends on a big supply system which involves convenient ordering/payment platform, kinds of restaurants neighborhood, instant feedback and huge amount of delivery labors. Plenty cheap labor is competitive advantage of China which also is a challenge to supply enough jobs for the huge non-employment labors. Waimai Meituan used these above advantages and re-constructed the food supply which made a win-win situation all around which also benefit the customers. Waimai Meituan's new business model changed the traditional food supply

solution which added more value on food supply in at least two of four categories: preference fit and transactional efficiency.

The customers can review the pictures of food and other customer reviews to decide which restaurant and what food they prefer. And they also can give instant comments on food/delivery to improve the service and help others know more relevant information about the ordering. These innovations made Waimai Meituan and restaurants supply food and service which fit customers' preference better. And compared to regular restaurants' ordering, Waimai Meituan made the customers more convenient to compare the food among restaurants in the following aspects: taste, style, price, expected delivery time and other customers' comment. Customers can choose, order and pay the food easily because of the function of accessing pictures of the food and tracking the order timely. Price and quality are out controlled from Waimai Meituan because they highly depend on particular restaurants' decision. And customers can easily compare the prices and quality among restaurants which are accessible information on Waimai Meituan. (Figure 3)

So Waimai Meituan's business model brought more value through changing the supply solution which made it was on the top market share of food online ordering in China and covers around 300 cities of China (Wikipedia, 2016).



Figure 3: Value Curve for Waimai Mituan v.s. Regular restaurant

GZWCOT Business model innovation both on demand and supply

Business model innovation also can take place both demand and supply. As a small Chinese high-technology company which set up in November 2015, Guangzhou Water Color Ocean Technology Co. Ltd (GZWCOT)'s mission is to developing the newest and most effective ocean technology solutions and serving the oceanography research. One founder of GZWCOT, Joey Sun is a senior marine optic engineer who had devoted on researching the marine Optic observation for more than ten years. According to his experiences, there are a huge market need on designing the fit equipment to assist the scientists on their researching whom did not have technology staff group or cannot afford the cost of keeping a technology group to assist them with testing their finding or their theory. GZWCOT has a strong marine technology team which is led by Joey who is a seasoned and senior marine optic engineer. They aim to cooperate with scientists on researching and designing the equipment to meet specific research needs which include highly relevant technology service and technology solutions.

At the present, there are plenty of marine equipment venders in China who mainly import and distribute the marine equipment which are developed in U.S. and Europe. On one hand, the original manufacturers tend to control the distribution/retail prices and achieve the exclusive technical profit. Therefore, the price of marine equipment is quite high. At this point, GZWCOT's equipment also has a high price because they do not scale produce their products but only design, assemble the equipment according to the customer's order. Compared to the equipment venders, GZWCOT's customers' specific researching needs can be satisfied and the cost of equipment is more understandable.

On the other hand, the venders tend to need a long ordering term which depended on the produce-speed of original manufacturers. Depends on different products, the delivery time was among 8 weeks to 6 months. GZWCOT keeps cooperation with its factories despite they do not mass produce the product, but they could have a clear produce process and production schedule which make their customer clear about the delivery time. And their products are more fit customer's researching needs and save more time on after purchasing and using process. Because GZWCOT cooperate with scientists, they could start their design and assemble early in the beginning of the scientific projects which also supply a high relevant technical service.

For the changes of demand, GZWCOT found a way to serve the existing researching market demand. And on the solution of supply, it got rid of mass production and charge a higher

premium price which decrease the stock cost and increase their profit. There is an advantage of GZWCOT that make it have a high price of their products is their close customers' relationship and excellent marine technology. In 2016, GZWCOT devoted to developing their own series equipment according to the co-researching with scientists. In 2017, they joined the new equipment test on scientific shipping which made their products and service popularize among marine science area and brought a big amount of orders in 2017 and 2018.

GZWCOT offer a high-relevant and high-matched service and product to its customers who pays a high price but save more due to push technology edges and having a special design equipment to assist their research. Therefore, GZWCOT used their advantages to assist their customers with gaining more value on researching, decreasing the equipment developing cost, and making the research& development process more efficiency. (Figure 4)



Figure 4: Value Curve for Guangzhou Water Color Ocean Technology Co. v.s. Other equipment venders

Conclusion

Business model innovations make it possible for a company to achieve business advantages and success. However, the realization of these achievements also depends on whether the innovation can bring additional new value to meet customers' needs. Customers care about price, preference fit, transactional efficiency and quality. For these four categories, a company should find feasible solutions of serving unsatisfied demand, or improving supply side or creating new values and

add values in both side. A company intends to use business model innovation to find new profit growth that should follow the below three aspects quicker than others:

First, the company needs to find out its extraordinary business advantages: low cost, excellent or unique technology, customer resource;

Second, based on its advantages, the company needs to identify the market opportunities on demand or supply, sometimes both: service unsatisfied demand or create new demand, new supply solution;

Third, the company needs to use its advantages and market opportunities to create new customer value or additional value from four categories: price, preference fit, transactional efficiency and quality. The company should be cautious about saving time cost to fulfill just one or two categories and maintain the rest on average level so that to achieve the high profit growth sooner than its competitors.

Reference:

Cachon, G., & Terwiesch, C. (n.d.). Matching Supply with Demand: An Introduction to
Operations Management (Third Edition ed.). McGraw-Hill Irwin.

- Day, George. (2004, Jul/Aug). Which Way Should You Grow? *Harvard Business Review*, 82(7/8), 24-26.
- Kim, W. C., & Mauborgne, R. (2004, Jul/Aug). Value Renovation. *Harvord Business Review*, 82(7/8), 172-180.
- Terwiesch, C., & Karl, U. (2009). *Innovation Tournaments: Creating and Selecting Exceptional Opportunities.* Harnard Business School Press.

Wikipedia. (2016, August). 美团团购 Takeaway. Retrieved from https://en.wikipedia.org/W/index.php?title=%E7%BE%8E%E5%9B% A2% E5% A4% 96% E5% 8D% 96 & oldid = 41044167

Wikipedia. (2017, November 28). *Airbnb.* Retrieved from https://en.wikipedia.org/wiki/Airbnb#History

Buyers' purchasing time and herd behavior on deal-of-the-day group-buying websites

Y Liu, J Sutanto - Electronic Markets, 2012 - Springer

BEYOND STEM, HOW CAN WOMEN ENGAGE BIG DATA, ANALYTICS, ROBOTICS AND ARTIFICIAL INTELLIGENCE? – AN EXPLORATORY ANALYSIS OF CONFIDENCE AND EDUCATIONAL FACTORS IN THE EMERGING TECHNOLOGY WAVES INFLUENCING THE ROLE OF, AND IMPACT UPON, WOMEN

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BEYOND STEM, HOW CAN WOMEN ENGAGE BIG DATA, ANALYTICS, ROBOTICS AND ARTIFICIAL INTELLIGENCE? – AN EXPLORATORY ANALYSIS OF CONFIDENCE AND EDUCATIONAL FACTORS IN THE EMERGING TECHNOLOGY WAVES INFLUENCING THE ROLE OF, AND IMPACT UPON, WOMEN.

Abstract:

In spite of the rapidly advancing global technological environment, the professional participation of women in technology, big data, analytics, artificial intelligence and information systems related domains remains proportionately low. Furthermore, it is of no less concern that the number of women in leadership in these domains are in even lower proportions. In spite of numerous initiatives to improve the participation of women in technological domains, there is an increasing need to gain additional insights into this phenomenon especially since it occurs in nations and geographies which have seen a sharp rise in overall female education, without such increase translating into a corresponding spurt in information systems and technological roles for women. The present paper presents findings from an exploratory analysis and outlines a framework to gain insights into educational factors in the emerging technology waves influencing the role of, and impact upon, women. We specifically identify 'ways for learning' and 'self-efficacy' as key factors, which together lead us to the 'Advancement of Women in Technology' (AWT) insights framework. Based on the AWT framework, we also proposition principles that can be used to encourage higher professional engagement of women in emerging and advanced technologies.

Key Words: Women's Education, Technology, Artificial Intelligence, Knowing, Confidence, Self-Efficacy, Learning.

Introduction

"I think it's very important to get more women into computing. My slogan is: Computing is too important to be left to men."

~ Karen Spärck Jones, Professor, Cambridge Computer Laboratory.

Women have been significantly underrepresented in scientific, technological and quantitative domains over the past few decades and in their reasonably comprehensive study

"Why so few? Women in science, technology, engineering, and mathematics" (Hill, Corbett, Rose, 2010), the authors advocate a proactive approach to cultivating an early interest in science, technology, engineering, and mathematics (STEM) disciplines and in articulating an inclusive STEM supportive environment for women in their educational settings. There are a variety of serious concerns that have been raised surrounding the low proportion of women in STEM. This proportion bias phenomenon reflects an underutilization of human capital, which has socioeconomic consequences, along with implications for educational frameworks for academia as well for employment frameworks in industry (Ong, Wright, Espinosa, & Orfield, 2011).

Global leaders, corporations, educational institutions and the world at large acknowledge the tremendous benefits of educating girls and women, especially in STEM disciplines and in providing a supportive environment for women in STEM associated professions. Yet, the reality is that the presence of women in education, research and in practice in computer science and STEM domains remains low. Additionally this plight is further compounded by the fact that even fewer women reach leadership positions in these domains, a reality aptly captured in the adage 'the higher up you look, the fewer women you see'. According to the National Girls Collaborative Project, women make up half of the total college educated workforce, however "only 29% of the science and engineering workforce." Some statistics that they provide are as follows: 35% of chemists are women, 11% of physicists and astronomers, 22.7% chemical engineers, 17.5% architectural engineers, 10% are computer hardware engineers. "Minority women comprise fewer than 1 in 10 employed scientists and engineers" (ngcproject.org). Although the percentage of women in male dominated fields has increased, the disparity is still staggering. Interestingly, recent trends show that "Female and male students enrolled in advanced science courses at comparable rates, with females slightly more likely than males to do so (22% versus 18%)" (http://ngcproject.org/statistics) – however the same 2016 report also shows that though math and calculus enrollments did not show significant gender based differences, yet "Male students were more likely than female students to take engineering (3% versus 1%) and computer science courses (7% versus 4%) and enrolled in AP computer science A at a much higher rate (81% males; 19% females)".

Much research has already been done on the topic of underrepresentation of women in STEM disciplines highlighting a variety of associated issues and factors (Diekman, Clark, Brown & Johnston, 2017; Bonham & Stefan, 2017; Tully, 2017; Daldrup-Link, 2017). Numerous useful recommendations have been provided and initiatives and programs have been implemented (Bystydzienski & Bird, 2006; Young, Young & Paufler, 2017; Katz, et. al., 2017; Hill & Rose, 2010). To the best our knowledge, our research is unique as we look into the future beyond STEM and into the emerging technological ecosystem immersed in Big Data, Analytics, Machine and Deep Learning, Artificial Intelligence and IoT, and explore the role of and impact upon women, with a lead research inquiry:

"How can women engage the big data, analytics, machine and deep learning, robotics and artificial intelligence wave?"

It is absolutely necessary to grasp the core difference between a generic STEM education, which is of itself of great importance, and the even more critical dimension of education and immersion into emerging technologies – this difference is elaborated upon in the literature review and subsequent sections of this study. Our research focuses on conducting an exploratory analysis of educational factors influencing the role of, and impact upon, women in the context of Big data, Machine learning, AI & related futuristic technologies.

Literature Review:

In the pursuit of progress and scientific advancement, humanity has developed numerous inventions and theories – a centerpiece of which in recent decades has been waves of technological innovations. Past developments of technology have created efficiencies which reduced the need for human muscle power. The information age facilitated humankind's dependence on commuting technologies for storing, processing and communicating information. Thus the technologies that we developed till recently allowed humankind to still remain 'on top', ruling over machines that did our bidding. Past and present STEM education for women and technological jobs for women movements were designed to address such technologies, where humankind intelligently took all decisions and controlled machines to do their bidding (Hill, C., Corbett, C., & St Rose, A., 2010; Katz, L. A., et al., 2017).

It is critical to note the characteristics of the present technological wave that has begun to emerge: 'Big Data, Analytics, Robotics and Artificial Intelligence'. 'Big Data' refers to the unprecedented nature of current data - vast quantities of data being generated, with variety (types of data), velocity (the speed at which data is being generated or transformed) and veracity (uncertainty) in high measure. This data is being used by industries and governments to gain insights, take data driven decisions and create value. This also creates challenges for privacy and individual rights, businesses, nature of society and its governance (Chen, H., Chiang, R. H., & Storey, V. C., 2012; O'Neil, C., 2017; Drosou, M., Jagadish, H. V., Pitoura, E., & Stoyanovich, J., 2017; LaValle, S., Lesser, E., Shockley, R., Hopkins, M. S., & Kruschwitz, N., 2011).

The science of robotics opens up possibilities for sophisticated automation and large scale replacement of human beings in a variety of activities. It also creates options for for substantial augmentation of human capabilities (Brynjolfsson, E., & Mcafee, A., 2017; Yang, G. Z., et al., 2016; Mataric, M., 2017). Artificial Intelligence (AI) technologies have vast disruption potential and possess power to outperform human beings on multiple intellectual dimensions – some of the recent developments provide machines with 'learning' capabilities, wherein machines are able to develop programs and insights based its ability to process vast quantities of data, improving iteratively using sophisticated algorithms (Olson, R. et al., 2017; Brynjolfsson, E., & Mcafee, A., 2017; Helbing, D. et al., 2017; Moulin-Frier, C. et al., 2017). The implications are enormous – traditionally, we developed machines and coded machine capabilities on a case-specific basis. In contrast, today we have developed technologies which can self-improve, self-learn, adapt dynamically and thus have increasing degree of autonomy, and proficiencies independent of human control.

This significantly alters the challenge of educating and supporting of women in technological domains. The emphasis of women-in-STEM thus far has been to create solutions which required active human management of technologies. If these solutions are implemented without adaption they will not sufficiently prepare women for the future dominated by big data, robotics, AI and similar technologies which have distinct characteristics, have been fostered in mostly masculine environments and are increasingly autonomous in nature. Supporting the education and professional participation of women in such emerging technologies, that create solutions that replace human beings, requires distinctly new insights and the discussion that follows initiate explorative ideation to address the same.

Women-Learning

"Investing in women is single most effective antidote to the world's pressing problems: war, poverty, disease. Woman plays a special role in society by contributing not only to family wellbeing, but to community wellbeing as a whole." ~ Global Fund for Women.

"Women as Learners" explores the idea that women learn differently from men. There is a significant body of research exploring gender sensitive learning and women's "ways of knowing" and gender specific differences (Belenky, M. F., et. al., 1986; Brown, L.M., & Gilligan, C., 1992). Past research has also shown that though the ways of learning and knowing differ, yet the performance remains comparable in certain settings (Zhang, Y. Y., Nayga Jr, R. M., & Depositario, D. P. T., 2015), and differs in other settings (Astur, R. S., Ortiz, M. L., & Sutherland, R. J., 1998) highlighting the need to better understand underlying factors and implications for practice. It is also notable that relatively fewer educators and researchers have used the insights associated with idea of women as learners, especially in STEM domains where there has been a focused effort on women's education. We see this gap as an opportunity and a strong need to further research women's ways of learning. Though questions have often surrounded the dynamics of how men and women learn differently, it has been argued that it is highly probable for men and women to learn differently, have different opportunities for learning, and different approaches to learning (Belenky, M. F., et. al., 1986; Barbour, K., 2016). However, having these differences in ways of knowing does not carry an implication that women's ways of knowing are inferior to men's, nor does it mean that women's ways of knowing is superior to men's (Hayes and Flannery, 2000).

Women's learning cannot be understood unless social context in which learning took place is taken into account. These contexts sometimes offer conflicting and complex opportunities for women. We, as educators, need to develop a greater awareness of the social dimension of learning in formal education taking into account other contexts of learning in which women not only learn skills or lessons about themselves, but also how women view themselves as learners and shape their future experiences (Hayes, E., & Flannery, D. 2000).

Sometimes women view themselves as distinct learners and other times they acknowledge the gender neutral common ground as learners. Very often, women are simply unaware of their learning needs and distinct educational wants. Various experiences influence women's identities as learners. As aptly stated: "Nevertheless, such settings influence but do not determine women's identities as learners. Women are actively engaged in reinventing these identities, just as they continually reconstruct other aspects of their identities." (Hayes, E. & Flannery, D. 2000). We, as educators, need to help women become aware of the learning that takes place in and outside of educational institutions, "validate this learning and connect it to the classroom learning experience."(Hayes, E. & Flannery, D. 2000). The way women learn is constantly influenced by their experiences which also influences their self-esteem. Women may not be aware of how gender and culture influence learning as well as how they affect their identities and self-esteem. 'Voice as identity' emphasizes that a key dimension of learning is how women develop and express identities. 'Voice as power' reflects women's desire to acquire their individual and collective power "through expression and validation of their interests, needs, and experiences." . Educators need to choose for themselves which meaning of voice and pattern of talk in group learning situations they want to become more aware of in their teaching and learning. Various meanings of the terms have emerged in professional literature and from women's narratives. Women's connections with themselves include the concepts of global processing, subjective knowing, and intuition (Hayes, E. and Flannery, D.t 2000).

There are numerous applications of the knowledge about women's ways of knowing to adult education practices. One useful area of application is that this knowledge can help educators take more informed actions. There are various explanations for the connected nature of women's learning which include physiological, psychological, sociological, anthropological explanations. One in particular I find very intriguing and that is the physiological explanation. For example, Carl Sagan's research concentrated on the brain and he found that the corpus callosum, which connects the two hemispheres of the brain, is actually larger in women. Today neuroscientists believe that because of the larger connection between the two hemispheres, women use more of the brain at one time when completing a motion or engaging in solving problems. Sagan (1998, p. CI) also states that although there is no hard evidence, " the larger connector may also account for a woman's tendency to exhibit greater intuition." So women are able to follow several trains of thought, whereas men "tend to be focusing intensely on single topics."(Sagan, 1998). The expectation here is that these different meanings of connectedness will add more understanding of women's learning and also enhance further research. We do not claim that men's ways of knowing stand in opposition to women's and past research shows that the differences could also be related to the subject matter addressed (Zhang, Y. Y., Nayga Jr, R. M., & Depositario, D. P. T., 2015; Astur, R. S., Ortiz, M. L., & Sutherland, R. J.,1998). These highlights from past research provide sufficient ground for researchers and adult educators is to "seek out a more complex understanding of this influence." A question that we can ask ourselves is how curriculum can be altered to reflect gender-influenced learning. As we begin to integrate this knowledge and awareness into our teaching practice, many presently male-dominant domains stand to benefit greatly as more women will enter those fields bringing fresh perspectives, insights and knowledge value additions. However, it requires a collaborative action for this transformation to take place, even as it is fairly obvious that it does need to take place(Watts ,2015; Tomlinson, 2014).

	Yr:	Yr:	%
Gender-Category ~ Educational Qualification	2013	2015	Change
Women Leaders /Practitioners ~ CIS %	78%	85%	8.97%
Women Leaders /Practitioners ~ Engineering %	19%	28%	47.37%
Women Leaders /Practitioners ~ Business %	39%	26%	-33.33%
Men Leaders /Practitioners ~ CIS %	92%	95%	3.26%
Men Leaders /Practitioners ~ Engineering %	40%	43%	7.50%
Men Leaders /Practitioners ~ Business %	24%	24%	0.00%

Table 1: Change in Educational Gender-Category ~ Educational Qualification

Jane Hugo in *Women as Learners* says (Hayes, Hugo, et. al., 2000) state: "We need to recognize that it's easier to think about women as learners than to do something with our knowledge." It is very important to keep the discourse on the topic of underrepresentation of women in male-dominant fields open and current. More research needs to be conducted and actionable questions need to be articulated and addressed. Helping women secure their place in computer science, information systems, analytics and artificial intelligence, will signify that education is equally accessible and supportive to everyone, irrespective of gender. As women's presence increases in technological domains, the benefits of educating girls and women will be more apparent as through the dynamics of fairness, diversity and balance, they will make this world a better place.

Confidence & Self – efficacy

Confidence and self-efficacy have been identified as critical factors in encouraging women towards education and career in STEM disciplines (Hill & Rose, 2010). Confidence has been identified as an important factor in academic success for students (Colbeck., Cabrera & Terenzini, 2001). Past research has also highlighted the lack of confidence as one of main barriers to women engaging and succeeding in technological domains (Howe-Walsh & Turnbull, 2016). However, we need a deeper understanding of the constitution and antecedents of confidence and self-efficacy.



Figure 1: Adapted Efficacy Model (AEM)

Using Bandura's (Bandura, 1977) model of unifying theory of behavioral change, we use inductive logic to proposition an 'adapted efficacy model' to specifically address the women's self-efficacy towards education in and practice of technology disciplines. Self-efficacy is a critical determinant of behavior, and therefore, the interpretation of experience and verbal stimuli become important factors as they influence self-efficacy. Verbal stimuli serves a motivational purpose and is can be exogenous to the person, while interpretation of experiences tends to be endogenous – thus, any attempt to improve the engagement and performance behavior of women must address these two factors (Bandura & Adams, 1977). Education improves skills, which also impacts the behavior and the outcomes, which in creates a sense of accomplishments.

as being objective measurable peak points attested by external agents, while experiences are viewed from a subjective framework. Though the 'Adaptive Efficacy Model' (AEM) is fundamentally gender neutral in its applicability, the factors in the model are sensitive to gender differences, highlighting the previous research supporting gender differences in self-efficacy towards technology (Scherer & Siddiq, 2015). Past research has highlighted that a "psychological sense of masculinity" influences self-efficacy, not biological gender (Huffman, Whetten & Huffman, 2013). This has important implications for gender sensitivity in the methods used to apply factors that influence self-efficacy.



Figure 2. Mean Salary By Education

Methodology, Data & Analysis

We use inductive reasoning based on literature review and analysis of current technological trends in conjunction with an exploratory analysis on readily available data from the NSF and Statista to identify critical factors and posit the AEM Model (above) and the AWT framework (below). In exploring available data from Statista, we observe (Table 1) a growing interest in technology and engineering education and a drop in business enrollment for women. We also observe that the mean salaries for women continue to remain lower related to their male counterpart for the same levels of education. Due to the paucity of data for direct measurement of the engagement of women in analytics, robotics and artificial intelligence education and practice, we used data from a study on the use of artificial intelligence devices by gender to identify gender differences by confidence and comfort levels.



Figure 2: Confidence in Using AI technologies By Gender

Based on the analysis of the data obtained from the "Familiarity with virtual digital assistants (VDAs) in the United States, as of September 2016, by gender" survey, we are able to use explorative analysis to indicate that men have greater confidence and self-efficacy with artificial intelligence - based devices (Figure 2.). This highlights a focused need for further study of associated phenomena and underpins the importance of the present research which posits that there is a need to develop self-efficacy using the AEM and AWT frameworks presented in this paper.

Discussion & Propositions



Figure 3: Advancement of Women in Technology (AWT) Framework

It becomes fairly obvious that there is a need to specifically address AI education for women specifically in the context of self-efficacy and gender sensitive learning. We need to address issues that can narrow the education and confidence gap. We need to explore teaching and learning practices that can be implemented to better reflect women's ways of learning. Key questions remain as to how can learning practices, pedagogy, academic frameworks and the educational ecosystem foster a supportive environment for female education? Using inductive logic from literature review, examination of women's ways of learning, exploratory analysis of secondary data and logical progression using fair proxies for AI usage confidence, we develop the following propositions which are reflected in the AWT framework presented below. We juxtapose identified trends in education with trends in AI usage and analysis of barriers to women's engagement with technology and extract insights.

Proposition 1: Women's self-efficacy toward technology must be improved using the AEM model to cross the efficacy-women's-learning-barriers threshold. (P1)

Proposition 2: (P2) Women's education must accommodate women's ways of learning and knowing. (P2)

Proposition 3: P1 & P2 must be simultaneously implemented in any method that seeks to cross the efficacy-women's-learning-barriers threshold (P3)

Proposition 3b: P3 can also be restated as the "Advancement" success zone being positioned at the integrated implementation of P1 & P2 per the AEM model. We have reserved more elaborate discussions on the nature of the barriers and the crossover thresholds for future research, which is purposed using empirical data and experimental studies to measure real impact of implementation self-efficacy improvement measures and women sensitive educational frameworks which cater to women's ways of knowing and gender optimized pedagogy.

Discussion & Conclusion

The progress seen to date indicates that the situation can be remedied by taking appropriate steps. This paper presents fresh opportunities for further research by presenting the AEM and AWT model and framework respectively. The research is weak in primary data analysis and we expect to address that issue in the future development of this stream of research. We intend to extent this exploratory analysis using experimental studies, case studies and expert surveys to further test and validate our proposed models. Our propositions while fairly robust from an inductive logic perspective, need to be adapted for hypothesis testing which is expected to provide additional insights.

The research is unique and valuable as it seeks to provide insights into emerging dynamics of education in technology and professional engagement for women. Practitioners can gain actionable insights from the present stream of research to ensure that women do not lose jobs or economic and social opportunities due to incorrect ways of gender engagement. It is possible that more women will lose jobs in technology than men in the forthcoming AI wave driven job loss and replacement of human labor by robotic labor. The present research thus provides some thought provoking insights and basis for further discussion and development.

References:

- [1.] Agrawal, A. K., Gans, J. S., & Goldfarb, A. (2017). What to Expect From Artificial Intelligence. MIT Sloan Management Review, 58(3), 23.
- [2.] Astur, R. S., Ortiz, M. L., & Sutherland, R. J. (1998). A characterization of performance by men and women in a virtual Morris water task: A large and reliable sex difference. Behavioural brain research, 93(1), 185-190.
- [3.]Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological review*, 84(2), 191.
- [4.]Bandura, A., & Adams, N. E. (1977). Analysis of self-efficacy theory of behavioral change. *Cognitive therapy and research*, *1*(4), 287-310.
- [5.] Barbour, K. (2016). Embodied ways of knowing. Waikato Journal of Education, 10(1).
- [6.]Belenky, M. F., Clinchy, B. M., Goldberger, N. R., & Tarule, J. M. (1986). Women's ways of knowing: The development of self, voice, and mind (Vol. 15). New York: Basic books.
- [7.]Bonham, K. S., & Stefan, M. I. (2017). Women are underrepresented in computational biology: An analysis of the scholarly literature in biology, computer science and computational biology. PLoS Computational Biology, 13(10), e1005134.
- [8.]Brown, L.M., & Gilligan, C. (1992). Meeting at the crossroads: Women's psychology and girls' development. Cambridge, MA: Harvard University Press.
- [9.]Brynjolfsson, E., & Mcafee, A. (2017). The business of artificial intelligence. Harvard Business Review.
- [10.] Bystydzienski, J. M., & Bird, S. R. (Eds.). (2006). Removing barriers: Women in academic science, technology, engineering, and mathematics. Indiana University Press.
- [11.] Chen, H., Chiang, R. H., & Storey, V. C. (2012). Business intelligence and analytics: From big data to big impact. MIS quarterly, 36(4).
- [12.] Colbeck, C. L., Cabrera, A. F., & Terenzini, P. T. (2001). Learning professional confidence: Linking teaching practices, students' self-perceptions, and gender. The Review of Higher Education, 24(2), 173-191.
- [13.] Daldrup-Link, H. E. (2017). The Fermi Paradox in STEM—Where Are the Women Leaders?. Molecular Imaging and Biology, 19(6), 807-809.
- [14.] Diekman, A., Clark, E., Brown, E., & Johnston, A. (2017). Seeking congruity between goals and roles: A new look at why women opt out of STEM careers.
- [15.] Drosou, M., Jagadish, H. V., Pitoura, E., & Stoyanovich, J. (2017). Diversity in big data: A review. Big Data, 5(2), 73-84.
- [16.] Hayes, Elisabeth, D. Flannery, A. K. Brooks, E. J. Tisdell, and J. M. Hugo. "Women as learners." *The Significance of Gender in Adult Learn* (2000).
- [17.] Helbing, D., Frey, B. S., Gigerenzer, G., Hafen, E., Hagner, M., Hofstetter, Y., ...
 & Zwitter, A. (2017). Will Democracy Survive Big Data and Artificial Intelligence. Scientific American. Feb, 25.
- [18.] Hill, C., Corbett, C., & St Rose, A. (2010). Why so few? Women in science, technology, engineering, and mathematics. American Association of University Women. 1111 Sixteenth Street NW, Washington, DC 20036.

- [19.] Howe-Walsh, L., & Turnbull, S. (2016). Barriers to women leaders in academia: tales from science and technology. Studies in Higher Education, 41(3), 415-428.
- [20.] Huffman, A. H., Whetten, J., & Huffman, W. H. (2013). Using technology in higher education: The influence of gender roles on technology self-efficacy. Computers in Human Behavior, 29(4), 1779-1786.
- [21.] Katz, L. A., Aloisio, K. M., Horton, N. J., Ly, M., Pruss, S., Queeney, K., ... & DiBartolo, P. M. (2017). A Program Aimed toward Inclusive Excellence for Underrepresented Undergraduate Women in the Sciences. CBE-Life Sciences Education, 16(1), ar11.
- [22.] LaValle, S., Lesser, E., Shockley, R., Hopkins, M. S., & Kruschwitz, N. (2011). Big data, analytics and the path from insights to value. MIT sloan management review, 52(2), 21.
- [23.] Mataric, M. (2017, February). Socially Assistive Robotics: Creating Robots That (Provide) Care. In 2017 AAAS Annual Meeting (February 16-20, 2017). aaas.
- [24.] Moulin-Frier, C., Puigbò, J. Y., Arsiwalla, X. D., Sanchez-Fibla, M., & Verschure, P. F. (2017). Embodied Artificial Intelligence through Distributed Adaptive Control: An Integrated Framework. *arXiv preprint arXiv:1704.01407*.
- [25.] Olson, R. S., Sipper, M., La Cava, W., Tartarone, S., Vitale, S., Fu, W., ... & Moore, J. H. (2017). A System for Accessible Artificial Intelligence. arXiv preprint arXiv:1705.00594.
- [26.] O'Neil, C. (2017). Weapons of math destruction: How big data increases inequality and threatens democracy. Broadway Books.
- [27.] Ong, M., Wright, C., Espinosa, L., & Orfield, G. (2011). Inside the double bind: A synthesis of empirical research on undergraduate and graduate women of color in science, technology, engineering, and mathematics. Harvard Educational Review, 81(2), 172-209.
- [28.] Scherer, R., & Siddiq, F. (2015). Revisiting teachers' computer self-efficacy: A differentiated view on gender differences. Computers in Human Behavior, 53, 48-57.
- [29.] Tomlinson, C. A. (2014). The differentiated classroom: Responding to the needs of all learners. Ascd.
- [30.] Tully, D. A. (2017). Discovering pathways to persistence for underrepresented racial minority women in STEM: a comparative study of women's, historically Black, and coeducational liberal arts colleges in the United States.
- [31.] Watts, L. A. (2015). Recommendations for Teachers and Researchers: Supporting Female Learners of Secondary Mathematics: A Review of Literature.
- [32.] Yang, G. Z., Bellingham, J., Choset, H., Dario, P., Fischer, P., Fukuda, T., ... & Berg, J. (2016). Science for robotics and robotics for science.
- [33.] Young, J. L., Young, J. R., & Paufler, N. A. (2017). Out of School and into STEM: Supporting Girls of Color through Culturally Relevant Enrichment. Journal of Interdisciplinary Teacher Leadership, 1(2).
- [34.] Zhang, Y. Y., Nayga Jr, R. M., & Depositario, D. P. T. (2015). Women and Men are Different but Equal: Observations of Learning Behavior in Auctions. In 2015 AAEA & WAEA Joint Annual Meeting, July 26-28, San Francisco, California (No. 205699).

Agricultural and Applied Economics Association & Western Agricultural Economics Association.

- [35.] <u>http://www.lifescied.org/content/16/1/ar11.full</u>
- [36.] <u>http://ngcproject.org/statistics</u>

BUSINESS EDUCATION: REAL-WORLD CAPSTONE

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Abstract

This paper emerges from a pedagogical philosophy that a business student should experience real-world problem solving that allows him or her to demonstrate evidence of learning and its application to the world of business. This paper builds the case that business education must lead the student toward a professional outcome where he or she can apply the knowledge and skills gained during the college journey so that he or she is prepared for all that is expected of the student as a business professional. The outcome of this paper is one college's journey to develop a capstone consulting experience that is transformative for the student and serves society. An important component of this capstone experience is the opportunity for the students to study a problem and to make a set of solution-driven recommendations that will lead to social good.

Key words: Business Education, service learning, pedagogy, capstone.

A SHIFT IN EDUCATION

There are many who believe formal education cannot replace professional experience. We suggest that education can accelerate experience when it is constructed with a strong goal in mind. Access to college emerged after WWII with the GI Bill. Bound and Turner (2002) indicate the substantial gains in the attainment of academic degrees among WWII veterans. Collegiate attainment became more accessible for veterans that were from families of upper socioeconomic status ranging from 15 to 20 percent among men born between 1921 and 1933. (Stanley, 2003). Access to education allowed a broader population to gain the credentials that would allow them to rise in positions of leadership that, perhaps in the past, were limited to more affluent families

who could afford college.

The rise of community colleges further made higher education accessible and affordable. Karabel (1972) explored 'educational inflation' among Americans. The emphasis is on the transformation of the economy and American philosophy of equal opportunity. The number of individuals who now had a college education was larger than ever before. Although college was more accessible, the retention of students from first generation and low-income backgrounds was still challenging (Thayer, 2000). Student support services at the community college level helped shape the education of the typical high school graduate to secure a worthwhile job where alumni could support their families upon attainment of their collegiate degree.

The proportions of women, non-traditional and part-time college students has also significantly increased since 1960 (Baker and Velez, 1996). Although the American culture still predominantly survived on single-family incomes.

As the need for college increased, managers who had not earned the first undergraduate degree criticized the value of an education as limited to "book learning." You would hear senior managers state that you can't learn "what I know after 20 years" in a classroom. The need for dedicated and balanced individuals that attain their business education should develop an 'engaging' managing style where it encourages practicing managers to learn from their own experience, insight, and analysis thereby building on the art of management through management education (Mintzberg, 2004).

Boyer (1985) demonstrates the significant periods of American higher education development since WWII:

- Students tripling from 2.5 million (1955) to 8.8 million (1974)
- Those ranging from 18 24 years of age nearly doubled via degree enrollment from 17.8 percent (1955) to 33.5 percent (1974)
- Minority students depicted an eightfold increase estimating from 95,000 (1955) to 814,000 (1974)
- Young women enrolled in higher education rose from one-third to one-half of all persons attending colleges/universities

- Higher education facilities doubled (1955 1974)
- Community colleges became highly competitive where 400 community colleges enrolled 325,000 students (1955) whereas 973 community colleges enrolled 3.4 million students (1974)
- Faculty increased from 266,000 (1955) to 633,000 (1974)
- Research estimations at universities were approximately \$312 million (1955) whereas it increased to approximately \$3 billion
- The federal government financed 55 percent of university –based research (1955) with an increase in financing totaling 64 percent (1974)

It is imperative that we identify with the implications that are reshaping higher education from: changing students, transforming faculty, shifting curricula, varying research connections, altering technologies, and changing governing structures.

BUSINESS EDUCATION – WHAT IS THE GOAL?

What is the goal of business education? Sustainable economic growth. Influencing future leaders that will focus not solely on profit taking, but on job-creation with profit being a healthy by-product.

Command and control management style that emerged from a society that had a draft. Most young men had served in the armed forces, so were accustomed the leadership and followership relationship.

In time, the culture of business changed. Organizations flattened, the new generation was not required to serve in the armed services. The entrepreneurial spirit emerged.

Business education broadened into the disciplines. Rather than the generic business degree, concentrations in Finance, Marketing, Accounting, and Management emerged. The need for expertise in these disciplines supported the elevation of the advanced degree, otherwise named the MBA – Master of Business Administration.

The development of corporate classrooms speaks to innovative strategies and implications

through this type of educational expansion. It is posited that corporations and universities should form educational yet networking connections, but remain independent (Eurlch, 1985).

Creating service-learning opportunities for students provides greater breadth of business education through association of applied educational experiences. It promotes civic engagement while balancing academic rigor with a richer academic experience. Rather than focusing on the former transactional goals of business education with emphasis on problem solving 'tool-kits', service learning incorporates the following four Rs: reality, reflection, reciprocity, and responsibility which is aiding to the transformation of today's business education philosophy (Godfrey et al, 2005).

PEDAGOGICAL PHILOSOPHY

The educational journey for a Molloy College student provides not only preparation for a professional path, but also for participation as an educated citizen of the world. A democracy must have citizens who understand the collective which serves the society. The professional major within a graduate or undergraduate program should accelerate the student's experience through education. The result is a level of expertise in the student's chosen profession. The curriculum is about depth. The outcome is an individual who is professionally self-sufficient, yet has a yearning for continuous learning.

Through transformative education, Molloy College promotes a lifelong search for truth and the development of ethical leadership (Molloy College Mission Statement). In 2012 the college-wide theme was "Civic Engagement." As a result, the capstone course was redesigned to significantly integrate the college theme with the student learning objectives. A capstone, by its nature, is that last stone put in place; it shows the world that the building is complete. The capstone course is therefore intended to provide the students with an opportunity to demonstrate the skills, knowledge, and disposition that have been gained because of the business education.

MICHAEL BLOOMBERG and "THE MAYOR's CHALLENGE

The Bloomberg Philanthropies' Mayors Challenge is an initiative created by Mayor Michael Bloomberg to aid today's U.S. city leaders to develop innovative ideas to confront and mitigate today's toughest problems with community expertise (Mayors Challenge, 2017).

Champion cities are chosen to test and refine their ideas, creating coast-to-coast civic solutions. They collaborate with innovation experts and urban practitioners from the Bloomberg Philanthropies' global network. They then refine their ideas and then submit a detailed application for further review.

Winners of the Mayors Challenge will then be awarded significant monetary prizes (ranging from \$1-5 million totaling up to \$9 million) in order to bring their ideas to fruition. Applications are evaluated accordingly: by vision, implementation, impact, and transferability. Ideas need to be bold and innovative, but ultimately should aid toward improving citizens lives within their communities. Cities must demonstrate their ability to gather support from both stakeholders and local citizens while putting the 'stretch principle' in place in order to expand their beneficial ideas to other cities. These cities have be able to adapt the vision to benefit their own constituents.

DEVELOPING A CAPSTONE EXPERIENCE

Initially clients were identified that mirrored the process established by Mayor Michael Bloomberg in 2012 when the "Mayor's Challenge" was created. Mayors of Long Island villages offered the students the opportunity to work on a problem that 'fit' into the Mayor's Challenge design of: Vision, Implementation, Impact, and Replicability. These early projects replicated the "Mayor's Challenge" by inviting small cities on Long Island, which are the "Incorporated Villages," to become clients for the Capstone students. An incorporated village has a mayor, a board of trustees, and runs as an independent municipality within the structure of the larger local government.

THE MOLLOY COLLEGE CAPSTONE – FIVE YEARS LATER

After a number of semesters, the need to expand the client-base allowed government agencies and ultimately not-for-profit organizations to become clients. Below we list the clients for each of the semesters starting in the fall semester of 2012 through to Spring 2017. These past five years have allowed the Molloy Division of Business to create a capstone experience that meets the overall learning objectives of both the undergraduate and graduate business programs. The clients were:

2012 Fall

- Undergraduate
 - Mayor Biondi and Village Clerk, Virgilia Gross The Incorporated Village of Mastic Beach, New York
- Graduate
 - Mayor Margot Garant The Incorporated Village of Port Jefferson, New York.
 - o Mayor Scordino The Incorporated Village of Babylon, New York

2013 Spring

- Undergraduate
 - o Mayor Robert Kennedy, Freeport, New York
- Graduate
 - Mayor Margot Garant The Incorporated Village of Port Jefferson, New York.
 - o Mayor Scordino The Incorporated Village of Babylon, New York

2013 Fall

- Undergraduate
 - o Mayor Robert Kennedy, Freeport, New York
- Graduate
 - o Nassau County Commission on Human Rights
 - o Long Island Regional Planning Council
 - o The Holocaust Memorial & Tolerance Center

2014 Spring

- Undergraduate
 - Social Enterprise Alliance (SEA) Long Island Chapter
 - o Mayor Robert Kennedy, Freeport, New York
- Graduate
 - Nassau County Commission on Human Rights, Nassau County Government, Mineola, New York
 - o Long Island Regional Planning Council
 - Office of Community Development, Nassau County Government, Mineola, New York

2014 Summer

- Graduate
 - Mercy Hospital, Rockville Centre, New York

2014 Fall

- Undergraduate
 - o Rotacare, Inc.
- Graduate
 - o Nassau County Bar Association, Mineola, New York
 - o Sustainable Long Island, Inc.

2015 Spring

- Undergraduate
 - o RotaCare, Inc.
- Graduate
 - o Island Harvest, Inc.
 - o Sustainable Long Island, Inc.

2015 Fall

- Undergraduate
 - o RotaCare, Inc. (Phase II)
 - Charles Evans Center, Inc.
- Graduate
 - o Island Harvest, Inc.

o Canine Companions for Independence, Inc.

2016 Spring

- Undergraduate
 - o Charles Evans Center, Inc. (Phase II)
 - Nassau Lend a Helping Hand, Inc.
- Graduate
 - The Health and Welfare Council of Long Island, Inc.
 - Canine Companions for Independence, Inc.

2016 Fall

- Undergraduate
 - The Book Fairies, Inc.
 - o Dream 68, Inc.
- Graduate
 - The American Arbitration Association (AAA)
 - The Health and Welfare Council of Long Island, Inc.

2017 Spring

- Undergraduate
 - o Smile Farms, Inc.
- Graduate
 - The American Arbitration Association, Inc.
 - Paths for Hope

A TYPICAL CAPSTONE PROJECT

The students in the Capstone Class are divided into two-three consulting teams. Each team was provided with a real-world client and a real-world consulting problem. Each team used the Bloomberg Philanthropies, "Mayor's Challenge" application to guide the consulting process. This process takes the students through four stages: (1) establishing a solution-driven vision, (2) developing a turnkey implementation plan, (3) determining the impact of the plan, and (4) determining if the solution can be replicated.

The team's vision is informed by the results of collective research; the team incorporates

programs and concepts that have been used by other organizations. It is *innovative* to the partnering client because the consulting teams create and use resources that the organizations might not have optimized in the past. The teams saw that improvements in areas that were charged or agreed upon with the clients proved to be beneficial for sustainable growth.

The outcome of the consulting experience is a professional presentation to the client and its board of trustees. In addition, the students build a detailed turnkey package which allows the client to execute the recommendations made by the student consultants. It is not sufficient that recommendations are simply made; they need to be actionable. The student consultants must have sufficient detail so that the client's organization will benefit from the students work.

IMPACT ON SOCIETY

There is a need for solutions, such as developed within these consulting teams, which can be transferred across industries. The students learn that the role of business is not simply about profit taking as a priority, but rather job creation and sustainable economic growth that services society – with profit as a healthy by-product. These are the business students that will build the healthy businesses of the future.

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REFERENCES

Baker, T. L., xe, & lez, W. (1996). Access to and Opportunity in Postsecondary Education in the United States: A Review. Sociology of Education, 69, 82-101. doi: 10.2307/3108457

Bloomberg Philanthropies' Competition Overview (2017, Mayors Challenge). Retrieved from http://mayorschallenge.bloomberg.org/competition-overview/
- Bound, J., & Turner, S. (2002). Going to war and going to college: Did World War II and the GI Bill increase educational attainment for returning veterans? *Journal of labor economics*, 20(4), 784-815.
- Boyer, E. (1985). Changing Priorities in American Higher Education. *International Journal of Institutional Management in Higher Education*, 9(2), 151-159.
- Eurlch, N. P. (1985). Corporate Classrooms: The Learning Business, with a Forward by ErnestL. Boyer. *The Carnegie Foundation for the Advancement of Teaching*.
- Godfrey, P. C., Illes, L. M., & Berry, G. R. (2005). Creating breadth in business education through service-learning. Academy of Management Learning & Education, 4(3), 309-323.
- Karabel, J. (1972). Community colleges and social stratification. *Harvard Educational Review*, 42(4), 521-562.
- Mintzberg, H. (2004). *Managers, not MBAs: A hard look at the soft practice of managing and management development*: Berrett-Koehler Publishers.
- Stanley, M. (2003). College education and the midcentury GI Bills. *The Quarterly Journal of Economics*, 118(2), 671-708.

Thayer, P. B. (2000). Retention of students from first generation and low income backgrounds.

CAN BRAND RELATED USER-GENERATED CONTENT PROVIDE EFFECTIVE SOCIAL MEDIA ADVERTISING?

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ABSTRACT

Brand related user generated content (UGC) appears on the vast majority of social media sites. This content is non-professional and can affect possible consumer's perception of a brand's service or product. A new conceptual framework in social media called <u>Principle Marketing</u> Strategy (PRI-MAR Strategy) is introduced to determine the effectiveness of brand related UGC as a form of social media advertising. We investigate whether user generated content can act as a form of effective advertisement when positive content is produced. This study aims to examine the effect of varying types of brand related UGC on consumer perception and promotion of a brand or company. Furthermore, variations across brand related UGC on YouTube, Facebook, and Twitter sites are investigated to determine which social media sites can be used as an effective form of advertising. This study also focuses on how companies such as Airbnb and Uber, can encourage positive brand related UGC among its consumers. Negative aspects of brand related user generated content is discussed in regards to public perception as well. This research paper addresses the following questions.

- 1. What are the merits and demerits of brand-related user generated content across social media platforms?
- 2. How can interaction between consumers and companies on social networking sites be encouraged?
- 3. How does UGC effect (positive and negative) consumer perception of a company or brand?
- 4. How can firms use PRI-MAR strategy for effective social media advertising?

Finally, we discuss limitations as well as implications for real world applications and opportunities for future research.

Keywords:

User-generated content, YouTube, Facebook, Twitter, Social Media Advertising, Firm Generated Content

INTRODUCTION

User-Generated Content (UGC) on social media occurs when consumers compose and broadcast their thoughts and opinions publically (Krishnamurthy and Dou, 2008). Across various social media platforms, UGC tends to be more brand-related and has a potential to influence their followers perceptions on brands (Smith, Fischer, and Yongjian, 2012). UGC can have a positive or negative effect on consumer's perception in regards to credibility, risks and usefulness. Although, there are arguments regarding the credibility of these sources, research suggests that consumers prefer UGC over FGC (Firm-Generated Content) because it contains the user's honest and trustworthy opinions (Hansen, Jin and Lee, 2014; Bahtar and Muda, 2015). Before consumers purchase new products, they utilize UGC to help lessen the perceived risk by understanding the information that is provided in such content. Materials provided through UGC are known to be user-friendly and are useful for sharing information or messages across social media in a quick and an efficient manner (Bahtar and Muda, 2015).

In this new age of the internet, brick and mortar firms have become an old fashioned way of purchasing goods. A new trend has been set called the click and mortar, where individuals make purchases online with a click of a button. Extant research states, that consumers have a pleasant experience while making an online purchase, they are more inclined to maintain a positive attitude towards the product or brand. (Shergill and Chen, 2005; Bahtar and Muda, 2015). Brand-related UGC on social media may enhance the consumer's probability of purchasing a product (Bahtar and Muda, 2005). We introduce <u>Principle Marketing strategy</u> (PRI-MAR) to better define how brand-related UGC helps consumers and businesses across social media.

There is a dearth of research in the topic of brand related UGC and social media advertising. This research paper furthers analyses brand-related UGC by utilizing PRI-MAR strategy on three specific social media websites: YouTube, Facebook and Twitter. The brands that will be compared among these sites are Airbnb and Uber. This paper aims to answer the following research questions:

- A. What are the merits and demerits of brand-related user generated content across social media platforms?
- B. How can interaction between consumers and companies on social networking sites be encouraged?
- C. How does UGC effect (positive and negative) consumer perception of a company or brand?
- D. How can firms use PRI-MAR strategy for effective social media advertising?

This paper is divided into four different sections. First, we identify merits and demerits of brand-related UGC, Airbnb and Uber on YouTube, Twitter and Facebook. In this section, we review the literature in the field of brand related UGC and introduce and define our PRI-MAR strategy. Second, both Airbnb and Uber UGC are examined in relation to their respective brands, as they have their own pages on social media where users follow them and interact with them. In this section we analyze the company's interaction with their customers and find better ways to enhance communication. Third, we classify how UGC can impact an individual's perception, either positively or negatively, on Airbnb and Uber. Lastly, we determine how firms can use UGC as their PRI-MAR strategy to produce effective social media advertising.

THEORETICAL BACKGROUND

Literature Review

Brand-related User Generated Content on social media:

Consumers are now relying more on user generated content than professionally made content (Hassan, Nadzim, and Shiratuddin, 2015). Consumers who produce UGC use their own individual opinion which has shown to be a reliable source on product or brand information (Mir and Rehman, 2013; Jonas, 2010). Perspective customers rely on UGC due to the assumption that the users are not biased to the product or brand (Mir and Rehman, 2013). When deciding whether to buy a certain product, consumers look toward UGC as determining factor (Bae and Lee, 2011).

There are two different types of content, organic or sponsored. Organic UGC is authentic, unsponsored feedback from consumers, while sponsored is celebrity endorsements that typically firms pay (FGC). These two different types of content have different pros and cons when advertising to consumers. Recent study results show that recommendation from a close friend generated more information-sharing attributions but less monetary gain than recommendations from a celebrity (Kim and Lee, 2016). This information helps marketers and consumers understand how these different recommendations affect information that is shared and how much profit is from purchases driven by UGC and FGC.

Firm-Generated Content on social media and Perceptions of the Consumers:

Firm-generated content (FGC) is typically known as the traditional media marketing. This is a non-personal and non-interactive way to directly communicate the message about their product or a brand to their consumers. With massive technological advancements in the past decade, most businesses have developed various methods of communications between the firm and the consumers (Osei-Frimpong and McLean, 2017). The major platform to enhance advertisement is the social media. FGC has taken advantage of that and are increasing their social media communication through posts, messages, pictures and other interactive means. FGC is taking advantage of UGC by understanding the pros and cons of their product through the reviews posted and making the product better for the future customers. Interaction through social media could enhance the company's credibility and increase trust between the firm and the customer (Lee, Hwang and Lee, 2006; Osei-Frimpong and McLean, 2017).

Theoretical Framework

Bahtar and Muda (2015) developed a conceptual framework with contributions from a previous study conducted by Mir and Rehman (2013). Figure 1 displays various concepts that are a part of the framework that involves UGC and online purchase intention. First, the three thought processes of the consumer: perceived credibility, perceived usefulness and perceived risk are established. Then, the relationship between these three thought processes contributes towards the consumer's attitude on UGC. Further analysis of this framework is to see if the consumer will have an intention to make an online purchase.

Figure 1 provides the conceptual framework that created the theory of this study. The framework contains how online purchase intention is affected by perceived credibility, perceived usefulness, perceived risk and the attitude towards UGC. In today's technologically driven world, firms are realizing that the best way to reach their consumers is through social media. Social media has become a platform for consumers to be able to give their opinion on a product or service. In the next section, we define how UGC and FGC have an impact on purchasing intentions of consumers. When firms use research and understand UGC, they are more likely to achieve a positive brand image and gain more profits.

The PRI-MAR Strategic model is shown below in Figure 2 and which builds upon Bahtar and Muda (2015), consumer perception model shown in Figure 1. The PRI-MAR Strategy introduces four propositions based upon the relationships between the concepts of <u>P</u>erception, <u>R</u>eviews, <u>I</u>mpact on performance, <u>M</u>arketing, <u>A</u>dvertising and <u>R</u>esearch.

Proposition 1: UGC results in positive consumer perception towards brands in social media resulting in better brand performance.

Consumers are finding new ways to stand out and gain popularity on the internet by using social media platforms. YouTube, Twitter and Facebook are three of the most common social media websites where UGC is found. UGC on these websites has been shown to impact consumer's perception after they have gathered information about the product or brand from other users.

Proposition 2: eWOM reviews are a part of UGC which further improves the impact of brands performance.

UGC is also being created by new users who are seeking internet fame when their endorsements or reviews of certain products have gone viral in the social media. This motivates users to create content that is aimed at informing users of their own opinion and a product or brand. Since the content being produced is not from the companies, users tend to rely on the information that is being presented. Their electronic word of mouth (eWOM) encourages viewers to get an understanding of a product and influences users to purchase specific brands. *Proposition 3: Firms who engage in research on UGC and FGC perform better in social media.* With the advancement of technology and an increase in social media usage, firms are taking advantage of using UGC to advertise their products. There is a positive feedback effect between UGC and FGC. Firms that research the success of UGC and FGC generate more success than firms who stick to more traditional marketing techniques. Firms gain a better understanding on what makes their consumers provide positive UGC when they perform research. UGC and FGC influence consumer's buying decisions.

Proposition 4: Firms use marketing and advertising on social media by publishing brand/success stories to perform better than others.

When consumers are happy with the outcome of their purchase of a product or service from a firm, they generally will post a review on social media to inform others of their experience. Prospective consumers will consider UGC rather than advertisements created by the company because they believe UGC is more honest. The percentage of consumers who read reviews has had a steady growth with the growth of social media. To gain a positive perception from potential consumers, they will publish positive reviews or stories. Individuals are more likely to purchase a product/service if the brand has a loyal consumer base. The percentage of consumers who read reviews has had a steady growth with the growth of social media.

CASE STUDIES

Social media platforms such as Facebook, Twitter and YouTube have transformed the accessibility of transportation and accommodation. An example of this is shown in companies such as Airbnb and Uber, which have become popular with rise of the sharing economy. These sharing economy platforms allow consumers to essentially rent an apartment, house, and ride. Previously discussed research suggests that user generated content on social media has a large impact on economic and social decisions. The way consumers seek and receive information has changed drastically with the increased accessibility and share ability of and traditional media has been replaced with networks like Facebook, YouTube and Twitter (Cheong and Morrison, 2008).

With the ease of access of communication, these social networks are how a majority of people interact with others and find out information about products, services, news, jobs and politics. All social media platforms contain user generated content. UGC can range from comments, videos, and pictures on product or service. Facebook is made up of the most picture UGC, Twitter is made up of the most networking UGC, and YouTube is made up of the most video UGC. According to Luca (2015) there are many challenges that come with trying to research how UGC affects profits, decision making of consumers, and describes the UGC platform as sometimes being insufficient to measure the impact it has on a market.

Although research shows that consumers prefer to rely on UGC rather than advertisements paid for by the company, there are still loopholes that firms use to keep their brand image looking pristine (Bahtar and Muda, 2015). For example, the firms in our studies both have legal pages on their website that say that they " may, in its sole discretion, remove, edit or disable User Content for any reason, including if Uber reasonably determines that User Content violates this Agreement" (Uber User Generated Content, 2017).

These two companies rely on UGC to create an affordable way to gain consumers attention. An example of this is a tweet about an experience with Uber or Airbnb that gains attention from retweets or likes. In one incident, an Uber consumer, Mohamad Elshieky, tweeted a comical tweet about him and his Uber driver being silent, and then giving him five stars. This single tweet got over 500,000 likes and 181,000 retweets (Uber User Generated Content. 2017). Due to the response and publicity, Uber rewarded him with Uber apparel. This action shows how the company such as Uber is encouraging UGC as a form of effective advertisement as the company received positive publicity from this user. The other company that we mentioned is Airbnb, whose brand narrative is "based on people's stories captured from videos and photographs" (Yannopoulou et al., 2013). In other words, they create their brand from user generated content. The company uses consumer interaction as the main source of credibility.

Airbnb is aware of the impact that UGC has on it maintaining its success. Almost 70% of posts from Airbnb are user generated content that they use to create a better brand image. Studies have shown that more than half of Americans trust UGC more than any other information source and that UGC is a major factor in decision making. Forty three percent of people are more likely to purchase a service if they had heard about it from a social channel, friends or family. Airbnb uses UGC by holding photo contests from past customers to show audiences what it is like to use the service (Shrivastava, 2017).

DISCUSSIONS AND IMPLICATIONS

Theoretical Implications

After reviewing a dearth of research and several case studies in the areas of user generated content and its relation to consumer perception and sales, we can begin to postulate theoretical outcomes related in these areas based upon the PRI-MAR framework. Following the PRI-MAR strategy, firms should be able to use UGC as an effective form of advertising. PRI-MAR strategy will enable firms to use the reviews and reactions from its customers to improve sales for their company by helping to improve overall perception of their brand. When a firm allows and encourages consumers to market for them, its sales and perceptions improve. When looking at case studies of Airbnb and Uber, their interaction with users, we can see how the PRI-MAR theory can be used. The implications of the propositions related to this theory is that it can be used across several different social media platforms to influence consumers.

Social Media websites offer a plethora of UGC. This UGC can alter perception of consumers. These reviews come in the form of tweets (Twitter), video reviews (YouTube), and

written reviews (Facebook) and have the ability to impact consumer's purchase decisions. When firm better understand how to encourage positive UGC they are able to use this UGC as advertising. Firms who use this process may be able to mitigate advertising costs and improve product performance while improving overall brand image.

Managerial Implications

This research shows that UGC can have a positive impact on consumer perception. Companies like Airbnb and Uber should put these findings to practical use to gain profits. Observations show that when firms do research on UGC, they have a better chance of understanding how their consumers make decisions. From a managerial view, a company should conduct more research on how to maintain positive UGC and what the implications are for positive feedback.

There are many advantages that occur when firms have a positive UGC and brand image. One of those advantages is creating an appealing product or service to entice the target market of a company. Another form of research that should be conducted would to be to gain an understanding on what social media platform works best for the product they are selling and the market that they are appealing too. To understand what social platform will reach this market, firms should research the age, sex, and other qualities that affect consumer buying habits.

This research will be effective by providing information on how to better reach possible consumers and understanding each individual experience that their customers receive. For example, studies show that 88% of eighteen to twenty-nine year olds use the social media platform Facebook (York, 2017). Therefore, if a company is trying to advertise or appeal to this demographic, the company should consistently check their Facebook and see if the UGC being posted is positive and encourage users to provide positive UGC.

Limitations and Future Research

This study has several limitations but has also created opportunities for future studies. This study does not contain the empirical evidence to provide proof of the effectiveness of the framework introduced. Future research may focus on surveying consumers to see what all social media platforms they use. Consider the top five social media websites instead of three and browse for all the possible brand related UGC and make them the case studies. Increasing the number of case studies will provide the reader with more accurate guide to see if UGC reflects in a positive way. Viewing positive UGC may enhance the consumer's knowledge about a specific good or service and encourage them to purchase it. PRI-MAR strategy focuses on the generic ideology that positive UGC provides better marketing. However, this study could also inspect the negative aspects of UGC. This may help determine what effect negative review may or may not have on consumer perception and purchase decisions.

CONCLUSION

Facebook, YouTube and Twitter are known as popular social media sites used for UGC. Current trends suggest the majority of consumers look at reviews before purchasing a product. Customers are generally more trusting of UGC than FGC. Positive brand related UGC reviews contribute to businesses such as Airbnb and Uber's successfulness. These firms are taking advantage of UGC by encouraging users to create positive reviews by providing these individuals with gifts or merchandises. The main goal of advertising is to drive consumers to purchase goods or services, and positive UGC has been shown to have a similar effect. Therefore, Airbnb and Uber are utilizing brand related UGC as their principal marketing strategy (PRI-MAR). These two case studies show potential for other firms to use brand related UGC as an effective form of advertisement.

References

- Bae, S., Lee, T. (2011). Gender differences in consumers' perception of online consumer reviews. *Electronic Commerce Research*, 11(2), 201-214.
- Bahtar, A.Z. & Muda M. (2016). The Impact of User Generated Content (UGC) on Product Reviews towards Online Purchasing – A Conceptual Framework. *Procedia Economics* and Finance, 37 (201), 337-342.
- Cheong, H. J. & Morrison M.A. (2008). Consumers' Reliance on Product Information and Recommendations Found in UGC. *Journal of Interactive Advertising*, 8 (2)..
- Hassan, S., Nadzim, S., & Shiratuddin, N. (2015). Strategic Use of Social Media for Small
 Business Based on the AIDA Model. *Procedia Social and Behavioral Sciences*, 172, 262–269.
- Jonas, J. R. O. (2010). Source credibility of company-produced and user-generated content on the internet: An exploratory study on the Filipino youth. *Philippine Management Review*, 17.
- Krishnamurthy, S., & Dou, W. (2008). Note from special issue editors: advertising with usergenerated content: a framework and research agenda. *Journal of Interactive Advertising*, 8(2), 1-4.
- Lee, S., Hwang, T., Lee, H.-H., (2006). Corporate blogging strategies of the Fortune 500 companies. Management Decision 44, 316-334
- Liu, Q. B., Karahanna, E., & Watson, R. T. (2011). Unveiling user-generated content: Designing websites to best present customer reviews. *Business Horizons*, 54(3), 231-240.
- Luca, Michael, User-Generated Content and Social Media (2015). Forthcoming in the Handbook of Media Economics, Simon Anderson, David Strömberg and Joel Waldfogel, eds.

- Mikyoung Kim, Mira Lee, (2017). Brand-related user-generated content on social media: the roles of source and sponsorship. *Internet Research*, 27 (5), 1085-1103.
- Mir, I. A., & Rehman, K. U. (2013). Factors affecting consumer attitudes and intentions toward user-generated product content on YouTube. *Management & Marketing*, 8(4), 637.
- Osei-Frimpong, K., & McLean, G. (2017). Examining the moderating effects of firm generated content on online social brand engagement.
- Shergill, G. S., & Chen, Z. (2005). Web-Based Shopping: Consumers' Attitudes Towards
 Online Shopping in New Zealand. *Journal of Electronic Commerce Research*, 6(2), 79–94.
- Shrivastava, T. (2017). How AirBnB Thrives on User Generated Content. https://www.pixlee.com/blog/how-airbnb-thrives-on-user-generated-content/
- Smith, A. N., Fischer, E., & Yongjian, C. (2012). How does brand-related user-generated content differ across YouTube, Facebook, and Twitter? *Journal of Interactive Marketing*, 26(2), 102-113.
- Uber User Generated Content. 2017. Retrieved from. https://www.uber.com/legal/other/user-generated-content/
- Yannopoulou, N., Moufahim, M., Bian, X. (2013). User-generated brands and social media: Couchsurfing and AirBnb. Contemporary Management Research, 9(1), 85-90.
- York, A. (2017). Social Media Demographics to Inform a Better Segmentation Strategy. Retrieved from http://sproutsocial.com/insights/new-social-media-demographics/



Figure 1. The Consumer's Perception (Bahtar and Muda, 2015)





CONSUMER BEHAVIOR OF OVER-THE-TOP TELEVISION SERVICE SUBSCRIBERS

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Abstract

This research will be diving into Millennial's decisions and perceptions of their television entertainment. We will be considering television services, as well as television viewing devices, and how Millennials view each. The methodology of our research will use frequency analysis, descriptive statistics, T-Test models, ANOVA model, regression model, and logistic regression models to see if there is any statistical significance among Millennials desire to switch from traditional television services to OTT television services and what devices millennials decide to use to watch their television entertainment. We conducted a survey to 65 college students at a public university in the northeast area in America, to collect and analyze our findings. While there have been many studies into cost, switching costs, quality, happiness, convenience, perceived usefulness, and perceived enjoyment, there is a lack of studies that encompass all these variables together to determine if they have a significant impact on Millennials switching television providers and what devices they prefer to use to watch television. The study found that even though most of the variables are of some importance to Millennials television viewing decisions, none have any significant impact on their decision to abandon their traditional television services to strictly an OTT television experience. The findings for devices for television use did find some significance as happiness, interactivity, and perceived usefulness were all shown to have significant statistical significance when it came to Millennials and what devices they consider using to watch television entertainment. The results were that Millennials are happier or more entertained when using a PC to watch television, they find the TV to be the most useful device, and that mobile devices are superior in terms of interactivity.

Keywords: OTT, Television, Millennials, Logistic Regression

Introduction

There is a noticeable change in how Millennials are choosing to watch television. Whether Millennials are choosing alternative devices to watch television, such as tablets, mobile devices, or computers, or are using OTT services like Netflix, Hulu, YouTube, or Amazon Prime. This movement is impacting traditional cable television providers in a significant way.

There have been many studies into how people are watching television and what motivations are causing people to change their television watching habits. Cohen's (2016) research shows adoption of the smartphone and internet enabled mobile devices is increasing towards full penetration in the demographic but consumers are still holding on to the idea of the television as being their primary viewing screen for most forms of content. Baccarne et al. (2013) also proves to strengthen this report analysis by concluding that as (low) price is the main factor for OTT TV success, it should also be considered that a (high quality) television signal over the internet also includes the cost, and limitations, of a (high-speed) internet connection. Research into the viewing habits of college students show that college students have unprecedented control over their reception or avoidance of advertising messaging resulting in control of when, where, and how they view television programming (Damratoski et al. 2011). Dickinson (2014) reports that binge-watching among Millennials is becoming an epidemic, where OTT platforms are the main source of binge-watching. Binge-watching is where an individual watch two through six episodes of a show in a 24-hour period.

Therefore, this research attempts to answer if Millennials are moving away from traditional television watching habits and moving to different services, products, or watching on-the-go. Factors we will be considering are if Millennials are moving away from traditional cable providers to OTT streaming providers like Netflix or Amazon Prime and what they choose to watch television on, such as, tablets, computers, phones, or a television.

Sampling of Millennials over the internet in the United States was done via an online survey questionnaire. A multivariate statistical analysis performs a hypotheses testing.

In Section 2, a review of prior studies is conducted. Section 3 presents methodology, followed by statistical results in Section 4. Managerial implications are given in Section 5. Finally, Section 6 concludes this study.

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Literature Review

As stated by Chulkoy D & Nizovtsev (2015) cable companies are struggling a lot by the new shift of internet streaming, before cable companies use to bundle up channels for customers. Now since cable companies are charging a premium for cable, many consumers are looking for options to obtaining video content online to save money on not having a cable service. Now cable companies are considering giving the ability to consumers to choose the channels they want to see, but also allowing them to subscribe to "a la carte" format.

Damratoski, Field, Mizell, Budden (2011) investigates television viewing behaviors of college students. The investigation methodology was a questionaries' distributed in 2010 to the students in a university in the southern of the U.S. The investigation covers 6 objectives that involves how different independent variables are affected by the number of hours watch by college students. The research results show how television viewership hours per day by college students has increased significantly, due to the convenience of watching television anywhere, anything and watching any program.

An investigation about what were the variables that have influenced generations viewing behaviors as well as consumption with a focus in how they access the media was conducted by Cohen, Maher (2016). The data was gather from an online survey conducted in 2015, and the results shows that there are two clear factors. The first one is that even though technology is advancing every day, consumers still mention television being as the primary view screen form. The second factor explain that both the cord cutters and cord-never have a big psychological connection to prejudiced views surrounding both media consumption and media cost.

Digitalization is advancing every single day, not only the internet is getting faster, but also there is more a wide Varity of alternative screens, and sources of television content. Baccarne, Evens, Schuurman (2013) conducted a study to measure the evolution of OTT services, they presented an examination of the market, and a large-scale end-user survey. The research had 1269 respondents that were target through mailing and social media. The results show that even though the technology keeps advancing, more than 61% of consumers still use their TV as a main primary screen to watch TV. Also, the results show that even though consumers find online streaming to have many benefits compare to cable, is very hard for consumers to cut the cord,

since most of them have the triple bundle of services, which Is distributed by a single distributor making it difficult to leave one of the services, dropping one would mean cutting all the services.

The movement from traditional television to internet-based television generally results in a physical or environmental change of how people watch television. Through literature study, market analysis, a design shop, and expert interviews Westerlund (2014) wanted to bring the concept of bringing the qualities of traditional television to the online streaming environment. The qualities of TV that people value when watching broadcasting television according to research was lean-back viewing, communal activity, and curated, aggregated, and recommended content. The most common negative perceptions of internet-based television were around different interfaces, interactions, and functionalities from the different providers. The results show that the future of broadcast television is still a part of the future and the changes of how people watch television does not have a significant impact.

According to Dickinson (2014), Millennials account for most TV binge-viewers. It is also noted that Millennials are the first generation to incorporate electronic media into every aspect of their multi-tasking lives. The research conducted considered the binge-watching epidemic that is affecting Millennials. The methodology for collecting data was by using surveys to collect millennial binge-viewing behavior from focus groups. The results found that 85% of binge-viewers preferred Netflix as their platform of choice, 50% of binge-viewers take part in binge-viewing rituals for "fun", 13% use binge-viewing to pass time, and 11.6% use binge-viewing to relax or wind-down. Millennials may perceive spontaneous binge-watching as a form of relaxation, but the findings show that this type of activity result in mental, emotional, and physical exhaustion.

Bury and Li (2015) conducted a study on the different devices used in viewing television because of time shifting, downloading, streaming and mobile technologies. Data was collected using an online survey during 2010-2011 from 671 participants. The researchers used descriptive and statistical analysis of new emerging modes and traditional means of viewing television. The research also examined whether significant differences exist across three demographic variables: age, country, and gender. Some interesting findings in the research do show that traditional modes of viewing are in decline with nearly 50% of Americans watch live television and that the demographic who watches the least television is younger viewers.

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Television broadcasters are scheduling, producing, and delivering content in new ways to take advantage of consumers viewing through multiple devices. Sorensen (2016) conducted research from BBC and Channel 4 to examine how live television is being reshaped to fit the multiple screen phenomenon. Sorensen (2016) proposed that BBC was not viewing live television as something of the past but that live television will be the core to its multi-screen strategy. The findings were that BBC and Channel 4 were using two of their core strengths, live television and reach to improve the television watching experience across multiple screens. The research noted that Facebook and Twitter were essential functions for promoting live television broadcasting productions. Using live media events are what is pulling viewers to stay watching live television and improving the experience through social media.

Chenghuan Sean Chu (2010) conducted research into what was viewed as cable's primary competitor, satellite television and how this competitor affected prices and product quality. Chu noted that DirecTV was the first notable cable substitute and could gain market share by offering products that were slightly less expensive. Chu (2010) used descriptive statistics to observe changes to cable menus over time as a reaction to the entry of satellite television. The findings were that cable responded by lowering prices, raising quality, or engaging in combination of the two. These results show that additional competitors in the television marketplace result in an overall improvement in consumer welfare gains.

Summarizing, there are many studies that focus on the evolution of internet streaming, companies like Netflix, Hulu, and Amazon prime, have decrease the percent of people watching TV from cable. All of the study's results share the same outcome, which is consumers tend to subscribe to internet streaming services due to there are inexpensive compare to cable, and the convenience of streaming TV anywhere anytime. However, the investigation would contain different regression models that would contain different combinations of variables, the results would give us better understanding of the millennials perception and behaviors when it comes to internet streaming. The investigation would also give us an insight of what the millenniums think is going to be the future for cable companies.

Methodology

Many studies argued that OTT aggregators are having a significant impact on the television industry. Also noted in these studies are that additional devices other than the traditional television are being used to watch some sort of television entertainment.

Hypotheses 1: Cost is significantly related to Millennials switching from traditional television services to OTT. Survey questions related to this hypothesis include:

- Cable/Satellite services that are available today are too expensive.
- Television services available today are too expensive.
- I think that OTT services are quite pricey.

Baccarne, Evens, and Schuurman (2013) noted that low monthly cost of OTT services is their main ingredient for OTT success. The research was collected from 1,269 respondents of an open call online survey of people between 20 and 50 years of age in the Flanders region of Belgium. When asked whether "Price" is an important dimension for you when it comes to television over the internet in the future, the results showed statistical significance with over 90% of respondents saying "Price" is either "Very Important" or "Important". Therefore, this study hypothesize that cost has a significant relationship with switching their traditional television services for OTT services. Brown (2005) tested cost in relation to the adoption of technology in households.

Hypotheses 2: Switching Cost is significantly related to Millennials switching from traditional television services to OTT. Survey questions related to this hypothesis include:

- Switching to a different television service would involve some hassle.
- It is complex for me to use a different television service.
- Some problems may occur when I switch to an OTT service.

It has been suggested that switching costs in the television industry are high and Shcherbakov's (2016) research found that monetary value, hassle, and utility costs are the main factors that go into switching costs. Accordingly, this research hypothesized that consumers consider switching costs when switching their traditional television services for OTT services. Kim (2009) tested switching costs in relation post-adoption phenomena.

Hypotheses 3: Convenience is significantly related to Millennials switching from traditional television services to OTT. Survey questions related to this hypothesis include:

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- Cable/Satellite services would enable me to access television anytime, day or night.
- OTT services would enable me to access television from home, from the office, on the road, or at other locales.
- It would be convenient for me to access television with any television provider.

Convenience of how, when, and where has shown to have an impact of what consumers are looking for in their television providers. Bury and Li (2015) found that a little more than half of Americans watch live television, there is a significant rise on online viewing, and computer usage for television is a viable alternative. And so, this study hypothesized that convenience has a significant relationship with consumers switching their traditional television to OTT services. Chan (2010) tested convenience in relation to citizen satisfaction with mandatory adoption of e-government technology.

Hypotheses 4: Quality is significantly related to Millennials switching from traditional television services to OTT. Survey questions related to this hypothesis include:

- Overall, I would give Cable/Satellite services high marks for my television entertainment.
- Overall, I would give the OTT services high rating in terms of quality for television entertainment.
- In general, my television services provided me with high-quality television entertainment.

Cory Barker (2016) noted the many different meanings of television quality from his literature review, whether it be textual conventions, large casts, sociocultural awareness, demographic makeup of the audience, or sense of artistry. Findings noted that networks deploy Quality TV as a branding strategy as a way to validate its programs and legitimize pay cable as a home for original series. Therefore, this study hypothesizes that quality has a significant relationship with Millennials switching from traditional television services to OTT. Xu (2013) tested information quality in relation to integrating service quality with system and information quality.

Hypotheses 5: Happiness is significantly related to Millennials switching from traditional television services to OTT. Survey questions related to this hypothesis include:

- Time flies when I'm watching television using OTT services.
- When I am watching television using Cable/Satellite, I forget everything else around me.

• I am immersed in television entertainment.

Karen Dickinson (2014) conducted research into Millennials using an online survey which consisted of 203 college students. From the respondents of the survey when asked "How do you usually feel after you binge-view TV shows", the results were 31% felt "exhausted", 27% felt "accomplished", and 31% felt "other". Other included items like "lazy", "Like I wasted my time", Like I ve been procrastinating", and "lame". Consequently, this study hypothesizes that happiness has a significant relationship with Millennials switching from traditional television services to OTT. Rodell (2010) tested Absorption in Job in relation to consequences of employee volunteerism.

Hypotheses 6: Convenience is significantly related to Millennials deciding what device to watch television entertainment. Survey questions related to this hypothesis include:

- It is easy for me to watch television using a TV.
- It is convenient for me to watch television using a PC/laptop.
- It is easy for me watch television using a mobile device (phone/tablet)

A study made by ComScore (2014) found that more than 56% of the respondents prefer to watch TV online because they could watch it on their own schedule, the second reason was that it was more convenient. The study show that most of the respondents prefer to watch TV online due to the convenience of watching TV anytime and anywhere. Thus, this research hypothesized that consumers consider convenience when deciding what device to use to watch their television entertainment. Hong (2004-2005) tested cognitive convenience in relation to information format and shopping task on consumer's online shopping behavior.

Hypotheses 7: Quality is significantly related to Millennials deciding what device to watch television entertainment. Survey questions related to this hypothesis include:

- In terms of television quality, I would rate the PC/Laptop highly for television entertainment.
- Overall, the TV that I used was of high quality for television entertainment.
- Overall, I would give the quality of mobile viewing (phone, tablet) a high rating for television entertainment.

Mike Meola (2016) conducted a survey in Hub Research that shows the actual television still is the most use device to watch TV compare to other devices. The main reason why the respondents prefer to watch their contents on a TV compare to another device is because they prefer to watch their shows/movies on an actual large TV screen. As a result, this research hypothesized that consumers consider quality when deciding what device to use to watch their television entertainment. Xu (2013) tested system quality in relation to integrating service quality with system and information quality.

Hypotheses 8: Happiness is significantly related to Millennials deciding what device to watch television entertainment. Survey questions related to this hypothesis include:

- I feel happy when I use a TV for television entertainment.
- I feel cheerful when I use a PC/Laptop for television entertainment.
- I feel sociable when I use a mobile device (phone, tablet) for television entertainment.

Television in and of itself has a meaningful impact on one's emotional well-being or happiness, as noted by Bruni and Stanca (2005), television reduces people's ambition to volunteer and engage in relational goods which are primary factors to one's overall happiness. Accordingly, this research hypothesized that consumers consider happiness when deciding what device to use to watch their television entertainment. Kim (2009) tested entertainment in relation to the impact of website quality on information quality, value, loyalty intentions in apparel retailing.

Hypotheses 9: Interactivity is significantly related to Millennials deciding what device to watch television entertainment. Survey questions related to this hypothesis include:

- The TV allows me to interact with it to watch my Cable/Satellite services.
- The PC/Laptop has interactive features, which help me watch my television entertainment.
- I can interact with my mobile device to tailor my OTT services to my specific needs.

A study found (Agirre, Arrizabalaga, and Espilla(2016) noted the three ways consumers interact with television and online video content (viewing, sharing, and creation) are not being adopted in a significant way and that consumers behave "differently according to content and context, rather than in response to a particular media." For that reason, this study hypothesized that interactivity has a significant relationship with consumers deciding what device to use to watch their

television entertainment. Kim (2009) tested interactivity in relation to the impact of website quality on information quality, value, loyalty intentions in apparel retailing.

Hypotheses 10: Perceived usefulness is significantly related to Millennials deciding what device to watch television entertainment. Survey questions related to this hypothesis include:

- Using a TV can improve my Cable/Satellite services.
- Using a PC/laptop can increase my television entertainment effectiveness.
- Using a mobile device (phone, tablet) can increase my OTT services effectiveness.

A study into drivers (Banerjee, Alleman, and Rappoport 2012) of viewership hours found that viewership hours increase rapidly with an increase to device count, meaning that perceived usefulness of devices increase television consumption. Hence, this research hypothesized that consumers consider perceived usefulness when deciding what device to use to watch their television entertainment. Parboteeah (2009) tested perceived usefulness in relation to the influence of website characteristics on a consumer's urge to buy impulsively.

Hypotheses 11: Perceived enjoyment is significantly related to Millennials deciding what device to watch television entertainment. Survey questions related to this hypothesis include:

- My interaction with a TV for Cable/Satellite services was enjoyable.
- My interaction with a PC/laptop for television entertainment was exciting.
- My interaction with my mobile device (phone, laptop) was pleasant for OTT services.

Torrents (2017) made a study to see on why the millenniums between the ages of 16-24 show enjoyment when watching TV online. The main reason Millenniums feel enjoyment is because the easiness to watch TV online while using any of their devices, such as cell phone, computers, iPad, etc. Therefore, this research hypothesized that consumers consider perceived enjoyment when deciding what device to use to watch their television entertainment. Parboteeah (2009) tested perceived enjoyment in relation to the influence of website characteristics on a consumer's urge to buy impulsively.

Research Framework



This study plans to build two models to show how different variables are impacting the television industry.

The first model's dependent variable is see if Millennials are choosing OTT over traditional cable/satellite providers for their television entertainment. The independent variables for the first model are as follows: cost, switching costs, quality, happiness, and convenience.

The second model's dependent variable is considering what devices Millennials are using to watch their television entertainment. The independent variables for the second model are as follows: quality, happiness, convenience, interactivity, perceived usefulness, and perceived enjoyment.

To further study our model/theory, we will be running various regression models. By doing this we will be able to pinpoint more clearly what factors and/or combinations of factors impact Millennials decision to switch from Cable/Satellite to OTT and what devices Millennials are using to watch their television entertainment.

Sampling Plan

Based on the independent variables, we've developed several hypotheses that will be tested using a questionnaire which was created for this study specifically. In person surveys were conducted at a public university in the Northeast area in America. About 100 students participated in the study and our sample used participants that identified as a millennial 18-34. We also included 4 demographic questions that will help us in generating intensive models and provide greater segmenting power for better understanding. Our questionnaire included 15 questions on Millennials choosing OTT over traditional cable/satellite television services and 18 questions on devices used to watch television entertainment. We believe that our data is sufficiently diversified and is a good random sample of the population and is valid in terms of testing our theories.

Results

Age

		Frequency	Percent	Valid Percent	Cumulative
Valid	17-25	47	72.3	72.3	72.3
	26-36	16	24.6	24.6	96.9
	37-52	1	1.5	1.5	98.5
	53+	1	1.5	1.5	100.0
	Total	65	100.0	100.0	

Approximately 97% of the sample ppulation is between the ages of 17-36, and from those 97% of the sample population nearly 73% can be classified as millennials (18-34).

Gender

		Frequency	Percent	Valid Percent	Cumulative
Valid	Male	38	58.5	58.5	58.5
	Female	26	40.0	40.0	98.5
	Prefer not to respond	1	1.5	1.5	100.0

Total	65	100.0	100.0	
Total	03	100.0	100.0	

We can determinate from the results above that 58.5% of the respondents are male, 40% are women, and 1.5% prefer not to answer.

Income

		Frequency	Percent	Valid Percent	Cumulative
Valid	0	1	1.5	1.5	1.5
	< \$25,000	14	21.5	21.5	23.1
	\$26,000 - \$35,000	4	6.2	6.2	29.2
	\$36,000 - \$50,000	4	6.2	6.2	35.4
	\$51,000 - \$75,000	8	12.3	12.3	47.7
	\$76,000 - \$100,000	8	12.3	12.3	60.0
	\$101,000 - \$150,000	5	7.7	7.7	67.7
	\$151,000 - \$200,000	1	1.5	1.5	69.2
	\$201,000	1	1.5	1.5	70.8
	Prefer not to respond	19	29.2	29.2	100.0
	Total	65	100.0	100.0	

21.5% of the respondents earn less than \$25,000. More than 50% of the respondents have purchasing power. However nearly fifth of respondents preferred not to disclose their income level.

Education

		Frequency	Percent	Valid Percent	Cumulative
Valid	Some High School	3	4.6	4.6	4.6
	High School Diploma	4	6.2	6.2	10.8
	Some College	13	20.0	20.0	30.8
	2-Year College Degree	4	6.2	6.2	36.9
	4-Year College Degree	36	55.4	55.4	92.3
	Master's Degree	4	6.2	6.2	98.5
	Missing	1	1.5	1.5	100.0
	Total	65	100.0	100.0	

Approximately 88% of the sample population has a high school diploma or a higher level of education, more than 56% of the respondents have a four-year college degree or higher.

Q47-	Switching?
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		Frequency	Percent	Valid Percent	Cumulative
Valid	No	52	80.0	80.0	80.0
	Yes	13	20.0	20.0	100.0
	Total	65	100.0	100.0	

Above is a frequency table to question 47 where it asked respondents if they intended to switch from cable/satellite to strictly OTT services as their primary television service. As we can see from the data, 80%, or 52 of the 65 respondents, responded with "No" they are not switching their television service.

	Ν	Minimum	Maximum	Mean	Std. Deviation
Cost	65	3	7	5.08	1.124
SwitchingCosts	65	1	7	4.29	1.205
Convenience	65	2	7	4.88	1.156
Quality	65	1	7	4.46	1.054
Happiness	65	2	6	3.90	1.074

Above is a Descriptive graph showing how our respondents answered our questions surrounding our first set of hypotheses regarding Switching from Cable/Satellite to OTT? The results show that Cost's mean was 5.08, meaning that cost is a significant factor in their television service experience. On the other hand, Happiness is below average with a mean score of 3.90, meaning this variable is of less importance regarding viewer's television experience. The other three variables fell in the mean of 4 meaning that the sample does not have any significant feeling one way or the other.

	n	Minimum	Maximum	Mean	Std. Deviation
CognitiveConvenience	65	2	7	4.95	1.144
SystemQuality	65	2	7	4.76	1.175
Entertainment	65	2	7	4.19	1.149
Interactivity	65	2	7	4.53	1.210
PerceivedUsefulness	65	1	7	4.49	1.134
PerceivedEnjoyment	65	1	7	4.41	1.249

The Descriptive graph above shows us how our respondents answered questions regarding the six variables in relation to devices they use to watch television. We can see all the variables fall

within the range 4.19 and 4.95 which is about average for the questionnaire showing that all the viewers have some emotion towards these variables but not significant either way.

Age		Ν	Mean	Std. Deviation	Std. Error
Cost	17-25	47	5.03	1.175	.171
	26-36	16	5.19	1.040	.260
SwitchingCosts	17-25	47	4.22	.951	.139
	26-36	16	4.71	1.623	.406
Convenience	17-25	47	4.82	1.125	.164
	26-36	16	5.13	1.154	.288
Quality	17-25	47	4.32	1.045	.152
	26-36	16	5.00	.943	.236
Happiness	17-25	47	3.80	.992	.145
	26-36	16	4.29	1.264	.316

Group Statistics by Age

t-Test by Age

	t	df	Sig. (2-tailed)	Mean Difference
Cost	481	61	.632	159
SwitchingCosts	-1.463	61	.149	488
Convenience	944	61	.349	309
Quality	-2.305	61	.025	681
Happiness	-1.590	61	.117	490

The t-test above compares age with five variables, which are cost, switching cost, convenience, quality, and happiness. Quality is statistically significant to alpha 0.05. Quality has a p-value of 0.025 which is less than alpha. Summarizing 19 out of 20 changes that age has a significant impact on quality.

Age		N	Mean	Std.	Std. Error
CognitiveConvenience	17-25	47	4.91	1.116	.163
	26-36	16	5.27	1.169	.292
SystemQuality	17-25	47	4.78	1.204	.176
	26-36	16	4.85	1.122	.280
Entertainment	17-25	47	4.16	1.183	.173
	26-36	16	4.46	1.003	.251
Interactivity	17-25	47	4.46	1.181	.172
	26-36	16	4.98	1.078	.270

PerceivedUsefulness	17-25	47	4.32	1.153	.168
	26-36	16	5.10	.900	.225
PerceivedEnjoyment	17-25	47	4.42	1.178	.172
	26-36	16	4.56	1.365	.341

t-Test by Age

t-test for Equality of Means	t	df	Sig. (2-	Mean
			tailed)	Difference
CognitiveConvenience	-1.111	61	.271	363
SystemQuality	216	61	.830	074
Entertainment	893	61	.375	295
Interactivity	-1.548	61	.127	518
PerceivedUsefulness	-2.475	61	.016	785
PerceivedEnjoyment	406	61	.686	144

The test above compares age with 6 variables, which are cognitive convenience, system quality, entertainment, interactivity, perceived usefulness, perceived enjoyment. Perceived usefulness is statistically significant to alpha 0.05. Perceived usefulness has a p-value of 0.016 which is less than alpha. Summarizing 19 out of 20 changes that age has a significant impact on perceived usefulness.

ANOVA Model Results by Age

	F	Sig.
CognitiveConvenience	1.566	.207
SystemQuality	.659	.581
Entertainment	1.259	.297
Interactivity	3.040	.036
PerceivedUsefulness	2.494	.068
PerceivedEnjoyment	1.787	.159

We use age as a demographics to see the impact it had on each of the variables. There is a marginal significance with perceived usefulness since the p-value is .068 which is lower than alpha 0.05. Interactivity is statistically significant with a p-value of .036 which is less than alpha of .05.

ANOVA Model Results by Age

	F	Sig.
Cost	0.297	.828
SwitchingCosts	2.971	.039
Convenience	1.901	.139
Quality	2.399	.077
Happiness	1.331	.273

We use age as a demographics to see the impact it had on each of the variables. There is a marginal significant with quality since the p-value is .077 which is lower than alpha 0.05. Switching costs show to be statistically significant with a p-value of .039 which is less than alpha of 0.05.

Dependent Variable (Y) = Switching (Y) Adjusted $R2 =035$						
Predictors	В	Std.	Beta	t	Sig.	
(Constant)	.641	.348		1.845	.070	
Cost	.005	.054	.015	.097	.923	
SwitchingCosts	004	.049	011	075	.941	
Convenience	052	.046	149	-1.129	.263	
Quality	.000	.057	001	008	.993	
Happiness	050	.058	134	872	.387	

The above is a full regression model testing the statistical significance of our Switching variable to our X variables. The model has a negative R2 telling us that the data meaning that the data does not support our model and that these variables have no statistical significance to consumers switching to OTT.

Dependent Variable = TV Adjusted R2 = .105						
Predictors	В	Std.	Beta	t	Sig.	
(Constant) CognitiveConvenience	1.207 288	.877 .218	225	1.376 -1.321	.174 .192	
SystemQuality	.219	.207	.176	1.060	.293	
Entertainment	.002	.215	.002	.010	.992	
Interactivity	.108	.233	.089	.463	.645	
PerceivedUsefulness	.555	.238	.430	2.332	.023	
PerceivedEnjoyment	174	.203	149	857	.395	

The full regression model above shows how our second set of variables are related to our dependent variable TV regarding using that device for viewer's television experience. The R2 shows that the model is marginally significant at .105. Perceived usefulness shows marginal significance with a p-value of .023 which is less than our p-value of 0.05.

Dependent Variable = PC Adjusted R2 = .143						
Predictors	В	Std.	Beta	t	Sig.	
(Constant)	.762	.834		.915	.364	
CognitiveConvenience	295	.207	237	-1.421	.161	
SystemQuality	.058	.196	.048	.297	.767	
Entertainment	.590	.205	.477	2.881	.006	
Interactivity	200	.221	170	904	.370	
PerceivedUsefulness	.209	.226	.167	.926	.358	
PerceivedEnjoyment	.063	.193	.056	.327	.745	

The full regression model above shows how our second set of variables are related to our dependent variable PC regarding using that device for viewer's television experience. The model has an R2 of .143 which tells us that the model some marginal significance. Entertainment in relation to our dependent variable of viewing television using a PC has a statistically significant p-value of .006.

Dependent Variable = Mobile Devices Adjusted R2 = .154					
Predictors	В	Std.	Beta	t	Sig.
(Constant) CognitiveConvenience	409 .118	.914 .227	.086	448 .518	.656 .606
SystemQuality	.146	.215	.109	.677	.501
Entertainment	.014	.224	.010	.062	.951
Interactivity	.631	.242	.487	2.603	.012
PerceivedUsefulness	285	.248	206	-1.151	.254
PerceivedEnjoyment	030	.212	024	143	.887

The full regression model above shows how our second set of variables are related to our dependent variable Mobile Devices regarding using that device for viewer's television experience. The model has an R2 of .154 which tells us that the model some marginal

significance. Interactivity shows statistical significance with a p-value of .012 with viewers using mobile devices to watch television.

Dependent Variable = Streaming Player Adjusted R2 = .154						
Predictors	В	Std.	Beta	t	Sig.	
(Constant)	.873	.988		.884	.381	
CognitiveConvenience	.382	.246	.278	1.553	.126	
SystemQuality	.161	.233	.121	.692	.491	
Entertainment	.063	.243	.046	.260	.796	
Interactivity	.240	.262	.185	.917	.363	
PerceivedUsefulness	182	.268	131	678	.501	
PerceivedEnjoyment	375	.229	299	-1.640	.106	

The full regression model above shows how our second set of variables are related to our dependent variable Mobile Devices regarding using that device for viewer's television experience. The model has an R2 of .154 which tells us that the model some marginal significance. None of the variables have any statistical significance in relation to using a streaming device to watch television. This implies viewers don't use this device for their television habits and we can't conclude any assumptions with our data.

Logistic regression model for switching from cable/satellite to OTT services shows no statistical significance (p=.689). Logistic regression model for TV television viewing shows a marginal significance [$X^2(6) = 10.44$, p = 0.107].

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	71.927a	.151	.208

	В	S.E.	Sig.	Exp(B)
CognitiveConvenience	.292	.413	.479	1.339
SystemQuality	.135	.347	.698	1.144
Entertainment	519	.361	.151	.595
Interactivity	010	.376	.979	.990
PerceivedUsefulness	.901	.427	.035	2.462
PerceivedEnjoyment	208	.343	.544	.812
Constant	-3.777	1.670	.024	.023

Variables in the Equation

Classification Table

Observed			Predicted				
			TV_2		Percentage		
			.00	1.00	Correct		
Step	TV_2	.00	38	4	90.5		
1		1.00	13	9	40.9		
-	Overall				73.4		

This model has successfully predicted 73.4% (=51/63) of the tested population.

Logistic Regression for PC television viewing shows statistical significance $[X^2(6) = 15.19, p=0.019]$.

	В	S.E.	df	Sig.	Exp(B)
CognitiveConvenience	181	.376	1	.630	.834
SystemQuality	248	.357	1	.488	.780
Entertainment	1.305	.427	1	.002	3.689
Interactivity	209	.385	1	.588	.812
PerceivedUsefulness	.083	.383	1	.828	1.087
PerceivedEnjoyment	178	.338	1	.599	.837
Constant	-2.433	1.480	1	.100	.088

Classification Tablea

	Predicted				
Observed		PC2		Percentage	
			.00	1.00	Correct
Step 1	PC2	.00	30	7	81.1
		1.00	12	15	55.6
Overall					70.3

This model has successfully predicted 70.3% (=42/64) of the tested population.
Logistic regression model for mobile device television viewing shows statistical significance $[X^2(6) = 13.867, p=0.031].$

Variables in the Equation

	В	S.E.	df	Sig.	Exp(B)
CognitiveConvenience	205	.393	1	.603	.815
SystemQuality	.438	.352	1	.214	1.550
Entertainment	.209	.357	1	.559	1.232
Interactivity	.754	.428	1	.078	2.126
PerceivedUsefulness	075	.396	1	.849	.927
PerceivedEnjoyment	261	.374	1	.486	.770
Constant	-4.635	1.738	1	.008	.010

Classification Tablea

			Predicted			
Observed		MobileDevices2		Percentage		
			.00	1.00	Correct	
Step 1	MobileDevices2	.00	36	6	85.7	
		1.00	10	13	56.5	
	Overall Percentage	;			75.4	

This model has successfully predicted 75.4% (=46/65) of the tested population.

Discussion

Switching to OTT

The research and results have shown that consumers are not considering switching from television services to OTT. In the frequency table for Q47 above shows that 80% of respondents are not considering the switch. While the Descriptive Statistics for Cost, Switching Costs, Convenience, Quality, and Happiness show to be of some importance to consumers when considering their television experience with Cost being the highest, with a mean rating of 5.08, these feelings about these variables do not seem to have any impact on cutting the cord with traditional television providers. The first T-Test above which shows the significance of the first five variables in relation to millennials show that there is a statistical significance between

people ages 17-36 and Quality of their television experience with a p-value of .025. This shows that for millennials, they consider the Quality of their television experience above the other factors, but this finding unfortunately does not affect their decision to switch services.

Hypotheses 1: Cost is significantly related to Millennials switching from traditional television services to OTT.

This paper found that cost was not statistically significant in relation with switching from traditional television services to OTT services, which was consistent with Baccarne (2013), who found "/OTT TV prices in Flanders are rather low, the monthly cost is still the main ingredient for success" and "Whereas there is potential for over-the-top television to grow, a large-scale cord-cutting scenario in a cable dominant market such as Flanders is unlikely to happen." Our T-Test shows that cost had the highest mean with 5.03 and 5.19 among millennials, meaning that cost is the most important variable among millennials when considering OTT services. The anova model shows that cost has a p-value of .828 and the linear regression model shows a p-value of .923. While the logistic regression model successfully predicts 80.0% of the sample population, we must conclude that hypothesis 1 is not supported with the data presented.

Hypotheses 2: Switching Cost is significantly related to Millennials switching from traditional television services to OTT.

This paper found that switching cost was not statistically significant in relation with switching from traditional television services to OTT services, which was opposite with Shcherbakov (2016), who found, "that consumer switching costs are economically and statistically significant and constitute roughly half of the annual variable service costs for each of the service providers." Our T-Test shows that switching cost had an average mean among the age groups with means of 4.22 and 4.71. The anova model shows that switching cost has a p-value of 0.39, meaning that the switching cost variable was statistically significant when comparing switching costs and age. The linear regression model shows a p-value of .941, showing very high insignificance. While the logistic regression model successfully predicts 80.0% of the sample population, we must conclude that hypothesis 2 cannot be accepted due to mixed results.

Hypotheses 3: Convenience is significantly related to Millennials switching from traditional television services to OTT.

This paper found that convenience was not statistically significant in relation with switching from traditional television services to OTT services, which was opposite with Bury (2011), who found,"that barely more than half of Americans watch live television." Our T-Test shows that convenience had an average mean among the age groups with means of 4.82 and 5.13, which is slightly above average for viewers on the importance Likert scale. The anova model shows that convenience has a p-value of 0.139, meaning that the convenience variable was marginally significant when comparing conveniences and age. The linear regression model shows a p-value of .263, showing insignificance. While the logistic regression model successfully predicts 80.0% of the sample population, we must conclude that hypothesis 3 is not supported by the data presented.

Hypotheses 4: Quality is significantly related to Millennials switching from traditional television services to OTT.

This paper found that quality was not statistically significant in relation with switching from traditional television services to OTT services, which was similar with Barker (2016), who found," participatory culture and Quality TV are not diametrically opposed, but the progression of Amazon's promotional work suggests that they serve distinctive functions, and that the television industry imbues them with different values." Our T-Test shows that quality had an average mean among the age groups with means of 4.32 and 5.00, which is about average for viewers on the importance Likert scale. The anova model shows that quality has a p-value of 0.077, meaning that the quality variable was marginally significant when comparing qualitys and age. The linear regression model shows a p-value of .993, showing very high insignificance. While the logistic regression model successfully predicts 80.0% of the sample population, we must conclude that hypothesis 4 is not supported by the data presented.

Hypotheses 5: Happiness is significantly related to Millennials switching from traditional television services to OTT.

This paper found that happiness was not statistically significant in relation with switching from traditional television services to OTT services, which was similar with Dickinson (2016), who found that millennials and their TV experience resulted in exhaustion or depression instead of happiness. Our T-Test shows that happiness had an average mean among the age groups with means of 3.80 and 4.29, which is below average for viewers on the importance Likert scale. The

anova model shows that happiness has a p-value of 0.273, meaning that the happiness variable was not significant when comparing happinesss and age. The linear regression model shows a p-value of .387, showing substantial insignificance. While the logistic regression model successfully predicts 80.0% of the sample population, we must conclude that hypothesis 5 is not supported by the data presented.

Hypotheses 6: Convenience is significantly related to Millennials deciding what device to watch television entertainment.

This paper found that convenience was not statistically significant in relation to what device to watch television entertainment, which was opposite with Comscore (2014), who found that "most of the respondents prefer to watch TV online due to the convenience of watching TV anytime and anywhere." Our T-Test shows that convenience had an average mean among the age groups with means of 4.91 and 5.27, which is above average for viewers on the importance Likert scale. The anova model shows that convenience has a p-value of 0.207, meaning that the convenience variable was not significant when comparing conveniences and age. The linear regression model shows a p-value of .192 for TV, .161 for PC, .606 for mobile devices, showing no statistical significance for any device. While the logistic regression model successfully predicts 73.4% for TV, 70.3% for PC, and 75.4% for mobile devices of the sample population, we must conclude that hypothesis 6 is not supported by the data presented.

Hypotheses 7: Quality is significantly related to Millennials deciding what device to watch television entertainment.

This paper found that quality was not statistically significant in relation to what device to watch television entertainment, which was opposite with Meola (2016), who found that most people prefer to use one device to watch television due to a larger screen and better quality. Our T-Test shows that quality had an average mean among the age groups with means of 4.78 and 4.85, which is about average for viewers on the importance Likert scale. The anova model shows that quality has a p-value of 0.581, meaning that the quality variable was not significant when comparing qualitys and age. The linear regression model shows a p-value of .293 for TV, .767 for PC, .501 for mobile devices, showing no statistical significance for any device. While the logistic regression model successfully predicts 73.4% for TV, 70.3% for PC, and 75.4% for

mobile devices of the sample population, we must conclude that hypothesis 7 is not supported by the data presented.

Hypotheses 8: Happiness is significantly related to Millennials deciding what device to watch television entertainment.

This paper found that happiness was statistically significant in relation to using a PC to watch television entertainment, which was similar with Bruni (2008), who found, "The pervasive and increasing role of television, through its crowding-out effect on relational activities, helps to explain why individuals tend to consume sub-optimal levels of relationality." Our T-Test shows that convenience had an average mean among the age groups with means of 4.16 and 4.46, which is about average for viewers on the importance Likert scale. The anova model shows that happiness has a p-value of 0.297, meaning that the happiness variable was not significant when comparing happiness and age. The linear regression model shows a p-value of .992 for TV, .006 for PC, .951 for mobile devices, showing no statistical significance for TV and mobile devices but statistically significant results for happiness and PC use. While the logistic regression model successfully predicts 73.4% for TV and 75.4% for mobile devices of the sample population, we must conclude that hypothesis 8 is not supported due to mixed results for these two dependent variables. The logistic regression model does successfully predict 70.3% for PC of the sample population. With a p-value of .002 for the logistic regression model and .006 for the linear regression model we can safely assume that hypotheses 8 is supported in that happiness is significantly related to Millennials deciding to use a PC to watch television entertainment.

Hypotheses 9: Interactivity is significantly related to Millennials deciding what device to watch television entertainment.

This paper found that interactivity was statistically significant in relation to using a mobile device to watch television entertainment, which was similar with Agirre (2016), who found, "research describes a television and video content landscape that is more and more multidimensional (Schrøder et al., 2003) and complex, in which the audience carries out a variety of practices and adopts different attitudes. As noted by Costello and Moore (2007), the audience behaves differently according to content and context, rather than in response to a media." Our T-Test shows that convenience had an average mean among the age groups with means of 4.46 and 4.98, which is about average for viewers on the importance Likert scale. The

anova model shows that interactivity has a p-value of 0.036, meaning that the interactivity variable was statistically significant when comparing interactivity and age. The linear regression model shows a p-value of .645 for TV, .370 for PC, .012 for mobile devices, showing no statistical significance for TV and PC but statistically significant results for interactivity and mobile device use. While the logistic regression model successfully predicts 73.4% for TV, 70.3% for PC, and 75.4% for mobile devices of the sample population, we must conclude that hypothesis 9 is not supported due to mixed results for TV and PC. But the p-value of .036 in the anova, the p-value of .012 for interactivity and mobile device use, and .078 for interactivity and mobile device use in the logistic regression model, hypotheses 9 is supported, that interactivity is significantly related to Millennials deciding what device to watch television entertainment.

Hypotheses 10: Perceived Usefulness is significantly related to Millennials deciding what device to watch television entertainment.

This paper found that perceived usefulness was statistically significant in relation to using a television to watch television entertainment, which was similar with Banarjee (2012), who found, "that viewership hours increase rapidly with an increase to device count, meaning that perceived usefulness of devices increase television consumption." Our T-Test shows that convenience had an average mean among the age groups with means of 4.32 and 5.10, which is about average for viewers on the importance Likert scale. The p-value for the T-Test was .016 which show statistical significance. The anova model shows that perceived usefulness has a pvalue of 0.068, meaning that the perceived usefulness variable was marginally significant when comparing perceived usefulness and age. The linear regression model shows a p-value of .023 for TV, .358 for PC, .254 for mobile devices, showing no statistical significance for PC and mobile devices but statistically significant results for perceived usefulness and TV use. While the logistic regression model successfully predicts 73.4% for TV, 70.3% for PC, and 75.4% for mobile devices of the sample population, we must conclude that hypothesis 10 is supported in that perceived usefulness is significantly related to Millennials deciding to use a TV to watch television entertainment. The logistic regression model for TV successfully predicts 73.4% and perceived usefulness has a p-value of .035 which is statistically significant.

Hypotheses 11: Perceived Enjoyment is significantly related to Millennials deciding what device to watch television entertainment.

This paper found that perceived enjoyment was not statistically significant in relation to what device to watch television entertainment, which was opposite with Torrents (2017), who found main reason Millenniums feel enjoyment is because the easiness to watch TV online while using any of their devices, such as cell phone, computers, iPad, etc. Our T-Test shows that perceived enjoyment had an average mean among the age groups with means of 4.42 and 4.56, which is about average for viewers on the importance Likert scale. The anova model shows that perceived enjoyment has a p-value of 0.159, meaning that the perceived enjoyment variable was marginally significant when comparing perceived enjoyments and age. The linear regression model shows a p-value of .395 for TV, .745 for PC, .887 for mobile devices, showing no statistical significance for any device. While the logistic regression model successfully predicts 73.4% for TV, 70.3% for PC, and 75.4% for mobile devices of the sample population, we must conclude that hypothesis 11 is not supported by the data presented.

Managerial Implications

This study was performed to get a more complete understanding of the factors that impact millennials perception of traditional television services versus OTT services as well as what devices millennials prefer to use to watch television. Previous studies have identified that millennials are adopting OTT services due to the variables presented in this case but that the adoption of OTT does not imply they are cutting ties with their traditional television services. This implies for managers that OTT is not becoming a large competitor to traditional television companies but merely a complementary product to viewer's television experience. Managers of traditional television services should consider implementing technology to integrate OTT into their television package since it is evident through this research as well as previous research OTT is growing substantially and since the risk of losing customers seems inconsequential then by doing so you would be increasing customer satisfaction and loyalty. Managers but also look at the experiences of the devices used for television entertainment. The findings show that viewer's happiness or entertainment in relation to PC use, perceived usefulness of a TV far outweighs other devices, and the interactivity of mobile devices is important to viewers. Managers need to adapt their programming to fit these needs of viewers.

Conclusion

After analyzing all the regression models, our results show that even though they are many variables that would trigger millenniums to choose over the tops services, and platform other than an actual TV, there are only three variables that show to be statistically significant to our study. Happiness is the first variable that is statistically significant which means that happiness is significant related to millenniums deciding to use PC to watch television entertainment. The second variable is interactive in relation to using a mobile device to watch television entertainment, even though there is no statically significant for TV and PC, there is a significant related to millenniums deciding what device to watch television entertainment, the results show that there is a statistically significant result for interactivity and mobile device use. The third variable is perceived usefulness, which it shows that is supported in that perceived usefulness is significant related to millennials deciding to use a TV to watch television entertainment.

Concluding, only 3 out of the 11 models shows to be statistically significant, even though not a lot of data sample was gathered, we still believe our study was overall successful when determining the variables that affect millenniums to change to OTT services, and to show which platform they prefer to use. We can conclude that Happiness, Interactivity, and Perceived Usefulness are the most important factors that influence millenniums. Contrary to our research we've found that cost, switching cost, quality, convenience, perceived enjoyment did not prove to be an important factor that affect the decision of a millenniums choosing an OTT service or another platform when watching TV entertainment.

Further studies

Even though our study had a mixed result, we believe that our study has contributed to other studies that focus on the evolution of internet streaming. There are many limitations we've encounter with and we recommend the following improvement for future studies. First, the sample data was only limited to 60 responses gathered in CCSU School of Business. We would recommend increasing the sample size to at least 100 respondents, and include respondents from around the campus not just students from the business school, also it would be more beneficial having sample data not only from CCSU students. Second, although we use more than 10+ variables, we believe that we should of have only focus in 5 variables to have a deep understanding. Lastly, we only used a few analytical models to get an understanding of the data

gathered, however other best-fit and advance models could have improved the correctness of the results.

Closing Remarks

This research subsidizes to literature regarding millenniums and OTT services. We focus in different variables that affect the millenniums when choosing their OTT services and platforms, and through our discoveries we have provided a way to further develop a more focus approach in analyzing other variables. Our study helps companies that offer OTT services to get to know millenniums very well, and to see what the most important variables when choosing OTT services are and what platforms they use.

References

- Agirre, I. A., Arrizabalaga, A. P., & Espilla, A. Z. (2016). Active audience?: Interaction of young people with television and online video content. *Communication and Society*, 29(3), 133-147.
- Barker, C. (2017). "Great Shows, Thanks to You": From Participatory Culture to "Quality TV" in Amazon's Pilot Season. *Television & New Media*, 18(5), 441-458.
- Barkhuus, L. (2009). Television on the internet: New practices, new viewers. *CHI '09 Extended Abstracts on Human Factors in Computing Systems*, 2479-2488.
- Baccarne, B., Evens, T., & Schuurman, D. (2013) The television struggle: an assessment of Over-the-Top television evolutions in a cable dominant market. *Communications & Strategies*, (92), 43-61.
- Brown, S., and Venkatesh, V. (2005). Model of adoption of technology in households: A baseline model test and extension incorporating household life cycle, *MIS Quarterly* (29,)3, 399-426.
- Bruni, & Stanca. (2008). Watching alone: Relational goods, television and happiness. Journal of Economic Behavior and Organization, 65(3), 506-528.
- Bury, R., & Li, J. (2015). Is it live or is it timeshifted, streamed or downloaded? Watching television in the era of multiple screens. *New Media & Society*, 17(4), 592-610.

- Campbell, D. E., Wells, J. D., and Valacich, J. S. (2013). Breaking the ice in B2C relationships: understanding pre-adoption E-Commerce attraction, *Information Systems Research* (24)2, 219-238.
- Chan, F. K. Y., Thong, J. Y. L., Venkatesh, V., Brown, S. A., Hu, P. J.-H., and Tam, K. Y. (2010). Modeling Citizen Satisfaction with Mandatory Adoption of an E-Government Technology, *Journal of Association for Information Systems*, (11)10, 519-549.
- Chu, C. (2010). The effect of satellite entry on cable television prices and product quality. *RAND Journal of Economics*, 41(4), 730-764.
- Chulkov, D., & Nizovtsev, D. (2015). Bundling, Cord-Cutting, and The Death of TV as We Know It. *Journal of the International Academy for Case Studies*, 21(6), 57-64.
- Cohen, B. H. (2016). Cutting the Cord: Where Are All the Generation Y Viewers Going? *Unpublished doctoral dissertation*, Drexel University.
- Dickinson, K., & Love, Gail. (2014). Confessions of the Millennial Binge-viewer: An Examination of the TV Show Binge-viewing Phenomenon, *ProQuest Dissertations and Theses*.
- Elgohary, W., Singh, Raj, Anantharamiah, Srinidhi, & Pizur, Tony. (2011). Online Technology and Organization Challenges: An Examination of Netflix and Customer Satisfaction, *ProQuest Dissertations and Theses*, Capella University.
- Gencer, Suzan Lema, and Mustafa Koc. (2012) Internet abuse among Teenagers and Its Relations to Internet Usage Patterns and Demographics. *Educational Technology & Society*, (15)2, 25–36.
- Hong, W., Thong, J. Y. L., and Tam, K. Y. (2005). The effects of information format and shopping task on consumers' online shopping behavior: A cognitive fit perspective, *Journal of Management Information Systems*, (21)3, 149-184.
- Kelly, Mary T., & Ying, John S. (2003). On measuring competitive viability and monopoly power in cable: An empirical cost approach. *Review of Economics and Statistics*, 85(4), 962-970.

- Kim, S. S., and Son, J.-Y. (2009). Out of dedication or constraint? A dual model of post-adoption phenomena and its empirical test in the context of online services, *MIS Quarterly*, (33)1, 49-70.
- Kim, H., and Niehm, L. S. (2009). The impact of website quality on information quality, value, and loyalty intentions in apparel retailing, *Journal of Interactive Marketing*, (23), 221-233.
- Laterman, M., & Williamson, Carey. (2015). NetFlix and Twitch Traffic Characterization, ProQuest Dissertations and Theses, *University of Calgary*.
- Meola, A. (2016). Most people watch online TV shows on this one device. Retrieved October 30, 2017, from http://www.businessinsider.com/most-people-watch-online-tv-shows-on-thisone-device-2016-5
- Murphy, I., Cante, Richard, Jones, Paul, & Palm, Michael. (2011). Netflix and emerging economies of media distribution, *ProQuest Dissertations and Theses*.
- Rappoport, Paul. (2012). Analysis of video-viewing behavior in the era of convergent and connected devices. *International Telecommunications Society*, 981.
- Rodell J. (2010) Antecedents and Consequences of Employee Volunteerism, Doctoral Dissertation, *University of Florida*.
- Shcherbakov, O. (2016). Measuring consumer switching costs in the television industry. *RAND* Journal of Economics, 47(2), 366-393.
- Schrøder, K., Drotner, K., Kline, S., & Murray, C. (2003). Researching audiences. London: *Hodder Arnold*, 422.
- Sørensen, I. (2016). The revival of live TV: Liveness in a multiplatform context. *Media, Culture & Society*, 38(3), 381-399.
- Summa, G. (2011). Social TV: the future of television in the internet age. Unpublished doctoral dissertation, *Massachusetts Institute of Technology*.
- Westerlund, O., Moll, J., & Artman, H. (2014). A concept on the Internet---based television. Unpublished doctoral dissertation, *Royal Institute of Technology*.

Xu, J., Benbasat, I., and Cenfetelli, R. T. (2013). Integrating service quality with system and information quality: An empirical test in the E-Service context. *MIS Quarterly* (37)3, 777-A9.

Appendix 1 - Questionnaire item reference table

Variable	Item	Source
	Cable/Satellite services that are available today are too	Brown and
Cost	expensive.	Venkatesh
	Television services available today are too expensive.	
	I think that Over-The-Top services are quite pricey.	(2005)
	Switching to a different television service would involve some	
Switching	hassle.	Kim and Son
Costs (SC)	It is complex for me to use a different television service.	(2009)
	Some problems may occur when I switch to an Over-The-Top service.	
	Cable/Satellite services would enable me to access television anytime, day or night.	
Convenience	Over-The-Top services would enable me to access television from home, from the office, on the road, or at other locales.	Chan, et al. (2010)
	It would be convenient for me to access television with any television provider.	
Television	Overall, I would give Cable/Satellite services high marks for my television entertainment.	
Quality	Overall, I would give the Over-The-Top services high rating in terms of quality for television entertainment.	Xu, et al. (2013)
	In general, my television services provided me with high- quality television entertainment.	
Absorption in	Time flies when I'm watching television using Over-The-Top services.	
TV	When I am watching television using Cable/Satellite, I forget everything else around me.	Rodell. J. (2010)
	I am immersed in television entertainment.	
Comitivo	It is easy for me to watch television using a TV.	Hang et al
Convenience	It is convenient for me to watch television using a PC/laptop.	(2005)
	It is easy for me watch television using a mobile device (phone/tablet)	
System	In terms of television quality, I would rate the PC/Laptop	
quality	Overall, the TV that I used was of high quality for television	Xu et al. (2013)
	entertainment.	
	Overall, I would give the quality of mobile viewing (phone,	

	I feel happy when I use a TV for television entertainment.	
Entertainment	I feel cheerful when I use a PC/Laptop for television entertainment.	Kim and Niehm (2009)
	I feel sociable when I use a mobile device (phone, tablet) for television entertainment.	
	The TV allows me to interact with it to watch my Cable/Satellite services.	Kim, H., and
Interactivity	The PC/Laptop has interactive features, which help me watch my television entertainment.	Niehm, L. S.
	I can interact with my mobile device in order to tailor my Over-The-Top services to my specific needs.	(2007)
D 1	Using a TV can improve my Cable/Satellite services.	
Perceived usefulness	Using a PC/laptop can increase my television entertainment effectiveness.	Parboteeah et al. (2009)
	Using a mobile device (phone, tablet) can increase my Over- The-Top services effectiveness.	
	My interaction with a TV for Cable/Satellite services was	
Dorooivod	enjoyable.	Parbotooph at al
Perceived enjoyment	enjoyable. My interaction with a PC/laptop for television entertainment was exciting.	• Parboteeah et al. (2009)

CUSTOMER RELATIONSHIP MANAGEMENT TO IMPORT CLOUD SERVICES PLATFORM

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Abstract

Customers are an important part of a business, and customer relationships are an integral and critical component of a company's operations. Along with the fast development of the information age, the adoption of the cloud application services to manage a company's various operations is also rising rapidly. This study will be focusing on the cloud customer relationship management applications and services to understand the needs of customers, to enhance the customer-business two-way communication, and to improve a company's operational efficiency.

By incorporating the customer relationship management system and using information technology to automate processes, a business can now collect more and different kinds of data about its customers rapidly. The use of analytical tools allows an enterprise to better understand its customers' needs, increase its customer base, improve its customer satisfaction, and generate more revenue. Build and use of the cloud application service platform for Nanotech International Co., Ltd., for example, have dramatically improved its customer communication and interaction channels. The cloud customer relationship management application service platform facilitates and makes real-time interaction easy: convenient to save the query results, flexible in message classification, and easy to set share target audience. The company and its customers become good interaction partners, and together contribute to the growth of the company. The cloud application service platform not only improves the efficiency of the traditional way of doing things, it also creates new ways of doing things and provides new opportunities. The enhanced interactions between a company and its customers increase values and lead to innovations.

[keywords] Cloud , Customer Relationship Management , Cloud Customer Relationship Management

1. Preface

New technologies such as cloud computing, mobile applications, smart devices, and big data continue to drive and dictate the major trends of industries. Combined with an environment where everything is connected via Machine to Machine (M2M) and Internet of Things (IoT), they also create a sea change in operation mode, data analysis, and industry outlook.

However, even as we are getting ready to enter the next new era, people are still the core of business. The consumers are still the driving force for the changes. As a result, the customer-oriented Customer Relationship Management (CRM) platform becomes the indispensable critical infrastructure of the future. Regardless of the size of a company and the number of customers, the company that will gain the forward-looking advantages is the one that can gather sufficient data on current and potential customers and the one that can fully take advantage of the combination of cloud computing, mobile applications, smart devices, big data, smart networking, and IoT.

2. Brief Introduction of Nanotech International Co.

2.1 Nanotech's Evolution

Nanotech International Co., Ltd. was founded on July 29, 2003. To meet the demands of such industries as the printed circuit board, semi-conductor, and optoelectronics, the company increased capital and invested in Kunshen Nanotech in 2004; in 2005, increased capital again and invested in Kyoto Technos; based on the market demand, established and expanded repair centers in 2007; successfully entered the semi-conductor sector and started selling clean room chemical filters manufactured in Switzerland in 2010; became authorized vendor of Beijing Precision Glass Engraving machines in 2013; started marketing phosphor bronze balls in 2014—all milestones as shown in Chart 1.

Nanotech's main business includes manufacturing of machines and equipment, installation, wholesale, and international trade. Specifically, the company sells CNC drills, molding machines (Klingelnberg, Mania, Takeuchi), glass engraving machines, clean room chemical filters; provides after-sale service; buys and sells used equipment; repairs various brands of spindles and sells spindle parts (WW, ABW, Hitachi, Toshiba, Precise, Yaskawa, MCT, LG Spindles).

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Nanotech International Co. provides various brands of drills and repair services for molding machine spindles. This enables our customers to achieve higher-quality and more efficient drilling. Nanotech maintains a complete inventory of maintenance equipment and original spare parts, provides fast and efficient spindle repair service, and offers high maintenance quality and highly competitive pricing. (Nanotech International's website: http://www.nano-tech.com.tw).

Nan	otech's Evolution
2003	Company Founded
2004	Capital increase; invested in Kunshen Nanotech
2005	Capital increase; invested in Kyoto Technos
2006	Purchased factory building located in Youth Industrial Park
2007	Established and expanded spindle repair centers
2010	Entered semi-conductor business; marketing clean room chemical filters manufactured in Switzerland
2013	Became authorized dealer of Beijing precision glass engraving machines
2014	Started sales of phosphor bronze balls

Chart 1 Evolution of the Company

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2.2 Nanotech's Current Development

Since the founding of the company in 2003 in Yang Mei, Taoyuan City, with a first-rate team consisting of talented staff and best maintenance equipment, the company has over 20 years of professional experience in PCB equipment sales and repairs. The service team has been home-based in Taiwan since the beginning and has successfully expanded PCB business to many countries: China, Singapore, South Korea, Thailand, Vietnam, and India. In recent years, the company has even more actively expanded the markets in South Korea and India in order to meet the rapid demands and development in the PCB industry. As the semi-conductor industry and the optoelectronics industry continue to lead the business trend, the company has also expanded into the arena of authorized agents for new products, participated in large-scale domestic and foreign exhibitions, introduced new products, and actively expanded into new industries. In order to maintain the highest level of service quality, the company, from time to time, sends professional engineers to the original manufacturers for training in order to provide the best professional services: speedy efficient service to match the high-quality products to satisfy the customers' needs and to serve the customers with sincerity and integrity.

The company's organization as shown in Chart 2 consists of four departments: Business, Maintenance, Management, and Finance. The Business Department is mainly responsible for assisting with domestic and foreign exhibitions, product promotion, gathering information on new products, visiting customers, preparing and making catalogues, advertising, formulating annual business objectives and marketing strategy, conducting analysis of customer order quotation, product sales price quotation and negotiation, and scheduling customer order delivery and coordinating delivery and logistics of installation and acceptance.

The Maintenance Department is responsible for bringing in new products and new technologies; collecting, organizing, and storing technical documents; installing equipment and assisting in acceptance; maintaining and troubleshooting customers' equipment; providing technical support; conducting analysis of customer complaints and handling technical anomalies. The Management Department focuses on formulating company rules and regulations; recruiting; employment and personnel changes. The Finance Department is in charge of Accounts Receivable, tax settlement, report generation, vendor funding requests, and responding to account auditing.

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Chart 2 Organization of the Company

3. VIdegree Cloud System

3.1 VIdegree System

The "VI" in VIdegree is the Roman numeral six. VIdegree means "Six Degrees of Separation," which is the guiding theoretical assumption that "all it takes is six intermediate people in between all the strangers in the world to build a good relationship." (VIdegree official website, 2015). Designed specifically for small and medium businesses, VIdegree, through the CRM, aims to understand the customers and their experience in order to align with a company's business model. Many CRM tools cannot be easily customized. Nanotech adopted the VIdegree cloud CRM platform, designed and built by experts for small and medium businesses. The VIdegree "Love Thy Customers" cloud CRM platform can comprehensively gather data on current and potential customers; it possesses powerful customization and easy implementation to meet a company's requirements. It completely dovetails with Nanotech's unique business model: enriching customer service and interaction, and satisfying the enterprise's actual needs for providing in-depth customer service. Combined with Facebook external communities, industry's information media and industry association operation platforms, the cloud CRM can effectively track customers' feedbacks and

market demands, and further provide business opportunities and precise marketing for the enterprise.

3.2 VIdegree Functionalities

The VIdegree "Love Thy Customers" cloud CRM includes the following features :

A. Customizable fields; accommodating specific details

The VIdegree "user-defined field" feature facilitates the creation of custom fields to suit different kinds of needs; it can flexibly define activity items and flows that are in line with the characteristics of various industries; it allows the easy setup of a CRM that is a closest match to the original operating habits of a company and thus satisfies the enterprise's actual needs for providing in-depth customer service.

B. Easy to categorize and organize; accessible via smart phone or tablet

The use of the customer database can be simplified and made easier through careful categorization, labelling, and proper organization; it can effortlessly breaks though time and space constraints, and by adding mobile apps, the management team and customers can be connected and interact instantly via the CRM, enabling the management to have instant grasp of the enterprise, client information, and business opportunities.

C. Exclusive personalized message; instant tracking and responding

Different contents can be delivered to different clients through newsletter or email, with personalized message to "shorten the distance between the company and the client," letting the client feel that this is an exclusive letter and respond more favorably. The delivery status can be

closely monitored to insure that the client does not miss important messages.

D. Quick start on contact scripting and client logging interface

Through pre-set scripts and schedules, announcements and reminders can be actively sent to the clients. The consumer logging feature can keep a complete record of what the customer orders each and every time, data that can be further utilized in more advanced searches later. The system is easy to operate, effectively lowering adjustment threshold (learning curving and time).

E. Review activity history and event tracking

The VIdegree home page conveniently provides an overview of activity records for the next few days and event tracking. For a larger group, members can interact with each other easily through the information display. New announcements or reminders can be added to each activity based on the actual needs and further supplement the activity log.

4. Implementation of VIdegree Cloud Customer Relationship Management System

4.1 Implementation Process

This study adopted Galaxy Software Services Corporation's VIdegree cloud service platform as the working platform for our Customer Relationship Management System platform. VIdegree software is designed to assist business enterprises with building a Customer Relationship Management (CRM) system; its goal is to understand the customers' needs in order to achieve precise marketing objectives. Building a customer-oriented cloud CRM service involves seven expected research steps:

A. Collection and Input of Customer's Basic Information: basic information includes name, phone numbers, email, company, and business cards.

- B. Building the Cloud CRM Platform: building VIdegree platform to establish the infrastructure of customer communication, interaction, and management.
- C. Identifying and Establishing Labelling Based on Customer Attributes: analyzing customer attributes, and according to different customers' conditions, screening, and classification, establishing cloud customer platform management labelling.
- D. Routine Planning and Activity Design: preparing customer activities; planning the company's campaign theme, contents, activities, and event dates.
- E. CRM Cloud System Brought Online: inviting customer to try out the VIdegree cloud service platform system; inputting account numbers and passwords to allow customer access.
- F. Maintaining Customer Relationship: through the use of the VIdegree cloud service platform, on anniversaries, important holidays, or school event dates, timely contacting the customers and delivering care messages to maintain good customer relationship.
- G. Normal Operation of Customer Relations: as a cloud CRM, the VIdegree system consists of a mobile app version and a web version; utilize this system to maintain the normal operation of customer relations.
- 4.2 Cloud Customer Relationship Management System

Based on the referenced literature and analyses, this study focused on the buildup of the CRM on a cloud platform as its Phase-1 effort. Additionally, five more phases related to contents of customer relationship management were added: exhibitions, product and maintenance knowledge, fellowship, ordering and business progress, satisfaction survey, and member notifications. We also compiled the company's internal "Delphi Check on the Contents Suitability of Nanotech International's Customer Cloud Service Buildup". The checklist included four parts: descriptions of the study, definition of terms, suggestions, and final summary.

Each question on the Delphi checklist has a field for assessing and marking the suitability of the question. Suitability is classified as: 1-Very Unsuitable; 2-Unsuitable; 3-Neutral; 4-Suitable; 5-Very Suitable. At the end of each question in all phases, fields for suggestions and final summary were available to solicit open comments on the modification or additions of questions. This is an effort to remediate any potential quantitative deficiencies.

The checklist consists of 15 "filling the blank" questions in 6 phases. Table 1 shows the Phases, Activities, Citations and References.

Phases	Activities		Citations	References	
A Exhibitions	A - 1		The objective is to improve the	1.	Loganayagi
			interaction and relationship among		and
	Suitability of		customers.		Sujatha.
	Exhibitions on a	2.	Immediate information sharing;		(2012)
	cloud service		easy interaction, easy to store,	2.	Sultan.
	platform		retrieve, and search; flexible		(2011)
			classification and easy to define	2	公共开
			the sharing audience.	3.	休忌石,
		3.	Forming a mutually beneficial		(2014)
			relationship between the company		
			and its customers.		
B Product	D 1	1.	Customer-oriented; combining	1.	Espadas et
and	В - 1		various available channels to		al.(2013)
Maintenance	Suitability of		establish customer relationship,	2	敵加丑
Knwloedge	product		providing what the customers need and at the same time		影如石
	knowledge on a				(2013)
	cloud service		increasing the profit.		÷7.∓.₩
	platform	2.	No need to invest in the setup,	з.	羿阳秦

Table 1 Phases, Activities, Citations and References in the Delphi Checklist

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		T			
	B - 2		deployment, and maintenance of		(2012)
	Suitability of		suppliers.	4.	董丁魁
	maintenance knowledge on a		All critical operational activities		(2011)
			can be more effectively and		
	cloud service		efficiently managed via the cloud		
	platform		service.		
		4.	Focusing on product-oriented		
			customer relationship and on		
			effectively maintaining long-term		
			close relationship with the		
			customers.		
C Fellowship	G 1	1.	Seeking organizational benefits for		┍╪╶┿╴═┷
	C - 1		cloud-based CRM; deeper		惈迏訉
	Suitability of		understanding of success factors		(2014)
	fellowship on a		and their interactions.	2	十 丽 挹
cloud service		2.	Developing and establishing	2.	工鹿蚏
	platform		customer loyalty programs from		(2012)
			customers' point of view;		
			encouraging customers and service		
			staff to forge long-term		
			relationships with the objective of		
			increasing customer satisfaction		
			and loyalty.		
D Business	D - 1 Price	1.	Facilitating an enterprise to obtain,	1.	Loganayagi
Progress	D-TTHEE		develop, and maintain good		and
	quote		customer relations.		Sujatha.
	D - 2	2.	With suppliers responsible for		(2012)
	D - 2		providing setup, deployment, and	2.	Bennett.
	Ordering		maintenance, it is a big benefit for		(2000)
	D - 3		small and medium enterprises.	3	林家瑋
	с - U		The more an enterprise invests in		
	Purchasing		the cloud service, its customers		(2013)
			will have more favorable	4.	楊庭維
			responses to its service innovation,		
			perceived values, product image,		(2011)
			satisfaction, and loyalty.		

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E Satisfaction	E 1	1.	The objective of a cloud service is	1.	Sriram and
Survey	E - 1		to enhance mutual friendly		Khajeh-Ho
	Suitability of		relations and to help the interests		sseini.(201
	satisfaction		of enterprises and customers.		0)
	survey on a	2.	Through the Internet, users can	2	ᅮᆿᇰ
	cloud service		utilize their favorite software to	2.	土國艮
	platform		build customer interaction		(2011)
			infrastructure on the cloud service	2	ᇃᇏ
			platform.	3.	扳剛止
		3.	Cloud computing lends itself to		(2011)
			easy central management and is		
			cost-effective, and its		
			infrastructure includes the		
			advantages of scalability and more		
			efficient computing performance.		
F Member	E 1	1.	Enterprises can selectively and	1.	Espadas.
Notification	F - 1		conveniently use their business		(2013)
	Suitability of		software based on subscription or	2.	Garg.
	member		pay-per-use.		(2013)
	notification on	2.	Enterprises can enjoy the same	3	林家琦
	a cloud service		functionalities of regular software	5.	小水牛
	platform		with a low-cost alternative		(2013)
			provided by software vendors:		
			software as a service.		
		3.	With apps from cloud-based		
			software vendors, services are		
			easily accessible through a		
			browser or interface on a		
			connected device.		

5. Conclusion

This survey used the internal "Delphi Check on the Contents Suitability of Nanotech International's Customer Cloud Service Buildup" as the basis, soliciting its customers and key management staff for their opionions and comments on the cloud service platform buildup and on its impact on customer relationship management. This study conducted two Delphi checks: first, soliciting open comments from the customers and from the company's key management staff; based on those comments, contents of the cloud service platform and questions on the checklist were adjusted or modified accordingly before conducting the second check. In addition, detailed descriptions were added to all indicators to make all the questions easier to understand. Finally, based on the analyses of the data collected from the second Delphi check, the average number of responses, four-point difference, and open comments were charted according to the significance and priority of each question. The Delphi Check activity ended when the customers' opinions and those of the key management staff converged.

References

- Bennett, K., Layzell, P., Budgen, D., Brereton, P., Macaulay, L., and Munro, M. Year (2000) *"Service-based software : the future for flexible software, "Software Engineering Conference,*2000. APSEC 2000. Proceedings. Seventh Asia-Pacific, IEEE2000, p. 214-221.
- Chang, V., Walters, R. J., and Wills, G. (2012) "The development that leads to the Cloud Computing Business Framework," International Journal of Information Management.
- Espadas, J., Molina, A., Jiménez, G., Molina, M., Ramírez, R., and Concha, D (2013)"*A tenant-based resource allocation model for scaling Software-as-a-Service applications over cloud computing infrastructures*," Future Generation Computer Systems (29 : 1), p273-286.
- Garg, S. K., Versteeg, S., and Buyya, R. (2013)"*A framework for ranking of cloud computing services*," Future Generation Computer Systems (29 : 4), p1012-1023.
- Lackermair, G. (2011). "*Hybrid cloud architectures for the online commerce*," Procedia Computer Science (3), p 550-555.
- Linstone, H. A. (1978). *The Delphi techniques. In Fowless*, J. (Eds.), Handbook of Futures Research, 273-300. London: Greenwood Press.
- Loganayagi, B., and Sujatha, S. (2012) "Enhanced Cloud Security by Combining Virtualization and Policy Monitoring Techniques," Procedia Engineering (30), p654-661.
- Park, S. C., and Ryoo, S. Y. (2012). "An empirical investigation of end-users' switching toward cloud computing : A two factor theory perspective," Computers in Human Behavior.

Rittinghouse, J. (2009) Cloud Computing : implementation, management, and security, CRC.

- Rong, C., Nguyen, S. T., and Jaatun, M. G. (2013) "Beyond lightning : A survey on security challenges in cloud computing," Computers & Electrical Engineering (39 : 1), p47-54.
- Shuai, Z., Shufen (2010). Z., Xuebin, C., and Xiuzhen, H. Year. "Cloud Computing Research and Development Trend," Future Networks, 2010.ICFN '10. Second International Conference on 2010, p. 93-97.
- Sriram, I., and Khajeh-Hosseini, A. (2010). "Research agenda in cloud technologies," arXiv preprint arXiv : 1001.3259.
- Sultan, N. A. (2011). "Reaching for the "cloud" : How SMEs can manage," International Journal of Information Management (31 : 3), p272-278.
- Wyld, D. C. (2009) "The Utility of Cloud Computing As A New Pricing-And Consumption-Model for Information Technology," International Journal of Database Management Systems (1 : 1), p 1-20
- Vaquero, L. M., Rodero-Merino, L., Caceres, J., and Lindner, M (2009) "A Break in the Clouds : *Towards a Cloud Definition*," ACM SIGCOMM Computer Communication Review (39) January, p 50-55.
- 王國良(2011)。**雲端與傳統運算架構之效益比較分析:以海軍艦艇修護資訊系統為例**(碩士論文)。 銘傳大學資訊管理學系碩士在職專班,台北市。
- 王麗娟(2012)。**雲端顧客關係管理之效益認定與實現模式研究**(博士論文)。雲林科技大學資訊管理系,雲 林縣。

- 14 -

林家瑋(2013)。**雲端服務為基礎的服務創新:以行動裝置為例**(碩士論文)。國立臺北商業技術學院商學 研究所,台北市。

張剛止(2013)。**基於雲端運算之 DVC 到 SVC 快速轉碼系統之建置**(碩士論文)。國立中正大學通訊工程 研究所義縣。

陳志誠(2014)。**從顧客觀點看顧客參與的影響**(博士論文)。國立中央大學企業管理學系,桃園市。

郭雨蓁(2012)。影響企業採用電子化顧客關係管理之關鍵因素。國立臺灣海洋大學航運管理學系。

董丁魁(2010)。**顧客關係管理雲端服務導入模式之研究**(碩士論文)。雲林科技大學資訊管理系,雲林縣。

鄭如君 (2013)。教師職能、**顧客關係管理與學校形象關係之研究-以高雄市高中職為例**(碩士論文)。正修 科技大學經營管理研究所,高雄市。

DEMOGRAPHIC FACTORS AND THEIR INFLUENCE ON INSTRUCTOR PERSPECTIVES OF ONLINE VERSUS FACE-TO-FACE EDUCATION AT A JESUIT INSTITUTION

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ABSTRACT

While instructors are a critical component of the education paradigm, research into instructor perspectives on online education are sparse. The purpose of this phase of a larger study is to explore how demographic factors affect instructor perceptions at a Jesuit, Catholic private University in the northeast. Previous research from the larger study demonstrated that online and face-to-face instructor perspectives significantly differed on many individual and program factors. The specific demographic factors analyzed in this paper include age, gender, school, rank and highest degree completed.

KEYWORD: instructor perceptions, online education

LITERATURE REVIEW

The purpose of this study is to explore differences in instructor perceptions of online verses faceto-face (FTF) instruction. Previously published research from this larger study demonstrates that instructor's perceptions between FTF and online education significantly differ on all individual and program factors (Fish & Snodgrass, 2017 In Press). Individual factors studied include motivation, difficulty, discipline, self-directed learning, independence, time and cost investment, preference, happiness, appropriateness of online and online development programs for online education. Program factors, which relates to the design of the courses and the activities included in the program design, studied included academic integrity, academic program rigor, academic program quality, communication mechanisms and course activities, course organization, interaction with other instructors, student-to-instructor interaction, student-to-student interaction, and technical program activities. The prior research found that instructors significantly differed in their perceptions for the individual perceptions on motivation, self-directed, time and cost investment but not on discipline, independence or schedule flexibility (Fish & Snodgrass, In Press). With respect to program factors, instructors' perceptions differed on student-to-student interaction, instructor-to-student interaction, and cheating but not on difficulty (Fish & Snodgrass, In Press). Additionally, the two groups differed on their perceptions of teaching environment preference, happiness and appropriateness.

While this isn't the first study to examine these issues, it is clear from a review of the literature that the impact of online education will continue to grow in higher education. Recent research highlighted the increase in online education throughout the higher education system (Allen & Seamen, 2013). There is a need to assess both the student and instructor's perspectives with respect to online education (Shieh, Gummer & Niess, 2008). In addition, the issues are ever

1

changing. A recent study on instructor attitudes with respect to instructor online presence noted that studies into instructor and student perceptions will continue to evolve as technology evolves (Richardson et al., 2016). In studies of student perceptions of online versus FTF education, gender, age and experience, and academic background have all been shown to yield differing results over time (Billings, Skiba & Connors, 2005; Dobbs et al. 2009; Tanner et al., 2004a, 2004b; Fish & Snodgrass, 2014). Information and knowledge regarding instructor beliefs are important to improving instructional effectiveness (Farrell & Kun, 2009). The question before us is: *How do instructors – those that have taught and those that have not taught online - perceive online education compared to face-to-face (FTF) education today?* Our research within this paper aims to provide insight into this question specifically analyzing demographic factors of age, gender, school participating in, rank and highest degree completed.

In 2004, faculty perceptions (at public and nonprofit private institutions in the United States) on the effectiveness of online instruction in terms of the seven principles of effective undergraduate education revealed that faculty rated online education slightly more effective overall and more effective for promoting prompt feedback, time on task, respect for diverse learning styles and communicating high expectations (Guidera, 2004). However, online education was rated less effective on promoting student-to-instructor contact and cooperation among students (Guidera, 2004). Over a decade ago, using the Delphi method, 36 business instructors from AACSB accredited universities who taught online were questioned on best practices in online education (Gallegos Butters, 2007). Results from the study highlighted the need for incentives to professors to teach online and need for professors to learn pedagogy respective to the online environment (Gallegos Butters, 2007). Similarly, in a 2009 survey of over 10,000 faculty members from close to 70 colleges and universities, most instructors felt that their institutions did not provide online support and incentives to teach online (Seaman, 2009). In a 2009 study, instructor perceptions of teaching and learning outcomes were strongly influenced by instructor experience in teaching online as those with positive experiences indicated that online and FTF outcomes were equivalent, while those who never taught online or had negative online experiences, did not feel that online and FTF outcomes were the same (Fish & Gill, 2009). However, these surveys were conducted over 8 years ago as MOOCs and online education were just starting to explode. By 2013, recent research highlighted the increase in online education throughout the higher education system (Allen & Seamen, 2013).

Demographic factors which may impact upon an instructor's perception of online versus FTF education include age, gender, major or discipline, level taught, faculty rank, highest education level, teaching experience, and technological skill level. As previously mentioned, we will analyze the factors that an instructor 'brings to the discussion by virtue of who he or she is' in this paper. Few researchers reported on instructor demographic factors and online perceptions. Specifically, age, gender, school taught in, rank and highest degree earned. In a literature search on instructor's perspectives on online education there were few studies reported to address these demographic differences. With respect to gender, male teachers are more interested in classroom technology use than female teachers (Vekiri, 2010). However, several studies report that female instructors reported significantly higher perceptions of online course effectiveness than males (Seok et al., 2010; Chang et al., 2014). Contrastingly, significant differences exist between male and female instructors in their perceptions toward the roles of e-instructors and their practice of e-Learning instruction, but female e-instructors perceive online instruction more positively than

their male counterparts, particularly for instructional design, facilitating learning, learning assessment, administration management, content expertise and research development (Chang et al., 2014). With respect to faculty rank, instructors with different ranks share the same perceptions and practices towards online instructor roles and practices (Chang et al., 2014).

While not intended to be a comprehensive review of literature on instructor perceptions of online education, the literature review serves to outline the lack of research in this area. As noted above, most available research is over a decade old, when available technology and instructor understanding of online education was very different. Also, the few studies performed differ in size (small, medium, large universities), audience (e.g. scientific versus social sciences, business versus non-business, and graduate versus undergraduate), and method of research (e.g. interview, survey). The context of the study may be an important factor to consider in interpretation of the survey results. As we noted in a similar study with respect to student perceptions (Fish & Snodgrass, 2016a, 2016b), as technology changes, online education changes and perceptions change as well. As noted above, there are very few studies on the demographic, instructor factors, and many that exist are over 10 years old.

We conducted our study at a mid-sized, Jesuit, Catholic, private school with a focus on teaching. The research focus lies in uncovering instructor perceptions that offers instruction in traditional arts and sciences, education and business and where FTF class sizes average 17 students. While online education is a growing educational method (Allen & Seaman, 2013), not all faculty have been trained in or participated in online course development. Based upon the literature, the intent of this research is to explore instructors' perceptions of the online experience for those who have taught in and those who have never taught in the online environment. Specifically, this research seeks to explore: Are there differences between men and women's perceptions? Are there differences between 'older' and 'younger' instructors? Are there differences in perspectives based upon instructor rank at the University (Professor, Associate Professor, Assistant Professor or Instructor)? Do instructor's perceptions for those who teach education courses differ from those who teach business courses or arts and sciences? Do instructor's perceptions differ based upon the highest degree that he or she completed? Specific individual perceptions analyzed include motivation, discipline, self-directed learning and independence, time and cost investment, preference, happiness and appropriateness for learning environment, online orientation, cultural differences, course organization, academic rigor, program quality, academic integrity, and the program factors studied include difficulty, student-to-student interaction, student-to-instructor interaction, communication mechanisms, and program technologies. Theoretically, instructors should perceive the environments equally and not favor either traditional or online education.

METHOD

At an AACSB-accredited, Jesuit, Catholic, private, University in the northeast, faculty received an online survey, which was available over a month and sent to instructors three times over the month. University Internal Review Board and Academic Vice President approval for distribution was granted. As a matter of context, it is important to understand that instructors at the University do not use online course designers, are responsible for delivery of online content, and are encouraged to use the University's platform (Desire2Learn) as well as other software and programs (e.g. Jing, Youtube, dropbox, Zoom, etc.) in online and FTF course delivery. Based

upon the above research and insight into the online versus FTF learning environments, the instructors designed a survey on instructor perceptions of online versus FTF learning environments (See Appendix A.) Initially, the survey asked demographic questions regarding age, gender, respective school the instructor associates with, teaching level (undergraduate, graduate, or both), level taught, highest education level completed, number of years teaching at school and in total, faculty rank, self-reported technological skill level, online course experience as a student, and online teaching experience. Then instructors who have taught at least 1 online course complete Section A questions, while instructors who have never taught in the online environment complete Section B questions. Sections A and B have corresponding questions on the perceptions noted; however, Section A statements are specific to "I found" versus Section B statements are "I perceive". Specific instructor perceptions include individual instructor perceptions of motivation, discipline, self-directed learning, independence, schedule flexibility, time and cost investment. The survey used a five-point Likert scale for each of the factors: significantly dislike, dislike, okay, like, significantly like. The last questions in each section asked the instructor if the instructor would prefer the opposite environment, the instructor's emotional happiness with the learning environment, and whether the instructor felt that online courses were appropriate for the institution. For instructors with online experience, the last openended question inquired as to why they chose to offer an online course. For instructors without online experience, the survey included an open-ended question inquiring 'why not'.

ANALYSIS

Ninety-six faculty members completed the survey with a response rate of 42.67%. However, not all instructors completed the entire survey, and only 82 surveys were useable (36.4% response rate). Participants were not required to answer every question. Fortunately, 41 instructors completed part A (online perception) and 41 instructors completed part B (FTF perception). Given the survey setup, responses positively viewed the environment that an instructor was part of. For example, if an online instructor felt that online was more difficult than FTF, he or she would indicate a significant 'positive' for the online environment. The scale for the FTF instructors was similar for their environment. Therefore, if the two groups perceive the teaching environment different than their own environment, a significant difference between the two groups would be detected. Since prior analysis demonstrated that the two groups – online and FTF, perceived motivation, self-directed, time and cost investment, student-to-student interaction, student-to-instructor interaction, cheating, preferred environment, happiness and appropriateness to favor the FTF environment, the two groups were analyzed separately to denote any significant differences within the group. Analysis was performed using SPSS.

As shown in Table 1, there was little correlation between most demographic factors studied here. The strongest relationship exists for the instructors completing the FTF survey, where rank and age are positively correlated (.7706). Overall, there appears to be a moderate relationship between rank and age (.545) but not necessarily for the group completing the online survey (.2536).

OL Instructors	School	Age	Gender	Rank	Highest Education
					Level
School	1				
Age	0.1367	1			
Gender	-0.1498	-0.1432	1		
Rank	0.0728	0.2536	-0.139	1	
Highest Education Level	0.0288	-0.0872	0.097	-0.2446	1
FTF Instructors	School	Age	Gender	Rank	Highest Education
					Level
School	1.0000				
Age	0.2346	1			
Gender	-0.1739	-0.2127	1		
Rank	0.2065	0.7706	-0.3010	1	
Highest Education Level	-0.0193	-0.0452	-0.2332	-0.10961	1
Overall	School	Age	Gender	Rank	Highest Education
					Level
School	1.0000				
Age	0.2197	1			
Gender	-0.0876	-0.150	1		
Rank	0.1635	0.545	-0.1970	1	
Highest Education Level	0.0365	-0.049	-0.0534	-0.1600	1

Table 1.	Correlation	Factors
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Age. As shown in Table 2, most instructors fell into the 51-55 range overall. However, while the majority of online instructors are within this range, the majority of FTF instructors are in the 41-45 range, a decade younger.

Table 2. Number of Instructors by Age

How old are you?	# OL Instructors	# FTF Instructors	Grand Total
26-30		1	1
31-35	2	1	3
36-40	4	7	11
41-45	3	9	12
46-50	3	2	5
51-55	13	6	19
56-60	5	5	10
61-65	6	3	9
66-70	3	2	5
71+	1	3	4
(blank)	1	2	3
Grand Total	41	41	82

Chi-Square analysis using the contingency coefficient as the nominal value was performed. With respect to the instructor perceptions, for all of the metrics, the instructors who teach online and those that teach FTF are not significantly different by age as shown in Tables 3 and 4 respectively.

Metric	Pearson Chi- Square Value	Df	Asymptotic Significance (2-sided)	Pearson's R	Spearman Correlation
Difficulty	26.905	32	.722	.237	.162
Motivation	21.553	32	.919	.383	.226
Interact between students	18.359	32	.974	.688	.691
Interact instructor-student	40.067	32	.155	.262	.299
Discipline	26.551	32	.739	.422	.517
Cheat	12.255	24	.977	.475	.488
Self-directed	31.161	32	.509	.127	.150
Independence	36.617	32	.263	.228	.237
Schedule flexibility	30.891	32	.523	.588	.717
Time investment	27.871	32	.676	.304	.350
Cost investment	24.086	24	.457	.546	.279
Preference opposite?	12.660	16	.697	.863	.830
Happiness with	34.863	32	.333	.723	.826
Appropriateness	11.314	16	.790	.287	.288

Table 3. OL Instructors by Age

* $p \le .05$ ** $p \le .10$

Table 4. FTF Instructors by Age

Metric	Pearson Chi- Square Value	Df	Asymptotic Significance (2-sided)	Pearson's R	Spearman Correlation
Difficulty	31.358	36	.689	.453	.589
Motivation	21.668	27	.754	.185	.212
Interact between students	25.437	27	.550	.957	.839
Interact instructor-student	19.619	18	.355	.863	.918
Discipline	26.471	27	.493	.325	.266
Cheat	27.850	27	.419	.764	.889
Self-directed	27.444	36	.846	.662	.845
Independence	16.581	27	.941	.294	.378
Schedule flexibility	32.913	36	.616	.311	.288
Time investment	24.652	27	.594	.484	.576
Cost investment	16.595	27	.941	.327	.474
Preference opposite?	16.759	18	.540	.746	.806
Happiness with environment	13.256	18	.776	.358	.376
Appropriateness	16.226	18	.577	.312	.357

* $p \le .05$ ** $p \le .10$

Gender. Slightly more than half of the participants in the study were men (40) and slightly less than half were women (38). More women (23) have taught online than men (17), while more men (23) participated in the FTF survey than women (15). Four instructors did not indicate their gender.

As shown in Table 5, men and women online instructors were similar in their perceptions on every factor. A slight significant difference for FTF instructors on instructor-to-student interaction exists, where men indicated that the interaction is significantly higher in FTF than women, as shown in Table 6.

Metric	Pearson Chi- Square Value	Df	Asymptotic Significance (2-sided)	Pearson's R	Spearman Correlation
Difficulty	3.620	4	.460	.481	.592
Motivation	4.876	4	.300	.070	.123
Interact between students	8.351	4	.080	.887	.823
Interact instructor-student	2.558	4	.634	.208	.226
Discipline	4.214	4	.378	.603	.822
Cheat	2.130	3	.546	.654	.930
Self-directed	5.964	4	.202	.086	.049
Independence	5.296	4	.258	.022	.027
Schedule flexibility	6.490	4	.165	.057	.055
Time investment	2.303	4	.680	.601	.877
Cost investment	1.944	3	.584	.415	.369
Preference opposite?	2.121	2	.346	.246	.230
Happiness with environment	5.831	4	.212	.043	.052
Appropriateness	2.695	2	.260	.131	.187

Table 5. OL Instructors by Gender

* $p \le .05$ ** $p \le .10$

Metric	Pearson Chi- Square Value	Df	Asymptotic Significance (2-sided)	Pearson's R	Spearman Correlation
Difficulty	5.292	4	.259	.550	.647
Motivation	3.266	3	.352	.285	.287
Interact between students	1.577	3	.655	.322	.320
Interact instructor-student	5.417	2	.067 **	.031	.047
Discipline	.512	3	.916	.921	.885
Cheat	.182	3	.980	.699	.707
Self-directed	6.601	4	.159	.071	.069
Independence	4.669	3	.198	.201	.161
Schedule flexibility	2.651	4	.618	.535	.455
Time investment	.582	3	.901	.486	.481
Cost investment	2.977	3	.395	.635	.754
Preference opposite?	2.207	2	.332	.506	.331
Happiness with environment	.547	2	.761	.484	.473
Appropriateness	.278	2	.870	.912	.860

 Table 6. FTF Instructors by Gender

* $p \le .05$ ** $p \le .10$

School. Forty-four (44) respondents were from the Arts & Sciences School, 27 were from the School of Education & Human Services, and 11 were from the School of Business. From the Arts & Sciences School, 13 respondents taught online while 31 taught FTF. For the School of Education and Human Services, 22 taught online while 5 taught FTF. For the School of Business, 6 taught online while 5 taught FTF.

As shown in Table 7, online instructors within the three schools at the University did not significantly differ on their perceptions except for on the interaction between students (χ = 19.608, df =8, p = .012) and preference to teach in the opposite environment (χ =.9.733, df=4, p = .045). With respect to student interaction, the Education & Health Sciences instructors preferred the online experience over the FTF environment. In comparison to the other two schools, the Education & Health Sciences school were indifferent to teaching online versus FTF (2.09), while the other two schools would prefer to teach FTF (Arts & Sciences =1.77, School of Business=1.17).

As shown in Table 8, FTF instructors across all three schools were very similar in their perceptions except for motivation (χ =.24.420, df=6, p = .037) and preference (χ =10.593, df=4, p=.032) with a slight significant difference on schedule flexibility (χ =14.380, df=8, p=.072). With respect to motivation, Arts& Sciences and School of Business FTF were strongly motivated to teach FTF, while the Education & Health Sciences instructors were more indifferent to motivational aspects of the two environments. As for teaching preference, FTF instructors in the Arts& Sciences and School of Business did not wish to teach online, while the instructors in the education school were more amenable to the idea of teaching online.
Metric	Average							
	Arts &	Education &	School of	Pearson Chi-	Df	Asymptotic	Pearson'	Spearman
	Sciences	Human Services	Business	Square Value		Significance	s R	Correlatio
						(2-sided)		n
Difficulty	3.15	3.59	3.5	7.445	8	.489	.341	.372
Motivation	2.62	3.18	2.33	7.955	8	.438	.973	.899
Interact between students	2.17	3.14	2.20	19.608	8	.012	.279	.191
Interact instructor-student	2.54	3.27	2.00	12.141	8	.145	.833	.913
Discipline	3.46	3.95	3.67	5.641	8	.687	.451	.608
Cheat	2.31	2.64	1.83	5.347	6	.500	.559	.559
Self-directed	2.54	3.05	2.67	11.00	8	.202	.580	.535
Independence	3.15	3.41	3.17	3.148	8	.925	.813	.814
Schedule flexibility	3.62	3.77	3.83	3.212	8	.920	.638	.630
Time investment	3.38	4.05	3.83	5.823	8	.667	.229	.258
Cost investment	3.17	2.95	3.17	6.918	6	.329	.815	.897
Preference opposite?	1.77	2.09	1.17	9.733	4	.045	.408	.455
Happiness with	3.08	3.82	2.83	10.579	8	.227	.839	.729
environment								
Appropriateness	1.54	1.14	1.67	5.748	4	.219	.8188	.768

Table 7. Online Instructors by School

* p < .05 ** p<<.10

Metric	Average							
	Arts &	Education &	School of	Pearson Chi-	Df	Asymptotic	Pearson'	Spearman
	Sciences	Human Services	Business	Square Value		Significance	s R	Correlation
				_		(2-sided)		
Difficulty	2.87	3.40	3.40	5.570	8	.695	.199	.144
Motivation	4.27	3.80	4.20	13.410	6	.037	.613	.713
Interact between students	4.13	4.75	4.00	3.413	6	.756	.915	.736
Interact instructor-student	4.23	4.75	4.60	3.976	6	.680	.240	.146
Discipline	3.27	3.40	3.40	6.114	6	.410	.705	.512
Cheat	3.90	3.80	3.60	5.033	6	.540	.443	.556
Self-directed	4.13	4.20	4.60	2.014	8	.981	.354	.539
Independence	3.86	3.20	3.60	4.417	6	.620	.319	.209
Schedule flexibility	3.34	2.75	2.60	14.380	8	.072	.117	.144
Time investment	3.13	2.80	2.80	1.638	6	.950	.318	.309
Cost investment	3.28	2.80	3.80	8.953	6	.176	.498	.852
Preference opposite?	2.74	2.00	3.00	10.593	4	.032	.929	.728
Happiness with	4.48	4.60	4.80	4.563	4	.335	.300	.226
environment								
Appropriateness	1.74	1.40	1.80	6.877	4	.143	.763	.505

Table 8. FTF Instructors by School

* p < .05 ** p <<.10

10

Rank at University. One lecturer, four assistant professors, 22 associate professors, 11 full professors and 2 'other' instructors completed the online survey. The FTF survey was completed by one lecturer, ten assistant professors, 14 associate professors, and 15 full professors.

As the correlation analysis demonstrated, rank and age are moderately related overall (.545) and particularly for the FTF instructors (.7706). Since the relationship within each of the populations with respect to each metric was insignificant, one would expect no relationship with respect to rank. Essentially this was the result for online instructors except for significance on appropriateness (χ =16.946, df=8, p=.031) and a slight significance for self-directed (χ =25.217, df=16, p=.066) as shown in Table 9. The majority of associate professors preferred to be in a FTF environment, while the other ranks were more indifferent to the teaching environment. In keeping with this, online associate professors preferred the self-directed nature of the FTF environment over the online one, while other ranks were more amenable to online. As shown in Table 10, the results for the FTF instructors was similar as there was only a slight significance for self-directed (χ = 13.442, df=8, p=.098) and independence (χ = 11.110, df=6, p=.085). However, FTF instructors significantly differed in their perspective on teaching environment preference (χ = 18.044, df=6, p=.006). The majority of full FTF professors did not wish to teach online, while the associate professors were indifferent and the lecturer wanted to teach online.

Metric	Pearson Chi- Square Value	Df	Asymptotic Significance (2-sided)	Pearson's R	Spearman Correlation
Difficulty	11.014	16	.809	.992	.889
Motivation	21.609	16	.156	.860	.729
Interact between students	14.161	16	.587	.430	.462
Interact instructor-student	13.063	16	.668	.415	.735
Discipline	19.184	16	.259	.353	.329
Cheat	8.441	12	.750	.864	.766
Self-directed	25.217	16	.066	.808	.685
Independence	18.346	16	.304	.488	.727
Schedule flexibility	22.567	16	.126	.522	.262
Time investment	20.050	16	.218	.562	.511
Cost investment	4.731	12	.966	.869	.745
Preference opposite?	16.946	8	.031	.875	.761
Happiness with environment	13.463	16	.639	.526	.666
Appropriateness	6.985	8	.538	.981	.837

Table 9. OL Instructors by Rank

* p < .05 ** p <<.10

Metric	Pearson Chi- Square Value	Df	Asymptotic Significance (2-sided)	Pearson' s R	Spearman Correlatio n
Difficulty	9.549	12	.655	.605	.538
Motivation	11.057	9	.272	.020	.028
Interact between students	12.800	9	.172	.097	.209
Interact instructor-student	12.722	9	.176	.240	.299
Discipline	7.670	9	.568	.898	.951
Cheat	6.122	9	.729	.321	.352
Self-directed	13.442	8	.098	.675	.535
Independence	11.110	6	.085	.527	.471
Schedule flexibility	8.026	8	.431	.481	.482
Time investment	12.387	9	.192	.539	.577
Cost investment	5.998	9	.740	.766	.683
Preference opposite?	18.044	6	.006	.135	.139
Happiness with	7.907	6	.245	.183	.158
Appropriateness	3.065	6	.801	.982	.935

Table 10. FTF Instructors by Rank

Highest Degree Completed. At the University, at a minimum, instructors are expected to have a masters' degree. With respect to online instructors, three completed their master's degree, 33 completed their doctorate and 5 completed a post-doctorate. For the FTF group, 6 instructors completed their master's degree, 31 completed a doctorate and 4 completed a post-doctorate.

With respect to the highest degree completed by the instructor, online instructors did not differ significantly except for happiness ($\chi = 15.522$, df=8, p=.050) and appropriateness ($\chi = 9.583$, df=4, p=.048) as well as a slight difference for preference for the opposite environment ($\chi = 9.303$, df=4, p=.054) as shown in Table 11. Instructors with masters or doctorate degrees were happy with the online environment, but instructors with post-doctorates were unhappy with the online environment. As for the appropriateness of online education at the college, instructors with post-doctorates were not in favor of online education. FTF instructors were indifferent on all of the metrics except time investment ($\chi = 21.255$, df =6, p=.002) and appropriateness ($\chi = 10.802$, df =4, p=.029) and a slight significance on discipline ($\chi = 12.560$, df=6, p=.051) as shown in Table 12. FTF instructors that completed their masters degrees indicated that FTF time investment was greater than online, while those with a doctorate were indifferent, and instructors who completed a masters or doctorate felt that online education was appropriate; however, instructors that completed a post-doctorate did not support online education.

Metric	Pearson Chi- Square Value	Df	Asymptotic Significance	Pearson's R	Spearman Correlation
Difficulty	13 442	8	098	695	663
Motivation	3.864	8	.872	.336	.295
.Interact between students	12.867	8	.117	.027	.029
Interact instructor-student	8.007	8	.433	.141	.121
Discipline	6.593	8	.581	.392	.371
Cheat	8.178	6	.225	.624	.429
Self-directed	3.710	8	.882	.276	.296
Independence	4.913	8	.767	.220	.285
Schedule flexibility	6.369	8	.606	.132	.109
Time investment	4.059	8	.852	.847	.924
Cost investment	4.547	6	.603	.653	.938
Preference opposite?	9.303	4	.054	.484	.414
Happiness with environment	15.522	8	.050	.008	.009
Appropriateness	9.583	4	.048	.055	.138

Table 11. OL Instructors by Highest Education Degree Completed

* p < .05 ** p<<.10

Table 12. FTF Instructors by Highest Education Degree Completed

Metric	Pearson Chi- Square Value	Df	Asymptotic Significance	Pearson' s R	Spearman Correlatio
Difficulty	11 229	8	(2-sided) 189	370	265
Motivation	2.878	6	.824	.395	.328
Interact between students	4.886	6	.558	.179	.182
Interact instructor-student	4.064	6	.668	.318	.255
Discipline	12.560	6	.051	.226	.106
Cheat	6.817	6	.338	.508	.644
Self-directed	4.113	8	.847	.437	.397
Independence	7.226	6	.300	.242	.225
Schedule flexibility	12.074	8	.148	.506	.573
Time investment	21.255	6	.002	.140	.058
Cost investment	8.395	6	.211	.848	.938
Preference opposite?	3.518	4	.475	.079	.065
Happiness with environment	1.354	4	.852	.306	.362
Appropriateness	10.802	4	.029	.002	.001

DISCUSSION

Prior research on the differences between instructors perceptions on different individual and program factors demonstrated that online instructors and FTF instructors perceived the environments differently on most factors (Fish & Snodgrass, In Press). Essentially, both groups favored FTF for the perceptions analyzed. This purpose of this study was to explore the demographic factors associated with these different perceptions.

For each demographic factor studied here, there were few significant differences within the respective group – online or FTF. With respect to age, no significant differences in instructor perceptions were noted for any factors for either the online or FTF group. Similarly, with respect to gender, only a difference with respect to instructor-to-student interaction was noted in the FTF group where men perceived FTF more positively than women. This result is in contrast to other research (Seok et al., 2010, Chang et al, 2014) that found women perceived online course effectiveness higher than males particularly on program factors. Men and women in our study perceived online education similarly, and in general, did not prefer online to FTF for the individual and program factors studied.

With respect to instructor rank, prior research found that instructors with different rank had similar perceptions for online education (Chang et al, 2014). A few significant differences by rank were noted in our study. Within the online group, for environment preference at the University, associate professors preferred to teach in a FTF class. Interestingly, within the FTF group, associate professors were indifferent to the environments, while full professors did not wish to teach online.

No prior research analyzed an instructor's associated school or highest degree completed as potential differentiating factors. Our study revealed that online instructors perceived student-tostudent interaction and environment preference differently, while FTF instructors differ in their perception of teaching in the online environment. With respect to both factors in the online group and the FTF group's teaching preference, the School of Education & Health Services instructors perceived online indifferently while the other schools favored FTF. While the specific reason that this occurred was not analyzed, perhaps since instructors in the School of Education & Human Services are actively involved in 'teaching' and tend to be exposed to different teaching methods more than the other two schools, they are more willing to be open to a different teaching environment. With respect to the highest degree completed, it is interesting to note that for both the online and FTF groups, post doctorate instructors indicate the online education is not appropriate, while masters and doctorate instructors are more accepting of online. In the online environment, post-doctorate instructors are not happy online. Within the FTF group, with respect to time investment, masters instructors felt FTF required more time than online, while doctorates were indifferent, and post-doctorates felt more time was spent preparing online. No anecdotal information as to why these perceptions resulted was gathered through the study, and while interesting, it's not clear why increasing education level (from masters to post-doctorate) would result in this change in perception.

The analysis clearly demonstrates that within each group for the demographic factors studied, there are very few differences in perception. While this is not 'significant', it demonstrates the

clear view that this population has on the topic of online education (Fish & Snodgrass, In Press). For each of the individual factors the results were:

- <u>Motivation</u>: Online and FTF instructors are more motivated in the FTF environment.
- <u>Discipline</u>: The groups are indifferent to the discipline required in the environments.
- <u>Self-directed</u>: Both the online and FTF groups enjoy the FTF environment more than online.
- <u>Independence:</u> Both the online and FTF groups enjoy the FTF environment more than online.
- <u>Schedule flexibility</u>: Both online and FTF groups are indifferent to the schedule flexibility offered by the environment.
- <u>Time investment</u>: The online group felt online required more time investment than FTF, while the FTF group did not perceive a difference in the time investment.
- <u>Cost investment</u>: The groups were indifferent to the cost investment.

Essentially, for this population, both groups favor the FTF environment on the individual factors. Interestingly, while many students in a similar study felt that online education offers schedule flexibility (Fish & Snodgrass, 2016a, 2016b), instructors did not perceive the schedule flexibility to favor online education.

With respect to program factors, for each of the demographic factors studied, the instructors preferred the FTF environment for student-to-student and instructor-to-student interaction. They were indifferent to the difficulty associated with one environment versus the other. Both the online and FTF group felt that it would be harder for students to cheat in the FTF environment than the online one. Essentially, instructors favored the FTF environment on the program factors.

With respect to the appropriateness and preferences for online, it appears that instructors that teach online have self-selected themselves to teach online as they are indifferent to a preference and happiness, while FTF instructors do not wish to teach online and are very happy teaching in the FTF environment. With respect to the appropriateness, online instructors felt online education was appropriate, but in general, FTF instructors were indifferent.

CONCLUSIONS

This study analyzed the relationship between demographic factors (age, gender, school associated with, rank and highest education level achieved) and instructor perceptions of the online versus FTF environment. While prior research found differences between the online and FTF instructor preferences, within the online and the FTF groups, the instructor's perceptions were similar. These results show the strong similar perceptions of these two groups, which both tend to favor the FTF environment. However, these results were for a private University whose main focus is teaching and not research. Perhaps the setting impacts upon the results, and other studies would reveal different perceptions depending upon the institutional setting. Future research to explore this is advised.

Limitations. A key limitation for this study was the sample size. While the response rate for the population is adequate, in some cases the analysis for each of the demographic factors studied,

subdivided the samples into very small groups. In future studies, a larger population, which could include adequate subgroup sizes (n>30), may reveal significant differences in perceptions.

REFERENCES

Billings, D.M., Skiba, D.J. & Connors, H.R. (2005). Best Practices in Web-based Courses: Generational Differences Across Undergraduate and Graduate Nursing Students. *Journal of Professional Nursing*, 21(2), 126-133.

Chang, C., Shen, H.Y. & Liu, E. Z. (2014). University Faculty's Perspectives on the Roles of E-Instructors and Their Online Instruction Practice. The International Review of Research in Open and Distance Learning, 15(3), 72-92.

Farrell, T. & Kun, S. (2008). Language policy, language teachers' beliefs, and classroom practices. *Applied Linguistics*, 29(3), 381-403.

Fish, L. A., & Snodgrass, C. R. (2016a). A Literature Review and Directions for Future Research on International Student Perceptions of Online versus Face-to-Face Education: Student-centered Characteristics. *The BRC Academy Journal of Education*, 5(1), 1-22. http://dx.doi.org/10.15239/j.brcacadje.2016.0501.ja01

Fish, L. A., & Snodgrass, C. R. (2016b). A Literature Review and Directions for Future Research on International Student Perceptions of Online versus Face-to-Face Education: Program-centered Characteristics. *The BRC Academy Journal of Education*, 5(1), 23-52. http://dx.doi.org/10.15239/j.brcacadje.2016.0501.ja02

Fish, L.A., & Snodgrass, C.R. (In Press). Instructor Perspectives of Online versus Face-to-Face education at a Jesuit Institution. Proceedings of the WNY Business Research Consortium, Niagara Falls, NY, April, 2017.

Fish, W.W. & Gill, P.B. (2009). Perceptions of online instruction. *The Turkey Online Journal of Educational Technology*, January 2009 ISSN: 1303-6521 volume 8 Issue 1 Article 6, pp. 53-64.

Gallegos Butters, A.M. (2007). Pedagogy in online graduate business learning environments. University of SanDiego and San Diego State University, ProQuest Dissertations Publishing. 2007. Accessed on 2/6/17 at http://search.proquest.com.ezproxy.canisius.edu/abicomplete/docview/304705005/fulltextPDF/8 15CEAC5802B4EEDPQ/1?accountid=26533

Guidera, S, G, (2004), Perceptions of the effective-ness of online instruction in terms of the seven principles of effective undergraduate education. *Journal of Educational Technology Systems*, Í2(2& 3), 139-178.

Richardson, J.C., Besser, E. Koehler, A., Lim, J. & Strait, M. (2016). Instructors' Perceptions of Instructor Presence in Online Learning Environments. *International Review of Research in Open and Distributed Learning*, 17(4), 82-104.

Seaman, J. (2009). Online learning as a strategic asset. Volume II: The paradox of faculty voices, Views and experiences with online learning, Washington, D.C.: Association of Public and Landgrant Universities.

Seok, S., DaCostas, B., Kinsell, C. & Tung, C.K. (201). Comparison of Instructors' and Students' Perceptions of the Effectiveness of Online Courses, *The Quarterly Review of Distance Education*, 11(1), pp. 25-36.

Shieh, R.S., Gummer, E. & Niess, M. (2008). The Quality of a Web-Based Course: Perspectives of the Instructor and the Students. *TechTrends*, November/December, 52(6), 61-68.

Tanner, J., Noser, T., Fuselier, J., & Totaro, M. (2004a). 'The Online 'Classroom': Differences in Perception between Business Students and Non-Business Students. *Journal of College Teaching and Learning*, 1(3), 37-44.

Tanner, J., Noser, T., Fuselier, J., & Totaro, M. (2004b). 'The Online 'Classroom': What Do Students Think? *Journal of Informatics Education Research*, 6 (1), 43-54.

Thomas, T.S. (2010). Online vs face-to-face: Educator opinions on professional development delivery methods. The University of Alabama, ProQuest Dissertations Publishing, 2010. Accessed on 2/6/17 at http://search.proquest.com.ezproxy.canisius.edu/docview/594970335/fulltextPDF/AE6AE0A8E3 1341BBPQ/21?accountid=26533

Vekiri,I. (2010). Boys' and girls' ICT beliefs: Do teachers matter? *Computers and Education*, 55, 16-23.

APPENDIX A Online Perspectives - Instructor Survey

<u>Please note</u>: The coding is the number in parentheses following the response and will not be viewed by the participant.

- Q1. What school do you teach in?
 - School of Arts and Sciences (1)
 - o School of Education and Human Services (2)
 - School of Business (3)
- Q2. How old are you?
 - o Less than 26(1)
 - o 26-30 (2)
 - o 31-35 (3)
 - o 36-40 (4)
 - o 41-45 (5)
 - o 46-50 (6)
 - o 51-55 (7)
 - o 56-60 (8)
 - o 61-65 (9)
 - o 66-70 (10)
 - o 71 or older (11)
- Q3. Are you:
 - o Male (1)
 - o Female (2)
- Q4. What is your rank at the University?
 - o Lecturer
 - o Assistant Professor
 - o Associate Professor
 - o Professor
 - o Other
- Q5. Do you teach undergraduate courses only, graduate courses only or both levels?
 - Undergraduate courses only (1)
 - Graduate courses only (2)
 - Both undergraduate and graduate courses (3)
- Q6. What is your highest education level?
 - o Associates
 - o Bachelors
 - o Masters
 - o Doctorate
 - o Post-Doctorate

- Q7. Would you classify your technological abilities as:
 - Do not use technology in the classroom or teaching at all.
 - o Beginner/Novice
 - o Advanced Beginner (eg. Use some Desire2Learn features, Microsoft Office)
 - Intermediate (e.g. use many Desire2Learn features in classes, Microsoft Office, other computer applications)
 - Superior (Extensive knowledge and use of various computer capabilities in the classroom)
- Q8. How many years have you taught at the University?
- Q9. How many years have you taught at the university level (any school)?
- Q10. Have you ever taken an online course at the University?
 - o Yes (1)
 - o No (2)
- Q11. Have you ever taken an online course at a school other than the University?
 - Yes (1)
 - o No (2)
- Q12. Have you taught an online course at the University?
 - o Yes (1)
 - o No (2)

<u>Section A:</u> Participants with online teaching experience are directed to the following questions, while participants with no online teaching experience are direct to Section B.

With respect to <u>teaching online</u> courses at the University compared to face-to-face (traditional classrooms), please rate the following responses:

- Q13. How many online courses have you taught at the University?
- Q14. Have you taught an online course at a school other than the University?
 - o Yes (1)
 - o No (2)
- Q15. How many online courses have you taught at a school other than the University?
- Q16. Prior to teaching an online course, did you take a course to prepare you for the online environment?
 - Yes (1)
 - o No (2)

- Q17. If yes, was the course offered by the University or the book publisher or other method?
 - o University (1)
 - o Book publisher (2)
 - Other (3)
- Q18. I perceive online courses to be _____ in difficulty than face-to-face courses.
 - o Significantly easier (1)
 - o Easier (2)
 - The Same Difficulty (3)
 - o Harder (4)
 - Significantly Harder (5)
- Q19. I am _____ motivated in online courses than face-to-face courses.
 - o Significantly less (1)
 - o Less (2)
 - Equally (3)
 - o More (4)
 - o Significantly more (5)
- Q20. I perceive the interaction between students in the online environment to be ______compared to the face-to-face course environment.
 - Significantly worse (1)
 - Worse (2)
 - The same (3)
 - o Better (4)
 - o Significantly better (5)
- Q21. I perceive the interaction between the instructor and students in the online environment to be ______ compared to the face-to-face course environment.
 - Significantly worse (1)
 - o Worse (2)
 - The same (3)
 - o Better (4)
 - Significantly better (5)
- Q22. I find the discipline required in taking online courses to be _____ than in face-to-face courses.
 - Significantly less (1)
 - o Less (2)
 - The Same (3)
 - o More (4)
 - o Significantly more (5)

- - o Significantly less (1)
 - o Less (2)
 - The Same (3)
 - o More (4)
 - Significantly more (5)
- Q24. I find online courses require _____ time investment in the course than face-to-face courses.
 - o Significantly less (1)
 - o Less (2)
 - The Same (3)
 - o More (4)
 - o Significantly more (5)

Q25. I find online courses total costs are _____ than face-to-face courses.

- o Significantly less (1)
- o Less (2)
- o The Same (3)
- o More (4)
- Significantly More (5)
- Q26. I perceive that it is _____ for students to cheat in the online environment than in face-to-face courses.
 - Significantly easier (1)
 - o Easier (2)
 - The Same (3)
 - o Harder (4)
 - Significantly harder (5)
- Q27. I enjoy the self-directed online learning environment _____ than the interaction in face-to-face courses.
 - o Significantly less (1)
 - o Less (2)
 - The Same (3)
 - o More (4)
 - Significantly more (5)
- Q28. I enjoy the independence associated with the online learning environment _____ than the interaction in face-to-face courses.
 - o Significantly less (1)
 - o Less (2)
 - The Same (3)
 - o More (4)
 - Significantly more (5)

- Q29. In the online environment, I feel these activities increase my students' understanding of the course material. (Check all that apply.)
 - Discussion boards (1)
 - In-class sessions (2)
 - Additional Reading (3)
 - o Homework (4)
 - o Videos (5)
 - o Instructor lectures (6)
 - Instructor chat (7)
 - Other students (8)
 - Problem Scaffolding & Hints (9)
 - o Textbook (10)
 - o Instructor Posted Notes (11)
 - o Surveys (12)
- Q30. In the online environment, I feel these activities decrease my students' understanding of the course material. (Check all that apply.)
 - o Discussion boards (1)
 - o In-class sessions (2)
 - o Reading (3)
 - o Homework (4)
 - o Videos (5)
 - o Instructor lectures (6)
 - o Instructor chat (7)
 - o Other students (8)
 - o Problem Scaffolding & Hints (9)
 - o Textbook (10)
 - Instructor Posted Notes (11)
 - o Surveys (12)
- Q31. Would you prefer to teach the class in a traditional face-to-face environment?
 - Yes (1)
 - o Undecided (2)
 - o No (3)
- Q32.. I am _____ with the online course environment for learning.
 - Not very happy (1)
 - Not happy (2)
 - o Okay (3)
 - o Happy (4)
 - Very happy (5)
- Q33. Given this institution, do you think online courses are appropriate?
 - Yes (1)
 - Undecided (2)
 - o No (3)

Q34. Why did you choose to teach the course online?

<u>Section B:</u> Participants with no online teaching experience are directed to the following questions, while participants with online teaching experience are direct to Section A.

With respect to <u>teaching</u> face-to-face courses (traditional) at the University compared to teaching online, please rate the following responses:

- Q35. I perceive face-to-face courses to be _____ in difficulty than online courses.
 - Significantly Easier (1)
 - o Easier (2)
 - The Same Difficulty (3)
 - o Harder (4)
 - Significantly Harder (5)

Q36. I would be _____ motivated in face-to-face courses than online courses.

- Significantly less (1)
- o Less (2)
- o Equally (3)
- o More (4)
- Significantly more (5)
- Q37. I perceive the interaction with other students in the face-to-face environment to be _____ compared to the online course environment.
 - Significantly worse (1)
 - o Worse (2)
 - o Equal (3)
 - o Better (4)
 - Significantly better (5)
- Q38. I perceive the interaction with the instructor in the face-to-face environment to be _____ compared to the online course environment.
 - Significantly worse (1)
 - Worse (2)
 - o Equal (3)
 - o Better (4)
 - Significantly better (5)
- Q39 I perceive the discipline required in taking face-to-face courses to be _____ than in online courses.
 - Significantly less (1)
 - o Less (2)
 - The Same (3)
 - o More (4)
 - Significantly more (5)

- Q40. I perceive that it would be _____ to cheat in the face-to-face environment than in online courses.
 - Significantly easier (1)
 - o Easier (2)
 - The Same (3)
 - o Harder (4)
 - o Significantly harder (5)
- Q41 I believe that I would enjoy the self-directed face-to-face learning environment _____ than the interaction in online courses.
 - o Significantly less (1)
 - o Less (2)
 - The Same (3)
 - o More (4)
 - Significantly more (5)
- Q42. I believe that I would enjoy the independence associated with the face-to-face environment ______ than the interaction in online courses.
 - Significantly less (1)
 - o Less (2)
 - The Same (3)
 - o More (4)
 - Significantly more (5)
- Q43. I believe that I would enjoy the schedule flexibility associated with the face-to-face learning environment _____ than in online courses.
 - Significantly less (1)
 - o Less (2)
 - The Same (3)
 - o More (4)
 - Significantly more (5)
- Q44. I believe that face-to-face courses require _____ time investment in the course than online courses.
 - o Significantly less (1)
 - o Less (2)
 - The Same (3)
 - o More (4)
 - o Significantly more (5)

- Q45. I believe face-to-face courses total costs are _____ than online courses.
 - Significantly less (1)
 - o Less (2)
 - The Same (3)
 - o More (4)
 - Significantly more (5)
- Q46. In the face-to-face environment, I feel these activities increase my students' understanding of the course material. (Check all that apply.)
 - Discussion boards (1)
 - o In-class sessions (2)
 - Additional Reading (3)
 - o Homework (4)
 - o Videos (5)
 - o Instructor lectures (6)
 - o Instructor chat (7)
 - o Other students (8)
 - Problem Scaffolding & Hints (9)
 - o Textbook (10)
 - o Instructor Posted Notes (11)
 - o Surveys (12)
- Q47 In the face-to-face environment, I feel these activities decrease the students' understanding of the course material. (Check all that apply.)
 - o Discussion boards (1)
 - In-class sessions (2)
 - Additional Reading (3)
 - o Homework (4)
 - o Videos (5)
 - o Instructor lectures (6)
 - o Instructor chat (7)
 - Other students (8)
 - o Problem Scaffolding & Hints (9)
 - o Textbook (10)
 - o Instructor Posted Notes (11)
 - o Surveys (12)
- Q48 Would you prefer to teach the class in an online environment?
 - Yes (1)
 - o Undecided (2)
 - o No (3)
- Q49. If not, why not?

Q50. I am _____ with the face-to-face environment for learning.

- Not very happy (1)
- Not happy (2)
- o Okay (3)
- o Happy (4)
- Very happy (5)

Q51. Given this institution, do you think online courses are appropriate?

- o Yes (1)
- o Undecided (2)
- o No (3)

E=MC²: How to Transform Social Media into "Social"? Establishing an <u>Expressive Individuality in Social Media Advertising with Collaborative</u> <u>Communities in the Publishing Industry</u>

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ABSTRACT

Extant research has distinguished between two meanings of 'social business': business meant to solve a social problem; and an emerging 'concept' that utilizes social media for advertising. In this research paper, we focus on 'social business' as a social media advertising concept, highlighting the transformational power of social media (M) to establish an expressive individuality (E) through collaborative community (C²) principles. Expressive individuality or E represents a concept of sharing personal information to form a connection with consumers, while collaborative community or C² promotes a shared purpose and focus through knowledge sharing on social media or M to drive structural changes within organizations. The primary focus of this research is to examine how embodying these novel principles generates internal and external benefits for a company's brand. We also investigate the application of these E=MC² principles through comparing how HarperCollins Publishers and Penguin Random House successfully use social media advertising. We address the following questions:

- How does expressive individuality (E) in social media (M) along with collaborative community (C²) principles affect social media advertising?
- How do companies use social media to better reach their customer-base and to rebrand themselves?
- What actions can an organization implement to encourage an employee's E and to stimulate a firm's C² in social media?
- How can E=MC² help organizations prepare for future social media opportunities and challenges?

Key Words: *expressive individuality, social media, collaborative communities, social media advertising, social business*

¹ Both authors contributed equally to the paper.

Social media has dramatically transformed the marketing landscape where a business's survival not only depends on using social media, but using it effectively to form brand stories. With the emergence and prevalence of social media, a social business is defined as a business that utilizes social media for marketing and advertising (Yunus, 2007; Weinberg et al., 2013). This concept differs from the pre-established notion that a social business is a business created to solve a social problem (Kim, 2009; Weinberg et al., 2013). The amount of users on social networks (e.g. Facebook and Twitter), are equivalent to entire virtual nations reaching upwards to over millions of users from different countries across the world. Due to this, businesses have realized the value of successfully employing social media advertising strategies in order to remain competitive in today's market (Carlson, 2012; Bharati, Zhang & Chaudhury, 2014). Weinberg et al. (2013) referenced Gartner's (2013) survey pointing out that 90% of collaborative-technology initiatives fail due to improper use and a lack of purpose. Due to its ability to instantaneously reach a potentially large consumer base, social media advertising involves effectively selecting and implementing among the variety of social media technologies (Bharati, Zhang & Chaudhury, 2014). Weinberg et al. (2013) stressed the importance of businesses to attain a high degree of expressive individuality through social media because it is advantageous for businesses that operate in collaborative communities. Collaborative communities describe individuals that work together and share information in order to resolve any issues and/or achieve certain goals (Weinberg et al., 2013). In the context of social media advertising, employees form collaborative communities with consumers to co-create brand identity. In order to survive in the ages of the internet, businesses need to differentiate their brand identity from their competition. Organizations should integrate collaborative community

principles in social media both internally and externally. Fostering an organizational culture that promotes collaborative community principles in social media within their organization as well as through advertising to consumers online, ultimately allows organizations to develop expressive individuality in their brand stories.

This research paper explores the relationship between expressive individuality (E), social media technology (M), and collaborative community (C^2) in relation to brand stories. E represents organizations and consumers sharing information through social media, which builds their brand stories within online collaborative communities in the form of firm generated content (FGC) and user generated content (UGC), respectively (Gensler et al., 2013). Sharing of information creates more personal relationships between organizations and consumers, and sets the foundation for collaboration on brand stories (Weinberg et al., 2013). C² promotes a shared purpose and focus through knowledge sharing to drive structural changes within organizations and to rebrand their products and services in response to consumer's UGC (Weinberg et al., 2013). Social media technologies include social networks (e.g. Facebook and Twitter); microblogging (e.g. Tumblr); photo sharing (e.g. Instagram and Snapchat); and video sharing (e.g. YouTube) (Bharati, Zhang & Chaudhury, 2014). There is a dearth of research of expressive individuality and collaborative communities examined through the lens of social media and social media advertising. In order to fill this gap, this research paper addresses the following questions:

- How does expressive individuality (E) in social media (M) along with collaborative community (C²) principles affect social media advertising?
- How do companies use social media to better reach their customer-base and how do they rebrand themselves with social media?

- What actions can an organization implement to encourage an employee's E and to stimulate a firm's C² in social media?
- How can E=MC² help organizations prepare for future social media opportunities and challenges?

This paper consists of four sections. First, we present a literature review in the area of E, M, and C². Next, we provide a theoretical framework $E=MC^2$ in relation to organizational structure and organization-consumer relationships. Then, we investigate the application of these $E=MC^2$ principles through two case studies of businesses (HarperCollins Publishers and Penguin Random House) that successfully use M advertising. Finally, we discuss the limitations, future challenges, and opportunities for further research.

THEORETICAL BACKGROUND

Conceptual Framework

Gensler et al. (2013) created a theoretical framework that organized the relationships between firm-generated and user-generated stories through social media to develop brand stories and ultimately form a brand's identity (Figure 1). As seen in Figure 1, select user-generated brand stories are absorbed into the overall collection of firm-generated brand stories and impact the brand identity (Gensler et al., 2013). This model is important because the framework represents the fluid communication between consumers and organizations through social media channels. It shows a directly proportional relationship between businesses to consumer (B2C). FGC influences consumer's thoughts, feelings, and perceptions about a brand. In turn, consumers reflect upon they perceive this FGC and produce their opinions into UGC. Thus, FGC and UGC create a cyclical relationship with each component generating content that

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impacts the other. This relationship is important in social media advertising when developing brand stories.

Since Collective Communities (C²), Expressive Individuality (E), and Social Media (M) are all concepts that have been researched separately, we propose a conceptual framework that intertwines these three subjects in relation to brand stories from UGC and FGC as seen in Figure 2. C² relates to the individual expressions of consumers in social media networks, and in turn, the user-generated content (UCG). E relates to an organization's response to consumers' brand stories through firm-generated content (FCG). While the framework mimics the open channels of communication found in Figure 1 to create a fluid back and forth model, we have created a more cyclical relationship that emphasizes the importance of each concept. C² in M acts the medium and storyboard to create UGC and FGC that contributes to the overall brand story of an organization and establishes its E.



Figure 1. Brand Story Theoretical Framework adapted from Gensler et al. (2013).



Figure 2. E=MC² Model for generating brand stories through social media.

Social media technology

Implementing social media within organizations requires little financial investment because "social media runs on publicly available platforms" (Bharati, Zhang & Chaudhury, 2014, p. 259). Social media is a financially beneficial tool that creates awareness, collaboration, and communication. Social media creates increased participation from consumers and connects individuals with organizations (Hennig-Thurau, Hofacker & Bloching, 2013). When organizations use social media to promote either a product or their business, their efforts do not automatically produce positive outcomes. Most oftentimes, organizations perceive that if either consumers or internal users (e.g., employees) are provided access to social media technologies, collaborative communities will be instantaneous (Bradley & McDonald, 2011). There is a misconception that no real effort is required. However, maintaining a social media presence that fosters collaborative community principles requires hard work and continual effort. A false impression of personal connection can be interpreted by consumers when companies do not maintain their social media technologies as responsive to consumer demands.

Proposition 1: Social Media is a useful tool for organizations when used properly and efficiently. It builds a gateway for employees and consumers to easily collaborate and leads to the co-creation of brand stories.

Expressive Individuality

The concept of expressive individuality represents a higher level of collaborative communities in social media. Weinberg et al. (2013) suggested that social media allows for "a high degree of individuality and expression of individuality" in collaborative communities. They coined the term "expressive individuality," which can be beneficial to both firms and individuals (Weinberg et al., 2013, p. 303). Additionally, expressive individuality creates internal and external opportunities for organizations. Within an organization, sharing personal information breaks down the hierarchical structure into a more horizontal network. This encourages employee relationships to strengthen and more collaboration on teams and projects. Externally, employees that are free to connect with consumers through social media build the flow of communication, indirectly building a company's brand (Weinberg et al., 2013)

Proposition 2: Expressive Individuality helps break down barriers between employees within organizations, which encourages collaboration and can lead to better teamwork.

User Generated Content (UGC) and Firm Generated Content (FGC)

As the name suggests, user generated content comes from the "everyday" person who volunteers information. In regards to the social media world, user generated content includes restaurant ratings, videos, and wikis (Krumm, Davies, & Narayanaswami, 2008, p. 10). Kumar et. al. (2016) describes firm generated content as the marketing communication that an

organization releases to the public. This content is often released through an organization's external social media technologies. An example of FGC is an organization's brand story, which will be discussed in more detail later.

Proposition 3: In today's market, organizations need be aware (and react properly) to UGC. Knowing what their consumers are saying, brand managers can properly release their FGC to a more receptive audience.

Brand Stories

Aaker and Joachimsthaler (2000) described "brand stories" as the characteristics that are attributed to consumers about a product or service through communication of marketing activities. Brand stories become a collage that gives a brand its identity. Reviews from consumers have a large influence on brand image (Labrecque et al, 2013). Hennig-Thurau, Hofacker & Bloching (2013) developed a pinball metaphor where companies have lost the majority of their control in marketing activities because much of their reputation is influenced by opinions and reviews of consumers, which in turns influences other consumers. In response to this new phenomenon, companies are now reactive to these consumers in forming their marketing strategies. Organizations have no longer work in isolation as control to "write" their brand stories has shifted to include consumer participation. They must now co-create their brand stories with their consumers (Gensler et al., 2013). Gensler et al. (2013) created a theoretical framework which details the interconnectedness of consumer's role in developing brand stories that ultimately form an organization's brand (Figure 1). Allen, Fournier, and Miller (2008) argued that consumers are no longer "passive absorbers" of marketing, but instead activer stakeholders in co-creating brand meanings with companies (p. 782).

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Proposition 4: Social media makes it easier for consumers to affect the brand story of organizations. Organizations need to optimize social media technologies in order to manage their "Brand Story".

Collaborative Community

While the concept of community (e.g. McMillan and Chavis, 1986; Sarason, 1974; Tönnies, 1887; Wellman, 1979) has been thoroughly researched, no general consensus has been reached on an agreed definition (Weinberg et al., 2013). Tönnies (1887) was the first to make an important distinction between two different types of community: *Gemeinschaft* and *Gesellschaft* (Weinberg et al., 2013). *Gemeinschaft* focuses on "small, intimate and more exclusive communities," whereas *Gesellschaft* refers to "larger, more rational and individualistic collectives" (Weinberg et al., 2013). Collaborative communities are ideal in order to achieve high levels of collectivism or *Gemeinschaft* and individualism or *Gesellschaft* (Weinberg et al., 2013). The four main principles of a collaborative community are a shared purpose, a contribution focus, processes for management and coordination, and a infrastructure for collaborative teamwork (Adler, Heckscher, and Prusak, 2011). The four key principles of collaborative communities can successfully leverage social media technologies.

Proposition 5: Organizations need to be aware of the aspects collaborative community and how it relates to their consumers.

CASE STUDIES

HarperCollins Publishers

HarperCollins Publishers is the 2nd largest publisher of consumer books in the world with headquarters in New York City and operations in 18 different countries. Throughout their history, HarperCollins Publishers has accumulated 120 branded imprints and publishes about 10,000 books each year in 17 different languages (HarperCollins Publishers, 2017). HarperCollins Publishers utilizes multiple social media platforms to communicate with their authors, readers and employees. These platforms include: Facebook (Live Video), Twitter, YouTube, Tumblr, Pinterest, Instagram, and SnapChat.

Celebrating their 200th year anniversary, HarperCollins Publishers launched a social media and giving campaign called "WhyIRead". This campaign encouraged employees, authors, and readers to join an online conversation and share their own passion for reading, using #WhyIRead and #hc200. HarperCollins Publishers also pledged to donate \$200,000 to a collection of literacy-related charities selected by its employees in this campaign. In the context of this research paper, this social media campaign started as FGC that exploits UGC for co-creating the company's brand story. The public was asked to share their individual stories of their reason for reading through Facebook, Twitter, and Youtube. Sharing their stories generated personal connections between employees of the organization to authors and readers, and established a sense of a community for a good cause.

Penguin Random House

Penguin Random House is an American publishing company formed from the 2013 merger of Random House and Penguin Group. Penguin Random House owns almost 250 independent imprints and publishing houses, which publishes more than 15,000 new titles annually (Penguin Random House, 2017).

Similar to HarperCollins Publishers, Penguin Random House utilizes multiple social media platforms to communicate with their consumers and employees. Some of the social media platforms include Facebook, Twitter, Google+, Tumblr, Pinterest, Instagram, Snapchat, Litsy, Vine and Storify. According to Farrington (2015), all book and author related content for the

company Penguin Random House will be posted under one of their brands, Penguin, which is the company's largest brand.

Penguin Random House's social media campaign, #GiveaBook, emphasizes collaborative community principles in practice. For every use of the hashtag #GiveaBook on Facebook and Twitter, the publisher pledged to donate a book to the Save the Children organization (up to 25,000 books). This campaign was developed from the brainstorming sessions by their sales representatives. The campaign issued a #GiveaBook video challenge to encourage consumer participation among both readers and booksellers.

In comparison to the #WhyIRead campaign from HarperCollins, the #GiveaBook campaign also initiated a connection with the consumers through social media. Penguin Random House created a campaign that formed a collective community between their readers and booksellers. Participants were encouraged to collaborate towards a shared cause that donates to the Save the Children organization.

Comparison of the two publishers

Since HarperCollins Publishers and Penguin Random House are in the same industry, they market similar types of products to the same group of consumers. They have similar marketing strategies and ways to utilize social media. Both publishers use social media to create social media movements that connect their consumers in order to share their love of reading. They also connect their consumers to ultimately donate to a worthy cause.

Although HarperCollins Publishers and Penguin Random House are both book publishers that launched similar social media and giving campaigns, there are key differences. HarperCollins Publishers rebranded their logo to celebrate their 200th year anniversary. On the other hand, Penguin Random House created an entirely unique mascot to give voice to their campaign. Inspired by their original penguin logo, they stayed within the animal kingdom and creatively personified a whale named Givingston. HarperCollins Publishers also included participation from their employees in their social media campaign. However, Penguin Random House focused more on including their readers and booksellers in their campaign.

HarperCollins Publishers uses basic social media platforms including Facebook, Twitter, YouTube, and Instagram. In additional to these social media platforms, Penguin Random House experiments with newer social media sites, including Litsy, Vine and Storify. This observation demonstrates that Penguin Random House is more adventurous to reach a larger consumer base through new social media outlets. HarperCollins Publishers does have an advantage with its Twitter account through one of its imprints of Harper Perennial. Harper Perennial's Twitter account has been very successful due to having a real person writing on its Twitter feed. In this way, an employee is able to represent the company and also personally connect to readers through sharing personal information of their thoughts and feelings on books coming to market. We did not find this as the case for social media accounts managed by Penguin Random House.

DISCUSSIONS AND IMPLICATIONS

Managerial Implications

In today's market, organizations need to properly understand the concepts and effects of $E=MC^2$. M is an effective tool for advertising when used properly and efficiently. M can help organizations implement C², which can create more open communication channels both internally and externally. This concept helps organizations to become more customer centric and to establish brand identity. Organizations also have to understand E because it is the product of collaboration between the firm-generated and user-generated content in social media. Working

through these concepts is a continual and evolving process. What may work in today's market may not work in the future.

There are many lessons that brand managers can take away from this research paper. In general, the more brand managers and organizations understand $E=MC^2$, the more they will be able to utilize social media and be prepared for future social media platforms that will be released. Brands can be personalized through powerful imagery and original images on the social media accounts that they manage. Brand managers can also use their imagery to rebrand the company if and when needed. Being able to rebrand themselves is a powerful tool for an organization.

Organizations also need to use visual tactics appropriate to the specific social media platform they are using. This means that Youtube is for posting videos and Twitter is for short and "to-the-point" messages. Organizations should also limit #hashtag usage for emphasis of important messages. HarperCollins Publishers and Penguin Random House limit their #hashtag usage to emphasize their prominent social media campaigns. Overuse of #hashtags can dull the brand story. #hashtags can also empower the community to tell the brand story through their perspective on multiple social media platforms. The case studies on HarperCollins Publishers and Penguin Random House showed that these publishers used social media to empower the community to tell their individual brand story. These social campaigns not only utilized the E=MC² principles and empowered their consumers to join, but were also used as a social media advertising tool to reach consumers through multiple social networks.

Limitations and Further Research

Our E=MC² model is limited to a number of factors. Some of these factors include that organizations vary depending on many aspects including, leadership, culture, resources,

capabilities, and market competition and what works for one company may not necessarily work for another in the same industry. Applications of this concept need to be determined according to each individual company. There are many factors that need to be taking into consideration with our concepts, such as control, openness, engagement, co-creation, and return on social media investment. Many companies are afraid to incorporate social media technologies because they dissolve corporate hierarchies and turn the relationships from business to business (B2B) and business to consumer (B2C) to people to people (P2P). When employees are allowed to directly connect to consumers, a richer relationship is developed between a company and its consumer. However, many companies are uncomfortable to lose more control of their brand story and to allow their employees more autonomy in their interactions to consumers.

There are topics within this research paper that can be researched further. The first topic that can be researched is exploring the impact of expressive individuality within organizations. This relates to how corporate policy needs to change for implementing $E=MC^2$. This research paper looked how expressive individuality impacted the publishing industry. Future research can investigate how it impacts brand stories in other industries.

CONCLUSION

This research paper looked into the concepts the built the E=MC² model and how it relates to managers and organizations. In today's economy, consumers have more control over the market. Social media enabled them to be more vocal with their participation. Instead of viewing consumer's involvement as adversarial to a brand's story, brand managers have the opportunity to co-create with consumer they market their products and services to. Social media provides an excellent channel to communicate and to receive feedback when cultivating a brand story. Upper management should promote a culture that encourages employees and consumers to interact and co-create brand stories. This leads to the high level of collaborative community and ability to attain expressive individuality. Social Media (M), Expressive Individuality (E), and Collaborative Communities (C²) are tools that can help organizations maintain a competitive advantage in an ever-changing marketplace.

REFERENCES

Aaker, D., & Joachimsthaler, E. (2000). Brand Leadership. New York, NY: Free Press.

- Adler, P., Heckscher, C., & Prusak, L. (2011). Building a Collaborative Enterprise. Harvard Business Review, July-Aug, 84-91.
- Allen, C., Fournier, S., & Miller, F. (2008). Brands and their Meaning Makers. In Curtis Haugtvedt, C., Herr, P., Kardes, F. (Ed.), *Handbook of Consumer Psychology*. (pp. 781– 822). New York, NY: Taylor & Francis.
- Bharati, P., Zhang, C., & Chaudhury, A. (2014). Social media assimilation in firms: Investigating the roles of absorptive capacity and institutional pressures. *Information Systems Frontiers*, 16(2), 257-272.
- Bradley, A. J., & McDonald, M. P. (2011). *The Social Organization: How to Use Social Media to Tap the Collective Genius of Your Customers and Employees*. Harvard Business Press.
- Carlson, N. (2012). Facebook now has 901 Million Monthly Users, with 526 Million coming back Every Day. *San Francisco Times*, April 24.
- Farrington, J. (2015, February 04). Penguin is PRH's 'biggest social media brand'. Retrieved November 7, 2017, from https://www.thebookseller.com/news/penguin-prhs-biggestsocial-media-brand

- Gartner (2013). Gartner Says the Vast Majority of Social Collaboration Initiatives Fail Due to Lack of Purpose, last accessed on October 22, 2017, https://www.gartner.com/newsroom/id/2402115.
- Gensler, S., Völckner, F., Liu-Thompkins, Y., & Wiertz, C. (2013). Managing brands in the social media environment. *Journal of Interactive Marketing*, 27(4), 242-256.
- HarperCollins Publishers. (2017). Company Profile. Retrieved November 11, 2017, from http://corporate.harpercollins.com/about-us/company-profile
- Hennig-Thurau, T., Hofacker, C. F., & Bloching, B. (2013). Marketing the pinball way: understanding how social media change the generation of value for consumers and companies. *Journal of Interactive Marketing*, 27(4), 237-241.
- Kim, P. (2009). Being Peter Kim; Social Business and Beyond "It's Time to Transform", accessed on October 22, 2017, available at http://www.beingpeterkim.com/2009/01/social-business.html.
- Krumm, J., Davies, N., & Narayanaswami, C. (2008). User-generated content. *IEEE Pervasive Computing*, 7(4), 10-11.
- Kumar, A., Bezawada, R., Rishika, R., Janakiraman, R., & Kannan, P. K. (2016). From social to sale: The effects of firm-generated content in social media on customer behavior.American Marketing Association.
- Labrecque, L., Esche, J., Mathwick, C., Novak, P., & Hofacker, C. (2013). Consumer Power: Evolution in the Digital Age. *Journal of Interactive Marketing*, 27 (4), 257–69.

McMillan, D., & Chavis, D. (1986). Sense of Community: A Definition and Theory. *Journal of Community Psychology*, 14 (1), 6-23.

Penguin Random House. (2017, November 02). Retrieved November 11, 2017, from https://en.wikipedia.org/wiki/Penguin_Random_House

Sarason, S. (1974). The Psychological Sense of Community: Prospects for a Community Psychology. San Francisco, CA: Jossey-Bass.

Tönnies, F. (1887). Community and Society. The Urban Sociology Reader, 13-22.

- Wang, M., Yang, T., & Hu, S. (2017). An exploration of Company's internal social media on social constructs and organizational values. *International Journal of e-Education, e-Business, e-Management and e-Learning*, 7(3), 212.
- Weinberg, B. D., de Ruyter, K., Dellarocas, C., Buck, M., & Keeling, D. I. (2013). Destination social business: Exploring an organization's journey with social media, collaborative community and expressive individuality. *Journal of interactive marketing*, 27(4), 299-310.
- Wellman, B. (1979). The Community Question: The Intimate Networks of East Yorkers. The American Journal of Sociology. 84(5). 1201-1231.
- Yunnus, M. (2007). Creating a world without poverty:Social Business and the Future of Capitalism. *Public Affairs*.
INFLUENCE OF DEMOGRAPHIC FACTORS ON ENTREPRENEUR SUCCESS IN KENYA

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ABSTRACT

Entrepreneurship has been linked to life-changing and breathtaking innovative businesses models that have shaped the new frontier of creative ventures and business opportunities to humankind. Entrepreneurs are catalysts for change under very unfamiliar circumstances. Entrepreneurs' creativity, risk-taking initiatives, competitiveness, and goal-oriented behaviour give them a unique role in a resource-based economy. Entrepreneurship acts as a bridge between society and the profit-oriented institutions established to take advantage of its economic endowments and to satisfy its economic desires. Many entrepreneurs have used their creativity to start and grow multi-million dollar business empires. The authors wanted to examine and establish the relationship between demographic factors such as age, education, and business experience and entrepreneurship success in Kenya. The study used both structured questionnaire for entrepreneurs and Interview for SME managers/Owners. A sample of 760 entrepreneurs was analysed using SPSS Statistical package on their age, education, and business experience. The findings indicate a significant positive relationship between age and education level of entrepreneurs and entrepreneur success while prior entrepreneurial experience contributed little to the success. These findings highlight the need to incorporate entrepreneurship skills at all levels of educational system as a matter of theory, policy, and practice contribution.

Keywords: Age, education, experience, entrepreneur success.

1.0 INTRODUCTION

1.1 Background to the Study

Entrepreneurship is globally recognised, but there is no consensus on a single precise definition. Valerio, Parton and Robb (2014); Klapper, Amit, Guillen and Quesada (2009) describe how, from a practitioner's standpoint, entrepreneurship is generally understood as a process of nurturing enterprises, to create new wealth, but for the purpose of measuring entrepreneurship, the definition narrows to the initiation of economic activities in the form of legal (formal) enterprises. Additionally, entrepreneurship is defined as a mechanism of achieving stable income flows and increased profits for vulnerable populations (Karlan & Valdivia, 2011).

Research in entrepreneurship has over the years generated interest is findings out what motivates individuals to become entrepreneurs. For example, why do people take financial risks, leave the safe environment of a job to pursue an uncertain future, and make the personal sacrifices required to start and grow a business? Previous studies have shown which factors contribute to the success of the entrepreneurs. McClelland (1987) identified some of the attributes of a successful entrepreneur. These are risk taking, opportunity and skills. Since these studies were conducted in different countries, it is impossible to extrapolate such studies to identify what account for success or failure of entrepreneurs to a universal set of factors. Kuratko, Hornsby and Nafziger (1997) noted that to understand the entrepreneurial process, one needs to identify the motivation behind entrepreneurs' decisions. Several factors, both internal and external, have been found to motivate entrepreneurs (Kuratko, Hornsby, & Nafziger, 1997; Robichaud, McGraw, & Roger, 2001). Some desire independence/autonomy, family security, self-fulfillment, and growth, financial gain, as well as opportunity recognition, are some of the factors that have been found to motivate individuals to engage in small businesses (Chu, Benzing & McGee, 2007).

Kenya, unlike most developing countries, has in official development policies recognised informal enterprises as more than a residual employer for the survival of poor households (Afande, 2015). Since independence, the Government has recognised the potential of the SMEs sector in employment creation and poverty reduction in its numerous policy documents. The importance of the SMEs in Kenya was first recognised in the International Labour Organization report (ILO) in 1972 *on 'Employment, Income and Equity in Kenya' (ILO, 1972)*. In the report not only was the phrase "informal sector" coined, but this concept played a key role in the whole analysis of the employment situation.

1.2 Statement of the Problem

Absent in the available literature is some clear indication(s) on which demographic factors enable and enhance entrepreneurial development in Kenya. This study was therefore designed to investigate and establish those factors which influence and enhance SME entrepreneurs' success in Kenya. While tests cannot predict success and should not be used to predict or define entrepreneurial ability, when one is starting and operating a micro or small business, he/she should recognise that starting a business includes a possibility of success as well as failure. One wonders whether the business owners consider the factors that influence the success of the business venture. It is necessary to find out the demographic factors that allow entrepreneurs to succeed with a view of cultivating the same across the country.

1.3 Research Objective

The research objective was to assess the influence of three demographic factors (age, education and business experience) on entrepreneur success in Kenya.

2.0 LITERATURE REVIEW

2.1 Theoretical Literature

2.1.1 Expectancy Theory

It is argued that the cognitive process of goal formation lead to success perceptions. This is at its core, an application of expectancy theory (Vroom, 1964). Expectancy Theory (ET) involves three relationships: valence, instrumentality and expectancy itself. Motivation or goal has valence commensurate with its importance, and instrumentality in comparison to other outcomes. Where valence and instrumentality are high, and the owner perceives that requisite effort will lead to the desired outcome then expectancy of achieving the outcome is high. When expectancy is high, and the goal is achieved, perceptions of success will likely be strong. Expectations can

vary from case to case in small business performance measurement, with both valence and instrumentality variable and personal in nature. For example, recent work on expectancy theory within entrepreneurship suggests that differences exist between the growth expectancies of men and women (Manolova, Brush, Edelman, & Shaver, 2012). Notwithstanding such variations, expectancy theory is of utility to predict the importance (salience) of a goal (and subsequent success perception) if the outcome will be both desirable and imaginable. However, once again the challenge of any performance measurement metric is the capacity to compare results, either temporally (same owner, two points in time) or between businesses for purposes of benchmarking.

Expectancy theory provides a framework for thinking about how people make choices based upon expectations. For example, it provides the basis under which entrepreneurs make choices on the marketing strategy they use to earn more returns. Focusing on expectations allows the theory to account for differences in choices between people despite the actual amount of effort necessary to achieve rewards and the actual value of rewards. The formula, expectancy times instrumentality times valence also agrees with basic intuition regarding motivation. If any of the three values that make up MF is zero, MF also equals zero. This makes intuitive sense: If someone believes his effort will have no chance of resulting in a certain reward, that a certain performance level will not lead to a reward or that a reward will have no value, he will have no motivation to work toward the reward.

For this study, expectancy theory provided the researcher with the thinking about how entrepreneurs make choices of the business they start based upon the customers' expectations. The theory provided the researcher with the basis under which entrepreneurs in developing countries like Kenya make choices on the marketing strategy, the source of their capital, and source of their information that they use to earn more returns from their SMEs. The theory further enabled the researcher to focus on expectations of SMEs entrepreneurs that allowed them to account for differences in their choices and customer's choice despite the actual amount of their efforts necessary to achieve rewards and the actual value of rewards.

The theory explains what keeps employees working in a certain organisation. Its underlying principle is that employees perform in work situations because they expect to receive a direct reward, a factor called expectancy. Their performance is tied to both the degree to which they

think they will be rewarded, which a factor is called instrumentality and the extent to which they want the reward, which is called valance. Understanding this theory is key in SMEs, many of which frequently run lean and, as such, could greatly benefit from having a well-motivated and highly productive workforce, good marketing strategies, good access to capital, good experience, availability of infrastructural services like good roads, access to information and having government support.

Expectancy Theory of Motivation highly contributes directly to the objective of this study. The theory implies that entrepreneurs will put more efforts towards the factors that contribute to their success because they expect to be rewarded with high profits in their business. This means that an entrepreneur will ensure that he/she has sufficient experience before starting a business, starts the business at an early age and the necessary education level. These demographic characteristics will also reward him/her with operating a successful SME since they have an influence on the success of business.

2.2 Empirical Review

2.2.1 Entrepreneurs' Level of Education and their business success

The relationship between education and entrepreurship is complex. On the one hand, education can help prospective entrepreneurs. A 2009 study by Erkan, Mehmet, Lenny, and Ekrem which looked at 20 years of American data, found significant returns to education – as measured by increased average income for every year of schooling completed – for entrepreneurs. Equally striking, these returns were higher for entrepreneurs than employees, even after taking into account any disparities between the two groups. Those working for themselves, according to Erkan, Mehmet, Lenny, and Ekrem (2009), have more flexibility in how they use their human capital, which leads to better returns. On the other hand, the same study found that more years of formal education in the United States made individuals less likely to want to become entrepreneurs. Worse still, the success of education systems worldwide in inculcating skills apparently has a negative relationship with how able graduates think they are to start a business.

Zhao (2012), compared national PISA math scores of economically developed countries with those nations' scores of perceived entrepreneurial ability, derived from Global Entrepreneurship Monitor survey data. The results suggest counter-intuitively that better skills correspond to less self-confidence over the ability to start a business. A better explanation is that the way skills are

taught undermines the attitudes needed to start a business. Zhao (2012) contends that "Traditional schooling aims to prepare employees rather than creative entrepreneurs. As a result, the more successful traditional schooling is (often measured by test scores in a few subjects), the more it stifles creativity and the entrepreneurial spirit" (p. 58).

2.2.2 Age of the entrepreneurs and their business success

A survey by the Simply Business Start-up Index found there has been a 29% rise in businesses started by 18-25 year-olds since the onset of the recession in 2008. This is backed up by figures released by the Office for National Statistics in the United Kingdom which show that the number of self-employed young people has grown by 71,000 since the start of the economic crisis. In addition, recent research by The Prince's Trust revealed that 43% of youth have already made money from entrepreneurial activity and one in four expect to start their own business within the next five years.

Meanwhile, many of the world's hugely successful entrepreneurs – particularly in the technology sector - were very young when they started their businesses. Facebook co-founder Mark Zuckerberg was 20 years old; Bill Gates, co-founder of Microsoft, was also 20; Steve Jobs, co-founder of Apple, was 21-years-old; and Sir Richard Branson was just 16 years old when he launched 'Student' magazine Mitchell (2013).

Grounded in theoretical reflections by McClelland (1961), the life span approach to entrepreneurship understands the enterprising actor as a developing person and highlights the importance of the early formative years (i.e. childhood and adolescence) in individuals' development towards entrepreneurial activity and success over the course of the career (Schmitt-Rodermund, 2007). Studying a person's formative years to predict his or her later work outcomes in the context of entrepreneurship is an understudied field of research, despite the fact that it may provide policy makers and educators with results relevant for the planning and implementation of entrepreneurship education programs (World Economic Forum, 2009). With regard to demographic factors, the common notion through various research findings (Brush and Brush, 2006) has been that female entrepreneurs start their business later in life than their male counterparts.

Reynolds et al. (2000) found that individuals in the age bracket between 25 to 44 years were the most entrepreneurially active. Findings from another study in India by Sinha (1996) revealed that

successful entrepreneurs were relatively younger in age. In their study on Internet café entrepreneurs in Indonesia, Kristiansen, Furuholt and Wahid (2003) found a significant correlation between age of the entrepreneur and business success. The older (>25 years old) entrepreneurs were more successful than the younger ones.

Donna et al. (2011) in the Global Entrepreneurship Monitor Report conducted a survey on Age Distribution of Early-Stage Entrepreneurs (TEA) at three economic development levels namely; Factor-Driven, Efficiency- Driven and Innovation-Driven Economies. The study revealed that early-stage entrepreneurs tend to be young to mid-career, from 25 to 44 years old. The two age categories which were represented in this range, the 25-34 year-olds and the 35-44 year-olds, were equally represented in the factor Factor-Driven economies and Innovation-Driven Economies. Additionally, the survey showed a tendency of young entrepreneurs (18-34 year-olds) being in the efficiency-driven economies. The Global Entrepreneurship Monitor (GEM) conducted its 13th annual survey of the rate and profile of entrepreneurial activity around the globe. GEM interviewed over 140,000 adults (18–64 years of age) in 54 economies, spanning diverse geographies and a range of development levels.

2.2.3 Experience of the Entrepreneurs and their Business Success

Kolvereid (1996) found that individuals with prior entrepreneurial experience had significantly higher entrepreneurial intentions than those without such experience. Conversely, Mazzarol et al. (1999) found that respondents with previous government employment experience were less likely to be successful founders of small business. Through experience, the skilful entrepreneurs have more opportunities to develop their human capital profiles compared to new entrepreneurs (Westhead et al., 2009). The previous experiences can have important role in recognition process of success opportunities. Experience-based knowledge can create a recognition path to improve creativity. Experience gives a framework for information processing to discernible models to allow the experienced entrepreneurs apply the benefits of identification of profitable opportunities. The most successful entrepreneurs are inclined to combine education and experience. The complexity of this relationship is less about new entrants as their experience is low. It seems that having business experience plays a pivotal role in future activities of entrepreneurship and performance of learners (Rosa & Peter, 2003).

Is an entrepreneur's performance helped or harmed when he or she exploits past experience? Most research on organisational experience is consistent with behavioural learning theory, which argues that organisations learn from experience (Greve, 2003). Yet, although experience may spill over from one activity to another (Nerkar & Roberts, 2004), the returns from exploiting experience may be more complicated and difficult to predict in other settings.

Ucbasaran, Wright and Westhead (2003) argued that an entrepreneur who starts a business can gain useful human capital, including knowledge of tactics, channels of distribution, and how to hire and fire people. Such entrepreneurs can then use this experience in their next venture (i.e., opportunity exploitation). By creating a venture, they gain customer capital, namely relationships with suppliers, customers, and regulators that they can use to identify new products, new markets, and funding sources. Although experience is multidimensional, the business press (Binsacca, 2000) and the scholarly literature (Alsos & Kolvereid, 1998) argued that entrepreneurs with previous entrepreneurial experience will do better than those without such experience.

Failure rates fall with the age of the firm because older firms have had time to form a more accurate view about their attributes, especially efficiency levels and cost structure (Ropega, 2011). Follower businesses (where the founder enters an existing business) have a better survival rate than newcomer businesses, largely because they are able to 'piggyback' on previously established connections to customers or from internal routines that have proved useful. Starting a business without experience in the industry sharply increases business mortality rates. Research also shows that younger firms tend to grow more rapidly, but that there are sector differences (Jasra et.al., 2011). The slowdown in growth in older SMEs may be due to a slackening in entrepreneurial motivation, mentioned above, once the business owner has achieved a satisfactory level of income, or it may have moved beyond its minimum efficiency level, or diseconomies may have emerged with the need to employ and manage others.

3.0 RESEARCH METHODOLOGY

The study applied a descriptive research design. The population for this study was SME entrepreneurs in Kenya. The researcher used both structured questionnaire that was designed for the entrepreneurs and interview schedules that were designed for SME managers/owners. The analysis of data was done using the Statistical Package for Social Sciences (SPSS version 23.0) computer software.

4.0 RESULTS AND DISCUSSION

The study sought to find out the demographic factors that determine the success of SME entrepreneurs in trade sub-sector.

4.1 Age of Entrepreneurs engaged in SMEs

4.1.1 Age of Entrepreneurs versus the number of employees in the business

The number of employees is an indicator of the success of a business. The more the number of employees in a business, the more the likelihood that the business is making good progress in its development, hence an indication that the business was successful to an extent.

A cross-tabulation between the age of SME entrepreneurs and the number of employees in their businesses indicated that there were a total of nine businesses with more than 20 employees out of which four of them were 41 - 60 years, three had 31 - 30 years and two were 21 - 30 years. Also, the majority of those entrepreneurs operating SMEs with 16 - 20 employees had the age group of between 41 - 50 years as shown in Table 4.32.

Table 1: Cross tabulation of age of entrepreneurs versus the number of employees in the business

	Number of employees in the business						Tota
	one/owne	2-5	6 - 10	Eleven - 15	sixteen -	Above	1
Age	r				20	20	
Below 20	9	6	1	2	0	0	18
years							
21- 30 years	70	84	22	45	8	3	232
31- 40 years	54	69	20	22	4	3	172
41- 50 years	46	98	33	21	13	2	213
51- 60 years	28	34	18	16	7	2	105
Above 60	2	6	3	1	2	0	14

years							
No response	2	3	1	0	0	0	6
Total	211	300	98	107	34	10	760

In order to establish whether the relationship between age of the entrepreneurs and number of employees in the business is positive, a Chi-square test was conducted to determine the statistical significance of the relationship and results are as presented in the Table 2.

Table 2: Chi-square test of the age of entrepreneurs and number of employees in the business

Chi-Square Tests						
	Value	df	Asymp. Sig.			
Pearson Chi-Square	35.641 ^a	30	.029			
Likelihood Ratio	36.074	30	.206			
Linear-by-Linear Association	.447	1	.804			
N of Valid Cases	760					

a. 21 cells (50.0%) have expected count less than 5. The minimum expected count is .07.

From Table 2, the significance value of the linear-by-linear association between age of entrepreneurs and the number of employees in the business is 0.804, implying that there was a strong relationship between age of entrepreneurs and number of employees in the business. The relationship was statistically significant as revealed by the Pearson Chi-Square Coefficient (alpha, p) value of 0.029 which less than 0.05. Since $p \le 0.05$, we reject the null hypothesis that there is a no positive relationship between age of entrepreneurs and number of employees in the business and accept the alternative hypothesis.

4.1.2 Age of Entrepreneurs versus number of years the business has been in operation

The number of years the business has been in operation indicated the success of the business. It was a general view that the more the number of years the business was in operation, the more the success of the business, hence entrepreneurs' success. In most cases, a business cannot operate for a long time if it is not successful or making profits. Most unsuccessful businesses operate for a short time and they close down if there are no good returns.

A cross-tabulation between the age of SME entrepreneurs in the study region and the number of years the business has been in operation revealed that most SMEs that have been in operation for 11 years and above were operated by entrepreneurs who were mostly between 31 - 60 years as compared to those who are 30 years and below. Worthy to note was that out of a total of thirteen (14) entrepreneurs who were above 60 years, six of them had been operating SMEs for more than 10 years. Very few entrepreneurs who were above 50 years had been in business for less than 5 years as shown in the Table 3.

	Number of ye	ears of expen	rience when	the busines	s was started	Total
Age	Below a year	1 - 5 years	6 - 10 years	11 - 15 years	Above 15 years	
Below 20 years	8	9	1	0	0	18
21- 30 years	34	131	54	10	3	232
31- 40 years	14	90	53	9	6	172
41- 50 years	19	90	74	28	2	213
51- 60 years	9	39	34	17	6	105
Above 60 years	2	5	1	2	4	14
No response	1	5	0	0	0	6

Table 3 Cross tabulation of the age of entrepreneurs versus number of years the business has been in operation

Total	87	360	217	66	21	760
Total	07	507	217	00	21	700

Further, a Chi-Square test was conducted to establish whether there is a relationship between age of the entrepreneurs and number of years he or she has been operating the business. The results are presented in Table 4.

Table 4: Chi-Square tests of age of entrepreneurs and number of years the business has been in operation

Chi-Square Tests						
	Value	Df	Asymp. Sig.			
Pearson Chi-Square	110.512 ^a	30	.031			
Likelihood Ratio	88.031	30	.106			
Linear-by-Linear Association	.917	1	.811			
N of Valid Cases	760					

a. 14 cells (40.0%) have expected count less than 5. The minimum expected count is .17.

From the results of Chi-Square tests in Table 4, the significance value of the linear-by-linear association between age of entrepreneurs and the number of years the business had been on the operation was 0.811. This implies that there is a positive strong relationship between age of entrepreneurs and number of years the business has been in operation even if the relationship is weak. The measured relationship was found to be statistically significant since the Pearson Chi-Square Coefficient (alpha, p) is 0.031 which is less than 0.05. With $p \le 0.05$, we reject the null hypothesis that there is no positive relationship between age of SME entrepreneurs and number of years the business has been in operation and therefore accept the alternative hypothesis that there is a positive relationship between age of SME entrepreneurs and the number of years the SMEs have been in operation.

4.1.3 Age of respondents versus average profit generated by the business per month

Profit generation is the main driver of any business. All business, whether small, medium or large, operate to generate profit. The more the profit generated in a business, the more the business is considered successful. This study looked at the influence of age of entrepreneur and his or her success on the basis of profit generated by the business per month.

A cross-tabulation in Table 5 shows that most entrepreneurs who generate high profits per month (Kshs. 301, 000 - 400, 000) are those aged between 41 and above compared to those who are below 40 years, while entrepreneurs who generate the least amount of profit per month

(Ksh. 100,000 and below) are mostly below 40 years compared to those who are 40 years. This indicates that there is a relationship between age of SME entrepreneurs and their success in business.

Table 5: Cross tabulation of age of respondent	s versus average profit	generated by the business
per month		

	Average profit generated by the business per month					
AgeofEntrepreneurs	0 - 100000	101000 – 200000	201000 - 300000	301000 - 400000	No response	
Below 20 years	4	7	6	0	1	18
21- 30 years	52	55	98	21	6	232
31- 40 years	53	57	47	9	6	172
41- 50 years	34	98	36	42	3	213
51- 60 years	20	24	41	17	3	105
Above 60 years	1	7	3	3	0	14
No response	2	3	1	0	0	6
Total	166	251	232	92	19	760

A Chi-Square test was conducted to establish whether the above relationship between age of entrepreneurs and the average amount of profit generated per month and Table 6 presents the results.

Table 6: A Chi-square test of age of respondents versus average profit generated by the business per month

Chi-Square Tests						
	Value	df	Asymp. Sig. (2-sided)			
Pearson Chi-Square	88.298 ^a	24	.003			
Likelihood Ratio	92.722	24	.000			
Linear-by-Linear Association	.335	1	.563			
N of Valid Cases	760					

a. 15 cells (42.9%) have expected count less than 5. The minimum expected count is .15.

The significance coefficient value of the linear-by-linear association between age of entrepreneurs and the average amount of profit generated by the business per month was 0.563. This implies that there is a moderate positive relationship between age of entrepreneurs and the average amount of profit generated by the business per month. The measure of the relationship was statistically significant since the Pearson Chi-Square Coefficient (alpha, p) is 0.003, which is less than 0.05. Following these findings, it is appropriate to reject the null hypothesis that there is no positive relationship between age of SME entrepreneurs and the average amount of profit generated by the business per month hence accept the alternative hypothesis that there is a positive relationship between age of entrepreneurs and the number of years the business has been in operation.

4.2 Education level of SME Entrepreneurs

This study investigated the influence of education level on entrepreneurs' success. Findings from interviews with SMEs entrepreneurs revealed that education has influence on the success of the entrepreneurs as discussed hereafter.

4. 2.1 Education level of SME Entrepreneurs versus number of employees in the business

The number of employees in a business indicates whether the business is successful or not. The more the number of employees in a business, the higher the business is deemed to be successful. Findings in Table 7 indicate that most SMEs with a higher number of employees have achieved high levels of education. For instance, a total of 10 SME entrepreneurs had more than twenty employees. Out of the 10, four of them have attained education up to certificate level, four of them have diploma, and one has a post-graduate degree, while one is educated up to secondary school level. Cumulatively, nine of the entrepreneurs with more than twenty employees obtained education beyond secondary level. Also, Table 4.38 shows that very few entrepreneurs with only secondary level education had more than fifteen employees.

Table 7: Cross-tabulation of education level of SM	E Entrepreneurs versus nu	umber of employees
in the business		

	Number of employees in the business						
Education Level	one/owner	2-5	6 - 10	11 - 15	16 - 20	Above 20	Total
Primary	10	17	4	7	0	0	38
Secondary	87	94	20	35	3	1	240
Certificate	46	85	25	19	15	4	194
Diploma	39	57	16	15	3	4	134
Graduate	23	37	26	21	9	0	116
Post graduate	6	10	7	10	4	1	38

Findings in Table 7 show that there a relationship between the education level of entrepreneurs and their success in business. A Chi-square test of the variables to measure the significance of the relation was conducted and the results are presented in Table 8.

Table 8: Chi-Square test of education level of SME Entrepreneurs versus number of employees in the business

Chi-Square Tests							
	Value	Df	Asymp. Sig. (2-sided)				
Pearson Chi-Square	66.332 ^a	25	.047				
Likelihood Ratio	68.803	25	.113				
Linear-by-Linear Association	1.344	1	.801				
N of Valid Cases	760						
a_{10} calls (27.8%) have expected	count loss the	n 5 The m	inimum expected count				

a. 10 cells (27.8%) have expected count less than 5. The minimum expected count is .50.

From the Chi-square tests in Table 8, the significance coefficient value of the linear-by-linear association is 0.801. This implies that there is a strong positive relationship between the education level of SME entrepreneurs and the number of employees in their businesses. The measure of the relationship between the two variables was statistically significant since the Pearson Chi-Square Coefficient (alpha, p) was 0.047 which is less than 0.05. We can, therefore, reject the null hypothesis which states that there is no positive relationship between education of SME entrepreneurs and the number of employees in his other business and accept the alternative hypothesis that there is a positive relationship between the education level of entrepreneurs and the number of employees in an operational business.

4.2.2 Education level of the Entrepreneurs versus number of years of operation of a business

Logically, the more the number of years a business has been in operation, the higher the chances that business is successful. The study sought to establish whether there is a relationship between education levels of SME entrepreneurs and their success in business. Findings in Table 9 indicate that most of the entrepreneurs whose businesses had been in operation for more than fifteen years had obtained higher education, which includes certificate, diploma, graduate and post-graduate levels as compared to those who had only primary and secondary education. For example, Table 4.40 shows that out of 67 entrepreneurs whose businesses had been in operation of higher education for more than fifteen years, a cumulative of 52 had academic qualifications of higher education compared to fifteen who had academic qualifications of up to primary and secondary school levels only. This shows that education plays a vital role in business success.

	Years of operation of the business						
Education Level	Below a year	1 - 5 years	6- 10 years	11 - 15 years	Above 15 years	No response	Total
Primary	0	14	11	11	1	1	38
Secondary	13	118	48	35	14	12	240
Certificate	8	60	60	26	24	16	194
Diploma	6	44	44	21	12	7	134
Graduate	3	35	27	28	10	13	116
Post graduate	5	11	11	2	6	3	38
Total	35	282	201	123	67	52	760

Table 9: A cross tabulation of education level of the Entrepreneurs versus number of years of operation of the business

A Chi-square test that was conducted to measure the significance of the relationship between the education level of the entrepreneurs and the number of years their businesses had been in operation. The results are presented in Table 10.

Table 10: A Chi-Square test of education level of the entrepreneurs versus number of years of operation of the business

Chi-Square Tests								
	Value	Df	Asymp. Sig. (2-sided)					
Pearson Chi-Square	59.424 ^a	25	.000					
Likelihood Ratio	58.785	25	.000					
Linear-by-Linear Association	3.801	1	.601					
N of Valid Cases	760							
a. 6 cells (16.7%) have expected count less than 5. The minimum expected count is								
1.75.								

The value of the linear-by-linear association between the education level of the entrepreneurs and the numbers of years their businesses had been in operation is 0.601, indicating that the relationship between the two variables is moderate. However, the relationship is statistically significant at 100% confidence level with Pearson Chi-square coefficient, alpha (p) being 0.000. We, therefore, reject the null hypothesis, and accept the alternative hypothesis that there is a positive relationship between the education level of SME entrepreneurs and their success in business.

4.2.3 Education level of the Entrepreneurs versus the average amount of profit per month

As discussed earlier, all businesses struggle to make profits for their sustainability. Any business that is not making profits is not operational. However, the amount of profit that a business makes

differs from one business to another depending on various factors, including the size of business, nature of business, among other factors. This study took the average amount of profit that SMEs make per month as a measure of the success of SMEs. The higher the profit the more successful the SME is deemed to be.

The researcher sought to establish the relationship between the education level of SME entrepreneurs and the average amount of profit they make per month.

A cross-tabulation between the level of education and the amount of profit that the SMEs make per month is shown in Table 11.

Table 11: A cross tabulation of education level of the Entrepreneurs versus the average amount of profit per month

Education	Average	profit gener	ated by the b	ousiness per	month	
Level	0 – 100000	101000 – 200000	201000 - 300000	301000 - 400000	No response	Total
Primary	10	10	12	5	1	38
Secondary	72	70	82	12	4	240
Certificate	55	65	49	23	2	194
Diploma	23	50	42	14	5	134
Graduate	6	43	34	28	5	116
Post graduate	0	13	13	10	2	38
Total	166	251	232	92	19	760

Table 11 indicates that most of the SME entrepreneurs who make the highest amount of profit (Kshs. 301,000 - 400,000) a month are those who have obtained academic qualifications up to higher education level compared to those who stopped at primary or secondary school level. Out of a total of 92 respondents who were interviewed, and revealed that they make a profit of between Ksh. 300, 000 and 400, 000 a month, 75 of them had obtained higher education

(certificate, diploma, graduate and post-graduate), 12 had obtained secondary school education, while five had only primary school education. This indicates that the higher the academic qualifications of an entrepreneur, the higher the chances that his or her business would be successful, hence higher profits per month. This is evident by the fact that most of the entrepreneurs who were interviewed and revealed that they make the lowest profit (Ksh. 0 - 100, 000) per month had low academic qualification with none of the entrepreneurs with post-graduate qualification revealing that he or she was making that little profit per month as shown in Table 11.

Chi-Square tests to measure the strength of the relationship between the education level of entrepreneurs and the amount of profit they make per month are presented in Table 12.

Table 12: A Chi-Square test of education level of the Entrepreneurs versus the average amountof profit per month

Chi-Square Tests							
	Value	df	Asymp. Sig. (2-sided)				
Pearson Chi-Square	78.257 ^a	20	.000				
Likelihood Ratio	90.319	20	.188				
Linear-by-Linear Association	1.563	1	.863				
N of Valid Cases	760						
a. 7 cells (23.3%) have expected count less than 5. The minimum expected count is							
.95.							

The significance value of linear - by - linear relationship in Table 12 is 0.863, implying that there is a strong positive relationship between the education level of the entrepreneur and the amount of profit the SMEs generate per month. This may be attributed to the market strategies that the entrepreneurs use and location of the business. The measure of the relationship between the two variables was statistically significant at 100% confidence level since Pearson Chi-Square

Coefficient (p) is 0.000. Therefore, we reject the null hypothesis that there is no positive relationship between the education level of SME entrepreneurs and the average amount of profit they make per month and accept the alternative hypothesis.

4. 3 Experience of the SME Entrepreneurs

Investigating the experience of the entrepreneurs in a specific area of business before starting the business was one of the objectives of the study. The main purpose of focussing on the experience that the entrepreneur had before starting a business was to determine whether such experience had influence on the success of the entrepreneur especially those who are operating SMEs.

4.3.1 Number of years of experience during start of SME versus number of employees in the business currently

The number of employees in a business indicates whether the business is successful or not. More employees mean the business is successful, while few employees mean the business has not grown hence not much successful. A cross-tabulation between the number of years of experience before the start of a business and the number of employees in the business is presented in Table 13.

Number of years of	Numbe	Number of employees in the business					
experience when the business was started	One / owner	2-5	6 – 10	11 – 15	16 - 20	Abov e 20	
Below a year	53	22	5	2	4	1	87
One - 5 years	119	160	26	50	11	3	369
6 - 10 years	29	94	44	37	10	3	217
Eleven - 15 years	6	18	19	14	8	1	66
Above 15 years	4	6	4	4	1	2	21

Table 13: Cross tabulation of number of years of experience during start of SME versus number of employees in the business currently

Total	211	300	98	107	34	10	760

From Table 13, it is clear that the number of years of experience that the entrepreneurs had before the start of business does not really influence or determine the number of employees that the entrepreneur currently has in his or her business. Most of the entrepreneurs who had more than fifteen employees in their businesses had between 1 - 5 years of experience before they started their businesses. Cumulatively, those entrepreneurs who had more than 10 years of experience before they started their business had few employees in their businesses compared to those who had less than 10 years of experience before they started their businesses. This is an indication that experience of entrepreneurs before the start of a business has little influence on the number of employees entrepreneurs work within the subsequent years. A Chi-Square test is presented in Table 14

Table 14: A Chi-Square test of the number of years of experience during start of SME versus number of employees in the business currently

Chi-Square Tests								
	Value	df	Asymp. Sig. (2-sided)					
Pearson Chi-Square	142.677ª	20	.000					
Likelihood Ratio	135.116	20	.000					
Linear-by-Linear Association	68.257	1	.000					
N of Valid Cases	760							

a. 10 cells (33.3%) have expected count less than 5. The minimum expected count is .28.

Table 14 shows the significant value of linear - by - linear association between the number of years of experience the entrepreneurs had before the start of business and the number of employees currently in his/her business is 0.000, an indication that there was no association between the two variables hence they are independent of each other. However, the measure of the relationship was statistically significant at 100% confidence level since Pearson Chi-Square

coefficient is 0.000. We, therefore, accept the null hypothesis that there is no positive relationship between the number of years of experience the entrepreneur had before the start of business and the number of employees he or she has in his or/her business.

4.3.2 Number of years of experience during start of SME versus number of number of years the business has been in operation

Table 15 shows a cross-tabulation between the number of years of experience that the entrepreneurs had before the start of a business and the number of years the business had been in operation.

Table 15: A cross tabulation of the number of years of experience during start of SME versus number of number of years the business has been in operation

Number of years of	Years o	Years of operation of the business					Tota
experience when the	Below	1 - 5	6- 10	11 - 15	Abov	No	1
business was started	a year	years	years	years	e 15	response	
Below a year	13	37	19	5	10	3	87
One - 5 years	17	202	65	40	20	25	369
6 - 10 years	3	35	112	39	14	14	217
Eleven - 15 years	2	5	4	38	9	8	66
Above 15 years	0	3	1	1	14	2	21
Total	35	282	201	123	67	52	760

From Table 15, the number of years of experience entrepreneurs had before the start of a business has little influence on the number of years the business had been in operation. Cumulatively the number of entrepreneurs who had less than 10 years of experience before the start of a business and their businesses had been in operation for more than 10 years is higher compared to those who had more than 10 years of experience before the start of businesses and their businesses had been in operation for more the start of businesses and their businesses had been in operation for more the start of businesses and their businesses had been in operation for more the start of businesses and their businesses had been in operation for more than 10 years. This is an indication that the

number of years of experience before the start of business does not really determine the number of years that an SME business will be in operation.

Table 16: A Chi-Square test of the number of years of experience during start of SME versus number of number of years the business has been in operation

Chi-Square Tests								
	Value	df	Asymp. Sig. (2-sided)					
Pearson Chi-Square	357.022ª	20	.000					
Likelihood Ratio	289.028	20	.000					
Linear-by-Linear Association	4.955	1	.026					
N of Valid Cases	760							
a. 7 cells (23.3%) have expected count less than 5. The minimum expected count is .97.								

A Chi-Square test in the Table 16 proves that there is no association between the number of years of experience before the start of business and the number of years the business had been in operation since the significant value of linear - by - linear association between the two is 0.026. However, the measure of the relationship between the two was statistically significant at 100% confidence level since Pearson Chi-Square coefficient (p) is 0.000. We, therefore, accept the null hypothesis that there is no positive relationship between the number of years of experience the entrepreneur had before the start of business and the number of employees he or she has in his or her business.

4.3.3 Number of years of experience during start of SME versus average amount of profit that the business generates per month

Table 17 shows a cross-tabulation between the number of years of experience entrepreneurs had before the start of business and the average amount of profit that the business makes per month.

Table 17: A cross-tabulation of the number of years of experience during start of SME versus average amount of profit that the business generates per month

Number of years of experience when the	Average month	Average profit generated by the business per month						
business was started	0 – 100000	101000 - 200000	201000 - 300000	301000 - 400000	No response	10000		
Below a year	20	30	27	7	3	87		
One - 5 years	99	123	114	27	6	369		
6 - 10 years	36	73	69	34	5	217		
Eleven - 15 years	9	17	17	20	3	66		
Above 15 years	2	8	5	4	2	21		
Total	166	251	232	92	19	760		

Results of cross – tabulation in Table 17 shows that cumulatively the number of entrepreneurs who had more than 10 years of experience before the start of business and their businesses make on average more than Ksh. 200,000 per month is higher compared to those who had less than 10 years of experience before the start of businesses and their businesses on average make more than Ksh. 200,000 per month. This is an indication that the number of years of experience before the start of business determines the average amount of money that the business makes per month. Also, worthy to note is that very few entrepreneurs who had more than 10 years of experience before the start of business make little profit of less than Ksh. 200, 000 compared to those who had less than 10 years of experience before the start of business make little profit of business.

Chi-Square test carried out to measure the importance of the relationship between the number of years of experience before the start of business and the average amount of profit that the businesses made per month.

Chi-Square Tests							
	Value	df	Asymp. Sig. (2-sided)				
Pearson Chi-Square	48.802 ^a	16	.000				
Likelihood Ratio	43.403	16	.000				
Linear-by-Linear Association	3.316	1	.690				
N of Valid Cases	760						
a. 5 cells (20.0%) have expected count less than 5. The minimum expected count is							
.53.							

Table 18: A Chi-Square test of the number of years of experience during start of SME versus average amount of profit that the business generates per month

Results in Table 18 shows that there is a moderate association between the number of years of entrepreneurs' experience before the start of business and the average amount of profit that the entrepreneur makes per month since the significant value of linear – by – linear association between the two is 0.69. The measure of the relationship between the two was statistically significant at 100% confidence level since Pearson Chi-Square coefficient is 0.000. We, therefore, reject the null hypothesis that there is no positive relationship between the number of years of experience the entrepreneur had before the start of business and the number of employees he/she has in his/her business currently and accept the alternative.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

The study revealed that there was significant positive relationship between age and level of education of the entrepreneurs and their success in SMEs businesses. However, background experience was found to have little influence on growth and success of SMEs.

5.2 Recommendations

Due to a strong and significant positive relationship between the education level of entrepreneurs and their success, the study recommends the revision of the educational curriculum in developing countries like Kenya to incorporate entrepreneurship skills at all levels of education i.e. right from primary to higher education. This will ensure that pupils and students acquire academic qualifications that include entrepreneurship skills which would help them establish small businesses for self-employment. This would help alleviate unemployment in developing countries.

REFERENCES

Afande, O. F. (2015). Factors influencing growth of small and microenterprises in Nairobi central business district. *Journal of Poverty, Investment and Development*, 9 (1), 104-139.

Alsos, G. A., & L. Kolvereid. (1998). The business gestation process of novice, serial, and parallel business founders. Entrepreneurship Theory and Practice, 101–114.

Brush, C. G., & Brush, C. G. (2006). Growth-oriented Women Entrepreneurs and Their Businesses: A Global Research Perspective. Edward Elgar Publishing.

Chu, H., Benzing, C., & McGee, C. (2007). Ghanaian and Kenyan entrepreneurs:

A comparative analysis of their motivations, success characteristics and problems. *Journal of Developmental Entrepreneurship*, *12*(3), 295-322.

Donna, J. K., Slavica, M., Singer & Michael, D. H. (2011). *The global entrepreneurship monitor: 2011 global report*. NewYork: Sage.

Erkan, B., Mehmet, D., Lenny, K., & Ekrem, H. (2009). A causal analysis of the Impact of information systems and supply chain management practices on operational performance: Evidence from manufacturing SMEs in Turkey. *International Journal of Production Economics*, *12*, 133–149.

ILO, (1978). Employment, Income and Equity in Kenya: a strategy for increasing productive employment in Kenya.

Rerieved from http://staging.ilo.org/public/libdoc/ilo/1972/72B09_608_engl.pdf Jasra, J. M., Khan, M. A., Hunjra, A. I., Rehman, R. & Azam, R. (2011). Determinants of business success of small and medium enterprises. *International Journal of Business and Social Science*, 2(20), 274-280. Karlan, D., & Valdivia, M. (2011). Teaching entrepreneurship: Impact of

Business on microfinance client and institutions. *Review of Economics and Statistics*, 93(2), 510-527.

Klapper, L., Amit, R., Guillen, F., & Quesada, J. M. (2009). *EntrepreneurshipAnd firm formation across countries in international differences in entrepreneurship*. Dallas:University of Chicago Press.

Kolvereid, L. (1996). Organizational employment versus self-employment: reasons for career choice intentions. Entrepreneurship: Theory and Practice.

Kuratko, D. F., Hornsby, J. S., & Naffziger, D. W. (1997). An examination of Owners' goals in sustaining entrepreneurship. *Journal of Small Business Management*, 35(1), 24-33.

Kristiansen, S. (2004). Social networks and business success: The role of subcultures in an African context. *The American Journal of Economics and Sociology*, 63, 1149-1171.

Manolova, T. S., Brush, C. G., Edelman, L. F., & Shaver, K. G. (2012). One size does not fit all: Entrepreneurial expectancies and growth intentions of US women and men nascent entrepreneurs. *Entrepreneurship & Regional Development,* 24(1-2), 7.

Mazzarol, T., T. Volery, N. Doss, & V. Thein. (1999). Factors influencing small business

start-ups. Internal Journal of Entrepreneurial Behaviour and Research, 5(2), 48-63.

McClelland, D. C. (1961). The Achieving Society. N. J.: Van Nostrand.

McClelland, D. (1987). Characteristics of successful entrepreneurs.

Journal of Creative Behavior, 21(3), 219-233.

Nerkar, A., & Roberts, P. W. (2004). Technological and product-market experience and the success of new product introductions in the pharmaceutical industry.

Strategic Management Journal, 25(8–9), 779–799. https://doi.org/10.1002/smj.417

Reynolds, P. D. (2000). 'National panel study of US business start-ups, Background and

Methodology'. Advances in Entrepreneurship, Firm Emergence and Growth, 4.

Robichaud, Y., & Roger, A. (2001). Toward the development of a

measuring instrument for entrepreneurial motivation.

Journal of Developmental Entrepreneurship, 6(1), 189-202.

Ropega, J. (2011). The reasons and symptoms of failure in SME. International

Advanced Economic Research, 17, 476-483.

Rosa, M., & Peters, B. (2003). Hardly likely to make the Japanese tremble. *International Small Business Journal*, *21*(4), 435–459.

Sinha, T. N. (1996). Human Factors in Entrepreneurship Effectiveness. The Journal of

Entrepreneurship, 5(1), 23–39. https://doi.org/10.1177/097135579600500102

Ucbasaran, D., Wright, M., & Westhead, P. (2003). A longitudinal study of habitual

entrepreneurs: Starters and acquirers. *Entrepreneurship & Regional Development, 15*(3), 207-228.

Valerio, A., Parton, B., & Robb, A. (2014). Entrepreneurship education and training program around world. New York: *Sage Journals*.

Vroom, V. (1964). Work and motivation. New York: Wiley.

Westhead, P., Ucbasaran, D., & Wright, M. (2009). Information

search and opportunity identification: The importance of prior business ownership experience. *International Small Business Journal*, 27(6), 659–680.

World Economic Forum. (2009). The Global Gender Gap Report 2009.

Zhao, Y. (2012). Linking innovation and creativity. Retrieved from

http://www.studentachievement.org/wp-content/uploads/Innovation-and- creativity.pdf

INFLUENCE OF ENVIRONMENTAL FACTORS ON SUCCESS OF ENTREPRENEURS IN THE TRADE SUB-SECTOR IN KENYA

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ABSTRACT

Entrepreneurship is heralded as the most powerful economic engine known to humankind. The entrepreneurship revolution that keeps permeating all sectors of national economies has generated interest and curiosity for research to understand and establish various factors that contribute to entrepreneurial success. The Small to Medium Size Enterprises have been at the center of much of the academic and practitioner debates and research to fully understand the extent to which local and national environmental factors influence trade sub-sectors in Kenya. The milliards of SMEs in the country are yearning for prospective strategic entrepreneurial direction that would re-energize and advance their entrepreneurship talent and vision. This research therefore, focused on the environmental factors that influence entrepreneurial success in the trade sub-sector in Kenya. The study used a structured questionnaire collect 760 responses for entrepreneurs and interviews for SME managers/owners. Data was analysed using SPSS statistical software. The results from the data analysis indicated that there is a significant relationship between environmental factors and entrepreneur success. The results also indicated that there was a weak relationship between government support initiatives and entrepreneur success. The key findings and recommends adequate government support to SMEs, improved technology, and free business information access by entrepreneurs, and development of quality physical infrastructure.

Keywords: *Marketing, capital access, government support, access to information, physical infrastructure, entrepreneur success.*

1.0 INTRODUCTION

1.1 Background to the Study

The role played by SMEs in any society is undoubtedly important. In Kenya, many unemployed youths and women have resolved to join SMEs for gainful income and sustainability., Nowadays, small and micro firms, have to lead us to look at entrepreneurship as full-time career that needs to be natured and as a development agent in the society. The importance of Small and Medium Enterprises (SMEs) in both national and international contexts undoubtedly is of high relevance. These firms are important not only for the concerns on its representation for economic analyses but also for the countries' economies and the implications for the society. These firms have an important role in many aspects, such as taxes, and innovations.

According to ILO (1972), SMEs have unique features that influence the way they respond to their business environment. They are generally found in small, underdeveloped niches of the market. They are not able to compete with large organisations in mass markets. Their markets normally have low entry costs and low exit costs as well. SMEs rely heavily on domestic resources which also influence their location. The majority of SMEs are family owned, and in most cases, are one person owned. The problem with the one-person owner is that it is difficult for the owner/manager to know everything and be able to carry out the jobs which in large organisations are done by different people handling specific functions (Torrence 1987).

To increase growth and reduce poverty, the World Bank Group and other international aid agencies provide targeted assistance to small and medium-size enterprises (SMEs) in developing economies. For example, the World Bank Group approved more than \$10 billion in SME support programs from 1998 to 2002 (World Bank, 2002). The World Bank also provides direct and indirect support to SMEs. Regarding World Bank activities, 80 percent of its programs are related to direct financial assistance to SMEs, while 20 percent of the World Bank programs are related to indirect support such as technical assistance for SMEs and institutions that support SMEs development.

SMEs advocates argue that SMEs enhance competition and entrepreneurship and hence have external benefits on economy-wide efficiency, innovation, and aggregate productivity growth. From this perspective, direct government support of SMEs help countries exploit the social

benefits from greater competition and entrepreneurship. Secondly, proponents of SME support claims that SMEs are generally more productive than large firms but financial markets and other institutional failures impede SME development (World Bank, 2002). Thus, pending financial and institutional improvements, direct government funding to SMEs can boost economic growth and development. Finally, some argue that SME expansion boosts employment more than large firm growth because SMEs are more labour intensive (World Bank, 2002).

Foley and Green (1989) note that despite the large number of SMEs and their diverse range of activities, they all have one thing in common; they all strive to be successful. Success in business can be interpreted in many different ways. The most common adopted definition of success in financial growth is associated with a high level of profits. However, other definitions of success are equally applicable, and many businesses set themselves alternative goals. Some gain satisfaction and attain success by developing new products. Havard Business School (1998) notes that the leading indicators of business success cannot be found in financial data alone. Quality, customer satisfaction, innovation, market share metrics like these often reflect a business' economic condition and growth prospects better than it is reported earnings. This study, therefore, sought to establish whether entrepreneurs in Kenya considered customer satisfaction, innovation, and market share as growth and success of their SMEs as opposed to their returns.

1.2 Statement of the Problem

Absent in the available literature is some clear indication(s) on which environmental and demographic factors enable and enhance entrepreneurial development in Kenya. This study is therefore designed to investigate and establish those factors which influence and enhance SME entrepreneurs' success in Kenya. While tests cannot predict success and should not be used to predict or define entrepreneurial ability, when one is starting and operating a micro or small business, he/she should recognise that starting a business includes a possibility of success as well as failure. One wonders whether the business owners consider the factors that influence the success of the business venture. With this in mind, there is need to carry out studies that would establish the conducive environmental factors that facilitate the entrepreneurship to start new ventures to facilitate the young idle people to be productively engaged. It is necessary to find out the environmental that allow entrepreneurs to succeed with a view of cultivating the same across the country.

1.3 Research Objective

The study sought to establish environmental characteristics prevalent among SME entrepreneurs in Kenya.

2.0 LITERATURE REVIEW

2.1 Theoretical Literature

2.1.1 Behavioural Theory of the Firm

The behavioural theory of the firm (Cyert & March, 1992) has been proposed as a theoretical lens to help understand business growth in small firms, in particular, to predict why success and growth reinforce each other (Zahra, Sapienza, & Davidsson, 2006). The behavioural theory of the firm (BTOF) stipulates that businesses consist of a coalition of many individuals that are likely to have many conflicting goals (Dew et al., 2008). Bounded rationality is a key element of the theory which implies that businesses aim at satisfying set targets instead of optimising the best imaginable solution for the firm (Pitelis, 2007).

The theory argues that ultimately, the organisational goals that are set are achieved through a bargaining process where coalition members agree on mutual targets and objectives (Cyert & March, 1992). While the goals of individuals within a coalition may be disparate, so long as the resources available are greater than the demands of the members, the coalition, and thus the organisation will be feasible. At any given time, organisations will have various goals about each of the diverse decision variables facing them. These goals must address a variety of subjects including sales, market share, profit, inventory, and production levels.

2.2 Empirical Review

2.2.1 Marketing and the Success of Entrepreneurs

Aremu and Adefemi (2011) in their research entitled Marketing Mix Practice as a Determinant of Entrepreneurial Business Performance found that a significant relationship exists between an enterprise's marketing and entrepreneurial orientations are both widely being responsible for corporate success. In addition, marketing affects the success of entrepreneurial ventures, while entrepreneurial approaches influence the success of marketing efforts. It would, therefore, seem vital for marketers to understand entrepreneurship. Views of marketing as a dynamic, socially embedded process can be linked with complexity theory.

Marketing and entrepreneurship have been recognised as two key responsibilities of a firm (Drucker, 2014; Mohr & Sarin, 2009). Despite the central and complementary roles of marketing and entrepreneurship responsibilities, research has largely examined marketing activities and the entrepreneurship processes separately. Marketing scholars have extensively examined research questions related to identification and understanding of the customer and translating customer needs into new products (Webb et al., 2011). In contrast, entrepreneurship scholars have instead examined factors, such as an entrepreneur's traits and behaviours that influence how entrepreneurs recognise opportunities, innovate, and then exploit opportunities (Baron 2008). "Management competencies" and "networks" are the new concepts of entrepreneurial marketing (Carson et al., 1995).

2.2.2 Access to the Capital and the Success of Entrepreneurs

Some governments have focused their efforts toward attracting new venture capital. The underlying assumption is that more venture capital allows an increase in successful entrepreneurial activity. The empirical evidence, however, is once again mixed. Cumming & Macintosh (2007), for example, found that the Australian Innovation Investment Fund governmental program, first introduced in 1997, has facilitated investment in start-up, early-stage, and high-tech firms, as well as cost-effective monitoring. Kreft and Sobel (2005), on the other hand, suggested that the causal relationship between entrepreneurship and venture capital is reversed—in other words, that entrepreneurial activity attracts new venture funding while the reverse is not true. Additionally, venture capital has been shown to account for only a very small amount of overall financing to entrepreneurship and to be of significance only for a relatively small group of high-potential ventures in a limited number of countries (Bygrave & Quill, 2006). With varied views on the relationship between the success of SMEs and access to capital, the study sought to investigate whether access to capital has influence on the success of entrepreneurs operating SMEs in Kenya.

2.2.3 Government Support for Entrepreneurship Development

The relationship between entrepreneurship and economic growth has seen increased interest at the local, state, and national levels and recent studies have shown that the contribution of the entrepreneurship sector to employment and GDP is increasing (Kumar & Liu, 2005). A significant amount of work has also established that entrepreneurial activity has important social

implications (Chell, 2007). As a result, policy discussions have centred on the idea that governments seeking to stimulate their economies should reduce constraints on entrepreneurship (Minniti, 2008).

Many attempts have been made at implementing policies that enhance financing offerings to entrepreneurs (Harrison, Mason, & Girling, 2004). Specifically, governments have promoted the reduction of financial constraints faced by entrepreneurial ventures by adding instruments like mutual credit guarantee and microfinance schemes to traditional bank loans. Mutual credit guarantees have the advantage of reducing information asymmetries, thereby reducing transaction costs. Microfinance schemes, instead, have the advantage of circumventing the financial risk of the borrowers by selecting collateral requirements that are satisfied by nonmonetary accountability based on reputation or small-group enforcement mechanisms. The empirical evidence on the effectiveness of financing support, however, is mixed. While microfinance schemes are usually assessed positively, other forms of financing have been criticised.

Governments have taken an interest in alleviating constraints and promoting entrepreneurship. According to Valerio (2014), governments can employ a number of policy tools to address the limitations to Micro and small enterprise development. Policymakers can support entrepreneurship endeavours with policies or programs aimed at modifying regulation, easing business environment constraints, expanding access to credit, promoting value chain integration, strengthening capacity to improve business practices, and establishing to support innovation and business start-ups (McKenzie & Woodruff, 2012). In the Kenyan scenario, the government enacted the Micro and Small Enterprise Act No. 55 of 2012. The Act established the Micro and Small Enterprises Authority (MSEA), a state corporation domiciled in the Ministry of Industrialization and Enterprise Development. The MSEA Strategic Plan 2013–2017 focuses on promoting the development of competitive and sustainable micro and small enterprises.

2.2.4 Access to Information and growth of SMEs

The performance of SMEs has been of interest to many researchers, international organisations, and policy makers, at least, since the Bolton Report (1971), and therefore has become the subject of a great deal of analysis. This performance may have two strategic outcomes that are often referred to in the literature as firm success or failure (Ostgaard & Birley, 1995).

In a management field, success and failure can be interpreted as measures of good or indifferent management, but it may occur for other reasons such as luck (Storey, 2011). Numerous terms have been used in the literature to describe the firm failure, for example: bankruptcy, insolvency, liquidation, death, deregistering, discontinuance, ceasing to trade, closure, and exit. These terms overlap each other to some extent, and thus, the concept of failure is ambiguous, as it can have different interpretations by different people (Wickham, 2001). The many different interpretations and definitions of both success and failure make it very hard to compare research findings on the performance of small firms.

In the entrepreneurship literature, the concept of success remains a topic of debate (Gorgieveski et al., 2011). This is despite the evidence that the 'success' of small firms has been subject to a great deal of research. However, there is no general agreement in the literature on what is meant by the success of a firm. Indeed, a myriad of perspectives, ranging from mere survival to the achievement of certain levels of performance, exist about such a concept in the entrepreneurship literature. Besides the multi-dimensional aspect of success, variables that contribute to the success of SMEs are not unanimously agreed upon by researchers. While some analysts suggested that the dynamics of the success of businesses remain a black box (Ligthelm, 2010), others argued that the success of enterprises is a function of both external and internal factors (Markman & Baron, 2003).

The literature on the performance of SMEs usually identifies several causal factors with regard to the internal and external environment of the firm. In terms of internal factors, several researchers have attempted to investigate the characteristics of SMEs and characteristics of the entrepreneur as the internal factors that influence SMEs performance. For the firm characteristics, several studies have revealed that size, age, and location of the firm could be related to business performance. On the other hand, other researchers have shown great interest in understanding the relationship between characteristics of the entrepreneur and business performance (Khan et al., 2011). The general environment consists of the political-legal, macroeconomic, socio-cultural, technological, demographic and global factors that might affect the organisation's activities. On the other hand, the competitive environment consists of other specific organisations that are likely to influence the profitability of the enterprise, such as customers, suppliers and competitors (Olawale & Garwe, 2010: Jasra et al., 2011).
2.2.5 Infrastructures and the Success of the Entrepreneurs

There is growing interest in Small and Micro Enterprises in developing countries as a contributor to economic growth, employment generation, livelihood diversification, and poverty reduction. Access to infrastructure is identified in some studies as a factor that affects non-farm rural employment but less attention has been paid to the constraints imposed by poor quality infrastructure (Gibson & Olivia, 2010). Considerations should be made on both the *accessibility* and the *quality* of rural infrastructure. This distinction makes sense from both policy and econometric perspectives. In terms of policy, there may be trade-offs between building new infrastructure to improving accessibility and upgrading the quality of existing infrastructure. However, spending to maintain or improve the quality of existing public infrastructure has often been neglected.

According to Agenor (2009) "inadequate funding for infrastructure maintenance has been a chronic problem in many countries in the developing world, resulting in rapid decay of public capital, such as roads and power grids" (p. 27). Accounting for differences in infrastructure quality also makes sense from an econometric point of view because the estimated effect of infrastructure access on rural non-farm enterprises may be biased if relevant quality attributes are ignored. Heterogeneous infrastructure quality implies that simply measuring quantities, such as spending on roads or the length of roads, may not be sufficient. This study also sought to find out whether the quality of physical infrastructure in Kenya, from an econometric point of view, affected success of SMEs. Particular focus was given to heterogeneous infrastructure quality in different regions of Kenya and their effect on success of SMEs.

3.0 RESEARCH METHODOLOGY

The study applied a descriptive research design. The researcher used both structured questionnaire that was designed for the entrepreneurs and interview schedules that were designed for SME managers/owners. The analysis of data was done using the Statistical Package for Social Sciences (SPSS version 23.0) computer software.

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4.0 RESULTS AND DISCUSSION

4.1. Marketing and the success of entrepreneurs

The study sought to establish whether there was a significant positive relationship between marketing and the success of entrepreneurs. To measure this, respondents were first asked to give their views on five marketing items/indicators using a Likert scale of 1 - 5 (1= strongly disagree and 5=strongly agree). The responses were as shown in Table 1.

Markating activity	Ν	Mean	Std.	Sig.
Marketing activity			Deviation	(2-tailed)
Entrepreneurs have a big market for product	760	4.2081	7.22978	.000
Entrepreneurs consider business successful	760	4.4422	7.29212	.000
through marketing				
Entrepreneurs have successful marketing	760	4.631	10.51086	.000
experience				
Entrepreneurs are keen with emerging	760	4.7511	10.39783	.000
business trends in the market				
Entrepreneurs customers about the products	760	4.7421	13.58926	.000
in the market				

Table 1: Entrepreneurs' responses on marketing indicators

From the results above, some respondents agreed (means of 4.2081 and 4.4422) that they have a big market for their products and they consider their businesses successful. Other respondents strongly agreed (means of 4.631, 4.7511 and 4.7421) that they have successful marketing experience, hence they are keen on the emerging trends in the market and they do educate customers about their products in the market.

SME owners/managers were asked how they market their business through in-depth interviews. A total of 100 SME owners gave different responses on ways in which they market their businesses with some of them giving more than one method that they use. Table 2 shows the methods that SME owners of Kenya use to market their businesses and the corresponding percentages.

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Ways of marketing business	Responses		
ways of marketing business	Ν	Percentage	
Online (social media and internet)	35	26.3%	
Face - to – face	18	13.5%	
Through Friends/relatives	16	12.0%	
Use of fliers/posters/brochures	13	9.8%	
Good display of products	11	8.3%	
Advertisements	10	7.5%	
Putting businesses at strategic locations	8	6.0%	
Educating consumers about the goods and services	4	3.0%	
Use of business cards	4	3.0%	
Personal visits	3	2.3%	
Having good customers relations	3	2.3%	
Use of letters	2	1.5%	
Through customer referrals	2	1.5%	
Providing best services to people	2	1.5%	
Through Newspapers	1	.8%	
Engaging the local people	1	.8%	

Table 2: Ways entrepreneurs use in marketing SMEs

From Table 2, most (26.3%) of the SMEs are marketed online (through social media and the internet), followed by face-to-face marketing at 13.5%, through friends and relatives at 12.0% and other methods as shown in Table 2.

Findings also indicate that online marketing is the most successful way of marketing SMEs, followed by face-to-face marketing and the other ways are shown in Table 3.

Most successful form of monitoring	Respons	ses
Most successful form of marketing	Ν	Percentage
Online marketing	43	38.7%
Face - to – face	12	10.8%
Good display of products	9	8.1%
Advertisements	9	8.1%
Popularity	7	6.3%
Personal visits/Door to door visits	7	6.3%
Good location of businesses	6	5.4%
Use of posters/fliers/brochures	4	3.6%
Social media (TV, Radio, etc.)	3	2.7%
Good customer relations	3	2.7%
Giving quality services	3	2.7%
Friends support	3	2.7%
Giving credit to loyal customers	2	1.8%

Table 3: Most successful form of marketing SME businesses

In order establish whether there is a significant positive relationship between marketing and the success of entrepreneurs, a Spearman correlation analysis between the responses to the above marketing indicators and responses to the success indicators was conducted. The outcome was as shown in Table 4.

Correlations							
			Business su	ccess indicat	ors		
			I consider	Му	Му	I consider	
Monkoting	indicators	my	business	revenue	government		
wiai Keung	mulcators		business	has grown	has	support	
			successful	very much	grown	relevant	
					very fast		
Spearman' I have a big		Correlation	422**	205**	240**	0.69	
s rho	market for	Coefficient	.423	.393	.342	.008	
	product	Sig. (2-tailed)	.000	.000	.000	.076	
		N	760	760	760	674	
	I have	Correlation	265**	208**	283**	052	
	successful	Coefficient	.505	.500	.205	.032	
	marketing	Sig. (2-tailed)	.000	.000	.000	.178	
	experience	Ν	760	760	760	674	
	I am keen with	Correlation	230**	266**	220**	010	
	emerging	Coefficient	.230	.200	.230	.010	
	business trends	Sig. (2-tailed)	.000	.000	.000	.797	
	in the market	Ν	673	673	673	672	
	I educate	Correlation	738**	161**	111**	- 135**	
	customers about	Coefficient	.230	.101		.135	
	the products in	Sig. (2-tailed)	.000	.000	.004	.000	
	the market	Ν	760	760	760	674	

Table 4: Correlation between Marketing indicators and success indicators

*. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed).

From the Spearman correlation Table 4 above, there is a positive relationship between entrepreneurs' marketing strategies and their business success. The analysis shows that the correlation between marketing and business success is statistically significant since alpha (p) < 0.05. This implies that there is a positive correlation/relationship between Entrepreneurs' marketing skills and their business success at 95% confidence level. However, the Spearman's rho of correlation between entrepreneurs' efforts in educating customers about the products in the market as a marketing factor and considering the government support relevant as a business success factor is negative. This implies that there is a negative relationship between the two indicators.

Influence of marketing on success of SMEs per region

Influence of marketing on the success of SMEs was further established per region in Kenya. And the study findings were shown in Table 5.

PECION	Marketing influence success of SMEs							
KEGIUN	Disagree	Not sure	Agree	Total				
Nairobi	14	12	81	107				
Nyanza	34	10	59	103				
Central	30	18	49	97				
Coast	23	3	68	94				
Western	17	14	53	84				
Rift Valley	41	10	45	96				
Eastern	8	17	72	97				
North Eastern	12	9	61	82				
Total	179	93	488	760				

Table 5: Influence of marketing on success of SMEs per region

Study findings in Table 5 show that the influence of marketing on the success of SMEs is different across various regions in Kenya. For instance, the influence of marketing on the success of SMEs is more in Nairobi region, followed by Eastern, and then Coast. Out of a total of 488 entrepreneurs who agreed that marketing influenced the success of their SMEs, most (81) of them were from Nairobi region, 72 were from Eastern region, while 68 were from Coast region. On the other hand, out of a total of 179 entrepreneurs who disagreed that marketing has influence on the success of SMEs, most of them (41) were from Rift Valley region, followed by 34 from Nyanza region, and then 30 from Central Kenya region.

4.2 Capital Access

Capital is an essential input for any business start-up. The amount of capital required to start a business depends on the size and type of business.

Source of capital for start of business

The source of capital for business start-up varies from one business person to another. The study sought to establish the source of capital for SMEs in Kenya and how it influences the success of entrepreneurs. Findings in Table 6 show that most (46.1%) of the SME entrepreneurs in Kenya started businesses using capital from personal savings (46.1%), followed by loans from micro-finances (19.1%), then friends and relatives support (18.2%), loans from banks (14.8%0 and a few (1.8%) from *Chama's*.

Business capital source	Frequency	Percentage
Personal savings	328	46.1
Microfinance institutions	146	19.1
Friends & relatives	140	18.2
Loans from banks	117	14.8
Chama	29	1.8
Total	760	100.0

 Table 6: Sources of capital for the SMEs
 Image: SMEs

In-depth interviews with some of the SME owners revealed that most (41.0%) of business owners in Kenya fund their businesses to execute minimal cash flow through personal savings. Other SMEs got funding to execute on minimal cash flow through loans from banks/micro-finance institutions, family support, sustaining the on-going business, *Chamas* and through inheritance as shown in Table 7.

Ways in which entrepreneurs funded their Percentage (%) Frequency SMEs to execute on minimal cash flow Personal savings 41 41.0 Loans from Banks/Micro-finances 27 27.0 Family support 16 16.0 Sustaining the business that is on-going 5 5.0 Chamaa 4 4.0 Inheritance 3 3.0 4 4.0 No response

Table 7: Ways in which entrepreneurs funded their SMEs to execute on minimal cash flow

Other sources of start-up capital that the business owners used include loans from banks, *chamaas*, borrowing cash from friends, reduction of personal expenses/salary, inheritance and Financial SACCOs as shown in the Table 8.

Other sources of funding	Responses		
	Frequency	Percentage (%)	
Loans from banks/micro-finance	43	42.6%	
Chamaas	19	18.8%	
Personal savings/salary	13	12.9%	
Borrowing Cash from friends	12	11.9%	
Reduction of personal expenses to fund business	9	8.9%	
Inheritance	4	4.0%	
Financial SACCOS	1	1.0%	

Table 8: Other sources of funding for the SMEs

Traditionally, SMEs have difficulties in accessing finances for start-up, therefore many of them start with personal savings or finances borrowed from family and friends (Entrepreneurs' Toolkit, 2012). However, in-depth interviews with some of the SMEs owners in this study revealed that most (42.6%) of SME owners interviewed accessed loan funds from the bank or micro-finance institutions, followed by Chamaas (19%); personal savings (13%), and borrowed cash from friends (11.9%), which are inconsistent with the existing literature. This scenario could be attributed to the level of efficiency brought by the emergence of mobile payment platforms such as M-pesa, which has made borrowing process to be easier than before. *Challenges business owners encountered when raising capital*

During the start of businesses, entrepreneurs undergo a number of challenges. Some of the challenges they face are associated with raising capital for their businesses. During in-depth interviews with the business owners, they were asked to highlight some of the challenges they faced when raising capital to start their businesses. Their responses were as represented in Table 9.

Challenges entrepreneurs face when raising capital to start	Responses	
business	Ν	Percentage
Paying bills (rent, electricity and water bills)	26	24.5%
Inadequate capital	13	12.3%
Lack of collaterals	10	9.4%
Saving money was a problem due to high standards of living	9	8.5%
Finding guarantors for bank loans was difficult	8	7.5%
No challenge experienced	7	6.6%
Banks charge high-interest rates when giving out loans	7	6.6%
Competing with personal needs that interfere with capital of	5	4.7%
the business		
Lack of adequate information	4	3.8%
Lack of a security title	4	3.8%
Insecurity in the area of business	4	3.8%
Affording the "good will"	3	2.8%
Convincing family members that business is my choice was a	2	1.9%
challenge		
Lack of support from anybody	2	1.9%
High-interest rates when borrowing	1	.9%
Inadequate business skills and business background	1	.9%

Table 9: Challenges entrepreneurs face when raising capital to start business

From Table 9, most of the respondents (24.5%) indicated payment of bills as a challenge; other challenges were inadequate capital (12%); and lack of collaterals (9%), which are consistent with the existing literature. Lack of support from anybody (2%), high-interest rates when borrowing (0.9%), and inadequate business skills and business background (0.9%), were considered not significant challenges by the respondents.

Capital access and success of entrepreneurs

This study sought to measure whether there is a significant positive relationship between government support and success of the entrepreneurs. On a Likert scale of 1 - 5 (1=strongly disagree and 5=strongly agree), respondents were asked to rate four indicators that were used to

measure whether they have access to capital for their business. Their responses are as shown in 10.

Capital access indicator N		Mean	Std.	Sig	
		wiean	Deviation	Sig	
Entrepreneurs have access to finance i.e.	760	4 2010	0.81668	000	
loans for business support		4.2919 4.4933 3.9659	9.01000	.000	
Entrepreneurs have the ability to obtain	760	4 4022	0 (5770)	000	
capital for business support		4.4955	8.03770	.000	
Entrepreneurs have different sources for	760	2.0650	7 50740	000	
acquiring business capital	/00	3.9039	1.30/49	.000	
Entrepreneurs have network of guarantors	7(0)	2 7250	0 10010	000	
to help acquire business capital		5.7259	8.10212	.000	

Table 10: Entrepreneurs' responses on capital access indicators

From Table 11, it is clear that majority of the entrepreneurs appreciate that they have fair access to capital for their businesses because all of them agree (means of more than 3.5 but less than 4.5) to the four capital access indicators that the researcher used to measure their level of access to capital for their businesses. They agreed that they have access to finance i.e. loans for business support, ability to obtain capital for business support, different sources for acquiring business capital and a good network of guarantors to help acquire business capital. The standard deviations of the four indicators are more than 1.0 implying that the variables have no consensus hence they are evenly distributed.

In order to determine whether there is a positive relationship between the entrepreneur's access to capital and their business success, a correlation analysis was carried out between access to capital indicators and business success indicators and the results are presented in the Table 12.

Correlation								
			Business su	iccess indica	ators			
			I consider	I have	My	Му	Ι	Ι
			my	been in	busine	revenu	consid	consid
			business	the	ss has	e has	er	er
Carit			successful	business	grown	grown	govern	busine
Capit	al access ind	icators		for many	very	very	ment	SS
				years	much	fast	suppor	relocat
							t	ion
							releva	
							nt	
Spea	I have	Correlatio						
rma	access to	n	.169**	.214**	.343**	.381**	.294**	160**
n's	finance i.e	Coefficient						
rho	loans for	Sig. (2-	000	000	000	000	000	000
	business	tailed)	.000	.000	.000	.000	.000	.000
	support	N	760	760	760	760	674	760
	I have the	Correlatio						
	ability to	n	.228**	.243**	.290**	.267**	.008	005
	obtain	Coefficient						
	capital for	Sig. (2-	000	000	000	000	821	001
	business	tailed)	.000	.000	.000	.000	.031	.901
	support	Ν	760	760	760	760	672	760
	I have	Correlatio						
	different	n	.204**	.233**	.460**	.397**	.294**	155***
	sources for	Coefficient						
	acquiring	Sig. (2-	000	000	000	000	000	000
	business	tailed)	.000		.000	.000	.000	.000
	capital	Ν	760	760	760	760	674	760

Table 12: Correlation between capital access indicators and business success indicators

I have	Correlatio						
network of	n	.168**	.258**	.472**	.427**	.381**	138**
guarantors	Coefficient						
to help	Sig. (2-	000	000	000	000	000	000
acquire	tailed)	.000	.000	.000	.000	.000	.000
business	Ν	760	760	760	760	674	760
capital	Sig. (2-	627	452	153	800	347	
	tailed)	.027	.+32	.155	.079	.5+7	•
	Ν	760	760	760	760	674	760

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

From the correlation analysis in Table 12, there is a positive relationship between entrepreneurs' access to capital for their businesses and their business success. This was justified at 95% confidence level since the correlation significance, alpha (p) < 0.05. The Spearman's rho (correlation coefficient) between the entrepreneurs' ability to obtain capital and considering the government support relevant is 0.831. This showed a very strong relationship between the two variables because as a rule of the thumb, the correlation/relationship is considered perfect when the correlation coefficient is between 0.8-1.0. This may be explained by the government's effort in giving entrepreneurs loans and incentives at subsidized interests hence considering their support relevant.

Influence of capital access on success of SMEs per region

The study further sought to establish the influence of capital access of SMEs per region. Study findings were shown in Table 13.

REGION	Capital access influence success of SMEs						
	Disagree	Not sure	Agree	Total			
Nairobi	17	8	82	107			
Nyanza	44	3	56	103			
Central	52	4	41	97			
Coast	22	4	68	94			
Western	23	9	52	84			
Rift Valley	23	12	61	96			
Eastern	86	0	11	97			
North Eastern	26	2	54	82			
Total	293	42	425	760			

Table 13: Influence of capital access on success of SMEs per region

From the findings shown in Table 13, capital access has more influence on the success of SMEs in Nairobi, Coast, and Rift Valley regions. Out of 425 entrepreneurs who agreed that capital access influence success of SMEs, most of them (82) were from Nairobi, followed closely by 68 from Coast, and then 61 from Rift Valley region. On the other hand, out of a total of 293 entrepreneurs who disagreed that capital access had influence on SMEs success, most of them were from Eastern region at 86, followed by Central region at 52, and then Nyanza at 44.

4.3.3 Government Support

From the literature review, it was realized that for a long time now the development of the SMEs has been regarded as crucial for economic growth of many nations through creation of employment especially to middle and low-class citizens, hence the achievement of broader development objectives, including poverty alleviation, economic development and the promotion of more democratic and pluralist societies. For this reason, government support to SMEs is very important unless their importance in the economic development of a country has not been realised. The respondents gave their views on government support to the success of their business through agreeing or disagreeing to five government support indicators. The responses are as shown in Table 14.

Government support indicators		Mean	Std.	Sig
		Wican	Deviation	Sig.
Government support SMEs to grow	760	3.5630	12.24636	.000
Government has strong legislative systems to	760	2 1 1 1 1	10 00720	000
nurture SMEs		5.1111	10.00730	.000
Government promotes business growth for	760	0 A705	10 16116	000
SMEs	/00	2.4783	10.40410	.000
Government has put mechanisms to support	760	2 2795	0 99750	000
SMEs from external competition	/60	2.2785	9.88739	.000
Government has tax waivered some products	760	2.9422	10.38522	.000

Table 14: Entrepreneur's responses on government support indicators

Table 14 shows that there are divided views among entrepreneurs with regard to government support. On whether the government supports SMEs to grow, most of the respondents (entrepreneurs) agreed with a mean of 3.560. Entrepreneurs were not sure (mean = 3.111) whether the government has strong legislative systems to nurture SMEs. The findings further indicated that the SME entrepreneurs of Kenya disagree with the fact that the government promotes business growth for SMEs and that it has put mechanisms to support SMEs from external competition with means of 2.4785 and 2.2785 respectively. On whether the government has tax waivers on some products, the SMEs were not sure (mean = 2.9422). The study sought to understand whether there was any form of assistance that SMEs of Kenya have received from the government with regard to improving their businesses. The findings from the in-depth interviews with SMEs owners/managers indicated that majority (91.0%) of the SMEs had not received any government support with regard to promoting their businesses activities while only 7% of had received government support to improve their businesses as shown in Table 15.

 Table 15: Whether entrepreneurs receive any government support

Any government support to SMEs?	Frequency	Percentage (%)
Yes	7	7.0
No	91	91.0
No response	2	2.0
Total	100	100.0

Responses in Table 15 indicated that there was very minimal government support for SMEs yet they contribute a lot to the economic growth of the country. The study went further to find out whether there are government initiatives that entrepreneurs would like the government to provide to them or those that would make the businesses improve. The findings indicate that most (23.2%) of the SME entrepreneurs want the government to lower interest rates for loans so that they have easy access to capital to improve their business activities hence high returns. Other initiatives that SMEs wanted the government to provide are as shown in Table 16 in a descending order with reduction of tax on products, improved security through security initiatives and provision of soft loans/grants to SMEs coming out at the top.

Table 16: Government support	initiatives	that SMEs need
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Government Initiatives that SMEs want	Responses	
	N	Percentage
Lower interest rates for loans	26	23.2%
Reduce tax on goods & services	22	19.6%
Improved security through security initiatives	11	9.8%
Provide soft loans/grants to SMEs	10	8.9%
Provide funds needy people who have potential to carry out	7	6.3%
business		
No need of initiatives from the government	5	4.5%
Develop infrastructure like roads, electricity, water, sewerage, etc.	4	3.6%
Improve on already existing initiatives e.g. youth & women funds	3	2.7%
Tax relief on imports	3	2.7%
Have a strategy to reduce ineffective competition	3	2.7%
Ensure ease access to product imports	3	2.7%
Reduce fees and penalties	3	2.7%
Remove strict regulation that hinders success of SME businesses	3	2.7%
Stop corruption	2	1.8%
Have clean-up programs to clean towns	2	1.8%
Create conducive environment	2	1.8%
Build more markets/malls, etc.	1	.9%
Subsidise some products like medical products	1	.9%

Creating more jobs	1	.9%	

This study went further to establish whether there was a positive relationship between government support and business success by carrying out a correlation analysis between government support indicators and business success indicators. Results are as shown in Table 17.

Correlat	tion							
			Business	success in	dicators			
			Ι	I have	My	My	Ι	Ι
			conside	been in	busine	revenu	consid	consid
			r my	the	ss has	e has	er	er
Comme			busines	business	grown	grown	govern	relocat
Governi	nent support maio		S	for many	very	very	ment	ing my
			success	years	much	fast	suppor	busine
							t	SS
							relevan	
							t	
Spearm	Government	Correlatio						
an's	supports SMEs	n	075	151**	272**	2/1**	444**	221**
rho	to grow	Coefficien	.075	.131	.575	.341	.444	231
		t						
		Sig. (2-	053	000	000	000	000	000
		tailed)	.055	.000	.000	.000	.000	.000
		Ν	760	760	760	760	758	760
	Government	Correlatio						
	has strong	n	052	13/**	346**	309**	412**	- 227**
	legislative	Coefficien	.052	.134	.540	.507	.412	227
	systems to	t						
	nurture SMEs	Sig. (2-	181	000	000	000	000	000
		tailed)	.101	.000	.000	.000	.000	.000
		Ν	760	760	760	760	758	760
	Government	Correlatio						
	promotes	n	061	150**	356**	353**	475**	- 072
	business growth	Coefficien	.001	.150	.550			.072
	for SMEs	t						
		Sig. (2-	.113	.000	.000	.000	.000	.061

Table 17: Correlation between government support indicators and business success indicators

		tailed)						
		Ν	760	760	760	760	758	760
Gover	rnment has	Correlatio						
put m	echanisms	n	034	112**	211**	21/**	407**	087*
to sup	port SMEs	Coefficien	.034	.115	.311	.314	.407	087
from	external	t						
comp	etition	Sig. (2-	373	003	000	000	000	024
		tailed)	.575	.005	.000	.000	.000	.024
		Ν	760	760	760	760	758	760
Gover	rnment has	Correlatio						
tax w	aivered	n	182**	158**	181**	125**	084*	248**
some	products	Coefficien	.162	.130	.101	.123	.004	.240
		t						
		Sig. (2-	000	000	000	001	029	000
		tailed)	.000	.000	.000	.001	.02)	.000

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The Spearman's correlation in Table 17 showed that the correlation coefficient between the government's support indicators and business success indicators were less than 0.5 between all the indicators with most of them being between 0.1 and 0.4. This implied that the relationship between government support and business success among entrepreneurs was weak. Where the coefficient was negative, it implied that there was a negative relationship. However, the correlation was statistically significant since p < 0.01 with a few indicators having more than 0.01.

Influence of government support on success of SMEs per region

Further analysis on government support was carried to establish its influence on SMEs success in each of the eight regions in Kenya. Findings were as presented in Table 18.

DECION	Government support influence success of SMEs						
REGION	Disagree	Not sure	Agree	Total			
Nairobi	22	4	81	107			
Nyanza	68	3	32	103			
Central	17	6	74	97			
Coast	45	3	46	94			
Western	22	1	61	84			
Rift Valley	54	8	34	96			
Eastern	93	0	4	97			
North Eastern	35	13	34	82			
Total	356	38	366	760			

Table 18: Influence of government support on success of SMEs per region

Table 18 shows that a total of 366 entrepreneurs agreed that they had received government support which boosted the success of their SMEs. Out of the 366, most of them were from Nairobi (81), Central (74), and Western regions (61). On the contrary, 356 entrepreneurs disagreed that they had received government support that influenced the success of their SMEs, most of whom were from Eastern at 93, Nyanza at 68, and Rift Valley at 54.

4.3.4 Information Access

Literature review revealed that access to adequate business information for SMEs is insufficient especially in developing countries. The study sought to investigate the whole idea surrounding SMEs with regard to access to adequate business information for the growth of their businesses. SMEs require some specific information about their businesses. SMEs owners were asked to highlight major information that they need for their businesses. Findings indicate that 21.5% of them require technological skills, 19.4% need marketing information, 18.1% need financial information, 16.0% need business management information, 15.3% need technical skills, a few (4.9%) need legal information, while the rest (4.9%) need information on the sources of raw materials as shown in Table 19.

Major information that SME Entrepreneurs need for	Responses		
their businesses	Ν	Percentage	
Technological skills	31	21.5%	
Marketing information	28	19.4%	
Financial information	26	18.1%	
Business management	23	16.0%	
Technical skills	22	15.3%	
Legal information	7	4.9%	
Source of raw materials	7	4.9%	

Table 19: Major information that SME Entrepreneurs need for their businesses

From Table 19, it is clear that most SMEs in Kenya had no access to technological skills that enhance access to adequate business information. In order to access the above information, entrepreneurs need some tools/facilities that would enable them to obtain the information that they require for their businesses. SMEs were asked to state the facilities that they needed to obtain the necessary information for their businesses. Their responses indicate that the Internet and mobile phones are the main tools/facilities that SMEs need to obtain information for the growth of their businesses with 29.3% of them preferring the Internet and an equal number (29.3%) preferring use of mobile phones to get information. Other entrepreneurs preferred other facilities like the use of people to get information, use of television, newspapers, radio, libraries and land line telephones in descending order respectively as shown in Table 20.

Table 20. Types of tools/factilities that SME Entrepreneurs need to obtain informatic	Table 20:	Types c	of tools/facilities	that SME Entrepreneurs	s need to obtain information
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Types of tools/facilities that SME Entrepreneurs need to	Responses		
obtain information	Ν	Percentage	
Internet	56	29.3%	
Cell phone	56	29.3%	
People	35	18.3%	
Television	18	9.4%	
Newspapers	14	7.3%	
Radio	8	4.2%	
Libraries	3	1.6%	
Land phone (fixed line)	1	.5%	

In the process of entrepreneurs' efforts to access information for their businesses, they did encounter barriers that hindered them from accessing the right information that they needed. The study sought to establish some of the barriers that hindered SMEs from accessing the information that they needed. Table 21 shows the findings outlining the barriers as presented by the respondents.

Kind of barrier in obtaining information		Responses		
		Percentage		
Non-availability of appropriate information	25	23.8%		
Lack of awareness of availability of information	20	19.0%		
Lack of technology skills	16	15.2%		
Inadequate time	16	15.2%		
Lack of current information	12	11.4%		
Lack of capital	8	7.6%		
Poor network	6	5.7%		
No barriers experienced	2	1.9%		

Table 21: Barriers entrepreneurs encounter in obtaining information

From Table 21, non-availability of appropriate information is the leading barrier that hindered SMEs in Kenya from accessing information that they wanted for their businesses, followed by, in a descending order, lack of awareness of availability of information, lack of technology skills, inadequate time, lack of current information, lack of capital to enable them access the required information and least is poor network especially on those entrepreneurs that rely on the Internet to access information for their businesses.

The study went further to establish the relationship between entrepreneurs' access to information and their business access, to fulfil one of its objectives and test the hypothesis. Three information access indicators were used and asked respondents to agree or disagree to the items using a Likert scale of 1 - 5 (1=strongly disagree and 5 = strongly agree). Table 22 shows the entrepreneur's responses.

Information access indicator	N	Moon	Std.	Sig. (2-	
mormation access indicator	IN	Ivicali	Deviation	tailed)	
Entrepreneurs are able to access information	760	1 5310	0 77224	000	
on the products easily	700	4.5517).11234	.000	
Entrepreneurs have several barriers to	760	1 7393	11 27022	000	
accessing information about my products	700	4.7373	11.27022	.000	
Entrepreneurs have access to information	750	1 9069	11 76967	000	
relevant to the products	130	4.0000	11.70007	.000	

Table 22:	Entrepreneurs'	responses of	1 information	access indicators
1 4010 22.	Lincpreneurs	responses or	1 11190111011	access marcarors

From Table 22 most entrepreneurs responded positively to the three information access indicators with a large number of them strongly agreeing (mean of more than 4.5) that indeed they have easy access to information with regard to their products; there are no barriers to accessing information about their products; and they access information relevant to their products.

A correlation analysis between the information access and business success indicators was conducted, in order to determine whether there was a positive or negative relationship between entrepreneurs' information access about their products and their business success. The results are presented in Table 23.

Correlation									
			Business success indicators						
			Ι	I have	Му	Му	Ι	Ι	
			consider	been in	busines	revenu	consid	consider	
			my	the	s has	e has	er	business	
Informat	tion according in	ndiaatana	business	business	grown	grown	govern	relocatio	
morma	non access n	luicators	successf	for many	very	very	ment	n	
			ul	years	much	fast	suppor		
							t		
							releva		
							nt		
Spearm		N	760	760	760	760	758	760	
an's rho	I am able	Correlati	.221**	.245**	.165**	.137**	.000	.118**	
	to access	on							
	informati	Coefficie							
	on on the	nt							
	products	Sig. (2-	.000	.000	.000	.000	1.000	.002	
	easily	tailed)							
		N	760	760	760	760	758	760	
	There are	Correlati	.101**	.094*	.031	.085*	.026	.233**	
	no several	on							
	barriers to	Coefficie							
	accessing	nt							
	informati	Sig. (2-	.009	.015	.415	.027	.507	.000	
	on about	tailed)							
	my	N	760	760	760	760	758	760	
	products								
	I access	Correlati	.215**	.218**	.180**	.156**	026	.138**	
	Informati	on							
	on	Coefficie							

Table 23: Correlation between information access indicators and business success indicators

relevant	nt						
to the	Sig. (2-	.000	.000	.000	.000	.506	.000
products	tailed)						
	Ν	758	758	758	758	757	758

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

From Table 23, Spearman's correlation coefficient was less than 0.5 in all correlated indicators. This implied that the relationship was weak. However, the correlation was statistically significant with two information indicators since p < 0.05 except the correlation with government support being considered relevant as success indicators where in both cases p > 0.05. The correlation of one indicator i.e. there being no barriers to accessing information about entrepreneurs' products, was not statistically relevant when correlating it to success indicators because the result shows that p>0.05 and 0.01.

Influence of access to information on success of SMEs per region

Study findings on the influence of access to information on the success of SMEs per region are presented in Table 24.

DECION	Information access influence success of SMEs								
REGION	Disagree	Not sure	Agree	Total	_				
Nairobi	27	7	73	107					
Nyanza	26	10	67	103					
Central	55	4	38	97					
Coast	20	6	68	94					
Western	13	9	62	84					
Rift Valley	60	2	34	96					
Eastern	4	0	93	97					
North Eastern	53	2	17	82					
Total	248	40	452	760					

Table 24:	Influence	of access to	information	on success	of SMEs per	region
1 <i>ubie</i> 27.	injinence	oj uccess io	injormanon	Un success o	of Smils per	region

Table 24 reveals that information access plays a very important role in the success of SMEs in Nairobi, Nyanza, Coast, Western, and Eastern regions of Kenya. This was ascertained by the fact that more than half of the entrepreneurs from those regions who agreed that they were able to

access relevant information on the products easily. On the other hand, more than half of the entrepreneurs from Central, Rift Valley, and North Eastern disagreed that they had access to relevant information on products in the market hence the success of their SMEs did not depend on their access to information.

4.3 Access to Physical Infrastructure

Infrastructure supports business in many ways. Table 25 shows entrepreneurs' responses with regard to how infrastructure supports their businesses.

Access to physical infrastructure indicators		Mean	Std.	Sig.
			Deviation	
There is enough infrastructure i.e. roads &	760	4.7511	9.72852	.000
technology to help my business				
Business is easily accessed by customers	760	4.6444	8.72466	.000
Availability of all the necessary infrastructure for	760	4.3496	8.77627	.000
the business				

Table 25: Entrepreneurs' responses to access to physical infrastructure indicators

From Table 25, most entrepreneurs strongly agreed (mean = 4.7511 and 4.6444) that there is adequate infrastructure (i.e. roads and technology to help their businesses), and that their businesses are easily accessed by customers. They also agreed (mean = 4.3496) that there is the availability of the necessary infrastructure for their businesses. The variables were evenly distributed hence the standard deviation was more than 1.0 in all infrastructure indicators shown in Table 25.

One of the critical issues about the infrastructure that this research sought to establish were the reasons that make SME entrepreneurs choose the physical location of their businesses. When the respondents were asked to give the factors they considered when choosing the physical location of their businesses, they gave varied responses with most of them (34.2%) saying that high concentration of people is the main reason why they chose the location in order to take advantage of the people who would patronise their business. Other reasons for the choice of the physical location of businesses are as outlined in the Table 26 in a descending order.

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What prompted entrepreneurs to decide on their current location	Responses	
of business	Ν	Percentage
High population in the area hence good flow of people	40	34.2%
Ease access to roads & other infrastructure	21	17.9%
Readily available market in the area	12	10.3%
Availability of business space & opportunity	11	9.4%
Popularity of the areas hence favouring business	7	6.0%
Proximity to market	6	5.1%
Enhanced security	5	4.3%
Availability of products from the source	4	3.4%
Proximity to area of residence	3	2.6%
Rent was affordable	3	2.6%
It was a strategic location	3	2.6%
Access to social amenities like water, etc	2	1.7%

Table 26: What prompted entrepreneurs to decide on their current location of business

Table 26 shows that easy access to infrastructure like roads is one of the factors that influence the decision of entrepreneurs on the location of businesses, hence the importance of a welldeveloped infrastructure in improving SMEs. In order to measure the relationship between entrepreneur's access to better infrastructure and their business success, the correlation analysis between responses to infrastructure indicators and business success indicators was carried out and results are presented in Table 27.

Correlations									
			Business success indicators						
			Ι	I have	Му	My	Ι	Ι	
		consider	been	busine	reven	conside	conside		
A googs to	nhycical infr	acturatura	my	in the	ss has	ue has	r	r	
Access u	, physical lift	astructure	business	busine	grown	grown	govern	busines	
muicator			successfu	ss for	very	very	ment	S	
			1	years	much	fast	support	relocati	
							relevan	on	
							t		
Spearm	There is	Correlatio							
an's rho	enough	n	232**	191**	103**	177**	- 066	043	
	infrastructu re i.e. roads & technology	Coefficien	.232	.101	.175	.1//	000	.043	
		t							
		Sig. (2-	000	000	000	000	088	259	
		tailed)	.000	.000	.000	.000	.000	.237	
	to help my	N	760	760	760	760	758	760	
	business			,	,	,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
	My	Correlatio							
	business is	n	.271**	.183**	.225**	.177**	.021	$.097^{*}$	
	easily	Coefficien							
	accessed by	t							
	customers	Sig. (2-	.000	.000	.000	.000	.578	.012	
		tailed)							
		N	760	760	760	760	758	760	
	Availabilit	Correlatio							
	y of all the	n	.251**	.265**	.239**	.180**	021	.243**	
	necessary	Coefficien							
	infrastructu	t							

Table 27: Correlation between access to physical infrastructure indicators and business success indicators

re for the business	Sig. (2- tailed)	.000	.000	.000	.000	.590	.000
	Ν	760	760	760	760	758	760

*. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed).

From the correlation Table 27, there is a positive relationship between access to better infrastructure and business success because the Spearman's correlation coefficient is positive in most infrastructure indicators that were correlated, except the correlation between government support as success indicator and the three infrastructure indicators which record negative correlation apart from one indicator.

Although there was a correlation, it was not a strong one since the correlation coefficient was less than 0.5 in most of them. However, the correlation was statistically significant with p<0.05 in most of the correlated indicators.

Influence of physical infrastructure on success of SMEs per region

Further analysis on physical infrastructure was conducted to show its influence on the success of SMEs in each of the eight regions in Kenya. The findings were as presented in Table 28. *Table 28: Influence of physical infrastructure on success of SMEs per region*

DECION	Physical infrastructure influence success of SMEs							
REGION	Disagree	Not sure	Agree	Total				
Nairobi	7	11	89	107				
Nyanza	17	3	83	103				
Central	16	8	73	97				
Coast	17	8	69	94				
Western	10	3	71	84				
Rift Valley	16	10	80	96				
Eastern	3	0	94	97				
North Eastern	10	2	70	82				
Total	96	55	629	760				

As shown in Table 28 physical infrastructure influenced the success of SMEs in all regions in Kenya. Most (more than half) of the entrepreneurs that participated in this study from each of the eight regions in Kenya agreed that physical infrastructure led to the success of their SMEs.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

From the findings, it is clear that there is a significant positive relationship between environmental factors (marketing, access to capital, access to information and physical infrastructure) and success of SMEs in Kenya. However, government support as an environmental factor has little influence to success of entrepreneurs in Kenya.

5.2 Recommendations

This study recommends that governments need to support SMEs adequately by prioritising entrepreneurial activities and formulation of effective policies and programmes that will lead to the achievement of the economic pillar of Vision 2030.

The study recommends that well-developed physical infrastructure like roads, security facilities, water, power, electricity and enhanced technology be put in place to enable SMEs to operate effectively. The study recommends improved technology and ensuring that business information is accessed by entrepreneurs as easily as possible. Access to business information will steer growth and development of SMEs, hence the need to ensure that information is availed and accessed promptly when required.

The study recommends marketing of SMEs using modern technologies like social media and online approaches. Since most entrepreneurs in developing countries have access to mobile phones that can access the Internet, they should adopt online marketing of their products since clients are currently advertised more through the Internet than other modes of marketing. The study recommends a comprehensive local driven SMEs Management Policy that specifically addresses issues of growth of SMEs in Kenya. The policy will seek to realign the overall SMEs policies with the envisaged devolution framework as outlined in the Kenyan Constitution. The study recommends a locally driven policy because of two reasons: First, the policy framework to promote the local economic development of SMEs has been pegged on wider national policies for a long time, with limited emphasis on locally led development strategies. Secondly, a window of opportunity has been opened through the County system of government with its focus on local economic development opportunities based on local resources. Therefore with a locally driven SMEs Management Policy, SMEs issue will be realigned including tax issues which is one of the factors that constitute to the SMEs' unfavourable economic environment, unnecessary competitions, and high interests on loans among others.

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REFERENCES

Aremu, M, A., & Adefemi, B. J. (2011). Marketing mix practice as a determinant of entrepreneurial business performance. Retrieved from http://dx.doi.org/10.5539/ijbm.v7n1p205 Baron, R. A. (2008). The Role of Affect in the Entrepreneurial Process. Academy of Management Review, 33(2), 328–340. https://doi.org/10.5465/AMR.2008.31193166 Bygrave, W, & M. Quill. (2006). Global Entrepreneurship Monitor. Babson College. Retrieved from http://www.babson.edu/Academics/centers/blank-center/globalresearch/gem/Documents/gem-2006-financing-report.pdf Carson, D., Cromie, S., McGowan, P., & Hill, J. (1995). Marketing and entrepreneurship in SMEs. London: Prentice Hall. Chell, E. (2007). Social Enterprise and Entrepreneurship: Towards a Convergent Theory of the Entrepreneurial Process. International Small Business Journal, 25(1), 5–26. https://doi.org/10.1177/0266242607071779 Cumming, D. J., & MacIntosh, J. G. (2007). Mutual funds that invest in private equity? An analysis of labour-sponsored investment funds. *Cambridge Journal of Economics*, 31(3), 445-487. https://doi.org/10.1093/cje/bel041 Cyert, R. M., & March, J. G. (2013). A behavioural theory of the firm. Cambridge, Massachusetts: Martino Publishing. Dew, N., Read, S., Sarasvathy, S. D., & Wiltbank, R. (2008). Outlines of a behavioural theory of the entrepreneurial firm. Journal of Economic Behaviour & Organization, 66(1), 37-59. Drucker, P. F. (2014). Innovation and entrepreneurship: Practice and principle. New York: Harper Business. Foley, P., & H. Green. (1989). Small Business Success. Liverpool Road: Paul Chapman Publishing Ltd. Gibson, J., & Olivia, S. (2010). The Effect of Infrastructure Access and Quality on Non-Farm Enterprises in Rural Indonesia. World Development, 38(5), 717– 726.https://doi.org/10.1016/j.worlddev.2009.11.010 Harrison, R., C. Mason, & P. Girling. (2004). Financial bootstrapping and venture development in the software industry. Entrepreneurship and Regional Development, 16, 307–333.

ILO, (1972). Employment, Income and Equity in Kenya: a strategy for increasing productive employment in Kenya. Rerieved from http://staging.ilo.org/public/libdoc/ilo/1972/72B09_608_engl.pdf Kreft, S., & R. Sobel. (2005). Public policy, entrepreneurship, and economic freedom. Cato Journal, 25(3), 595–616. Kumar, S, & D. Lui. (2005). Impact of globalization on entrepreneurial enterprises in the world markets. International Journal of Management and Enterprise Development, 2, 46-64. Ligthelm, A. A. (2010). Entrepreneurship and small business sustainability. Southern African Business Review, 14(3), 131-153. Markman, G., & Baron, R. (2003). Person-entrepreneurship fit: Why some people are more successful as entrepreneurs than others. Human Resource Management, Review, 13(2), 281-301. McKenzie, D., & Woodruff, C. (2012). What are we learning from business training and entrepreneurship evaluations around the developing world? Washington DC: World Bank. Minniti, M. (2008). The Role of Government Policy on Entrepreneurial Activity: Productive, Unproductive, or Destructive? Entrepreneurship Theory and Practice, 32(5), 779–790. https://doi.org/10.1111/j.1540-6520.2008.00255.x Olawale, F., & Garwe, D. (2010). Obstacles to the growth of new SMEs in South Africa: A principal component analysis approach. African Journal of Business Management, 4(5), 729-738. Pitelis, C. N. (2007). A Behavioural Resource-Based View of the Firm: The Synergy of Cyert and March (1963) and Penrose (1959). [Article]. Organization Science, 18(3), 478-490. Storey, D. J. (2011). Optimism and chance: The elephants in the entrepreneurship room. International Small Business Journal, 29(4), 303–321. https://doi.org/10.1177/0266242611403871 Valerio, A., Parton, B., & Robb, A. (2014). Entrepreneurship education and training program around world. New York: Sage Journals. Webb, J, W, Duane I, R., Michael, A., Hitt, G, M., & Kistruck, L. T. (2011). Where is the opportunity without the customer? Journal of the Academy of Marketing Science, 39(4), 537-554 Wickham, P. A. (2006). Strategic entrepreneurship. A decision-making approach to new venture creation and management. London: Financial Time Prentice Hall, 2006.

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World Bank. (2002). *World Bank review of small business activities*. Washington, DC: World Bank.

Zahra, S. A., Sapienza, H. J., & Davidsson, P. (2006). Entrepreneurship and dynamic capabilities: A review, model and research agenda. *Journal of Management Studies*, 43(4), 917–955.

https://doi.org/10.1111/j.1467-6486.2006.00616.x

KNEEL AND YOU'RE FIRED: FREEDOM OF SPEECH IN THE WORKPLACE

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Abstract

The divisiveness of race relations, using sports as a political platform and President Trump himself aside; does the National Football League have the right to terminate their employee for kneeling during the National Anthem? Does an NFL employee have a protected right to "Freedom of Speech" without putting their employment at risk?

This paper will examine the legal rights of employers to terminate employees for engaging in workplace speech. Part One of the paper will examine job security and an analysis of employment as a protected property interest. Part Two will analyze freedom of speech in the workplace. Part Three will provide a legal analysis of the NFL players protest. Part Four will conclude, suggest solutions and possibly solve other impossible world problems.

Key Words: Workplace free speech

Introduction

During a campaign rally for U.S. Senator Luther Strange in Huntsville, Alabama, on Friday September 22, 2017, President Donald Trump rhetorically asked, "Wouldn't you love to see one of these NFL owners, when somebody disrespects our flag to say: 'Get that son of a bitch off the field right now. Out. He's fired. He's FIRED!" ⁱ

Trump's comments refer to National Football League players who have kneeled, raised a fist or put a hand on a teammate's shoulder during the playing of the national anthem in the hope that their symbolic acts of protest will raise awareness of racial social injustice in the United States and encourage change.

The divisiveness of race relations, using sports as a political platform and President Trump himself aside; does the National Football League have the right to terminate their employee for kneeling during the National Anthem? Does an NFL employee have a protected right to "Freedom of Speech" without putting their employment at risk?

This paper will examine the legal rights of employers to terminate employees for engaging in workplace speech. Part One of the paper will examine job security and an analysis of employment as a protected property interest. Part Two will analyze freedom of speech in the workplace. Part Three will provide a legal analysis of the NFL players protest. Part Four will conclude, suggest solutions and possibly solve other impossible world problems.

Employment as a Protected Property Interest

The United States is still one of the only countries that adheres to the employment-at-will philosophy. No industrialized countries and few developing countries have adopted and maintained this Labor Relations theory. Employment at will jurisdictions allow employers to discipline their employees up to and including discharge, with or without cause and with or without notice.ⁱⁱ In the United States, almost all jurisdictions federal, state and local presume all employment relationships are at will.ⁱⁱⁱ

This presumption is a default condition under the law. Many employment relationships are not at will. Employees may not be at will employees if their employment relationship is modified by an express or implied contract, a collective bargaining agreement or their status as a civil servant or tenured employee.

Employees who negotiate an individual employment contract usually limit the employer's right to terminate. An express employment contract, written or verbal, creates a requirement that "just cause" be established to terminate the employment relationship without resulting in a breach of contract finding by the court.^{iv} In the United States typically only high level or highly compensated employees with highly sought after skills have the leverage to negotiate individual employment contracts.

Express contracts include carefully drafting written agreements between the legal representatives of the employer as well as verbal promises made during the onboarding promise.^v Conduct by the employer may create an implied contract also limiting a right to terminate. Employee handbooks or policies and procedures manuals have been held to create a contractual obligation. Additionally, if all employees are given a verbal warning, than a written reprimand before they

are terminated, the employer may be on questionable legal grounds to terminate the next employee without acting similarly. ^{vi}

Statutory and common law tenure schemes also create enhanced job security protections. Teachers and administrators, protected by these laws, are not employees at will. They may be disciplined up to and including termination only pursuant to the legal due process requirements and just cause limitations afforded them.^{vii} While many of these tenure rights have been the subject of both legal and political challenges, a majority of states have retained tenure as an employment protection.^{viii}

Employees hired according to federal, state or local civil service laws are also not employees at will. Unlike private sector employees at will, these federal, state and local government employees enjoy procedural protections before they can be terminated from employment. These rights come from the Fifth Amendment of the United States Constitution, which prohibits the government from affecting the employee's property interest without the requisite legal due process. The federal government agencies must follow the required process pursuant to the Civil Service Reform Act of 1978 or applicable state or municipal law if employee termination is sought. ^{ixx}

Employees covered by a collective bargaining agreement are also not at will employees. Collective bargaining agreements prioritize limiting management discretion in hiring, promoting, compensation and discharge whenever possible. Clauses requiring a "just cause" burden of proof for any disciplinary action up to and including termination is standard form.^{xi} Employees may benefit from collective bargaining agreement protection whether or not they are union members. All members of the collective bargaining unit receive such protection in most jurisdictions.

At will employment allows employers to terminate the employee for any reason except for an illegal reason. The burden of proof is on the plaintiff employee to prove they were terminated for a prohibited reason under the law. This seems to be a common misunderstanding among both job applicants and employees who believe their employer needs a "good reason" to fire them.^{xii} Professor Pauline Kim's empirical study found 80-90% of employees believe the law of the United States requires employers to treat employees fairly and that a good reason (just cause) is required to terminate.^{xiii}
Exceptions to pure employment at will have been created at common law and by statute.^{xiv} Most jurisdictions have adopted in whole or in part, one or more of the implied contract exception, public policy exception or the implied covenant of good faith and fair dealing exception.^{xv}

The public-policy exception holds an employee at will may not be terminated if the rationale for their discharge violated the public policy standard within the jurisdiction of their employment. Termination for refusing to comply with an order by his or her employer to commit a crime, for whistleblowing or for filing a workers compensation claim would be common examples. Although some of these aforementioned acts may be protected by state statutes, the public policy exception provides protection in states without a statutory prohibition.^{xvi}

The Implied Contract Exception, previously mentioned incorporates limitations created by the conduct of the parties into the employment relationship. Stated policies, either orally or in writing, regulating conditions of employment such as employee discipline up to and including discharge, create legally binding limitations on an employers' rights. Typically, promises made during onboarding, verbally or in writing and employee policies and procedures manuals with language promising continued employment except for "just cause" are the basis for these implied contracts. Currently 41 states and the District of Columbia recognize some form of the implied contract exception.^{xvii}

The Covenant-of-Good-Faith Exception is the least recognized of the three exceptions. Courts usually interpret this exception to mean an employee may not be terminated without a good reason. Courts have created both implied in fact covenants and implied in law covenants. Covenants implied in fact have been found in factual objective manifestations, such as regular promotions or wage increases. Courts have held these actions by the employer might reasonably give an employee cause to believe that he or she will be treated fairly and have job security absent just cause.

California courts have interpreted an implied in law covenant of good faith and fair dealing. In the minority of jurisdictions, California state courts have held every employment contract carries with it an implied covenant that neither party will impede the other from receiving the benefits of the agreement. The benefits of the agreement and related employer promises can be interpreted to mean the employee maintains legal protection from discharge absent a legitimate economic or legal reason. As this is very similar to just cause, states which have adopted the covenant of good faith and fair dealing have essentially rejected employment at will as the law within their jurisdiction.^{xviii}

Every jurisdiction has enacted statutory exceptions to employment at will. Employers may not adversely affect any term or condition of employment for these legislatively decreed reasons. Common statutory exceptions include discrimination based on race, color, age, disability, gender, religion and veteran status. Some states also prohibit discrimination in employment based on marital status, sexual orientation and even legal off site activities (e.g. smoking).^{xix}

Disciplined or terminated employees at will have the burden of proof in an action against their employer to show the reason for the adverse action is prohibited by law. If the employee can establish they are not an employee at will, the employer will bear the burden to establish "just cause" for the discharge.^{xx}

In a due process analysis, "just cause" refers to contractually standards of conduct that an employee must breach before he or she can be disciplined or discharged. A widely accepted standard for defining "just cause" is Arbitrator Carol Daugherty's Seven Part Test articulated in Empire Wire. It assessed the reason for the discharge, the notice, fairness and application of the rule and the appropriateness of the punishment.^{xxi}

Freedom of Speech in the Workplace

The First Amendment of the U.S. Constitution states, "Congress shall make no law...abridging the freedom of speech."^{xxii} This protection is against government action. The U.S. Supreme Court has consistently held private sector employees have no First Amendment protection against their employers absent some proof of state action.^{xxiii}

Public sector employees have First Amendment rights subject to certain restrictions. Any restriction of speech by a public sector employer has First Amendment implications. In the private sector, no such rights exist unless created by another statutory scheme.^{xxiv}

Even in the private sector, speech that is defamatory or constitutes sexual or racial harassment is actionable and victims protected under state and federal law. Employees terminated for whistleblowing or filing workers compensation claims or discrimination claims would also have such "speech" protected even in the private sector.^{xxv}

Statutes that prohibit disclosure of medical records, trade secrets or certain financial information also may abridge the speech of a private sector employee. These restrictions on speech are required by other laws. The National Labor Relations Act is an example of a federal statute that does limit a private sector employer's right to limit speech.

Employees' protected speech under the National Labor Relations Act (NLRA) is actually an exception to an employer's broad rights to restrict both speech and expression at work. Section 7 of the NLRA gives employees the right to engage in speech related to wages hours and working conditions and organizing a union. An employee complaining about his or her employer on social media may be seen by the NLRB as concerted action or advocating unionization. That speech would fall within the purview of the NLRA Section 7 protections.^{xxvi}

These protected activities, including communication, apply whether the private workplace is unionized or not. A single employee may also engage in protected concerted activity if he or she is acting on the authority of other employees, bringing group complaints to the employer's attention, trying to induce group action, or seeking to prepare for group action.^{xxvii}

While the commitment to free speech is deeply ingrained in our society, including in the workplace, it is important to remember, private sector workplace actions are balancing one citizen's rights with another's. These private actions not involving any government action abridging freedom of speech does not raise a First Amendment issue.

Speech protesting against the United States government is fully protected speech under a First Amendment analysis. The government may regulate speech reasonably as to time, place and manner as long as the regulation is content neutral and narrowly tailored to serve a significant government interest while leaving open some alternative means of communication. Furthermore, even speech that enjoys the most extensive First Amendment protection may be restricted on the basis of its content if the restriction passes "strict scrutiny" (i.e., if the government shows that the restriction serves "to promote a compelling interest" and is "the least restrictive means to further the articulated interest"). ^{xxviii} Unprotected speech, such as obscene speech, defamatory speech, speech inciting lawlessness, treason, copyright infringement child pornography may be prohibited based on content as it has held to not be within the protection of the First Amendment.^{xxix} In Texas v Johnson, the US Supreme Court's landmark case, the Texas state statute criminalizing desecration of a venerated object (American Flag) at the Republican National Convention was held unconstitutional.^{xxx} Johnson's "symbolic speech" was held to be expressive in nature and the political subject matter intended to be protected by the original framers.^{xxxi}

NFL Players Protests and Protections

We will now apply the employment protections and workplace free speech analysis to the NFL players kneeling in protest during the National Anthem as it is played at the beginning of each NFL contest. NFL Players are not employees at will. They are protected by a collective bargaining agreement negotiated by their representative the NFLPA. If the NFL wanted to discipline a player for any action or behavior, such as kneeling during the playing of the National Anthem at the start of an NFL game, the due process rights and disciplinary guidelines negotiated in their contract must be complied with.^{xxxii}

Each NFL player's terms and conditions of employment are contractual. As a private sector employee the player's Free Speech Rights are limited to the statutory protected types of speech previously discussed. His First Amendment Free Speech rights only protect him from actions by the government. While NFL Commissioner Roger Goodell earns five times more money annually than all the US Governors plus the President combined, he is not the government.^{xxxiii}

A player's rights, as an employee, are primarily determined by two applicable contracts. The player's employment contract with his team and the collective bargaining agreement that governs the player's working conditions as an employee of one franchise in the league. Every NFL player must sign the standard NFL Player's Contract. As a private sector employer, the team contract may legally contain content restrictions on free speech without violating First Amendment guarantees.

Paragraph 2 of the NFL Player Contract contains language regulating the player's conduct on and off the field in exchange for his employment and services.

2. EMPLOYMENT AND SERVICES. Club employs Player as a skilled football player. Player accepts such employment. He agrees to give his best efforts and loyalty to the Club, and to conduct himself on and off the field with appropriate recognition of the fact that the success of professional football depends largely on public respect for and approval of those associated with the game. Player will report promptly for and participate fully in Club's official mandatory minicamp(s), official preseason training camp, all Club meetings and practice sessions, and all preseason, regular season and postseason football games scheduled for or by Club. If invited, Player will practice for and play in any all-star football game sponsored by the League. Player will not participate in any football game not sponsored by the League unless the game is first approved by the League.^{xxxiv}

Could a team discipline a protesting player and argue he is in breach of this clause because his actions have negatively impacted "public respect" for "those associated with the game?" How would this broad language be interpreted? The player protests impact on "public respect" varies depending upon which fan base, target market or demographic queried.^{xxxv}

Another basis within the NFL Player's Contract that might cited for disciplining a protesting player is paragraph 11, "Skill, Performance and Conduct."

11. SKILL, PERFORMANCE AND CONDUCT. Player understands that he is competing with other players for a position on Club's roster within the applicable player limits. If at any time, in the sole judgment of Club, Player's skill or performance has been unsatisfactory as compared with that of other players competing for positions on Club's roster, or if Player has engaged in personal conduct reasonably judged by Club to adversely affect or reflect on Club, then Club may terminate this contract. In addition, during the period any salary cap is legally in effect, this contract may be terminated if, in Club's opinion, Player is anticipated to make less of a contribution to Club's ability to compete on the playing field than another player or players whom Club intends to sign or attempts to sign, or another player or players who is or are already on Club's roster, and for whom Club needs room.^{xxxvi}

Notice in Paragraph 11 the player has agreed the "Club may terminate this contract" if the "Player has engaged in personal conduct reasonably judged by the Club to adversely affect or reflect on Club." This paragraph gives substantial power to the Club/team to judge the affect personal conduct such as a protest has on the Club. If a team "reasonably judges" the protests are diminishing the team's brand, it might terminate the player's contract citing a Paragraph 11 breach.

The "Integrity of the Game" clause found in paragraph 15 of the NFL Player's Contract is another contractual provision, which a team using its bargained for "broad discretion" could argue has been breached by a player protesting during the National Anthem.

15. INTEGRITY OF GAME. Player recognizes the detriment to the League and professional football that would result from impairment of public confidence in the honest and orderly conduct of NFL games or the integrity and good character of NFL players. Player therefore acknowledges his awareness that if he accepts a

bribe or agrees to throw or fix an NFL game; fails to promptly report a bribe offer or an attempt to throw or fix an NFL game; bets on an NFL game; knowingly associates with gamblers or gambling activity; uses or provides other players with stimulants or other drugs for the purpose of attempting to enhance on-field performance; or is guilty of any other form of conduct reasonably judged by the League Commissioner to be detrimental to the League or professional football, the Commissioner will have the right, but only after giving player the opportunity for a hearing at which he may be represented by counsel of his choice, to fine Player in a reasonable amount; to suspend Player for a period certain or indefinitely; and/or to terminate this contract.^{xxxvii}

Paragraph 15 specifically references gambling and drugs potential to erode the public confidence in the game, but broad language here could allow for application to protesting players' conduct being a breach. It refers early on to "good character of NFL players." While some might argue speaking out against social injustice demonstrates superior character, others have opined the use of the National Anthem as the vehicle for the protests is unpatriotic.

Later in paragraph 15, the player agrees to be subject to fine, suspension or termination for "any other form of conduct reasonably judged by the League Commissioner to be detrimental to the League or professional football." This restriction, similar to paragraph 1, contains broad if not vague conduct prohibitions with broad discretion given away by the player to the Commissioner. Although the player is guaranteed a hearing for any alleged paragraph 15 breach, the basis for the protests being a breach remains viable.

The League and team retain broad discretion in disciplinary matters as evidenced again in the Collective Bargaining Agreement between the players and League specifically, Article 46, "Commissioner Discipline."

ARTICLE 46

COMMISSIONER DISCIPLINE

Section 1. League Discipline: Notwithstanding anything stated in Article 43: (a) All disputes involving a fine or suspension imposed upon a player for conduct on the playing field (other than as described in Subsection (b) below) or involving

action taken against a player by the Commissioner for conduct detrimental to the integrity of, or public confidence in, the game of professional football, will be processed exclusively as follows: the Commissioner will promptly send written notice of his action

to the player, with a copy to the NFLPA. Within three (3) business days following such

written notification, the player affected thereby, or the NFLPA with the player's

approval, may appeal in writing to the Commissioner.^{xxxviii}

In all cases of a fine or suspension for on the field conduct (except Sec. 1(b) unnecessary roughness or unsportsmanlike behavior) or conduct detrimental to the integrity of the game, the Commissioner has the right to appoint the initial decision maker and or hear the final appeal.

Section 2. Hearings:

(a) Hearing Officers. For appeals under Section 1(a) above, the Commissioner shall, after consultation with the Executive Director of the NFLPA, appoint one or more designees to serve as hearing officers. For appeals under Section 1(b) above, the parties shall, on an annual basis, jointly select two (2) or more designees to serve as hearing shared equally by the NFL and the NFLPA. Notwithstanding the foregoing, the Commissioner may serve as hearing officer in any appeal under Section 1(a) of this Article at his discretion.

A player terminated for protesting could attempt to argue the Article 43, Non-Injury Grievance provisions of the CBA should apply.

ARTICLE 43

NON-INJURY GRIEVANCE

Section 1. Definition: Any dispute (hereinafter referred to as a "grievance") arising after the execution of this Agreement and involving the interpretation of, application of, or compliance with, any provision of this Agreement, the NFL Player Contract, the Practice Squad Player Contract, or any applicable provision of the NFL Constitution and Bylaws or NFL Rules pertaining to the terms and conditions of employment of NFL players, will be resolved exclusively in accordance with the procedure set forth in this Article, except wherever another method of dispute resolution is set forth elsewhere in this Agreement.^{xxxix}

The League would contend Article 46 controls citing the Art. 43 Sec.1 language, "except wherever another method of dispute resolution is set forth elsewhere in this agreement." If the NFLPA prevailed, it would get the grievance away from the Commissioner to a mutually selected, probably more neutral, arbitration panel. The same arguments would be heard about the impact of the protests and if they were held to have been "reasonably judged by Club to adversely affect or reflect on Club." While the arbitrator would be more objective, the players have bargained away significant control of their conduct and the related discipline thereof.

The arbitrators would then issue an award. Under Article 43, the award is considered the full, final and complete disposition of the grievance. The losing side could challenge the arbitration award in federal court, but federal courts give great deference to arbitration awards. Convincing a federal appeals court to vacate an arbitration award is, as Tom Brady discovered, not easy.^{xl}

Defamation law may also be a viable cause of action. If an owner criticizes a protesting player as "Unpatriotic or Un-American" the player might consider filing a defamation lawsuit. Proving the owner made a false statement of fact rather than an opinion would be an uphill battle. If the owner cut or fined the player the damages element would not be difficult to prove. Since NFL players are public figures, the player would be required to demonstrate the owner's statement was made with "malice." The owner knew or should have known the objectively determinable statement of face was untrue. Also, not easy.

The unanimity of the players' protests probably makes the success of a discrimination claim less likely. If a private sector employer like the NFL, discriminated against an employee because of their status in a protected class such as race, it would be a violation of federal and state discrimination laws.^{xli} Players have been unified in their protests to the point of West Point graduate, decorated Army Ranger and Pittsburgh Steeler player Alejandro Villanueva apologizing for not protesting enough.

On September 24, 2017 in Chicago, the Pittsburgh Steelers had agreed as a team to remain in the locker room during the playing of the National Anthem prior to the start of their game against the Chicago Bears. The team reasoning was to avoid continued controversy with their options on the field being protest or not. Several players and coaches later explained, that coming out after the anthem was a neutral message and would allow the team to focus on playing the football game.

Villanueva walked to the end of the tunnel leading to the field. He later explained he hoped to respect his teammate's decision while still demonstrating his respect for the flag and anthem of his country. Villanueva's presence alone at the end of the tunnel was captured by the media and led to, what he described, as an embarrassing situation. He stated the next day he felt "he left his teammates behind" (a very meaningful military sentiment, as any veteran will explain). ^{xlii}

Villanueva spent four years at West Point and served three tours of duty in Afghanistan. If he is conflicted over the appropriate time, place, and manner for these player protests, it is no wonder it remains a divisive and difficult to reconcile issue for the public.^{xliii}

Conclusion and Final Recommendations

NFL players have bargained away many of their protections. The nature of collective bargaining is the employer and employee reaching an agreement as to the terms and conditions of employment for the entire bargaining unit. The League maintained significant control over the discipline process including selection of arbitrators, hearing officer and the appeals process.

A generous reading of the NFL Player Contract and the CBA would still result in the League Commissioner having the contractual right to discipline the protesting players. As private sector employees, the players would have no strong constitutional argument that their symbolic speech was protected against action from their private sector employer.

State and federal statutes, which provide additional legal options such as employment discrimination, defamation or labor laws do not appear to be any more promising from the players' perspective.

The players' best protection is not in state or federal court, but rather in the court of public opinion. Players and their agents love to talk about protecting their "brand." From the original Dream Team playing in the Olympics to the public relations makeover of Alex Rodriguez when he returned from suspension, image and public perception can be managed. Anthem protests have gone from Colin Kaepernick sitting during the anthem and no one noticing (August 14 and 20, 2016) to all players on the Chiefs, Broncos, Patriots and Seahawks team linking arms during the anthem (September 11,2016) to almost all the NFL teams playing linking arms or kneeling during the anthem (September 24, 2017.)^{xliv} In week 13 of the NFL season, only 23 players out of about 2000 players and coaches protested in some way.^{xlv}

The creation of company employment and labor law policies and the application of those policies should address three important questions. Does this policy and its enforcement enable the company to comply with all required laws and regulations? Does this policy and its enforcement minimize grievance and litigation expenses? Does this policy and its enforcement maximize employee productivity considering the impact on morale, and corporate culture?

On Monday November 27, 2017, the NFL announced a proposed donation of \$100 million to African-American communities and related charities who provide assistance for social justice causes, at the heart of the player protests. In keeping with the theme of disagreement, several players announced they were in disagreement with the structure of the donation negotiated with the 40-player group founded by Malcolm Jenkins and Anquan Boldin.^{xlvi}

The legal right to terminate does not necessarily mean that termination is the best decision for the company. The termination of an employee or group of employees can have as pervasive a devastating impact to organization profitability as terminating a product line the employer has every right to terminate. Anybody remember New Coke?

Decisions to discipline up to and including discharge should be made after thorough analysis of all relevant factors and consequences, internal and external, legal and ethical, long term and short term. NFL owners and Commissioner Goodell should continue to support and speak out against social injustice. They must resist the urge to do what they legally can do but instead to should patiently act with moral courage.

- ⁱⁱⁱ http://www.ncsl.org/research/labor-and-employment/at-will-employment-overview.aspx
- ^{iv} http://employment.findlaw.com/hiring-process/employment-contracts-and-compensation-agreements.html

^{vii}Richard M. Ingersoll, Who Controls Teachers' Work? Power and Accountability in America's Schools (Cambridge, MA: Harvard University Press, 2006), 109; See also <u>http://www.ecs.org/clearinghouse/94/93/9493.pdf</u>; See also Vergara v. California - Appellate Decision (California Court of Appeal, Second Appellate District, Division 2 April 14, 2016).

^{viii}Dana Goldstein, The Teacher Wars: A History of America's Most Embattled Profession (New York: Doubleday, 2014); See also David Finley, "Teacher Tenure: An Innocent Victim of

ⁱ https://www.youtube.com/watch?v=vrW-GI_9IL8

ⁱⁱhttps://www.law.upenn.edu/journals/jbl/articles/volume3/issue1/Summers3U.Pa.J.Lab.&Emp.L. 65(2000).pdf

^v https://ag.ny.gov/labor/can-you-be-fired

^{vi} https://www.bls.gov/opub/mlr/2001/01/art1full.pdf

Vergara v. California," Education Week, March 4, 2015; See also Caitlin Emma, "Vergara, New Mexico Edition?," Morning Education, Politico, April 29, 2015; See also

^{ix}See MERIT SYSTEMS PROTECTION BOARD (MSPB), WHAT IS DUE PROCESS IN FEDERAL CIVIL EMPLOYMENT? (2015),

http://www.mspb.gov/netsearch/viewdocs.aspx?docnumber=1166935&version=1171499&applic ation=ACROBAT

[[]hereinafter "What is Due Process"]; 5 U.S.C. §§ 4303, 7513.

See also http://work.chron.com/can-fired-civil-service-jobs-19492.html

^x https://patimes.org/pre-post-termination-hearings-public-employees-entitled-due-processhearings/

xi http://uwua.net/what-are-the-benefits-of-being-a-union-worker/

^{xii} https://www.nolo.com/legal-encyclopedia/employment-at-will-definition-30022.html

xⁱⁱⁱ Pauline T. Kim, Norms, Learning and Law: Exploring the Influence on Workers' Legal

Knowledge, 1999 U. Ill. L. Rev. 447; See also Robert C. Bird, Employment as a Relational

Contract, 8 U. Pa. J. Lab. & Emp. L. 149, 196-197 (2005)

xiv https://www.bls.gov/opub/mlr/2001/01/art1full.pdf

^{xv} https://paywizard.org/main/labor-law/dismissal/states-with-exceptions-to-employment-at-will ^{xvi} See Firestone Textile Co. Division, Firestone Tire & Rubber Co. v. Meadows, 666 S.W.2d 730 (1983); See also

https://pdfs.semanticscholar.org/75bb/c93b4a0ede6dad930bb463409797d93133ab.pdf; See also https://www.law.com/sites/michaelkraemer/2014/03/12/pennsylvania-public-policy-wrongful-discharge-lawsuits/?slreturn=20171104195338

^{xvii} <u>http://www.ncsl.org/research/labor-and-employment/at-will-employment-overview.aspx</u> ^{xviii} See Khanna v. Microdata Corp., 170 Cal. App. 3d 250, 215 Cal. Rptr. 860 (1985); See also Kerr v. Gibson's Products Co., 733 P.2d 1292 [Mont. 1987]

xix <u>https://www.eeoc.gov/laws/statutes/;</u> See also <u>https://www.americanprogress.org/wp-</u> content/uploads/issues/2012/06/pdf/state_nondiscrimination.pdf

^{xx} Ross v. Garner Printing Co., 285 F.3d 1106, 1113 (8th Cir. 2002); See also Lucas v. Whittaker Corp., 470 F.2d 326, 328 (10th Cir. 1972); Rosecrans v. Intermountain Soap & Chem. Co., 605 P.2d 963, 965 (Idaho 1980); See also <u>http://www.tlgattorneys.com/news-resources/workplace-discrimination-and-the-plaintiffs-burden-of-proof/</u>

xxi<u>https://www.hawaii.edu/uhwo/clear/home/EnterpriseWire.html;</u> See also

https://hr.berkeley.edu/hr-network/central-guide-managing-hr/managing-hr/er-

labor/disciplinary/just-cause

xxii U.S. Const. amend. I

^{xxiii} See Garcetti v. Ceballos, 547 U.S. 410(2006); See also Connick v. Myers, 461 U.S. 138 (1983);See also Pickering v. Board of Education, 391 U.S. 563 (1968);

xxiv <u>http://corporate.findlaw.com/law-library/freedom-of-speech-in-the-workplace-the-first-amendment-revisited.html</u>

xxv https://www.nolo.com/legal-encyclopedia/wrongful-termination-retaliation-

whistleblowing.html; See also https://supreme.justia.com/cases/federal/us/573/13-483/

xxvi https://www.hrexaminer.com/is-there-free-speech-at-work/

xxviii https://www.nlrb.gov/rights-we-protect/employee-rights xxviii https://fas.org/sgp/crs/misc/95-815.pdf

xxix https://constitutionallawreporter.com/amendment-01/freedom-speech/unprotected-speech/ xxx Texas v. Johnson, 491 U.S. 397 (1989).

^{xxxi} Brandenburg v Ohio, 395 U.S. 444; See <u>http://democracyweb.org/freedom-of-expression-history;</u> see also

https://www.alternet.org/story/54214/a history of the fight for free speech in america; xxxii https://nfllabor.files.wordpress.com/2010/01/collective-bargaining-agreement-2011-2020.pdf

xxxiii <u>https://https://ballotpedia.org/Comparison_of_gubernatorial_salaries;</u>

http://www.businessinsider.com/how-much-does-the-us-president-get-paid-2016-11

xxxiv<u>https://nflpaweb.blob.core.windows.net/media/Default/PDFs/General/2011_Final_CBA_Sear</u> <u>chable_Bookmarked.pdf</u> xxxv <u>http://www.baltimoresun.com/news/maryland/bs-md-ravens-reax-20171001-story.html</u> xxxvi

https://nflpaweb.blob.core.windows.net/media/Default/PDFs/General/2011_Final_CBA_Searcha ble_Bookmarked.pdf

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^{xl} https://www.nytimes.com/2016/04/26/sports/tom-brady-deflategate-new-england-patriotssuspension-reinstated.html

xli See 42 U.S.C. 2000e; See also https://www.eeoc.gov/laws/statutes/titlevii.cfm

xlii https://www.cbsnews.com/news/steelers-alejandro-villanueva-refuses-to-join-anthem-protest/

^{xliii} Full disclosure requires me to inform you my three daughters are involved in public service. Kristen is an EMT who services a disadvantaged community where she has seen too many lives lost. Casey served four years in the USMC and was deployed to the Middle East and Africa. Kerry is a 2017 graduate of the US Naval Academy. She will be leaving for Okinawa shortly as a member of the USMC.

^{xliv} http://www.abc10.com/news/local/quiet-gesture-sparks-loud-debate-a-timeline-of-nflnational-anthem-protest/478582333

^{xlv} http://www.espn.com/blog/nflnation/post/_/id/259964/nfl-players-who-protested-during-national-anthem-in-week-13

^{xlvi} http://www.espn.com/nfl/story/_/id/21606390/nfl-offers-100-million-plan-social-justiceorganizations-partnership-players

LINER SHIPPING ALLIANCES AND SHIPPING CONNECTIVITY IN SOUTH EAST ASIA

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Abstract

The period from 2014 to 2017 saw significant changes to the container shipping industry with the ending of the G6 Alliance and CHKYE Alliance and subsequent formation of the 2M Alliance, Ocean Alliance and The Alliance. These events affected more than 80% of the world's container ship capacity where fourteen out of the top fifteen carriers belonging to an alliance. South East Asia remains a major market for container transshipment in the world hosting port calls from all of the major container shipping lines in the world. As such, the paper aims to analyze the impact of recent changes in the alliances on shipping service connectivity in the region. The focus is on the Asia-Europe trade which is the second largest east-west container trade and a major market of competition for transshipment containers between the ports of Singapore, Port Klang and Tanjung Pelepas. The research found that changes in shipping alliances had profound effects on port calls at the three transshipment hubs. Results showed substantial capacity rationalization in the number of shipping services deployed along the trade route. In addition, while majority of the shipping services were operated by non-alliance shipping lines in 2013, the number of such services was only four out of 31 by 2017, indicating alliance participation as an important strategy to compete on this important trade route. Hence, enticing shipping alliances to hub at the port becomes a key strategy. The latest round of changes in alliances also saw Singapore remaining as the regional hub for the Asia-Europe trade. As a whole, the paper highlighted strategic and commercial implications for relevant decision makers including terminal operators and port authorities on the need to address priorities associated with the operational requirements and commercial viability of an entire shipping alliance's network rather than a few key players.

Key words: shipping alliance, container shipping service, Asia-Europe trade, port connectivity, South East Asia

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1. Introduction

The period from 2014 to 2017 saw significant changes to the container shipping industry. Specifically, the industry saw the ending of the G6 Alliance and CHKYE Alliance. The period also saw Hanjin going bankrupt and merger and acquisition involving liner companies APL, CCNI, CMA CGM, COSCO, CSAV, CSCL, Hamburg-Sud, Maersk, OOCL and UASC. The period also witnessed formation of three new container shipping alliances. These are the 2M alliance, Ocean Alliance and The Alliance. These events affected more than 80% of the world's container ship capacity where fourteen out of the top fifteen carriers belonging to an alliance. The concentration ratio of the top ten container shipping lines rose further from 64% in 2013 to 82% by 2017 (Alphaliner, 2013 and 2017a). The series of events and affected liner companies are shown in table 1 below:

	2014		2016		2017
Jul	Maersk and MSC form 2M	Mar	China Cosco Shipping	Feb	Hanjin bankrupt
	alliance		Corp formed by COSCO	May	Hapag-Lloyd and UASC
	Hapag-Lloyd bought CCNI		and CSCL merger		merge
Dec	Hapag-Lloyd bought	May	Hapag-Lloyd, K Line,	Aug	Maersk bought Hamburg Sud
	CSAV		MOL, NYK and Yang	Jul	COSCO bought OOCL
			Ming form The Alliance		
		Jun	CMA CGM bought APL		
		Nov	CMA CGM, COSCO,		
			Evergreen and OOCL form		
			Ocean Alliance		
		Dec	ZIM tie-up with The		
			Alliance		
			Hyundai tie-up with 2M		

Table 1: Container shipping lines affected by alliance changes, mergers and acquisitions

Sources: various, including World Maritime News (21 August 2014), CCTV.com (19 February 2016), Lloyd's List (16 May 2016), Marine Link (4 November 2016), JOC.com (7 December 2016), American Shipper (12 December 2016), CNBC (17 February 2017) and The Maritime Executive (24 May 2017).

The Asia-Europe trade is a key east-west container trade. Container traffic volume on the trade was estimated to be 23 million TEUs in 2017 (UNCTAD, 2017). The trade route connects key load centers of East Asia with those of Europe and the Mediterranean regions. Container shipping lines that ply the Asia-Europe trade also call at key transshipment ports in South East Asia, South Asia and the Middle East. It is worth noting that eighteen of the twenty busiest container ports in the world are situated along the trade route (American Association of Port Authorities, 2017). Of these, the ports of Singapore, Port Klang and Tanjung Pelepas were ranked in the positions of 2nd, 12th and 18th respectively in 2015. The three ports altogether accounted for almost all of South East Asia's transshipment traffic (Yap and Notteboom, 2011).

The Asia-Europe trade route is a major source of transshipment containers for the three major ports in South East Asia. In 2015, the ports of Singapore, Port Klang and Tanjung Pelepas handled 51.6 million TEUs of containers (American Association of Port Authorities, 2017). Of this amount, 80.6% or 41.6 million TEUs consisted of transshipment containers thereby presenting the region as one of the largest container transshipment markets in the world. Specifically, 66.7% or 7.9 million TEUs of containers handled in Port Klang were transshipment containers (Malaysia Ministry of Transport, 2016) whereas the comparative figures for Singapore and Tanjung Pelepas are 82.2% or 25.4 million TEUs and 94.6% or 8.3 million TEUs respectively. Given the fact that transshipment is a mainstay of container traffic in these three container ports, it is assumed that all container shipping services that are calling at these ports involve some degree of transshipment operations.

Given the fact that South East Asia is a major transshipment market in the world and with all three shipping alliances having well developed shipping service connectivity in the ports of Singapore, Port Klang and Tanjung Pelepas (Lam and Yap, 2008), the paper aims to investigate the impact from the latest round of mergers and acquisitions and changes in alliance membership for the period 2013 to 2017 on shipping connectivity for each of the key container port in the region for the Asia-Europe trade route. The paper is organized as follow with the following section covering research effort devoted to this subject. Section three presents the research methodology

while section four presents the results of our analysis. Section five concludes with recommendations for future research.

2. Literature review

The advantages and disadvantages of shipping alliances have seen much research effort committed to this subject. Lam (2013) proposed that shipping lines could pool their container shipping fleet capacity to realize various economies associated with a bigger cargo volume and lower unit cost of operation. The benefits of shipping alliances would also include improved operational efficiency and synergy by slot sharing and joint services (Evangelista and Morvillo 1999; Ryoo and Thanopoulou 1999) while Slack *et al.* (2002) observed that wider markets could be served through shipping alliances. Wen (2012) also observed that collaborative arrangements could boost logistics capabilities and competitive advantages of shipping lines.

Nonetheless, liner shipping alliances were seen to be unstable given the series of structural changes over the years (Das, 2011). Rau and Spinler (2017) suggested that intensity of competition and cost of complexity of the alliance, and freight rate volatility led to alliance instability. Ferrari *et al.* (2008) noted that optimizing shipping networks could contribute to the success of shipping alliances and Midoro and Pitto (2000) suggested stability and efficiency of shipping alliances could be enhanced with less partners with clear differentiation of roles and contributions, and through synchronizing marketing and sales. Yang *et al.* (2011) saw that the strategy of jointly using mega ships with the emphasis on lowering unit costs for member lines would aid alliance stability.

On the issue of shipping connectivity, Ducruet (2016) brought out the importance of the Panama and Suez canals for trade exchanges between Asia, Europe and North America. Related to this and on the concept of centrality, Wang and Cullinane (2016) found the port of Singapore to be the most central in South East Asia. However, Lam and Yap (2011) observed that the relationship between two competing ports is by no means straight forward as it can simultaneously be competitive or complementary contingent on the nature of the trading network where the ports intend to serve. Furthermore, attracting carriers to call at the port would call for having the necessary facilities to handle related shipping volume with consequences on contestability (Yap,

2014) and spatial and environmental perspectives (Yap and Lam, 2013). Notteboom *et al.* (2017) further observed in the case of North West Europe that involvement by shipping lines in container terminals did not necessarily bring about direct calls by alliance members.

The latest developments in the liner shipping industry is unparalleled in its scale. It affected all the key container trades and more than 80% of the world container fleet capacity. In view of the prominence of South East Asia as a key transshipment market for several countries along the Asia-Europe trade route, the intention of this paper is to examine the implications of these developments on the state of connectivity for the three major transshipment ports in South East Asia.

3. Research methodology

The research uses a bottom up approach by computing for each of the three ports, individual container shipping services that are deployed to call at them on the Asia-Europe trade route. As mentioned, the specified ports of Singapore, Port Klang and Tanjung Pelepas are major transshipment hubs in the region and South East Asia is also one of the largest container transshipment markets in the world. The analysis focused on the time period of year 2013 to 2017 which witnessed the latest changes to shipping alliances as well as mergers and acquisitions concerning many of the major carriers. Under the framework, container shipping services were distinguished by those operated in shipping alliances and those that were not.

The proposed research framework is presented in figure 1 below. The method considered six differentiating elements to determine the characteristics of a particular liner service that called at either of the three ports. The first step is to find out those shipping services that are calling on the Asia-Europe trade. This is done using information on trade route deployment for container shipping services from Containerisation International Yearbook 2013 (Informa Plc, 2013) and Alphaliner (2017b). Apart from information relating to trade routes that the container shipping services are deployed on, information regarding the size of container vessels employed, port-of-rotation and shipping lines involved were also recorded. The information is subsequently updated to 2017 based on deployment information obtained from the websites of the major shipping lines.

The second step is to identify those shipping services operating on the Asia-Europe trade route which are calling at Singapore, Port Klang or Tanjung Pelepas and after which, we will be able to determine the names of the shipping services, shipping lines and ports-of-call. Having ascertained the key parameters of the shipping services parameters, the next steps shall pin point whether the service is calling only at one ports or making parallel calls involving any of the two other ports. The objective is to distinguish between calls made solely at a single port or whether the shipping service involves two or all of the three ports. Calls made solely at a single port could indicate hub status for the port with respect to the shipping network of the shipping line or shipping alliance. The last step is to determine whether the calls are made on a westbound journey or eastbound journey or whether double calls are made on both legs of the service. Given the location of the three container ports in relation to the flow of container trade between Asia and Europe, the head haul leg of the service would consist of a westbound voyage. Correspondingly, the eastbound voyage would indicate back haul traffic.

Figure 1: Framework to determine the characteristics of liner services that called at Singapore, Port Klang and Tanjung Pelepas for the Asia-Europe trade route



In summary, the framework aims to offer an objective and detailed review of changes in shipping service deployment effected by the series of mergers and acquisitions and new alliances that affected the liner shipping industry from 2013 to 2017. The purpose is to examine the implications for shipping service connectivity seen in the three major container transshipment ports in South East Asia over the same period of time. Results of the analysis are presented in the section that follows.

4. Results and discussion

Results shown in table 2 are organized into two time periods which are year 2013 and year 2017. The year 2013 preceded the latest round of merger and acquisition activity and changes in alliance while year 2017 represents the more recent state for the container shipping industry.

Calls by shipping services		2013		2017	Change
Solely at Singapore	26	9 by G6 Alliance7 by CKYH Alliance7 by other lines	16	7 by The Alliance5 by Ocean Alliance3 by 2M alliance1 by other lines	-10
Solely at Port Klang	6	2 by CMA/CSCL/UASC 1 by CSCL/ZIM 1 by CSCL/UASC 1 by ZIM/OOCL 1 by ZIM	1	1 by ZIM	-5
Solely at Tanjung Pelepas	5	2 by Maersk 2 by Evergreen 1 by Evergreen/Hanjin	2	2 by 2M alliance	-3
Singapore & Port Klang	4	4 by Maersk	6	5 by 2M alliance 1 by COSCO/Ever/OOCL	+2
Singapore & Tanjung Pelepas	5	2 by MSC/CMA CGM 1 by CMA CGM 1 by CKYH Alliance 1 by other lines	5	4 by Ocean Alliance 1 by CMA CGM	0
Port Klang & Tanjung Pelepas	0	-	0	-	-

Table 2: Shipping connectivity at South East Asia's three key transshipment ports (2013-2017)

All the three ports	4	4 by Maersk/CMA CGM	1	1 by Ocean Alliance	-3
Total for the three ports		50			-19

Source: Author's computation.

The year 2013 recorded 50 services on the Asia-Europe trade route which called at either of the three ports. Of these services, 26 were made solely at the port of Singapore. These consisted mostly of services operated by the G6 Alliance, CKYH Alliance and MSC. 18 out of 19 of these services included Singapore on both legs (i.e. head haul and back haul) of the voyage. The exception was the CKYH-Green Alliance North Europe 3 service which included Singapore only on the westbound-leg to Europe. The rest of shipping services deployed in the region was made up of 13 services which made parallel calls at either of the three ports and 11 that made dedicated calls only at either Port Klang (6 services) or Tanjung Pelepas (5 services). Shipping services that called at Port Klang were mostly made by carriers CMA CGM, CSCL, UASC and ZIM. As for Tanjung Pelepas, most of the shipping services that called at the port were operated by Maersk and Evergreen. This could be attributed back to 2002 when the shipping line Evergreen relocated its container shipping hub in South East Asia to Tanjung Pelepas from Singapore.

By 2017, the shipping connectivity landscape changed significantly. New shipping alliances came onto the scene by the exit of major shipping lines such as APL, CSCL, Hanjin and UASC which either went bankrupt or were bought or merged with another liner company. In the new shipping landscape, Singapore continued to be the main port-of-call getting dedicated calls by 16 services. 15 of these shipping services were operated by shipping alliances. More importantly, 10 of these services called at Singapore on both the head haul and return legs of trade route and another four had included Singapore on their cargo-heavy westbound leg. The only exception was The Alliance's Far East-Europe 3 service which called at Singapore on the back haul leg of the voyage. For Tanjung Pelepas, the Malaysian port located just next to Singapore began to receive calls by MSC in addition to Maersk with both shipping lines being members of the 2M alliance. Maersk had also been a major customer of Tanjung Pelepas since 2000. Evergreen also continued to call at Tanjung Pelepas although the shipping services now consisted of other carriers and included jointly calling at Singapore on top of Tanjung Pelepas. Turning to Port Klang, the port also saw continuation of calls made by CMA CGM and CSCL (through COSCO in the

merged entity) as major customers for the Asia-Europe trade route. However as with Tanjung Pelepas, many of the shipping services that used to call solely at the port now included jointly calling at Singapore.

On the whole, our results showed that the following observations could be made. Firstly, we found significant rationalization of shipping capacity to take place between the two time periods. While there were 50 services on the trade route that included either of the three ports in 2013, the corresponding number for 2017 fell to 31, representing a decline of 38%. Most notably, 27 out of the 31 services were operated in the form of shipping alliances. Of the 27 services, 10 were operated each by the 2M alliance and Ocean Alliance and seven operated by The Alliance. If we include the service operated by CMA CGM and the other service which is a joint consortium of COSCO, Evergreen and OOCL where they are all members of the Ocean Alliance, the total number of services related to members of this alliance would increase to twelve. By comparison, only 17 out of 50 services were operated by the G6 Alliance or CKYH Alliance in 2013. The behavior of carriers in the new industry landscape suggested substantial overcapacity in terms of number of services offered which compelled rationalization to take place. The results also seemed to suggest participation in shipping alliances as an important strategy to compete successfully on the Asia-Europe trade route.

Secondly, parallel calls remained significant with 13 shipping services taking such form in 2013 and 12 in 2017. The share of shipping services making parallel calls at either of the three ports increased from 26.0% in 2013 to 38.7% by 2017. More importantly, all these shipping services included Singapore. In other words, these parallel calls were made jointly at Singapore and included either Tanjung Pelepas or Port Klang. Shipping services that called jointly at Singapore and Tanjung Pelepas were mostly by Maersk and MSC which belonged to the 2M alliance. Shipping services that called jointly at Singapore and Were mostly under the Ocean Alliance. However, while 2013 saw four services operated jointly by Maersk and CMA CGM which included all three ports in 2013, the number of such services was reduced to only 1 (i.e. by Ocean Alliance) in 2017. As a whole, we saw the Ocean Alliance put greater weight on Singapore with many of their shipping services including the port on the westbound leg or both legs of the voyage. By comparison, many of those shipping services

operated by the 2M alliance have a tendency to put more emphasis on Tanjung Pelepas by including the port for the westbound leg and Singapore on the eastbound leg from Europe to Asia.

The third observation was the continued dominance of Singapore as a port-of-call for shipping services operating on the Asia-Europe trade route. While the number of shipping services that called at Singapore declined from 39 in 2013 to 28 in 2017, market share of shipping services that called at Singapore vis-à-vis Port Klang and Tanjung Pelepas increased from 78.0% in 2013 to 90.3% in 2017. In fact, Singapore was the only major container transshipment hub in the region to receive calls by members of all the three shipping alliances. In contrast, the only shipping alliance that called at Port Klang was Ocean Alliance whereas Tanjung Pelepas saw calls made only by the 2M alliance and Ocean Alliance.

5. Conclusion

Our analysis showed that there was substantial rationalization of shipping capacity that occurred given the recent spate of mergers and acquisitions and changes to alliances. Shipping line behavior in the new landscape suggested that participation in shipping alliances could be important for being able to compete successfully on the Asia-Europe trade. Secondly, the results revealed that parallel calls continued to be significant and all of the services included Singapore in the port-of-rotation. Thirdly, calling patterns revealed Singapore's dominance as a port-of-call with the port's market share for shipping services rising from 78.0% in 2013 to 90.3% in 2017. Furthermore, Singapore was the only port among the three to get calls by all three shipping alliances which are the 2M alliance, Ocean Alliance and The Alliance.

The analysis also observed Singapore strengthen its position as a major port-of-call for the trade route. This could be due to the incumbent presence of dedicated terminals by shipping lines COSCO, MSC and CMA CGM which might have helped to entrench the liner networks operated by the 2M alliance and Ocean Alliance. Although Maersk continued to call at its hub in South East Asia which is situated at Tanjung Pelepas, the shipping line devoted a sizeable proportion of its service calls in the region to Singapore. These were operated together with its alliance partner MSC. As for CMA CGM which used to hub at Port Klang, buying over of APL saw the shipping

line announce its intention to hub at Singapore which will result in more service calls made at Singapore (The Straits Times, 8 December 2015). This was aided by CMA CGM investing jointly with PSA to operate four container berths with an annual capacity of 4 million TEUs at the new Pasir Panjang Terminal (The Straits Times, 27 March 2017). As a whole, the study showed the importance of targeting and entrenching shipping lines and notably, their alliances in order to secure the network of the entities in the port. This is made even more crucial with most shipping lines and services operating under shipping alliances on the trade route compared to just four years ago in 2013. Hence, the paper highlighted strategic and commercial implications for relevant decision makers including terminal operators and port authorities on the need to address priorities associated with the operational requirements and commercial viability of an entire shipping alliance's network rather than a few key players.

The research contributes to the literature and policy analysis by detailing the impact and importance of shipping alliances in view of the recent alliance reshuffle and merger and acquisition on the state of shipping connectivity for key transshipment hubs in South East Asia on the Asia-Europe trade. The research approach adopted considered the supply dimension with the help of information on shipping services calling at the various ports. Future research could address the implications for other trade routes to offer a comprehensive understanding on network dynamics adopted by the newly formed alliances in other major container handling regions.

References

Alphaliner (2013, October 25). Top 100. Retrieved from http://www.alphaliner.com

Alphaliner (2017a, September 26). Top 100. Retrieved from http://www.alphaliner.com

Alphaliner (2017b, October 1). Services. Retrieved from http://www.alphaliner.com

- American Association of Port Authorities (2017, October 29). World Port Rankings 2015. Retrieved from http://www.aapa-ports.org/unifying/content.aspx?ItemNumber=21048
- Barnard, B. (2016, 7 December), Zi THE Alliance teams with Zim on trans-Atlantic service. *JOC.com.* Retrieved from https://www.joc.com

Containerisation International Yearbook (2016). Containerisation International. London.

- Das, S.S. (2011). To partner or to acquire? A longitudinal study of alliances in the shipping industry. *Maritime Policy & Management*, 38(2): 111-128.
- Ducruet, C. (2016). The polarization of global container flows by interoceanic canals: geographic coverage and network vulnerability. *Maritime Policy & Management*, *43*(2): 242-260.
- Dupin, C. (2016, 12 December), HMM forms space-sharing agreement with Maersk, MSC. *American Shipper*. Retrieved from https://www.americanshipper.com
- Espina, K. (2016, 16 May). Newly formed The Alliance seen as match for 2M and Ocean Alliance. *Lloyd's List Maritime Intelligence*. Retrieved from https://lloydslist.maritimeintelligence. informa.com/
- Evangelista, P., & Morvillo, A. (1999). Alliances in liner shipping: an instrument to gain operational efficiency or supply chain integration? *International Journal of Logistics: Research and Applications*, 2(1): 21-38.
- Ferrari, C., Parola, F., & Benacchio, M. (2008). Network economies in liner shipping: the role of home markets. *Maritime Policy & Management*, 35(2): 127-143.

Informa plc (2013). Containerisation International Yearbook 2013. London, UK: Informa plc.

- Hu, N. (2016, 19 February). COSCO and China Shipping merge in Shanghai. CCTV.com. Retrieved from http://english.cntv.cn
- Lakshmi, A. (2016, 4 November). Ocean Alliance vs 2M. *Marine Link*. Retrieved from https://www.marinelink.com/
- Lam, J.S.L. (2013). Benefits and barriers of supply chain integration: empirical analysis of liner shipping. *International Journal of Shipping and Transport Logistics*, *5*(1), 13–30.

- Lam, J.S.L., & Yap, W.Y. (2008). Competition for transshipment containers by major ports in Southeast Asia: slot capacity analysis. *Maritime Policy & Management*, *35*(1), 89-101.
- Lam, J.S.L., & Yap, W.Y. (2011). Container port competition and complementarity in supply chain systems: evidence from the Pearl River Delta. *Maritime Economics and Logistics*, 13(2), 102-120.
- Malaysia Ministry of Transport (2016, October 26). Transport Statistics Malaysia 2016. Retrieved from http://www.mot.gov.my/en/Statistik%20Tahunan%20Pengangkutan/Transport%20Stati stics%20Malaysia%202016.pdf
- Midoro, R., & Pitto, A. (2000). A critical evaluation of strategic alliances in liner shipping. Maritime Policy & Management, 27(1): 31-40.
- Notteboom, T.E., Parola, F., Satta, G., & Pallis, A.A. (2017). The relationship between port choice and terminal involvement of alliance members in container shipping. *Journal of Transport Geography*, 64: 158-173.
- Rau, P., & Spinler, S. (2017). Alliance formation in a cooperative container shipping game: Performance of a real options investment approach. *Transportation Research Part E*, 101: 155-175.
- Ryoo, D.-K., & Thanopoulou, H. (1999). Liner alliances in the globalization era: a strategic tool for Asian container carriers. *Maritime Policy & Management*, *26*(4): 349-367.
- Slack, B., Comtois, C., & McCalla, R. (2002). Strategic alliances in the container shipping industry: a global perspective. *Maritime Policy & Management*, 29(1): 65-76.
- The Maritime Executive (2017, 24 May), Hapag-Lloyd and UASE merger is complete. *The Maritime Executive*. Retrieved from https://maritime-executive.com
- CNBC (2017, 17 February), S. Korea court declares Hanjin Shipping bankrupt. *CNBC*. Retrieved from https://www.cnbc.com
- UNCTAD (2017). Developments in International Seaborne Trade. *Review of Maritime Transport* 2017 (pp. 1-19). Geneva, Switzerland: United Nations Publication.
- Wang, Y., & Cullinane, K. (2016). Determinants of port centrality in maritime container transportation. *Transportation Research Part E*, 95: 326-340.
- Wen, Y-H. (2012). Impact of Collaborative Transportation Management on Logistics: Capability and Competitive Advantage for the Carrier. *Transportation Journal*, *51*(4): 452-473.

- Woo, J. (2015, 8 December). French shipping giant CMA CGM to reinforce Singapore's hub status. The Straits Times. Retrieved from http://www.straitstimes.com/
- Woo, J. (2017, 27 March). PSA, CMA CGM double capacity of container terminal joint venture. The Straits Times. Retrieved from http://www.straitstimes.com/
- World Maritime News (2014, 21 August). Maersk, MSC to start 2M alliance in January. *World Maritime News*. Retrieved from https://worldmaritimenews.com
- Yang, D., Liu, M., & Shi, X. (2011). Verifying liner Shipping Alliance's stability by applying core theory. *Research in Transportation Economics*, *32*(1): 15-24.
- Yap, W.Y. (2014). P3 Alliance and Its Implications on Contestability in Major Gateway Ports in North America. *Transportation Journal*, 53(4): 499-515.
- Yap, W.Y., & Lam, J.S.L. (2013). 80 Million-TEU Container Port? Sustainability Issues in Port and Coastal Development. Ocean & Coastal Management, 71, 13-25.
- Yap, W. Y., & Notteboom, T. (2011). Dynamics of liner shipping service scheduling and their impact on container port competition. *Maritime Policy & Management*, 38(5), 471-485.

MANAGING RISK AND VULNERABILITY: A MULTILEVEL MODEL OF RESILIENCE IN SUPPLY CHAIN NETWORKS

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Abstract

Resilience has become a key construct for understanding and managing supply chain risk and vulnerability. Although often conceptualized in the literature as a dynamic, multidimensional and multiscale construct, consideration of level issues is missing in emerging models of supply chain resilience. In this research, we develop a multi-level model of resilience composed of individual, firm and system level factors. The presumption is that supply chain resilience may be influenced by internal processes in the supplier network, actions of individual firms in the supply chain, which in turn, may be influenced by individual actors either as individuals or groups within member organizations. We suggest that greater attention to level of analysis in supply chain resilience research will lead to greater conceptual and empirical clarity. Addressing the level of analysis issues in supply chain research is important because both the level of theory and measurement in organizational research needs to be aligned to avoid the misspecification of theoretical and empirical models. Explicating level of analysis issues also enhances practical intervention strategies for strengthening supply chain network resilience as well by directing the attention of analysts and managers to problems at each level of the supply chain.

Keywords: Multi-level analysis, supply chain resilience, supply chain networks, individual resilience, organizational resilience, system resilience

INTRODUCTION

Supply chains, the collection of processes and resources required to manufacture and deliver products to final customers, have become the backbone of the global economy, explaining the rise of such giant conglomerates like Walmart and Amazon (van der Vegt, Essens, Wahlstrom & George, 2015). Despite their importance, supply chains are vulnerable to disruptions and face substantial risk and their management has not always been easy and there is a bourgeoning amount of research on finding new ways for dealing with, and overcoming, the well-documented risks and disruptions supply chains face (Sheffi, 2005).

The emerging research has increasingly identified the concept, resilience, as a tool for managing supply chain risk and vulnerability (Ponomarov & Holcomb, 2009; Sheffi, 2005 Christopher & Peck, 2004; Eltantawy, 2016). Given its importance, our understanding of how resilience is developed, managed and measured is of theoretical and practical importance. With roots in ecology, resilience has rapidly been applied in several disciplines within the organizational sciences and supply chain management literature (see Tukamuhabwa, Stevenson, Busby, & Zorzini, 2015 for a recent review). Despite this bourgeoning research, supply chain resilience (SCRes) remains a poorly understood phenomenon. In particular, there appears to be a lack of conceptual clarity and the concept remains under-theorized (Tukamuhabwa et al., 2015). Of particular concern here is the failure to systematically explore the level of analysis issues that arise with the study of what is clearly a dynamic, multifaceted and multidimensional phenomenon (Tukamuhabwa et al., 2015; Eltantawy, 2016).

Research has shown that resilience in organizations can be brought about by factors at individual or organizational level (e.g. Sutcliffe & Vogus 2003), and that supply chain resilience is often not determined just by organizational resources and capabilities, but by the interrelations

and interactions that organizations have with other actors along the supply chain (Urciuoli, Hinsta, & Boekesteijn, 2014). More important, system-wide resilience may not necessarily be an indication of resilience at individual firm level (Pournader, Rotaru, Kach, & Razavi, 2016) and there is the recognition that there are differences between resilience of an agent and the resilience of the supply chain as a whole (Pereira, Christopher & Da Silva, 2014; Pournader et al., 2016; Vegt et al., 2015). These findings point to the need for understanding the level issues inherent in SCRes. Despite that recognition, very few studies have set out to explicitly address level issues in SCRes. For example, Kim, Chen and Linderman's (2015) review of a sample of 14 articles on supply chain disruption and resilience showed that only half of the articles focused on supplier network as a level of analysis; slightly more than a third had no clear level of analysis specified, a few on firm level, firm and network level with none of the studies focusing on a composition of individual, firm and supply network level of analysis in the same study. These and similar other findings highlight the need for exploring the level of analysis issues in supply chain resilience and there is no shortage of direct calls for a greater understanding of multilevel issues in resilience research (see, e.g. Tukamuhabwa, 2015, Pathak, Day, Sawaya & Kristal, 2007, Linnenluecke, 2015).

We respond to those calls and need by developing a multilevel framework for supply chain resilience in this paper and in so doing fill an important gap in existing SCRes research. The rest of the paper is organized as follows. First we present a model of supply chain resilience, exploring how resilience emerges at the individual, organization and system levels. Second, we explore key contingencies that facilitate the emergence of desired behaviors at each level of analysis. Third, we examine the consequences of supply chain resilience at the three levels of analysis. We aggregate the effects of lower level variables and relate them to higher level variables through

bridging propositions (House, Rousseau & Hunt, 1995). A discussion of the theoretical and practical implications of the research conclude the paper. Figure 1 presents our summary model in schematic form. It shows that supply chain resilience is influenced by what happens at the employee, firm and supply network level with resilience at lower levels influencing resilience as we move up. Of course, there may be reciprocal influences between the levels as individuals and agents enact organizational behavior (indicated by the broken arrows, but not the main thrust here) and that reciprocity may be present between all the levels. We suggest that whether the key antecedents of resilience actually lead to resilience may depend on key contingencies embedded in the firm's ability to leverage these capabilities or enable individuals to deploy resilience enhancing behaviors. Following previous research, we conceptualize supply chain networks as complex adaptive systems to describe their dynamic structure (Pathak, Day, Nair, Sawaya & Kristal, 2007).

By definition, resilience is a complex and multidimensional phenomenon and resilience has been studied through a multilevel lens in ecology from where researchers in supply chains literature seemed to have borrowed the concept (Christopher & Peck, 2004). Resilience theorists have acknowledged the necessity of exploring complex systems and problems through a multilevel approach by introducing the concept of "panarchy" (Gunderson & Holling, 2002). According to the Resilience Alliance (http://www.realliance.org), no system can be understood or managed by focusing on it at a single scale. All systems exist and function at multiple scales of space, time and social organization, and the interactions across scales are fundamentally important in determining the dynamics of the system at any particular focal scale. This interacting set of hierarchically structured scales has been termed a panarchy. As Gunderson & Holling (2002) note, resilience is a property of a system, one that cannot be predicted or understood simply by

examining the parts of the system. Panarchy allows for the possibility of interactions across levels and thresholds through system feedback as well as for interaction between levels and the possibility that resilience at lower levels does not automatically increase the overall resilience of the system (Gunderson & Holling, 2002; Robards & Greenberg, 2007) and similar dynamics in fact operate within supply chains. Key capabilities such as trust and collaboration in the SCRes literature may have different characteristics at the individual, firm and system-wide levels (Hohenstein, Feisel, Hartmann, & Giunipero, 2015). To understand a system's resilience, therefore requires that we identify the capabilities and capacities of important parts of the system, and to examine how they interact with one another and with their environment to predict key performance outcomes at different levels of analysis before and after a disruptive event (van der Vegt et al., 2015).

Insert Figure 1 about here

Supply Chain Resilience

Several definitions of SCRes exist (see Kamalahmadi & Parat, 2016, for a recent review). Resilience has been defined in many ways in the emerging literature but one of the most widely cited definitions is based on Christopher and Peck (2004, p.2) who define resilience as "the ability of a supply chain to return to its original state or move to a new, more desirable state after a disturbance." Holling's (1973) original work identifies two forms of resilience: engineering and ecological resilience. While engineering resilience focuses on efficiency and a system's capacity to recover quickly after a disruption, ecological resilience as a more adaptive approach to resilience. An adaptive notion of resilience sees resilience as a dynamic process of continual development (Pendall, Foster & Cowell, 2010). A common set of properties of resilient supply chains is emerging. A resilient supply chain demonstrates readiness, responsiveness, recovery and

the capacity for growth and renewal following a disruption and resilience has been measured largely in terms of recovery time (Christopher & Peck, 2004, Sheffi & Rice, 2005) but some researchers have incorporated cost as a parameter for measuring resilience (Vugrin & Ehlin, 2011). *Supply Chains as Complex Adaptive Systems (CAS)*

Supply chains have been conceptualized as CAS to reflect their dynamic nature and structure (Wycisk, McKelvey & Hulsmann, 2008). CAS consist of a number of active "agents" who share a common schema or norms of behavior and interact with each other according to sets of rules that requires them to examine and respond to each other's behavior in order to improve their behavior and the behavior of the system they comprise (Stacey, 1996; Choi et al., 2001). In the case of supply chains, the agents (firms) interact by exchanging information and physical goods (Pathak et al., 2007). At the same time however, the agents are heterogeneous and operate at multiple scales with degrees of freedom to act independently when necessary (Surana, Kumara, Greaves & Raghavan, 2005; Choi et al., 2001). CAS interact with their environment, adapt and co-evolve to create dynamic, emergent realities (Wycisk et al., 2008) and SCRes has been described as an adaptive phenomenon (Aditya et al., 2014). CAS exhibit nonlinearity (Choi et al., 2001) and making predictions about nonlinear phenomena is difficult, if not impossible because small changes in system variables can result in either large, small or no effect at all, leading to what some call the "butterfly effect" (Lorenz, 1963), a feature not unlike the "bullwhip effect" in supply chains. Next, CAS exhibit self-organization and emergent behavior, a process by which order emerges without any external control (Nicolis & Prigogine, 1989) and supply chains have been described as self-organizing systems (Nilson & Gammelgaard, 2012). CAS have the ability to engage in dynamic learning as a strategy to attain fit with their environment because learning helps adaptation (Wysick et al., 2008). The qualities of a CAS and the description of a supply chain as a

complex adaptive system implies that resilience itself may best be understood as a dynamic and nonlinear concept since resilience is a feature of such dynamic systems (Nilson & Gammelgaard, 2012).

CONCEPTUAL FOUNDATIONS: RESILIENCE AT THREE LEVELS

The dynamic and multidimensional nature of resilience raises level of analysis issues. In this research, we explore resilience as a phenomenon that arises (1) at the individual level as dispositions (2) as a set of capabilities that facilitates firm level resilience, and (3) how these are aggregated to resilience at the system or supply chain network level.

Individual/Employee Resilience

The micro-foundations of inter-firm behavior may be important to understanding inter-firm phenomena such as SCRes especially since there is agreement that social forces such as trust and collaboration are at the heart of SCRes (Ghosh & Fedorowicz, 2008). As Morgeson & Hofmann (1999) observed, an understanding of resilient individuals provides a useful starting place for defining resilient organizations because it is the actions and interactions among individual organizational members that underpins the emergence of a firm's collective resilience. Studies on individual resilience have demonstrated that resilience, a capability that can be developed deliberately, is related to problem-solving capabilities, positive reinforcement, and strong faith (Zolli & Healy, 2012). Research has shown that a critical source of capacity for organizational resilience is contained in the characteristics of employees (Lengnick-Hall, 2011; Luthans, Youssef, & Avolio, 2007). Coutu (2002) suggested that employee capabilities are important for building resilience and organizations can manage psychological strength in employees. Luthans (2002)

proposed that one of variables leading to psychological strength is resiliency, defined as 'the capability of individuals to cope successfully in the face of significant change, adversity, or risk' and as 'the positive psychological capacity to rebound, to "bounce back" from adversity, uncertainty, conflict, failure or even positive change, progress and increased responsibility' (p. 702).

Behavioral psychologists use the notion of personal resilience to describe the extent to which individuals are able to deal with, and recover from, personal traumas and adversity (O'Dougherty, Wright & Masten, 2013). Research on individual resilience has expanded on this initial focus on response to adversity to include the capacity to adapt and even thrive, in the face of challenges (Flectcher & Sankar, 2016). Not everyone has the same degree of resilience and some individuals are more resilient than others (Leipold & Greve, 2009). Those with high resilience have been found to be resourceful, flexible, energetic and have the ability to detach in order to problem solve (Block & Block, 1980). Resilient individuals are also known to have positive emotions (Tugade & Frederickson, 2004) and demonstrate high self-efficacy (Kidd & Shahar, 2008). A number of characteristics may make some individuals more resilient than others, including personal traits such as optimism and confidence (Bonanno et al., 2007), faith (Pargament, 1997). There are clearly significant implications for firms that have resilient individuals. The ability of resilient employees to persevere, demonstrate mental toughness and their capacity to adopt coping strategies when faced with challenges (Reivich et al., 2011) should come handy during a disruption to the supply chain. Resilient people are able "to overcome, steer through, bounce back and reach out to pursue new knowledge and experiences, deeper relationships with others and [find] meaning in life" (Luthans, Youssef, & Avolio, 2007, 123). Resilient individuals are also known for maintaining effective relationships with others (Criss et al., 2015) and this disposition should help both trust building and collaboration with others. The sort of behaviors associated with resilient employees should positively impact the capacity of supply chain firms to deploy individual behaviors in the face of supply chain disruptions. Individuals often serve as key boundary role persons in inter-firm relationships. Resilient individuals have the ability to collect, process and act on information following stress because they tend to have high cognitive ability (Shia et al., 2015). Work conditions that allow for frequent interaction between employees increases their individual and collective resilience (Wrzesniewski & Dutton, 2001) and membership in rich social networks promotes personal resilience (Pressman et al., 2005).

According to Youssef and Luthans (2007), resilient individuals react to adverse circumstances by recognizing and acknowledging the impact, investing in time, energy and resources needed to "bounce back" to equilibrium and resilience allows individuals to use setbacks as opportunities to grow.

Organizational Resilience

As a CAS, the performance of a supply chain depends on the fitness of the individual heterogeneous agents or firms (Choi et al. 2001; Wycisk et al. 2008). Vogus & Sutcliffe (2007) define organizational resilience as the ability of the organization to maintain positive adjustment to difficult situations through resourcefulness. A resilient organization is able to adapt to internal and external disturbances, maintain its integrity as a system, re-organize itself, and increase its capacity by transforming challenges into opportunities for learning and innovation (Folke, 2006). Bowers, Kreutzer, Cannon-Bowers, & Lamb (2017) identify the kinds of "difficult" situations resilient organizations can deal with to include crises, unexpected events, deviations from normal functioning and emergent risks and supply chain disruptions fit these sort of deviations
(Christopher & Peck, 2004; Sheffi, 2005). Rudolph & Repenning (2002) observed that an accumulation of small stresses and deviations and catastrophic events both pose significant risks to organizations. Resilient organizations have a capacity for adaptation and this is a necessary capability for managing supply chain disruption Ponomarov & Holcomb 2009) and adaptation is a key characteristics of a CAS (Wysick et al., 2008). A resilient organization also has a capacity for learning and agents in CAS have the ability to learn from past experience (Choi et al., 2001). Resilient organizations also have the capacity to activate their latent resources as they prepare their capacity for adaptation (Bowers, Greve, & Mitsuhashi, 2017). Resilience at the organizational level is facilitated by several factors: the firm's ability to quickly adapt to unexpected events (Lengnick-Hall et al., 2011); a capacity for monitoring events and the ability to learn from the past (Vogus and Sutcliffe, 2007). The firm's adaptive capacity enables it to make decisions in crisis situations (MacManus, Seville, Vargo & Bundson, 2008).

Resilience at the organizational level should have a positive impact on the organization. Resilient organizations are able to use their human resources effectively by developing the knowledge, skills and abilities of its employees (Lengnick-Hall et al., 2011), have a better chance of building collaborative relationships (Werner & Smith, 2001) and promote self-organizing structures (Lengnick-Hall et al., 2011). Brodsky, Welsh, Carrillo, Scheibler & Butler, 2011) have also identified resilience processes at the organizational level to include: a sense of community, positive team culture, and a striving to achieve organizational mission. Lengnick-Hall et al. (2011, p. 244) suggest that organizational level resilience is embedded in a set of individual knowledge, skills, and abilities and organizational routines and processes and organizations can apply strategic human resource management systems to develop the knowledge, skills and abilities

of individual employees to invoke the appropriate collective routines for generating resilient outcomes.

Organizational level capabilities are more than additive composites of individual capabilities (Ashmos & Huber, 1987) and organizational level resilience is built by meaningful interactions between resilient employees within the organization. In turn, organizational level factors either facilitate or hinder desired behaviors that enhance organizational level resilience. A key mechanism through which individual level resilience facilitates organizational level resilience is through strategically managing human resources to create competencies among employees. These individual competences are then aggregated at the organizational level to foster organizational resilience. In these respects, an organization's resilience is a collective attribute that arises from the capabilities, actions, and interactions of individuals and units within a firm. Organizations can use key integrating mechanisms for achieving collective resilience capability at the organizational level (Lengnick-Hall et al., 2011). Organizations that facilitate meaningful interactions will build the inherent resilience (McCubbin & McCubbin, 1996) of the organization. Firm level resilience may be developed for purposes unrelated to disruptions but would nonetheless be able to be adapted quickly to respond to disruptions (Juttner & Maklan, 2011). The "strength" of the organization, much like that of a resilient family, depends on the resilience of individuals and resilient employees should have a positive impact on organizational resilience. Therefore,

Proposition 1. Individual employee resilience facilitates the emergence of resilience at the organizational level.

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Inter-firm level resilience

System level resilience can be defined as the capability of the supply chain network as a system to withstand and survive disruptions and be able to develop new capabilities to thrive. The resilience of a system is an emergent property of the resilience of its components: a system's resilience depends on how the components interact, not simply on their individual resilience metrics (Fiskel, 2003). As Kozlowski, (2012, p. 267) observes, system resilience is a collective construct that "is the result of bottom-up processes whereby phenomena and constructs that originate at a lower level of analysis through social interaction and exchange combine, coalesce, and manifest at a higher collective level of analysis." Therefore, the emergence of inter-firm resilience is compositional; the emergence of system level resilience arises from firm-level resilience. Supply chains as CAS are made up of heterogeneous agents who may be following different schemas or norms, yet they all have a collective interest in enhancing the fitness of the system as a whole (Wysick et al., 2008). Indeed, each firm in the supply chain may be operating at a different level with different rules because agents have different roles. Yet the resilience of the supply chain as a collective emerges from the interactions of the different firms that make up the supply network as they apply strategies and rules designed to increase their fitness. Mitchell and Beyeler (2015) found that a system in which entities select their own strategies provides less agent-level resilience, but the system as a whole is more efficient. There are several capabilities that facilitate the emergence of resilience at the inter-firm level and these are discussed later on in the paper. Suffice to mention that the presence of system level resilience has significant positive impact on the supply chain.

Resilience at the inter-firm level facilitates the system's collective's capacity to adapt to new fitness landscapes (Kauffman, 1993) because agents at different levels have similar concerns. There are constant changes in the environment of CAS and resilience at the system level facilitates the adaptation necessary for weathering the environmental dynamism and change that the system faces (Dooley et al., 2001). Resilience at the system level also facilitates self-organization (Nilson & Gammelgaard, 2012). Decisions made by firms at the organizational level may cause new structures and properties to emerge at the system level without any individual firm unilaterally controlling the system. Each agent tries to achieve its own goal but this in turn contributes to the collective behavior of the entire network (Tukamuhabwa et al., 2015).

There may be tradeoffs, at least in the short term, between agent and system resilience. Mitchell and Beyeler (2015) found that agents that build redundancy in the form of holding inventory as a protection against shocks may survive, but at a cost of reduced efficiency at both the firm and system level. This finding suggests that while systems in which agents select their own strategies provide less component-level resilience overall, the system overall is more efficient and the harmful effects of disruptions may be less severe on the agents. In the long term then, firm level behavior that promotes system resilience is ultimately beneficial to the agent despite the tradeoffs. Therefore,

Proposition 2: Resilience at the firm level facilitates system or supply chain level resilience.

ANTECEDENTS OF RESILIENCE

Individual Resilience

We focus on three individual-level characteristics: individual learning goal orientation, selfleadership and trusting orientation since these underlie some of the key behaviors for explaining resilience at the firm and system level.

Learning goal orientation. The concept of learning goal orientation (LGO hereafter) is defined as individuals' disposition to "increase their competence and to understand or master something new" (Dweck,1986, p. 1040). LGO has proven to be an important motivational force that leads to

learning, knowledge mastery, and creativity (Van Knippenberg, Chen, & Sacramento, 2011). Although a person's learning orientation may exhibit the many qualities of a trait, research shows that this trait is somewhat malleable (Van Hooft & Noordzij, 2009) and can be developed (Dweck, 2006). Individuals with high LGO see challenging situations as an opportunity to learn and improve themselves (Ashford, Blatt, & VandeWalle, 2003). Such individuals are also better at receiving negative feedback or confronting adversity in social interaction (VandeWalle & Cummings, 1997). Individuals with LGO tend to be use self-referenced criteria in evaluating their performance instead of comparing themselves with others, i.e. other-referenced standard thereby being better at self-leadership and cooperation with others (Poortvliet & Darnon, 2010). Previous studies indicated that employees with a stronger LGO are more likely to show proactive behavior and learning behavior, seek feedback more often (Parker & Collins 2010), and demonstrate higher levels of self-efficacy than employees with a weaker LGO (Payne, Youngcourt & Beaubien, 2007). Moreover, because individuals with stronger LGO are more confident in their own abilities- and less anxious about new situations-when compared to employees with a weaker LGO, they are more likely to seek out ways to improve their competencies, engage in uncertain and/or challenging tasks, and set higher goals in said situations (Payne et al., 2007). LGO has been found to boost leadership effectiveness (Hendricks & Payne, 2007).

Individuals with a strong learning orientation not only have a higher propensity to develop new knowledge, but also believe that their learning efforts can be instrumental to attaining desirable goals (Maurer et al., 2003; VandeWalle, 1997). Collectively, people with higher LGO should tend to be more resilient than those with lower LGO because of the qualities associated with LGO. More specifically, a strong learning orientation facilitates persistence in goal attainment and encourages more effective planning about how to execute personal goals (VandeWalle, Cron

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& Slocum, 2001). Such individuals are not only able to maintain their current knowledge set but are also able to seek out how their current knowledge can be expanded and leveraged to address new challenges (Gong & Fan, 2006), and that should help their ability to solve problems in uncertain situations (Baum et al., 2011).

Proposition 3. Learning goal orientation facilitates individual resilience

Trusting disposition. Dispositional trust is based on individuals' pre-dispositions to trust or distrust in a given situation (Stern & Coleman, 2015). Trusting disposition may be a personalitybased trait people develop through their life experience (Tan & Sutherland 2004). Research suggests that trust depends, in part, on trusting disposition (Mayer, Davis, & Schoorman, 1995). This form of trust is based on an individual's belief that people in general can be trusted. Individuals with high disposition to trust tend to have a general inclination to show faith or belief in humanity and adopt a trusting stance toward others. McKnight, Cummings and Chervany (1998) suggest that dispositional trust is a two-dimensional construct: faith in humanity and trusting stance. Faith in humanity refers to 'the extent to which one believes that nonspecific others are trustworthy' (McKnight et al., 1998, p. 478). Faith in humanity contributes towards the positive perception about others, an aspect of personal resilience. Individuals with faith in humanity would tend to be resilient people because such individuals are able to deal with adversity, including unrequited trust from others, and forge ahead stronger. Trusting disposition should help trust development in a relationship because it confers a measure of goodwill. Faith in people is especially important in the initial stages of a relationship (Mayer, Davis, & Schoorman, 1995). Since trust, even between firms, is an interpersonal thing (Mayer et al., 1995) individuals disposed to trusting would positively impact trust development at the supply chain level. Trusting disposition may also help facilitate resilience because it entails an expectation that others will be responsive to one another's

needs, even if they conflict with an individual's own preferences (Rempel, Ross & Holmes, 2001). Faith in humanity and expectations that people will respond to faith in them in kind rests on hope. A virtue such as hope helps individuals to deal with adversity and move forward, sturdier than before (Bright, Cameron, & Caza, 2006). Although we suggest that resilience is an outcome of trusting disposition, resilience should also have a reciprocal effect on trust. Resilient individuals are better prepared to deal with disappointment. When a trusted party does not respond in kind, resilient individuals have the capacity to try and work through the failure and build trust (Bright & Exline, 2011). Therefore,

Proposition 4: Trusting disposition facilitates individual resilience

Self-leadership. Self-leadership (Manz, 1986) is a process through which people influence themselves to achieve the self-direction and self-motivation necessary to perform. Although self-leadership is conceptualized as learned behavior (Manz, 1986), some theorists have argued that the construct is virtually indistinguishable from personality traits (Markham & Markham, 1998). The fundamental idea behind self-leadership is that individuals look first within themselves for the necessary tools and strategies to motivate and control behavior and thought. According to Manz and Neck (2004), self-leadership strategies can be classified into three categories: behavior-focused strategies involve the self-regulation of behavior through the use of self-assessment, self-reward, and self-discipline (Manz and Neck, 2004). Natural reward strategies include finding intrinsic reward in the task and engaging in job or task re-design.

Self-leadership positively impacts individual resilience primarily through the capacity for recovery following failure. To realize that one has failed necessitates self-observation and self-

evaluation. Self-evaluation involves determining the root cause of failure and ascertaining if there is anything that could have been done to avoid it. Self-leadership also promotes self-goal setting (Sims and Manz, 1996) and promotes action towards recovery following failure (Boss and Sims, 2008). Individuals often adopt one of two opposing thought patterns: "opportunity thinking" or "obstacle thinking" and self-leadership involves opportunity thinking (Neck & Manz, 1992). Opportunity thinking involves a pattern of thoughts focusing on opportunities, worthwhile challenges, and constructive ways of dealing with difficult situations. Obstacle thinking, on the other hand, involves a focus on reasons to give up and retreat from problems. Boss and Sims (2008) argue that opportunity thinkers take a more active role in dealing with challenges, exerting greater effort and persistence in overcoming challenging situations. Coutu (2002) argues that resilient individuals possess three common characteristics: acceptance of reality, a strong belief that life is meaningful, and the ability to improvise, all examples of opportunity thinking. In general, selfleadership facilitates resilience through the use of cognitive and behavioral strategies to accomplish tasks, overcome challenges and bounce back after failure. Resilient individuals are known to retain the belief that they will be able to exert control over themselves under adverse conditions and are more likely to persevere in their efforts (Bandura, 1977). Therefore,

Proposition 5: Self-leadership facilitates individual resilience

Organizational Level Antecedents of Resilience

There are some key organizational capabilities that facilitate resilience at the organization level. We discuss team resilience and risk management culture as factors that facilitate the development of an organization's resilience capacity.

Team resilience. Team resilience is the capacity that teams have for overcoming crisis and difficulties. According to Bennett, Aden, Broome, Mitchell and Rigdon (2010) resilience may be

viewed both as an individual trait and social factor (existing in teams or groups). Individual and team resilience may be related, but are distinct constructs (Alliger, Cerasoli, Tannenbaum, William, 2015). Resilient teams are known to have collective creativity, efficacy, cohesion, social support and trust (Stephens, Heapy, Cazrmeli, Spreitzer & Dutton, 2013). Teams that possess collective efficacy, or shared group belief in their joint capacities to organize and to execute courses of action are resilient. Organizations can create the enabling environment for team resilience. For example, it has been shown that face-to-face meetings allow individuals and team members to feel more connected with their co-workers (Warkentin, Sayeed & Hightower, 1997). Developing conditions where team members develop respectful interactions promotes group resilience because these are key factors for group collaboration (Lengnick-Hall et al., 2011). Sutcliffe and Vogus (2003) argued that resilience can be fostered through problem-solving networks, and the presence of social capital in teams because the greater use of respectful interaction can accelerate and enrich the exchange of information and the capacity to process it. It seems therefore that the more team members act as a team, the more resilient they become and the clearer the goals they have, the more resilient they will be.

Team resilience should have a positive impact on organizational resilience as resilient teams often develop the capacity to see failures and imperfections as sources of learning and progress (Edmondson, 2012). Resilient teams focus on problem solving, rather than attributing error to individuals. This positive learned behavior is made possible by the tendency of resilient teams to build rich relationships among team members (Pentland, 2012). Explicit communication and the sharing of ideas in resilient teams should further enhance their capacity for adaptation. Team resilience should have a positive influence on the team's ability to recover after a stressful situation since resilient teams tend to have a capacity for positive adaptation through collective

interactions (West, Patera & Carsten, 2009). Resilient teams also keep a collective memory (Ilgen, Hollenbeck, Johnson & Jundt, 2005) and that can promote higher levels of performance in the face of challenges. Of course, team resilience may be influenced by organizational level resilience as well. To sum up, we posit,

Proposition 6: Team resilience facilitates resilience at firm level

Risk management culture. Risk culture is defined as the process of embedding risk management formally within the decision-making processes at every level of the culture of an organization (Christopher and Peck, 2004). Autry and Bobbitt (2008) note that an important factor for countering vulnerability is creating and supporting an organizational culture that focuses on risk management. Risk management culture promotes organizational resiliency by "endowing employees with a set of principles regarding the proper response when the unexpected occurs," (Sheffi, 2005, p.244). Risk management needs to be integrated into an organization's culture to provide a legal path for risk management activities in an organization (Christopher and Peck, 2004). Risk management is essential for identifying potential sources of risks and vulnerability drivers in supply chain activities (Ozlen, Zlatar & Dzakmick, 2013). The development of a supply chain risk management culture is considered essential, as the influence of culture to operational, strategy and supply chain goals is significant (Williams, Ponder & Autry, 2009).

Risk management culture contributes to resilience by providing employees with a set of principles regarding the proper response when disruptions occur (Bredell & Walters, 2007). There are positive impacts of supply chain risk culture on firm level resilience. In addition to providing appropriate behavioral guidelines to employees, risk management culture helps firms to implement mitigation strategies more effectively and the existence of a higher risk management culture enhances the positive effect of mitigation strategies on supply chain effectiveness (Kurniawan et al., 2017). Organizations that proactively build risk management culture, are better able to react to and recover from supply chain disruptions (Worthington, Collins & Hitt, 2009). A culture of risk management can impact on managers' ability to process risk and disruption information, rationalize and exercise discretion in their vulnerability mitigation decision-making processes. Prior research shows that risk management culture in an organization serves as a guide for developing risk mitigating strategies (McShane, Nair & Rustambekov 2011). Firms that have a risk management culture and develop strategic mitigation measures would be able to reduce vulnerability and thus contribute to a resilient supply chain (Christopher, 2003). Organizations that proactively build risk management culture are better able to react to and recover from supply chain disruptions (Worthington et al., 2009), and firms without a strong risk management culture often perform poorly when it comes to managing supply chain disruption (Dowty and Wallace, 2009). The risk management culture coupled with strategic mitigation measures tends to reduce vulnerability and thus contributes to a resilient supply chain (Christopher, 2003). Therefore, **Proposition 7:** Risk management culture facilitates firm level resilience

CONTINGENCIES OF RESILIENCE

The emergence of resilience at both individual, organizational and inter-firm level cannot be taken for granted. Key antecedents discussed have the potential for the emergence of resilience at the respective levels of analysis. However, key contextual factors may either frustrate or enhance the emergence of resilience at each level. Accordingly, we discuss some key contingency factors that may moderate the emergence of resilience at the levels.

Contingencies of Individual Resilience

Individuals may possess the dispositions to learn, trust or lead themselves. Yet, these dispositional factors can only be activated and demonstrated in behaviors in an organizational environment that

allows it or actively promotes it. As Lengnick-Hall et al., (2011) put it, "without the conduit of relationships, processes, and intangible assets that form the contextual foundation, there would be few ways to synthesize resilient cognitions and behaviors into an organizational wide capability" (p.247). The fact is organizations are multilevel systems and resilience at the individual level may be influenced by events and systems at the organizational level.

Psychological Safety. A safe environment where individuals are encouraged to share their thoughts and feelings with others can help facilitate individual resilience (Relvich et al., 2011). Edmondson (1999) calls this psychological safety, the degree to which people perceive their work environment as conducive to taking interpersonal risks. Lengnick-Hall and Beck, (2005) suggest that resilient individuals are more willing to take initiative when they know that the organization tolerates mistakes, encourages individuals to ask questions, engage in experimentation, and offer critical feedback when necessary without any negative repercussions on them. Individuals with a strong learning orientation are more prone to engage in 'active experimentation'– in which they acquire new knowledge through experiences in real-life situations (Baum, Schwens & Kabst 2011) and context affects how learning orientation is manifested (Ames & Archer, 1988). For example, people may become more learning-oriented when they confront the need to undertake challenging tasks, or receive encouragement from others to question their current knowledge set (e.g. Ames & Archer, 1988).

Organizational environments that facilitate the emergence of what Ireland et al., (2002) call deep social capital also promotes individual resilience, team and organizational resilience. Deep social capital emerges from the presence of respectful interactions in an organizational community. Deep social capital emerges from face-to-face meetings and dialogue based in trust, honesty and self-respect. Deep social capital supports resilience because it encourages people to share personal knowledge and the building of intellectual capital (Adler & Kwon, 2000). Deep social capital also facilitates cross-functional collaboration, builds interdependence thereby allowing the building of both internal and external partnerships. In addition, organizations that promote self-accountability and encourages individuals to exercise discretion as they work towards organizational goals will promote resilience. Broad resource networks promote resilience development because resilient individuals have the capacity to develop relationships with people with whom they can get access to resources (Werner & Smith, 1982). The presence of the aforementioned conditions should positively impact resilience at the organizational level because people would be more willing to engage in behaviors that promote resilience and engage in change efforts through a proactive approach (Grant & Ashford, 2008). In other cases, it may be able to develop some of these traits to facilitate the emergence of individual resilience. For example, organizations can help employees cultivate a more learning-oriented mindset by implementing seminars and training tools designed to show that skills can be learned, and that mistakes are a natural step in the learning process (Dweck, 2006). To date, much of the focus of HRM practitioners with regard to resilience has been on training interventions (Bonanno 2004). Training interventions as well as authority and reward structures have been shown to help foster a learning orientation and resilient individuals are better equipped to cope with a constantly changing workplace (Shin, Taylor & Seo 2012). Therefore,

Proposition 8: Psychological safety, (defined as a supportive organizational environment that encourages meaningful interactions) facilitates the emergence of firm level resilience from individual level resilience

Contingencies of Firm Level Resilience

The development of system-level resilience requires that firms have the enabling and supportive environment for firm level resilience capabilities to translate to and facilitate the emergence of system level resilience.

Supply Chain Orientation. Firm that have a philosophy geared towards supply chain management are more likely to deploy behaviors that lead to inter-firm level resilience. This sort of internal commitment to supply chain management has been labeled supply chain orientation (SCO). Min and Mentzer (2004, p. 63) define SCO as "the implementation by an organization of the systemic, strategic implications of the tactical activities involved in the management of goods, services and information flow in the supply chain." Pounader, Rotaru, Kach & Haiagha, 2016) observed that incorporating SCO and firm's resource reconfiguration capabilities would increase the precision of resilience assessment. Two perspectives emerge on SCO: first SCO has been described as involving making strategic choices to compete on the basis on supply chain capabilities (Defee & Stank, 2005) and using this strategic emphasis to drive the performance of business units within the firm. Strategic SCO involves encouraging employees to be proactive in managing supply chain activities including supplier management, seeking integration, synchronization and convergence of intra and inter-firm operational and strategic capabilities. The second, structural SCO perspective suggest that SCO involves building organizational factors to promote relational exchange. Trust, commitment, cooperative norms, and organizational capability are key elements of structural SCO. Under this view, organizations develop 'intra-firm structural elements that facilitate effective supply chain management through an emphasis on behaviors, systems and cultures necessary for integrated supply chain exchange" (Esper, Defee & Mentzer, 2010, p.163).

Esper et al., (2010) make a conceptual advance when they integrate the two dimensions of SCO. The authors proposed that both the firms' strategic intention to compete through supply chain capabilities and the firm's internal structures are needed to fully understand the value of SCO. Esper et al.'s (2010) framework incorporates the actor's strategic intent to adopt a systemic and holistic view of supply chain management, the development of supply chain capabilities and an emphasis on integration through across business units with organizational design that focuses on internal integration and collaboration. Firms with SCO must hire employees with key supply chain management skills or train them in these skills (Lengnick-Hall et al., 2011, p. 172) and focus on employee satisfaction and develop structures that facilitate learning and cross functional team development and cooperation. Finally, firms with SCO adopt diagnostic and monitoring measures that facilitate supply chain alignment, learning and innovation.

Supply chain orientation should positively enhance inter-firm level resilience as it promotes behaviors that may be manifested at the firm level. For example, collaboration is an important supply chain capability. Effective internal collaboration promotes relational effectiveness (Ellinger, Elmadağ, Ellinger, Wang, & Bacharach, 2011). Employees with supply chain management skills will engage in behaviors that promote resilience at the firm level which are then aggregated to the inter-firm level. Systems that facilitate employee and team learning within the organization would be very useful in facilitating resilience at the inter-firm level since learning competence is a key element of inter-firm level resilience. Blackhurst, Dunn and Craighead (2011) found that employees who were trained in their understanding of supply chain management were more prepared to act when a disruption occurred thereby enhancing the supply chain resilience. The authors also found that employees who had comprehensive understanding of the cost and benefit trade-off where better prepared to handle supply chain disruptions. Chowdury and Quaddus (2016) found that SCO had a positive effect on supply chain resilience. Firms that learn from post disruption feedback are generally better prepared to handle future supply chain disruptions. In addition, well-define communication networks, channels, presence of crossfunctional risk management teams, predefined contingency plans all were positively associated with resilience. Thus,

Proposition 9. Supply chain orientation facilitates the emergence of system resilience from firm level resilience

Quality interactions. Human resource practices in an organization can be used to create the collective mindset conducive to achieving organizational resilience (Lengnick-Hall et al., 2011). Lengnick-Hall et al., (2011) proposed six employee contributions that promote resilience at both the personal and organizational levels. We draw on that research to elucidate this part of the paper. According to the authors, six specific employee contributions are particularly important for developing a firm's collective cognitive capabilities that contribute to resilience. These include: (a) expertise, (b) opportunism, (c) creativity, (d) decisiveness despite uncertainty, (e) questioning fundamental assumptions, and, (f) conceptualizing solutions that are novel and appropriate. According to the authors, these behaviors can be supported by HR principles related to the cognitive dimension of resilience. They include: (a) developing a partnership orientation with employees, (b) localizing decision making power, (c) creating fluid team-based work and job design, (d) building relational rather than transactional relationships with employees, (e) minimizing rules and procedures, (f) hire to ensure a range of different experiences, perspectives, and competencies are available in the workforce, (g) place a high value on pluralism and individual differences, (h) invest in human capital, and (i) use both formal and informal social integration mechanisms. The goal here is to "create a workplace in which simple rules and core organizational values shape priorities and guide behavior especially in the face of unexpected events" (p.251).

Other HRM associated strategies can be used to promote resilience. First, is social support. Wilson and Ferch (2005) proposed that resilience in the work-place can be enhanced through caring relationships, defined as those that involve the dynamic interplay of self and others. Second work life balance practices (WLB) may enhance employee resilience because WLB effects on employee commitment and performance (e.g. Wood, Van Veldhoven, Croon & de Menezes, 2010). Third, Luthans et al., (2006) suggest that human resource development (HRD) programs can be used to develop resilience: a proactive approach involves structuring the organization to anticipate the need for resilience through reliance on three specific strategies: risk-focused, assetfocused and process-focused. The second approach is reactive (or supportive) and focuses upon the importance of reminding employees to think positively and find meaning behind negative or adverse events. Fourth, research on employee assistance programs (Berry, Mirabito & Baun, 2010) has demonstrated that their use by organizations can lead to the development of resilient employees. To build resilience, it was deemed important to build an increased awareness of personal assets such as talents, skills and social networks. Most of these practices may be particularly attractive during periods of organizational change and supply chain disruption. Finally, research has shown that it is possible to increase self-efficacy, hope, optimism and resilience through brief training interventions (Luthans et al. 2006). Therefore,

Proposition 10: Quality interactions among employees facilitates the emergence of inter-firm resilience from firm level resilience

Contingencies of Inter-Firm Resilience

A key question is whether inter-firm level resilience will emerge once firm level resilience has been developed. We suggest that it is most likely to develop when the inter-firm context promotes the convergence of resilience across individual firms in the supply chain. Factors that promote inter-firm collaboration, learning, system flexibility and adaptation through the use of HR systems and capabilities developed to promote employee and organization resilience initiatives and adaptive capacity will facilitate the emergence of inter-firm resilience from organizational resilience.

Inter-Firm Trust and Collaboration. Trust has been mentioned as an important ingredient in supply chain relations (e.g., Trust is one of the most frequently cited dimensions of supply chain relationships (Ghosh & Fedorowicz, 2008). Trust among players is one important enabler of system-level resilience. The concept of institutional trust, also known as system trust, comes from sociology and is a two-dimensional construct: structural assurance and situational normality (McKnight et al., 1998). Institutional trust assumes that situations or environmental setting impacts on the outcome of an endeavor within the situation and thereby influence trust. This construct is influenced by the situational attributes (i.e. structural assurance) rather than the trustworthiness of trustees and the perception that the situation is normal (i.e. situational normality). Trust between firms is an expectation that partners will not act in an opportunistic manner, even if there are short-term incentives to do so (Chiles & McMackin, 1996) and when present, trust can contribute significantly to the long-term stability of an organization and its supply chain (Spekman, Kamauff, & Myhr 1998). This form of benevolent or goodwill-based trust is especially important in supply chains. Trust even between firms is essentially an individual level thing.

Trust between firms promotes system level resilience because it confers certain benefits to the actors. When present, trust reduces risk, promotes collaboration, creates a sense of community and makes social life predictable (Cook, 2003). Trust also allows for risk sharing, fosters greater cooperation (Axelrod, 1984), reduces functional conflict and enhances integration and decisionmaking under conditions of uncertainty and ambiguity. Inter-firm trust also promotes communication and information sharing (Muller & Sonja, 2011). Sinha et al. (2004) stated that lack of trust is one of the major factors that contribute to supply chain risks. Interparty trust promotes resilience by facilitating cooperation and collaboration to take place both within the organization and across partners in the supply chain (Faisal, Banwet, & Shankar, 2007). Collaborative relationships help effective risk management of the supply chain (Sinha et al., 2004). Collaboration has been cited as the glue that holds supply chain organizations together in crisis (Adams, Richey, Autry, Morgan & Gabler, 2014). Collaboration contributes to reduce uncertainty and event readiness. Decision synchronization and incentive alignment, two key elements of supply chain collaboration are essential for effective system-level disruption responses (Simatupang & Sridharan, 2005). Sheffi (2001) stresses that collaboration is equally important after the disruptions are overcome in order to share experiences among the parties. High levels of collaboration working across supply chains can mitigate risk (Christopher & Peck, 2004).

Proposition 11: Trust and collaboration facilitates supply chain resilience from firm resilience.

Supply Chain Risk Management Culture. Risk management is essential to identify the potential sources of risks and vulnerability drivers in supply chain activities (Ozlen, Zlatar & Dzakmic 2013). Although similar to and related to agent risk management culture, system or supply chain risk management culture (SCMRC) has been described as a separate construct (Chowdhury & Quaddus, 2016; Christopher & Peck, 2004). The primary focus of SCRM is the identification and mitigation of risks for reducing supply chain vulnerability. Cultural factors clearly influence mitigation strategy and responses to disruptions at both the firm and system level (Braunscheidel & Suresh, 2009). The development of a SCMC is considered essential, culture affects agent behavior in supply chain networks. Having a SCMRC helps agents to identify risks and the likelihood of risks so that they can take action to mitigate them (Wieland & Wallenburg,

2013). According to Jüttner and Maklan (2011), SCRMC encourages risk sharing attempts, risk reducing efforts and gathering knowledge about risk as important attributes of SCRes. Much like firms, risk culture at the level of the supply chain involves the formal integration of risk management within the decision-making processes at every level of the company (Christopher & Peck, 2004) and SCRMC positively impacts supply chain resilience (Chowdhury & Quaddus, 2016). Thus,

Proposition 12: Risk management culture facilitates system resilience from firm level resilience.

Adaptive capability. Adaptive capacity refers to flexibility in response during disruptions. Supply chain resilience focuses on the system's adaptive capability to deal with temporary disruptive events. Adaptive capacity promotes resilience because adaptive capability allows a firm to prepare for unexpected events and to respond to disruptions and recover from them (Robert, 1997). A supply chain's capacity for resilience can be promoted by building its adaptive capacity through adaptive management strategies. According to Walker, Holling, Carpenter and Kinzig (2004), adaptive capacity involves "(1) making desirable basins of attraction wider and/or deeper, and shrinking undesirable basins (2) creating new desirable basins, or eliminating undesirable ones; and (3) changing the current state of the system so as to move either deeper into a desirable basin, or closer to the end of an undesirable one." Adaptive management provides a framework for learning about a system in a way that enhances the capacity for identifying and reducing uncertainty and surprise (Garmestani, Allen & Cabezas, 2009). The goal of adaptive management is to build the capacity to reorganize the system within desired states in response to changing conditions and disturbing events (Walker et al., 2004). A key part of adaptive management involves an iterative process of decision making, designed to identify and reduce uncertainty and surprise (Benson and Garmestani, 2011). At some level, adaptive management involves sense making (Weick, 1988), a process that allows managers to use information they get about the system to adapt to changing situations as management tries out interventions and learns what works and what does not (Garmestani et al., 2009). Empowering all firms in a supply chain network to become co-owners and to make local decisions as they get new knowledge and information about the supply chain would go a long way in promoting the ecological resilience of the supply chain. Marchese et al., (2012) suggest that companies with resilient supply chains have clearly defined governance structures with clear accountability. In summary, we posit:

Proposition. 13 Adaptive capability facilitates the emergence of inter-firm resilience from firm level resilience

Cooperative learning. Individual and organizational learning is important for building inter-firm resilience (Folke, Hahn, Olsson & Norberg, 2005). CAS are capable of learning. Agents in a CAS learn by obtaining system information about the environment in which they are (Choi et al., 2001, Pathak et al., 2007). The term "cooperative learning" refers to the ability of supply chain members to share knowledge, information and resources (Morrison & Mezentseff, 1997). Organizations develop cooperative relationship through creating a learning environment so that they can facilitate mutual learning. Cooperative learning emphasizes the role of cooperation in a network of firms (Morrison & Mezentseff, 1997). This happens in a supply chain as well, where firms develop and maintain effective learning processes (Hult, Ketchen & Nichols, 2003). Cooperative learning promotes supply chain learning. Flint, Larsson and Gammelgaard (2008) defined supply chain learning as the process of "ensuring that one's own firm as well as suppliers and customers are actively managing the learning process aimed at supply chain management issues" (p. 264). The capacity for such learning allows the agents to modify their capabilities and change their schema to improve their fitness levels and performance (Tukamuhabwa et al., 2015). Garmestani et al.,

(2014) note that a key area of learning in CAS is knowing what constitutes the critical thresholds of the system with the goal of preparing the system for adaptation and resilience. Learning on the part of each supply chain member is especially important since effective learning will improve their organization's capacity to take corrective action as learning is important for dealing with illdefined problems in dynamic systems (Nonaka & Takeuchi, 1995). At the system level, learning that questions existing fundamental assumptions will prepare the system to adapt to new positions after a disruption. Ruhl, Glen and Hartman (2005) observe that processes that generate learning and knowledge of the dynamics of the system are useful in developing the social capacity for responding to change. Supply chain actors must engage in "double loop learning" (Argyris, 2001) in which basic underlying assumptions, norms and objectives are questioned to stimulate new learning about the system after a disruption. Double loop learning requires a new mental model as old assumptions are rigorously challenged. It also enables a system to identify whether its mission and principles are still appropriate under the current circumstances. This should be especially important in supply chain management since the actors may need to question some of their old models about resilience. Prior research has, in fact, documented that organizational learning enhances supply chain resilience by aiding adaptation and through modifying resilience strategies (Pettit, Fiskel & Croxton, 2010). It can be expected that firms with a high level of supply chain learning will actively question how well their organizational processes work and seek better ways to be organized (Chen et al., 2009). As a result, these firms are likely to use approaches such as cross-functional teams internally to break down the functional silos; externally, they may also take more integrative methods to handle relationships with suppliers and customers.

Proposition 14: Cooperative learning facilitates the emergence of supply chain resilience from resilience at the firm level.

CONSEQUENCES OF RESILIENCE

Individual resilience and employee performance

Resilience at each of the levels has performance implications. Individual resilience has been linked to enhanced employee performance in stressful or turbulent environments (Avey, Nimnicht & Pigeon 2010). Research in positive psychology suggests that organizations that build or develop resilience in their employees will be more adaptive and successful over time (Luthans et al., 2002). Resilience has also been linked to employee psychological capital, which in turn has been linked to several work-related outcomes. Studies have shown that psychological capital (consisting of hope, efficacy, optimism, and resilience) is related to positive employee emotions that (in turn) are related to attitudes and behaviors relevant to organizational change. Psychological capital has also been linked to job satisfaction, work happiness, organizational commitment and performance (Luthans et al. 2007; Youssef & Luthans, 2007; Avey et al., 2008). It must be noted that Avey et al., (2009) found a significant negative relationship between positive psychological capital and the variables of employee stress, intentions to quit and job search behaviors. Lengnick-Hall et al., (2010) suggest that organizations can create resilience competencies among employees, enabling the organization to improve and more successfully adapt to change and adversity. The authors conclude that resilient employees can become a key resource and a source of competitive advantage for firms.

Proposition 14: Individual resilience facilitates employee role performance

Organizational resilience and performance

Resilient organizations are able to absorb, respond to and potentially capitalize on disruptive surprises (Hamel & Valikangas, 2003). Such organizations also tend to be resourceful, demonstrate strategic agility or the capacity to sense threats and change direction when needed (McCaan, 2004).

A capacity for resilience enables a firm to take appropriate actions and undergo transformation in response to unanticipated events that may potentially threaten its existence because a strong capacity for resilience creates "a useful internal guidance system for organizational analysis and decision making" (Lengnick-Hall et al., 2011, p.). In addition, resilient organizations are able to engage in sensemaking or the capacity to interpret and provide meaning to unprecedented events and situations (Weick, 1999). Collectively, resilient organizations tend to have the right mix of cognitive and behavioral conditions, what Coutu (2002) calls "ritualized ingenuity." Useful habits and behavioral preparedness yield simple rules to guide organization choices under turbulent conditions (Lengnick-Hall et al., 2011). Supply chain risk and disruptions are often unprecedented events and having the capabilities for creativity, ingenuity and sensemaking should have positive impact on the firm in the event of a disruption. Firms with these capabilities should not only be able to demonstrate greater capacity to anticipate disruptions, but be better prepared to mobilize for quicker recovery.

Proposition 16: Organizational resilience facilitates adaptation and recovery after disruptions

Inter-firm resilience and supply chain performance

The goal of a resilient supply chain is to be able to recover, respond to and restore performance to at least a pre-disruption stage following a disruption (Christopher & Peck, 2004). There are positive outcomes associated with resilient supply chains. First, they can confer competitive advantage on actors. The capacity to manage supply chains for resilience requires a set of capabilities and competences that maybe come a source of competitive advantage (Sheffi, 2005). For example, the capacity for both efficient demand and supply management, adaptation, learning and transformation puts resilient supply chains at a competitive advantage. Second, resilient supply chains would be able to deal more effectively with disruptions (Ponomarov & Holcomb, 2009).

Resilience enhances the system's capacity to predict as well as mobilize in a timely manner in the event of a disruption (Hohenstein, Hartmann & Giunipero, 2015). Third, resilient supply chains benefit from business growth. Resilient supply chains are able to better reorganize following disruptions. Resilience confers a capacity for seeing new opportunity from challenges and possibilities for moving to a new and improved business condition that results in business growth (Datta, Christopher & Allen, , 2007). Colicchia, Melacini and Perotti (2010) found that supply chains focused on improving one of the main sources of vulnerability studied in the literature: supply lead time led to improved revenue growth in future. Finally, resilience supply chains will be able to reduce risk. The goal of resilience is to manage risk and vulnerability to disruptions because they have the capabilities needed to deal with such disruptions. Collectively, these outcomes hint at a resilient supply chain's capacity to fulfil their primary mission: sustained customer service, including the capacity for adaptation, learning, transformation and growth in the face of disruptions.

Proposition 17: Inter-firm level resilience positively impacts overall supply chain performance

DISCUSSION

Supply chain networks have been described as the product of complex interplay between supply chain members, indicating that resilience at the level of member firms is tied inextricably to that of the supply chain network and events at one level inevitably affect outcomes at other levels (Pereira, Christopher & Da Silva, 2014). Organizational theorists have identified levels of theory and levels of measurement as fundamental issues in research (e.g. Klein et al., 1994), and a focus on resilience at one, but not all levels, may offer an incomplete understanding of resilience of the system (van der Vegt et al., 2015). Therefore, the multilevel approach taken in this research

advances research and improves our understanding of resilience in supply chains. In presenting a framework that incorporates resilience across three levels, this research offers a more holistic understanding of supply chain resilience than previous studies. Supply chains as complex adaptive systems are certainly made up of agents who interact with each other with the system itself demonstrating nonlinearity with feedback mechanism among and between agents. A multilevel approach to supply chain resilience allows us to show how supply chain resilience is shaped by individuals and the internal systems in member firms as well as how member firms are shaped by what happens at the level of the supply chain. This multilevel approach helps our understanding of supply chain resilience in several ways and the research makes important theoretical and practical contributions.

Theoretical Contributions

This research makes a number of theoretical contributions. First, we present a richer understanding of resilience by focusing on the dynamics of resilience at three levels. Research on both organizations (Klein et al., 1994), and ecological systems from which much of the work on resilience comes from (Gunderson & Holling, 2002; Berkes & Ross, 2016) and the supply chain literature have shown that level issues are fundamental concepts in understanding complex phenomena, system resilience and supply chain resilience (Tukamuhabwa et al., 2015).

Second, a focus on level issues clarifies measurement and theory development on SCRes. In terms of theory, level issues are important for model specification and theory development. As Klein et. al. (1994, p.4) note "no construct is level of analysis free." Our understanding of resilience at the individual, firm and supply chain network level will facilitate more rigorous testing of supply chain resilience models because the appropriate measurement of constructs aids hypothesis testing and the falsifiability of theories (Bacharach, 1989). Aligning the levels of theory and measurement is important for developing conceptual and empirical clarity (Klein et al., 1994). Indeed, a failure to achieve alignment between levels of theory and measurement would lead to model misspecification. Rousseau (1985) notes that misspecification occurs when a construct is theoretically attributed to one level when it is measured at another level. For example, if a claim about supply chain network resilience is based on data on member firms only, as opposed to the tiers in the system, one cannot then go on to generalize the findings to the supply chain network as a system. A misspecification problem also occurs if variables of a theory that are correlated with other variables are not included in that theory, then models of that theory will necessarily be incorrectly specified and estimates will be biased (Singh, 1991). More important, a failure to clarify level of analysis issues may lead to ecological fallacy (over-generalizing findings at a higher level to a lower level. For example, resilience at the level of the supply chain would be equated with resilience at the firm level. The other form of fallacy that we may commit without attention to levels of analysis is atomistic fallacy or overgeneralizing findings at a lower level to a higher level. In both cases, we make misleading conclusions.

Finally, a multilevel approach should foster more integrated inquiry into SCRes. Our model includes SCRes antecedents, contingencies and consequences across individual, firm and system levels, thereby presenting a more holistic understanding of the SCRes construct. The study raises some research issues some of which have already been raised by other researchers. For example, despite the inherent challenges, studying a dynamic, complex system requires longitudinal, rather than cross-sectional approaches as well as some effort to move away from single respondents and instead using multiple respondents and determining intra-class agreement. Other measurement issues are also important, but fraught with challenges. As Carpenter et al., (2001) noted, to understand resilience requires that we clearly define the concept in terms of "what to what" in terms of the system state that is being considered and what failure modes are involved. Tierney et

al., (2007) incorporate time into what they call "resilience triangle" by highlighting the relationship between a disruptive event and business indicators, using customer satisfaction as the main objective of the supply chain. The incorporation of time is an important improvement in assessing resilience. Another useful approach to measuring SCRes may be to compute supply chain index based on the individual supply chain company's resilience index using a linear additive aggregation approach (Zhou et al., 2006; Barroso et al). Agent-based modeling (ABMs) is another effective means of modeling, understanding, and measuring resilience of complex systems (Data et al., 2007) and both quantitative and qualitative approaches may be suitable for studying SCRes and CAS.

Practical Contributions

This study makes a number of contributions to practice. First, this research has shown that managers and analysts should adopt a multilevel approach to understanding supply chain resilience. Any management approach should consider the reciprocal influence of elements at all levels to understand the intricacies of managing resilient supply chains. The idea is that the resilience of the supply chain can only be understood by looking at individual behaviors, how the organizational context facilitates supportive behaviors that are then manifested at the supply chain level. As Pournader et al., (2016) noted measuring resilience at multiple levels allows for the identification of any substantial differences in resilience across the tiers of the supply chain. Second, attention to all levels can help the timely identification and remediation of major sources of risk in the supply chain. It also provides for a better understanding of how to build an integrated supply chain that is more likely to promote resilience. Third, the research highlighted some key employee skills needed for building SCRes. For example, besides hiring the right people, firms can train their employees to engage in desirable behaviors discussed. Providing the skills that

individuals need to demonstrate inter-organizational level behaviors is important. For example, self-leadership characteristics can be influenced through training (Neck & Manz, 1996). More importantly, managers need to recognize that it is important to focus on those factors that facilitate the emergence of resilience across the levels. For example, building a strong risk management culture and training employees to be more aware of risk will enhance employee vigilance toward supply chain risk (Kurniawan, Zailani, Iranmanesh, Rajagopal, 2017).

Resilience continues to be an important element for managing risk and vulnerability in supply chain networks and greater clarity in conceptual development and theorizing around the construct would positively impact the refinement of the construct and contribute towards a greater understanding of its practical usefulness. We presented a multilevel framework of resilience, incorporating the antecedents of resilience at each level as well as contingencies and outcomes of resilience at each level. This study advances current research on supply chain resilience by theorizing on the relationships between resilience at three levels. The hope is the research spurs additional research that expands and refines the conceptual framework presented here as well as empirical verification of the propositional inventory generated in the study.

REFERENCES

- Adams, F.G., Richey, R.G., Autry, C.W., Morgan, T.R. and Gabler, C.B. (2014), "Supply chain collaboration, integration, and relational technology: how complex operant resources increase performance outcomes", *Journal of Business Logistics*, Vol. 35 No. 4, pp. 299-317
- Adler, P, Kwon. S. (2002). "Social capital: Prospects for a new concept", Academy of Management Review, Vol. 27, 17 – 40
- Alliger, George & P. Cerasoli, Christopher & I. Tannenbaum, Scott & B. Vessey, William. (2015). Team resilience. *Organizational Dynamics*. 44. 176-184
- Ambulkar, S., Blackhurst, J. and Grawe, S. (2015), "Firm's resilience to supply chain disruptions: scale development and empirical examination", Journal of Operations Management, Vols 33/34, pp. 111-122
- Ames, C. and Archer, J. (1988), "Achievement goals in the classroom: students' learning strategies and motivation processes", Journal of Educational Psychology, Vol. 80 No. 3, pp. 260-7.
- Argyris C. (2001), On Organizational Learning, 2nd ed., Blackwell Publishers, Malden, MA.
- Ashmos, D.P., & Huber, G.P. 1987. "The systems paradigm in organization theory: Correcting the record and suggesting the future", *Academy of Management Review*, Vol. 12, 607 – 621
- Autry, C.W. and Bobbitt, L.M. (2008), "Supply chain security orientation: conceptual development and a proposed framework", International Journal of Physical Distribution and Logistics Management, Vol. 19 No. 1, pp. 42-64
- Bandura, A, 1977. "Self-efficacy: Toward a unifying theory of behavioral change", *Psychological Review*, Vol. 84, 191 215.
- Baum, M., Schwens, C. and Kabst, R. (2011), "A typology of international new ventures: empirical evidence from high technology industries", Journal of Small Business Management, Vol. 49 No. 3, pp. 305-30.
- Bennett, J.B., Aden, C.A., Broome, K., Mitchell, K. and Rigdon, W.D. (2010), "Team resilience for young restaurant workers: research-to-practice adaptation and assessment", *Journal of Occupational Health Psychology*, Vol. 15 No. 3, pp. 223-236.
- Benson, M. H. Garmestani, A. S. (2011), "Embracing panarchy, building resilience and integrating adaptive management through a rebirth of the National Environmental Act. *Journal. of Environmental Management, Vol.* 92, pp. 1420-1427.

- Berg, J.M., Wrzesniewski, A., Dutton, H.E. 2010. "Perceiving and responding to challenges in job crafting at different ranks: When proactivity requires adaptivity", *Journal of Organizational Behavior*, Vol. 31, 158 – 186
- Berry L.L., Mirabito A.M., Baun W.B. What's the hard return on employee wellness programs? *Harvard Business Review*. 2010; 88 (12):104–112,142
- Blackhurst, J., Dunn, K.S. and Craighead, C.W. (2011), "An empirically derived framework of global supply resiliency", *Journal of Business Logistics*, Vol. 32 No. 4, pp. 374-391.
- Bonanno, G.A. 2004. "Loss, trauma, and human resilience: Have we underestimated the human capacity to thrive after extremely aversive events?" *American Psychologist*, Vol. 59, 20 28
- Bowers, C., Kreutzer, C., Cannon-Bowers, J., & Lamb, J. (2017). Team Resilience as a Second-Order Emergent State: A Theoretical Model and Research Directions. *Frontiers in Psychology*, 8, 1360.
- Braunscheidel, M.J. and Suresh, N.C. (2009), "The organizational antecedents of a firm's supply chain agility for risk mitigation and response", Journal of Operations Management, Vol. 27 No. 2, pp. 119-140
- Bredell, R. and Walters, J. (2007), "Integrated supply chain risk management", Journal of Transport and Supply Chain Management, Vol. 1 No. 1, pp. 1-17
- Brodsky, A. E., Welsh, E., Carrillo, A., Talwar, G., Scheibler, J., & Butler, T. (2011). Between synergy and conflict: Balancing the processes of organizational and individual resilience in an Afghan women's community. *American Journal of Community Psychology*, 47(3–4), 217–235.
- Chiles, T.H., & McMackin, J.R. 1996. "Integrating variable risk preferences, trust, and transaction cost economics", *Academy of Management Journal*, Vol. 21, 73 99
- Choi, T.Y., Dooley, K.J. and Rungtusanatham, M. (2001), "Supply networks and complex adaptive systems: control versus emergence", Journal of Operations Management, Vol. 19 No. 3, pp. 351-366.
- Chowdhury, M.H. Quaddus, M (2016) "Supply chain readiness, response and recovery for resilience", Supply Chain Management: An International Journal, Vol. 21, pp.709-731,
- Christopher, M. and Peck, H. (2004), "Building the resilient supply chain", International Journal of Logistics Management, Vol. 15 No. 2, pp. 1-14
- Cohen, M.W. and Levinthal, D.A. (1990), "Absorptive capacity: a new perspective on learning and innovation", *Administrative Science Quarterly*, Vol. 35 No. 1, pp. 128-152

- Colicchia, C., Melacini, M. and Perotti, S. (2011), "Benchmarking supply chain sustainability: insights from a field study", Benchmarking: An International Journal, Vol. 18 No. 5, pp. 705-32.
- Cook, K. (2003), Trust in society. Sage, New York, NY.
- Coutu, D.L. (2002), "How resilience works", Harvard Business Review, Vol. 80 No. 5, pp. 46-55
- Datta, P. Christopher, M & Allen, P. (2007) "Agent-based modelling of complex production/distribution systems to improve resilience," *International Journal of Logistics Research and Applications*, vol. 10, no. 3, pp. 187–203, 2007
- Defee, C.C. and Stank, T.P. (2005), "Applying the strategy-structure-performance paradigm to the supply chain environment", *International Journal of Logistics Management*, Vol. 16 No. 1, pp. 28-50
- Dowty, R.A. and Wallace, W.A. (2009), "Implications of organizational culture for supply chain disruption and restoration", Report, Rensselaer Polytechnic Institute
- Dweck, C.S. (1986), "Motivational processes affecting learning", American Psychologist, Vol. 41 No. 10, pp. 1040-8
- Edmondson, A.C. (2012), Teaming: How Organizations Learn, Innovate, and Compete in the Knowledge Economy, Jossey-Bass, and San Francisco, CA
- Ellinger, A. E., Elmadağ, A. B., Ellinger, A. D., Wang, Y. L., & Bachrach, D. G. (2011). Measurement of service organizations' investments in social capital: The employee perspective. Journal of Business Research, 64(6), 572–578.
- Esper, T.L., Defee, C.C. and Mentzer, J.T. (2010), "A framework of supply chain orientation", *The International Journal of Logistics Management*, Vol. 21 No. 2, pp. 161-179
- Folke, C., Hahn, T., Olsson, P. and Norberg, J. (2005), "Adaptive governance of socio-ecological systems," *Annual Review of Environmental Resources*, Vol. 30, pp. 441-473.
- Ghosh, A. and Fedorowicz, J. (2008), "The role of trust in supply chain governance," *Business Process Management Journal*, Vol. 14 No 4 pp. 453–470
- Giles Hirst, Daan Van Knippenberg, Chin-hui Chen, and Claudia A. Sacramento. (2011). How Does Bureaucracy Impact Individual Creativity? A Cross-Level Investigation of Team Contextual Influences on Goal Orientation–Creativity Relationships. *Academy of Management Journal*, 54:3, 624-641
- Gong, Y. and Fan, J. (2006), "Longitudinal examination of the role of goal orientation in cross-cultural adjustment", Journal of Applied Psychology, Vol. 91 No. 1, pp. 176-184

- Grant, A.M., & Ashford, S.J. 2008. "The dynamics of proactivity at work", *Research in Organizational Behavior*, Vol. 28, 3 34
- Gunderson, L. and Holling, C. (Eds) (2002), Panarchy. Understanding Transformations in Human and Natural Systems, Island Press, Washington, D.C.
- Hohenstein, N.O., Feisel, E., Hartmann, E. and Giunipero, L. (2015), "Research on the phenomenon of supply chain resilience: a systematic review and paths for further investigation", *International Journal of Physical Distribution & Logistics Management*, Vol. 45 Nos 1/2, pp. 90-117.
- House, R., Rousseau, D. M., & Thomas-Hunt, M. (1995). The meso paradigm: A framework for the integration of micro and macro organizational behavior. In: L. L. Cummings & B. M. Staw (Eds), *Research in Organizational Behavior* (Vol. 17, pp. 71–114). Greenwich, CT: JAI Press
- Hult, G.T.M., Ketchen, D.J. and Nichols, E.L. (2003), "Organizational learning as a strategic resource in supply management", Journal of Operations Management, Vol. 21, pp. 541-56.
- Ilgen, D.R., Hollenbeck, J.R., Johnson, M. & Jundt, D. (2005), "Teams in organizations: from input-process-output models to IMOI models", Annual Review of Psychology, Vol. 56, February, pp. 517-543
- James B. Avey, James L. Nimnicht, Nancy Graber Pigeon, (2010) "Two field studies examining the association between positive psychological capital and employee performance", Leadership & Organization Development Journal, Vol. 31 Issue: 5, pp.384-401,
- Jüttner, U. and Maklan, S. (2011), "Supply chain resilience in the global financial crisis: an empirical study", Supply Chain Management: An International Journal, Vol. 16 No. 4, pp. 246-259.
- Jüttner, U. and Maklan, S. (2011), "Supply chain resilience in the global financial crisis: an empirical study", Supply Chain Management: An International Journal, Vol. 16 No. 4, pp. 246-259.
- Kamalahmadi, M. and Parast, M.M. (2016), "A review of the literature on the principles of enterprise and supply chain resilience: major findings and directions for future research", International Journal of Production Economics, Vol. 171 No. 1, pp. 116-133.
- Kauffman, S.A. (1993), *The Origins of Order: Self Organization and Selection in Evolution*, Oxford University Press, New York, NY
- Klein, K.J. Dansereau, F. & Hall, R.J. 1994. "Levels issues in theory development, data collection, and analysis", *Academy of Management Journal*, Vol. 19, 195 229

- Kozlowski, S. W. J. (2012). Groups and teams in organizations: Studying the multilevel dynamics of emergence. In A. B. Hollingshead & M. S. Poole (Eds.), Research methods for studying groups and teams: A guide to approaches, tools, and technologies (pp. 260–283). New York, NY: Routledge
- Kurniawan, R, Zailani, S.H., Iranmanesh, M. & Rajagopal, P. (2017) "The effects of vulnerability mitigation strategies on supply chain effectiveness: risk culture as moderator", *Supply Chain Management: An International Journal*, Vol. 22: 1-15,
- Leipold, B. and Greve, W. (2009), "*Resilience: a conceptual bridge between coping and development*", *European Psychologist*, Vol. 14 No. 1, pp. 40-50.
- Lengnick-Hall, C.A. Beck, T.E. Lengnick-Hall, M.L. (2011). "Developing a capacity for organizational resilience through strategic human resource management", *Human Resource Management Review*, Vol. 21, 243 – 255
- Linnenluecke, M.K. (2015), "Resilience in business and management research: a review of influential publications and a research agenda", International Journal of Management Reviews, Vol. 28 No. 4,
- Luthans, F., Youssef, C.M. and Avolio, B.J. (2007), *Psychological Capital*, Oxford University Press, Oxford.
- Manz, C.C. (1986), "Self-leadership: toward an expanded theory of self-influence processes in organizations", Academy of Management Review, Vol. 11, pp. 585-600
- Manz, C.C. and Neck, C.P. (2004), *Mastering Self-Leadership: Empowering Yourself for Personal Excellence*, 3rd ed., Pearson Prentice-Hall, Upper Saddle River, NJ.
- Marchese, L Paramasivan, S, Held, M (2012) Bouncing back: Supply chain risk management lesson from post-tsunami Japan. *Industry Week*, March 9. <u>http://www.industryweek.com/global-economy/bouncingback-supply-chain-risk-management-lessons-post-tsunami-japan</u>. Retrieved November 4th, 2017.
- Markham, S.E. and Markham, I.S. (1998), "Self-management and self-leadership reexamined: a levels of analysis perspective", in Dansereau, F. and Yammarino, F.J. (Eds), Leadership: The Multiple-level Approaches, Classical and New Wave, JAI Press, Stanford, CT, pp. 193-210.
- Marley, K.A., Ward, P.T. and Hill, J.A. (2014), "Mitigating supply chain disruptions a normal accident perspective", Supply Chain Management: An International Journal, Vol. 19 No. 2, pp. 142-152
- Masten, A.S., Best, K.M. and Garmezy, N. (1990), "Resilience and development: contributions from the study of children and young people who overcome adversity", Development and Psychopathology, Vol. 2, pp. 425-44
- Mayer, R. G, Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. Academy of Management Review, 20, 709-734

- McCubbin, M. A., & McCubbin, H. I. (1996). Resiliency in families: A conceptual model of family adjustment and adaptation in response to stress and crises. In H. I. McCubbin, A. I. Thompson, & M. A. McCubbin (Eds.), Family assessment: Resiliency, coping and adaptation-inventories for research and practice (pp. 1–64). Madison, WI:
- McDonald, M., & Westphal, J. (2013). Access denied: Low mentoring of women and minority first time directors and its negative effects on appointments to additional boards'. *Academy of Management Journal*, 56, 1169–98.
- McKnight, D., Cummings, L. and Chervany, N.L. (1998), "Initial trust formation in new organizational relationships", Academy of Management Review, Vol. 23 No. 3, pp. 473-90.
- McManus, S., Seville, E., Vargo, J. and Brunsdon, D. 2008, 'Facilitated process for improving organizational resilience', *Natural Hazards Review*, May 2008, pp. 81-90
- McShane, M.K., Nair, A. and Rustambekov, E. (2011), "Does enterprise risk management increase firm value?", Journal of Accounting, Auditing & Finance, Vol. 26 No. 4, pp. 641-658.
- Mehrdokht Pournader, Kristian Rotaru, Andrew Philip Kach, Seyed Hossein Razavi Hajiagha, (2016) "An analytical model for system-wide and tier-specific assessment of resilience to supply chain risks", Supply Chain Management: An International Journal, Vol. 21 Issue: 5, pp.589-609
- Michael D. Mitchell and Walter E. Beyeler, (2015). "Studying the Relationship between System-Level and Component-Level Resilience," *Journal of Complex Systems*, vol. 2015: 1-9
- Mohd Nishat Faisal, D.K. Banwet, Ravi Shankar, (2007) "Information risks management in supply chains: an assessment and mitigation framework", Journal of Enterprise Information Management, Vol. 20 Issue: 6, pp.677-699
- Morgeson, F.P., & Hofmann, D.A. 1999. "The structure and function of collective constructs: Implications for research and theory development", *Academy of Management Review*, Vol. 24, 249 – 265
- Morrison, M. and Mezentseff, L. (1997), "Learning alliances-a new dimension of strategic alliances", Management Decision, Vol. 35 No. 5, pp. 351-357
- Müller, M. and Sonja, G. (2011), "An empirical investigation of antecedents to information exchange in supply chains", International Journal of Production Research, Vol. 49 No. 6, pp. 1531-1555.
- Neck, C.P. and Manz, C.C. (1992), "Thought self-leadership: the impact of self-talk and mental imagery on performance", Journal of Organizational Behavior, Vol. 12, pp. 681-99.

- Nicolis, G. and Prigogine, I. (1989), *Exploring Complexity: An Introduction*, W.H. Freeman, New York, NY
- Nilsson, F. and Gammelgaard, B. (2012), "Moving beyond the systems approach in SCM and logistics research", *International Journal of Physical Distribution & Logistics Management*, Vol. 42 Nos 8/9, pp. 764–83
- O'Dougherty Wright, M., Masten, A. S., & Narayan, A. J. (2013). Resilience processes in development: Four waves of research on positive adaptation in the context of adversity. In S. Goldstein & R. B. Brooks (Eds.), Handbook of resilience in children (pp. 15–37).
- Ozlen, M.K., Zlatar, D. and Dzakmic, D. (2013), "Managing risks in the supply chain", International Journal of Academic Research in Economics and Management Sciences, Vol. 2 No. 2, pp. 56-68
- Pargament, K. I. (1997). The psychology of religion and coping: Theory, research, practice. New York, NY: The Guilford Press.
- Parker, S.K. & Collins, C.G. 2010. "Taking stock: Integrating and differentiating multiple proactive behaviors", *Journal of Management*, Vol. 36, 633 662
- Pathak, S.D., Day, J.M., Nair, A., Sawaya, W. and Kristal, M. (2007), "Complexity and adaptivity in supply chain networks: building supply network theory using a complex adaptive systems perspective", Decision Sciences, Vol. 38 No. 4, pp. 547-62.
- Payne, S.C., Youngcourt, S.S. and Beaubien, J.M. (2007), "A meta-analytic examination of the goal orientation nomological net", Journal of Applied Psychology, Vol. 92 No. 1, p. 128
- Pendall, R., Foster, K. A., & Cowell, M. (2010). Resilience and regions: Building understanding of metaphor. Cambridge Journal of Regions, Economy and Society, 3, 71–84.
- Pentland, A. (2012), "The new science of building great teams", *Harvard Business Review*, Vol. 90 No. 4, pp. 60-69
- Pereira, R.C., Christopher, M. and Da Silva, L.A. (2014), "Achieving supply chain resilience: the role of procurement", Supply Chain Management: An International Journal, Vol. 19 No. 5/6, pp. 626-642
- Pereira, R.C., Christopher, M. and Da Silva, L.A. (2014), "Achieving supply chain resilience: the role of procurement", *Supply Chain Management: An International Journal*, Vol. 19 No. 5/6, pp. 626-642.
- Pettit, T. J., Fiskel, J. and Croxton, K. L (2010), "Ensuring supply chain resilience: Development of a conceptual framework," *Journal of Business Logistics*, Vol. 31 No 1 pp.1-21
- Ponomarov, S.Y. and Holcomb, M.C. (2009), "Understanding the concept of supply chain resilience", The International Journal of Logistics Management, Vol. 20 No. 1, pp. 124-143
- Poortvliet, P.M. & Darnon, C. (2010), "Toward a more social understanding of achievement goals: the interpersonal effects of mastery and performance goals", *Current Directions in Psychological Science*, Vol. 19 No. 5, pp. 324-328
- Pournader, M., Rotaru, K., Kach, A.P., Hajiagha, S.H. R. (2016), "An analytical model for system-wide and tier-specific assessment of resilience to supply chain risks," *Supply Chain Management: An International Journal*, Vol. 21 No 5 pp. 589 – 609.
- Reivich, K. J., Seligman, M. E. P., & McBride, S. (2011). Master resilience training in the U.S. Army. *American Psychologist*, 66, 25–34.
- Rempel, John & Ross, Michael & Holmes, John. (2001). Trust and communicated attributions in close relationships. *Journal of Personality and Social Psychology*. 81. 57-64.
- Robert E. Spekman, John W. Kamauff Jr, <u>Niklas Myhr</u>, (1998) "An empirical investigation into supply chain management: a perspective on partnerships", *Supply Chain Management: An International Journal*, Vol. 3 Issue: 2, pp.53-67
- Rudolph, J.W. and Repenning, N.P. (2002), "Disaster dynamics: understanding the role of quantity in organizational collapse", *Administrative Science Quarterly*, Vol. 47, pp. 1-30
- Ruhl, J. B Glen, A. and Hartman, D. (2005), "A Practical Guide to Habitat Conservation Banking Law and Policy," *Natural Resources and Environment*, Vol. 20 No 1 pp. 26-32.
- Scholten, K. & Schilder, S. (2015), "The role of collaboration in supply chain resilience", *Supply Chain Management: An International Journal*, Vol. 20 Issue: 4, pp.471-484
- Sheffi, Y. and Rice, J.B. (2005), "A supply chain view of the resilient enterprise", *Sloan Management Review*, Vol. 47 No. 1, pp. 41-48.
- Shia, R. M., Hagen, J. A., McIntire, L. K., Goodyear, C. D., Dykstra, L. N., and Narayanan, L. (2015). Individual differences in biophysiological toughness: sustaining working memory during physical exhaustion. *Military Medicine*, 180, 230–236.
- Shin, J., Taylor, M. S., & Seo, M. G. (2012). Resources for change: The relationships of organizational inducements and psychological resilience to employees' attitudes and behaviors toward organizational change. Academy of Management Journal, 55, 727– 748
- Simatupang, T.M. and Sridharan, R. (2005), "The collaboration index: a measure for supply chain collaboration", International Journal of Physical Distribution & Logistics Management, Vol. 35 No. 1, pp. 44-62

- Spekman, R.E., Kamauff, J.W. Jr and Myhr, N. (1998), "An empirical investigation into supply chain management: a perspective on partnerships", International Journal of Physical Distribution & Logistics Management, Vol. 28 No. 8, pp. 630-50.
- Stephens, J., Heaphy, E.D., Carmeli, A., Spreitzer, G.M. and Dutton, J.E. (2013),
 "Relationship quality and virtuousness: emotional carrying capacity as a source of individual and team resilience", *Journal of Applied Behavioral Science*, Vol. 49 No. 1, pp. 13-41.
- Stern, M. J., and K. J. Coleman. 2015. The multi-dimensionality of trust: applications in collaborative natural resource management. *Society and Natural Resources* 28(2):117-132
- Surana, A., Kumara, S., Greaves, M. and Raghavan, U.N. (2005), "Supply-chain networks: a complex adaptive systems perspective", International Journal of Production Research, Vol. 43 No. 20, pp. 4235-65
- Sutcliffe, K.M. & Vogus, T.J. (2003), "Organizing for resilience", in Cameron, K.S., Dutton, J.E. and Quinn, R.E. (Eds), *Positive Organizational Scholarship: Foundations of a New Discipline*, Berrett-Koehler, San Francisco, CA, pp. 94-110.
- Tan, F.B. and Sutherland, P. (2004), "Online consumer trust: a multi-dimensional model", Journal of Electronic Commerce in Organizations, Vol. 2 No. 3, pp. 40-58.
- Tugade, M. and Frederickson, B. (2004), "Resilient individuals use positive emotions to bounce back from negative emotional experiences", Journal of Personal Social Psychology. 86(2): 320–333.
- Tukamuhabwa, B.R., Stevenson, M., Busby, J. and Zorzini, M. (2015), "Supply chain resilience: definition, review and theoretical foundations for further study", International Journal of Production Research, Vol. 53 No. 18, pp. 5592-5623
- Urciuoli, L., Mohanty, S., Hintsa, J. and Boekesteijn, E. (2014), "The resilience of energy supply chains: a multiple case study approach on oil and gas supply chains to Europe", Supply Chain Management: An International Journal, Vol. 19 No. 1, pp. 46-63
- Van der Vegt, G.S., Essens, P., Wahlstrom, M., & George, G. (2015). From the editors: Managing risk and resilience. *Academy of Management Journal*, 58, 4, 971-980.
- Van Hooft, E.A.J. and Noordzij, G. (2009), "The effects of goal orientation on job-search and reemployment: a field experiment among unemployed job seekers", *Journal of Applied Psychology*, Vol. 94 No. 6, pp. 1581-1590
- VandeWalle, D. (1997), "Development and validation of a work domain goal orientation instrument", *Educational and Psychological Measurement*, Vol. 57 No. 6, pp. 995-1015

- VandeWalle, D. Cron, W.L. and Slocum, J.W. (2001), "The role of goal orientation following performance feedback", *Journal of Applied Psychology*, Vol. 86, pp. 629-640.
- VandeWalle, D. and Cummings, L.L. (1997), "A test of the influence of goal orientation on the feedback-seeking process", *Journal of Applied Psychology*, Vol. 82 No. 3, pp. 390-400
- Vugrin, E.D., Warren, D.E. and Ehlen, M.A. (2011), "A resilience assessment framework for infrastructure and economic systems: quantitative and qualitative resilience analysis of petrochemical supply chains to a hurricane", Process Safety Progress, Vol. 30 No. 3, pp. 280-290.
- Warkentin, M.E., Sayeed, L. and Hightower, R. (1997), "Virtual teams versus face-to-face teams: an exploratory study of a web-based conference system", Decision Sciences, Vol. 28, pp. 975-96.
- Werner, E. E., & Smith, R. S. (1982). Vulnerable but not invincible: A longitudinal study of resilient children and youth. New York, NY: R. R. Donnelley and Sons, Inc.
- West, B.J., Patera, J.L. and Carsten, M.K. (2009), "Team level positivity: investigating positive psychological capacities and team level outcomes", Journal of Organizational Behaviour, Vol. 30 No. 2, pp. 249-267
- Williams, Z., Ponder, N. and Autry, C.W. (2009), "Supply chain security culture: measure development and validation", International Journal of Logistics Management, Vol. 20 No. 5, pp. 243-260.
- Wilson, S.M. and Ferch, S.R. (2005), "Enhancing resilience in the workplace through the practice of caring relationships", Organization Development Journal, Vol. 23 No. 4, pp. 45-60
- Wood, S., van Veldhoven, M., Croon, M. and de Menezes, L.M. (2012), "Enriched job design, high involvement management and organizational performance: the mediating roles of job satisfaction and well-being", *Human Relations*, Vol. 65 No. 4, pp. 419-446.
- Worthington, W.J., Collins, J.D. and Hitt, M.A. (2009), "Beyond risk mitigation: enhancing corporate innovation with scenario planning", Business Horizons, Vol. 52, pp. 441-450
- Wycisk, C., McKelvey, B. and Hülsmann, M. (2008), "Smart parts" supply networks as complex adaptive systems: analysis and implications, International Journal of Physical Distribution and Logistics Management, Vol. 30 No. 2, pp. 108-125.
- Zolli, A. & Healy, A.M. (2012), Resilience: Why Things Bounce Back, Headline, London.



Figure 1: Multilevel Framework of Supply Chain Resilience

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MINDSET, JOB SATISFACTION AND EMPLOYEE ENGAGEMENT AT WORKPLACE: PRELIMINARY RESULTS

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Abstract

The purpose of this paper is to evaluate personal demographics and whether it influences our mindset and job satisfaction. Mindset can either be growth or fixed. The intention is to reveal the relationship of job satisfaction and motivation with employee engagement and then isolate the mindset to see if there is any statistical significance. A survey was given to students in a state university in the northeast area in the United States. For four of our hypotheses we used t-tests and the ANOVA model and found there was no statistically significant relationship between mindset and job satisfaction, age and job satisfaction, income and job satisfaction, as well as education and job satisfaction. We used cross tabular analysis for gender and mindset and found there was a statistically significant relationship with a ten-point difference between male and females. For our last two hypotheses, we had used the regression model and found there was a moderately significant relationship between employee motivation and employee engagement for overall mindset, which includes both fixed and growth. After isolating fixed mindset, we found that there was a statistically significant relationship between job satisfaction and employee engagement with a growth mindset.

Keywords:

Mindset, Human Resources, Demographics, Job Satisfaction, Employee Engagement

Introduction

In efforts to ensure better job satisfaction, it is important to understand how both fixed and growth mindset individuals feel about their overall job satisfaction. There are several dependent

variables such as age, gender, education, income, political orientation, current relationship status, parent's relationship status, and location that will help narrow down some facts on which dependent variables have a significant role in a person's mindset. The research will help human resources better understand the placement of new talent at the business. This will help them be more globalized in the current marketplace, as well as having employees with a higher level of engagement and overall job satisfaction. The more satisfied an employee is, the more productive they are, and so it will ultimately help the overall operation and could even make them more successful.

There are several studies that focus on different aspects of the topic. Saif-Ud-Din's (2012) research focuses on job satisfaction and how different employee demographics cause people to have different attitudes towards their organization. Different demographics were analyzed to see their significance on mindset. It is well known that all employees have diverse demographic attributes, which has implications to different degrees of job satisfaction for things such as pay, job assignment, and promotion. Dweck is very well-known researcher and psychologist. Her research has focused on why people succeed and how to view success. She came up with the idea of "Mindset" as a simple idea and grouped mindsets into two groups: fixed or growth mindset. She believes that a person with a fixed mature. People with a growth mindset believe that their intelligence is that of a fixed nature. People with a growth mindset believe that their intelligences can be further developed with persistence and hard work. Ultimately, our research question will ask if a growth mindset does influence enhanced motivation, productivity and ultimately job satisfaction and employee engagement.

The purpose of this study is to first determine if a person has a growth or fixed mindset based on a survey of seven demographic and personal factors. Once the person's mindset has been discovered we will examine through another survey their level of job satisfaction, job engagement and job motivation. We will use a seven-point Likert scale to survey employees and students for our research, create some hypotheses and build a regression model to determine if mindset is statistically significantly related to job satisfaction, motivation and job engagement. Our literature review revealed that there is a gap in the literature regarding this unique connection to mindset. We will use the information from the questionnaire respondents to build a regression model and an ANOVA model in SPSS which should provide answers to our hypotheses. This paper will include a literature review, methodology, results, discussion and a conclusion.

Literature Review

This study is based on Carol Dweck's mindset theory. Her research focuses on the idea that people have different mindsets towards different aspects of their lives. During Dweck's research, she found that mindset has to do with how we view our personality. She determined that she could categorize mindset into two different groups. A "fixed mindset" believes that our character, intelligence, and creative ability are something that we naturally possess and that it cannot be changed in any significant way. Fixed mindsets also believe that success is the result of that innate intelligence. The people who possess a fixed mindset tend to strive for success while trying to avoid failure at all costs. This their way of maintaining their sense of being intelligent. On the other hand, a growth mindset is very open to challenges, and sees failure as a sign of growth, and not any hindering ability on their part. Her research has also found that our mindsets manifest from a very young age and explains a lot about one's behavior. The relationship with failure and success both within personal life and professionalism is ultimately how a person determines their own happiness.

Burnette, O'Boyle, Vanepps, Pollack and Finkel (2012) explore how implicit theories affect self-regulation. The reference to implicit theories in this article is specific to fixed or growth mindset attributes. The authors examine the effect of these mindsets as they relate to self-regulation in the context of goal setting, goal achievement and goal monitoring. In place of fixed and growth mindset language the authors refer to incremental theory (growth mindset) and entity theory (fixed mindset). The incremental theory suggests that intelligence can grow and is changeable with enough effort. The entity theory suggests rather that intelligence is fixed.

Lyon and Bandura (2017) discuss the effect of mindset in relation to employee development and ways to respond to different presentation of mindset by employees. The authors seek to link employee performance and an employee's mindset. Since every employee exhibits mindset, it is important to understand it and work with it. The main question looks at how managers can react, adapt and harness the mindset of their employees.

French (2016) proposes that before mindset can be practically applied the definition of mindset must be clear, although he agrees that mindset does have an impact on an organization's effectiveness. French's research was completed by comparing literature that discusses different view of mindset and attempted to clarify the definition. Of interest was the connection he made to nature (fixed) and nurture (growth) elements of psychology.

H1: Mindset is significantly related to job satisfaction.

Questions pertaining to Hypothesis 1 on the survey are the following:

- Your intelligence is something very basic about you that you can't change very much. (Fixed)
- No matter how much intelligence you have, you can always change it quite a bit. (Growth)
- Only a few people will be truly good at sports, you must be born with the ability. (Fixed)
- The harder you work at something, the better you will be (Growth)
- I often get angry when I get feedback about my performance. (Fixed)
- I appreciate when people, parents, coaches or teachers give me feedback about my performance. (Growth)
- Truly smart people do not need to try hard. (Fixed)
- You can always change how intelligent you are. (Growth)
- You are a certain kind of person and there is not much that can change it. (Fixed)
- An important reason why I do my school work is that I enjoy learning new things. (Growth)

Dweck's' research states that "Just by knowing about the two Mindsets, people can start thinking and reacting in new growth-orientated ways" (Dweck, 2006). She also found that "Mindsetrelated learning led to measurable differences in motivation, engagement and effort levels". Benjamin Barber, an eminent sociologist, once said, "I don't divide the world into the weak and the strong, or the successes and the failures... I divide the world into the learners and nonlearners." There is also the Mindset theory of action phases which is devised on the difference between motivation and volition, which is suggested by the Rubicon model which claims that prior to making a goal decision people use motivational principles whereas soon after their volitional principles set in. The theory proposes that different cognitive procedures are triggered when people engage in the task of choosing goals versus implementing them. The task demands regulate the features that characterize the deliberative versus implemental mindset. (Lange, 2012) This helps to better understand some of the foundations of mindsets and how it affects people's attitude toward personal success. Grant also conducted a study that focuses on the achievement goals and has illuminated basic motivational processes. The study was conducted to show that the impact of learning and performance goals depends on how they are set. The research shows that active learning goals set the foundation for active coping, sustained motivation, and overall higher achievement, when faced with a challenge. Performance goals predicted withdrawal and increased poor performance in the face of challenge. This directly relates to Dweck's study of the difference between a growth and a fixed mindset.

Saif-Ud-Din Khan, Nawaz and Ali Jan (2012) did research that focused on job satisfaction and how different demographics can lead to employees having different attitudes towards their organization. Different demographics were analyzed to see their significance on employee engagement, attendance, and turnover. All employees have diverse demographic attributes, and this has implicated a different degree of job satisfaction for things such as pay, job assignment, and promotion.

H2: Gender is significantly related to mindset.

H3: Age is significantly related to job satisfaction.

H4: Income is significantly related to job satisfaction.

H5: Education is significantly related to job satisfaction.

Janssen, Backes and Uschi (2011) did research on how Frederick Herzberg (a psychologist) and Abraham Maslow (a behavioral scientist) proposed a theory about job factors that motivate employees. Maslow, developed a theory about the ranking and satisfaction of many human needs and analyzed how people pursue these needs. The study investigated the relationship between typical stereotypes at work and overall job satisfaction.

Chengdzai (2014) provides information about the relationship between job satisfaction factors and life satisfaction and how the two may be related. He also discusses the components that employees find important for job satisfaction. The connection to mindset is that the satisfaction of high use of skills relates to a growth mindset.

Keating and Heslin (2015) consider mindset as it relates to employee engagement in the workplace. They look at mindset from the perspective of how to unleash the positive effects of a

growth mindset. They look at employee engagement as a general sense of positive interaction and dedication in the workplace. Engaged employees are not simply going through the motions of being at work. The need to increase employee engagement is obvious in that even small increases in employee engagement can have dramatic effects on the success of any organization.

H6: Job satisfaction is significantly related to employee engagement.

H7: Employee motivation is significantly related to employee engagement.

Questions pertaining to the Hypothesis 6 & 7 on the survey provided to our sample mean are the following:

- All things considered, I am satisfied with my job. (job satisfaction) (Hoppock, 1935)
- I feel as though my skillset matches my current role. (job satisfaction) (Hoppock, 1935)
- In the last year, I have had opportunities at work to learn and grow. (engagement) (Gallup, 2013)
- At work, my opinions seem to count. (motivation) (Gallup, 2013)
- All things considered, I am very engaged with my job. (engagement)
- I feel as though I am very motivated at work. (motivation) (Hise, 1994)
- I know what I should do to help the company meet its goals and objectives. (motivation) (Hise, 1994)
- I am determined to give my best effort at work each day. (engagement) (Hise, 1994)
- I have a good working relationship with my boss and fellow employees. (job satisfaction) (Hise, 1994)

Rastgar, Ebrahimi, & Hessan (2014) consider the changes in the current work era. The research provided evidence on how personality traits affect career attitudes. Two career attitudes were evaluated; protean and boundless. They used the Big Five Personality model to determine their attitude in the work place. They found that highly agreeable people are averse to changeable career orientation. Extroverted individuals were attracted to protean and boundless careers. This information can be used by Human Resources to fill positions based on dynamics of a team and how an individual's career plans to be directed, either by themselves or the organization.

Caluori (2014) determined that mindset is the driving force behind our daily activities. We all have needs whether it be survival or social. Motivation drives us to fulfill those needs. If those needs are not met, then we lose motivation. A growth mindset makes it easier to achieve goals

and give us a better sense of fulfillment in our professional and personal lives. Fixed mindsets are focused on extrinsic factors such as wealth and status and are more averse to change. Per the happiness equation 40% of a person's happiness is based on our intentional need to be internally rewarded.

Mitchell, Mitchell, & Smith (2008) used a sample of 220 entrepreneurs to identify a relationship between recognition of failure and the commitment mindset. They sought to find out which businessmen were willing to continue, and which were not after learning from their failure. The transaction commitment mindset considers the extent an individual is committed to participate in new socioeconomic interactions. Being able to recognize an opportunity out of failure is important to the growth mindset.

The survey questions that relate to the job satisfaction include:

- 5. I often get angry when I get feedback about my performance.
- 6. I appreciate when people give me feedback about my performance.
- 10. An important reason I do my school work is that I enjoy learning new things.
- 11. I feel as though my skillset matches my current role.
- 13. In the last year, I have had opportunity at work to learn and grow.
- 15 At work my opinions seem to count.
- 16. There is someone at work who encourages my development.
- 20. I am proud to be a member of the team.
- 22. I am satisfied with my overall compensation.
- 23. I have a good working relationship with my boss and fellow employees.

These questions reveal either directly or indirectly an employee's satisfaction with their job. Feeling angry about feedback would have a negative effect on job satisfaction. A person who is satisfied with their job with a growth mindset will welcome feedback. Appreciation of feedback, which is a trait connected to a person with a growth mindset could indirectly reveal that a person is satisfied with their job. Being able to accept positive or negative feedback properly will lead to greater job satisfaction. The enjoyment of learning new things is another factor that could indicate satisfaction with a person's job. While the question refers to school it is the level of enjoyment with learning new things that can translate to job satisfaction. Question 13 will reveal the same feeling by asking the question about learning and growing in a different way. The two responses will support job satisfaction. An employee who feels that their skillset matches the role they are in is likely to have a great deal of job satisfaction. If the skills match the role, then the employee will be successful, produce quality work and receive positive performance reviews which will further contribute to job satisfaction. Working at a company where your opinions count will reveal more about job satisfaction. If an employee feels that their opinions count they will possibly be more satisfied. Job satisfaction, motivation and engagement will be derived from the opportunity of the employee to be part of the company's success and good outcomes. A good working relationship (23) and a person or team that encourages an employee's development (16 and 20) will increase job satisfaction. Certainly, feeling included and part of a team in addition to good working relationship with a boss will increase job satisfaction. These factors may have more of an effect on job satisfaction than others. Compensation is a factor in job satisfaction assuming the amount is fair. Job satisfaction can be derived from compensation, but this factor will not be primary. Compensation only will go so far to affect a person who hates their job. The same compensation can be found elsewhere so the other factors are more important.

Stangeland and Thoresen's (2016) research supports the idea that a properly motivated employee with be more satisfied and have higher performance. The ability of an employee to learn and develop is critical to what makes a person with a growth mindset thrive on the job. Their research provides further support for the usefulness of our survey questions that ask about learning new things (10), opportunities to learn and grow (13) and others encouraging their development (16).

Ryan's (1987) research is another piece that studied the effects on feedback as motivational variables. People that are more task involved focus on mastering it and therefore higher levels of motivation. Higher motivations and successful take completion will lead to employee satisfaction and good feelings about their job. The question about an employee's skillset matching their role is also applicable to Ryan's research.

Research Methodology

Based on the hypotheses proposed by the previous section, we develop a research framework as follows:



Our analysis will take place in two steps. First, we will examine the relationship between the independent variables (income, age, gender, education,) and the dependent variable of mindset or job satisfaction. Our initial research question is: How do these factors relate to the type of mindset a person has which could be either fixed or growth?

After the type of mindset is established for each subject the type of mindset then becomes the independent variable and we have the dependent variables of job satisfaction. We will use a logistical regression model to predict which of the mindset groups the subjects belong to.

In addition, we plan to utilize a regression model on the results of our survey responses to learn about which factors affect mindset and then further support the idea that a growth mindset leads to higher job satisfaction.

Results

We received 112 responses to our survey which was conducted in a state university in the northeast region.112 students responded to the survey out of about 2000 students in the state university's business school. The results of the descriptive statistics are shown below. Most of the responses are from people between the ages of 17-30. This is because most of the people surveyed were college students.

	Frequency	Percent
17-21	30	26.8
22-25	49	43.8
26-30	15	13.4
31-36	10	8.9
37-52	6	5.4
53+	2	1.8
Total	112	100.0

There were 48 surveys from males and 64 from females. The results tilt in favor of females as the majority, but not too far apart from each other.

	Frequency	Percent
Male	48	42.9
Female	64	57.1
Total	112	100.0

The results show that most of the responses are from people with at least some education beyond high school. About 67% have earned a 2-year degree or beyond.

	Frequency	Percent
High School Diploma	5	4.5
Some College	32	28.6
2-year College degree	33	29.5
4-year College degree	35	31.3
Master's Degree	7	6.3
Total	112	100.0

	Frequency	Percent
<\$25,000	26	23.2
\$26,000-\$35,000	19	17.0
\$36,000-\$50,000	12	10.7
\$51,000-\$75,000	23	20.5
\$76,000-\$100,000	13	11.6
\$101,000-\$150,000	13	11.6
\$151,000-\$200,000	3	2.7
\$201,000+	3	2.7
Total	112	100.0

Income is clustered mostly below \$100,000 (83%) with a large portion below \$50,000.

A t-test was performed to test Hypothesis 1 that mindset is significantly related to a person's job satisfaction. We defined two mindsets, growth (Group 1) and fixed (Group 2). Is a person's job satisfaction greater if they have a growth mindset? Is it lower if they have a fixed mindset? The results show that there is not a significant relationship to job satisfaction for either mindset (p=0.116). The means are very close to each other.

A cross-tabulation chart was created to test Hypothesis 2 which seeks to understand the relationship between gender and mindset. Growth mindset is (1.00) and fixed mindset is (2.00). Based on the results of 112 people who responded there were 48 males and 64 females. The males had higher percentage (79%) of responses that indicated a growth mindset. Females that have a growth mindset were at (69%), a full 10 points below males. This does indicate that gender is a factor in the type of mindset a person has.

		Gender		Total
		Male	Female	
Mindset_2	1.00	38	44	82
	2.00	10	20	30
Total	•	48	64	112

Most of the people who responded are between the ages of 17-30 (82%), with only a few people over 37. Comparing the means reveals that the least satisfied group are the youngest ages between 17-25. Except for the 6 people in the 37-52 age group, the mean level of job satisfaction increases as age increases with the most satisfied 53 and over. The ANOVA test reveals that age is not significantly related to job satisfaction. The p-value at (.398) is greater

than .05 which indicates no relationship. Some patterns are evident, however overall age does not matter. Even when looking at the multiple comparisons there are not any age groups where the p-value is less than .05.

The survey results show that most of the people who responded have an income level below \$75,000. The means between the level indicates that the average level of satisfaction between the groups is very similar. ANOVA Results show no statistical significance for Hypothesis 4 - Income is significantly related to job satisfaction. This ANOVA model has a p-value of .288 which indicates that the relationship between income and job satisfaction is not significant because it is below .05. Our hypothesis (H4) is not true. There is no significant relationship between income and job satisfaction.

Most of the people that responded had some level of college degree (89%). Only seven respondents had a Master's degree. The ANOVA test shows that our hypothesis five is also not true. (p-value of .305) Education is not significantly related to job satisfaction. The multiple comparison chart also does not show any significant relationship between education and job satisfaction.

The Pearson Correlation shows that engagement is positively correlated with motivation and that job satisfaction is positively correlated with motivation.

	Engagement (Y)	Job Satisfaction (X1)	Motivation (X2)
Engagement (Y)	1	.052	.191*
Job Satisfaction (X1)		1	.311**
Motivation (X2)			1

*p<0.05, **p<0.01 (1-tailed)

The overall regression model is statistically significant with a p-value = 0.017 and an adjusted R-squared of .019. While we include both mindsets in our regression model, evidence shows no statistical significance on Hypothesis 6. We found there is no meaningful relationship between job satisfaction and employee engagement as the p-value = .934. The relationship between employee motivation and engagement is moderately significant with a p-value = .053. Data supports Hypothesis 7 marginally.

Regression Model – Overall – Fixed and Growth Mindset (Reductions)							
Dependent Variable = Employee Engagement (Y) A divised $R^2 = 0.19$ E(2.111) = 2.061*							
Predictors	Predictors B Beta t Sig.						
Constant 3.185 2.417 .017							
X1-Job Satisfaction006008083 .934							
X2-Employee Motivation	.508	.193	1.953	.053			

*p<0.05

We have isolated growth mindset for this reduced regression model and found that the overall model is statistically significant with a p-value of 0.049 and an adjusted R-squared of .005. We found there is no statistical significance between job satisfaction or employee motivation with employee engagement. The p-values were .894 and .217 respectively. We cannot support H6 or H7. There is no statistical significance between job satisfaction and employee engagement or motivation and employee engagement for persons with a growth mindset.

Regression Model – Reduced – Growth Mindset							
Dependent Variable = Employee Engagement (Y) Adjusted $R2 =005$, $F(2,81) = .801$							
Predictors	В	Beta	t	Sig.			
Constant	Constant 3.691 2.001 .049						
X1-Job Satisfaction011016134 .894							
X2-Employee Motivation	.439	.145	1.243	.217			

We have now isolated fixed mindset for this reduced regression model and found that the overall model is statistically significant with a p-value of 0.020 and an adjusted R-squared of .452. We found that the relationship between job satisfaction and employee engagement was statistically significant with p-value=.048, whereas the relationship between employee motivation and engagement was not statistically significant, p-value = .108. We can support that job satisfaction is significantly related to employee engagement. We cannot support that employee motivation is significantly related to employee engagement.

Regression Model – Reduced – Fixed Mindset							
Dependent Variable = Employee Engagement (Y) Adjusted R2 = $.452$, F(2,29) = 12.953 *							
Predictors	В	Beta	t	Sig.			
Constant 1.773 2.480 .020							
X1-Job Satisfaction	.414	.417	2.068	.048			

X2-Employee Motivation	.325	.335	1.663	.108
*p<0.05				

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Discussion

H1 - Mindset is significantly related to job satisfaction.

Our results have shown that neither fixed nor growth mindset is significantly related to job satisfaction. A t-test was performed which resulted in p-values greater than .05. These values indicate no significant relationship. Dweck' research did not address this specific question, but involved research that could be inferred to lead to job satisfaction. It makes sense that job satisfaction is not directly attributed to the research because of the assumption that some of the results of having a growth mindset may not necessarily lead to job satisfaction. Dweck's work suggests that mindset affects a person's attitude toward personal success. (Dweck, 2006) We might assume that this can be associated with job satisfaction, but it also may not. The study done by (Burnette et al. 2012) has similar findings as Dweck. The authors also suggest that people with a growth mindset leads to positive behaviors that we assumed may lead to job satisfaction, however a direct connection was not studied. At least based on our literature review we have contributed new information for further study about the effect of mindset on job satisfaction.

H2 Gender is significantly related to mindset.

The cross-tabulation chart that we developed did indicate that gender is significantly related to mindset. The data shows that the percentage of males with a growth mindset is 10 points higher than females. There was no literature that was reviewed that studies the relationship between gender and mindset. We chose to examine gender as a point of study to add to the current research related to mindset (Dweck, 2006).

H3 Age is significantly related to job satisfaction.

Most of the people who took the survey were in younger age ranges. Most respondents were under age 37. In our study, the ANOVA test that was performed showed that age is not significantly related to job satisfaction. We discovered that as age increases in most cases job satisfaction increases, but the results overall are not significant. Saif-Ud-Khan, Nawaz and Ali Jan's (2012) research about job satisfaction and demographics came to the same conclusion. Their research found that age played no role in job satisfaction. The research likely means that while age is not significant there are other factors that have a greater impact on job satisfaction that involve the employer rather than the employee.

H4 Income is significantly related to job satisfaction.

Our survey results showed that most of the respondents had an income level below \$75,000. Based on our survey results it was determined that income and job satisfaction are not significantly related (p=.288). As with age (H3) Saif-Ud-Khan et al. (2012) research showed that income also does not have a significant relationship with job satisfaction. We think that like age the factors that have a greater relationship to job satisfaction related more to attributes about the employer rather than individual persons.

H5 Education is significantly related to job satisfaction.

Like age and income education is not significantly related to job satisfaction. The results from the ANOVA model showed a p-value of .305 which is greater than .05 level of significance. While not specifically mentioned in the study that Saif-Ud-Khan et al. (2012) did have a result similar along the lines as age and income where no significance was found. The hypothesis that education is significantly related to job satisfaction cannot be supported. Since H3-H5 are not supported this lends further support that most demographic factors are not significantly related to job satisfaction.

H6 Job satisfaction is significantly related to employee engagement.

The results from our regression analysis show in the overall model shows that job satisfaction is not significantly related to employee engagement with a p-value of .934. These results from the overall model include both fixed and growth mindsets. When we considered the same regression, model applied only to people with a growth mindset the results did not show any significant relationship between job satisfaction and employee engagement with a p-value of .894. Surprisingly however when we considered only the people with a fixed mindset it supports that there is a significant relationship between job satisfaction and engagement. While this does seem opposite of what would be expected we did learn from our hypothesis one (H1) that mindset is not significantly related to job satisfaction. We suppose that if a person is fit into a job that suits their mindset they will be satisfied. The study by Burnette et al. (2012) supports this theory by showing that people with different mindsets will choose different strategies to go about their work as well as have different needs, however if they are fit into the right position

they will be satisfied. Lyon and Bandura (2017) further support that same idea that it is finding ways to appeal to the mindset by a manager that will make a difference in job satisfaction.

H7 Employee motivation is significantly related to employee engagement.

Our study shows from the overall model that employee motivation is moderately related to employee engagement with a p=value of .053. This result considers both a fixed and growth mindset. We also discovered that when looking only at people with a growth mindset that there is no significant relationship between motivation and employee engagement with a p-value of .217. When we applied the model to only people with a fixed mindset the same is true. There is no significant relationship between employee motivation and engagement. Lyon and Bandura (2017) has produced research that supports the same idea that fulfilling the needs of mindset will increase employee engagement regardless of type of mindset. Overall H7 is not supported by our results.

Managerial implications

We prepared this study to understand the factors that influence mindset, job satisfaction and employee engagement. The purpose is so that a company can use the information to help understand employee job satisfaction and engagement. By understanding these two important qualities of employees in theory the employer will be able to develop programs to ensure that employees have the best chance to succeed. Many of the factors that we considered were not significant factors in determining engagement and job satisfaction. We did learn however that job satisfaction is related to engagement for people with a fixed mindset. The moderate overall relationship between motivation and engagement should also be considered. It was also discovered that mindset is not significantly related to job satisfaction, however based on other studies the company should consider learning about mindset so that the employee will be placed into a position that considers the strengths of their mindset. Despite our study not showing and significant relationship with mindset it still should be understood and used as a tool for job placement.

Conclusion

Mindset can be acquainted with our attitudes towards different aspects of our lives. This study wanted to investigate the influence of mindset on job satisfaction and employee engagement. Our

evidence has suggested otherwise. After looking at gender we found evidence that supports Dweck's theory that gender influences mindset while mindset, age, income and education do not have a significant amount of impact on job satisfaction. Whereas the overall mindset of someone who was satisfied in their job would suggest they were likely to be engaged. We dug a little deeper and found that the research showed individuals with a fixed mindset who were satisfied in their jobs were likely to be engaged unlike a growth mindset. There was insufficient evidence to prove someone with a growth mindset who was satisfied or motivated was also engaged.

Further studies on this material should be explored. Other variables to consider for further investigation into mindset are industries in which employees are working as well as job category. While our study did not result in very many statistically significant findings as they relate to job satisfaction, it does rule out the factors we tested so a future researcher can move forward with a new idea and not be concerned with demographics having any relation to job satisfaction or engagement. Further research could include an analysis of how job duties, job characteristics, feelings about a supervisor and personality impact job satisfaction and engagement.

Human Resource departments can still use this information to fill certain positions. If there is a deeper understanding of mindset and job satisfaction it can be used as a hiring and retention tool to fill positions with the right employees. Managers can nurture and develop talent with people who are willing to grow as opposed to a fixed mindset who can fill roles that are change adverse. This is not to say that having a fixed mindset is negative, but rather it is important to find the right position for either mindset since both provide important skills and contributions to the company.

Our study did not yield many statistically significant results, but it did eliminate the need to study the factors we tested in future research. Our contribution to the literature is made on the finding that mindset or demographic factors do not have a significant impact on job satisfaction or engagement. There was one significant finding that in the fixed mindset subgroup that job satisfaction is related to employee engagement, however this should be re-tested in future research with new variables.

References

- Blaudziunas, R. (2016). Information about article authors. *Engineering Economics*, 27(2). doi:10.5755/j01.ee.27.2.14867
- Burnette, J. L., O'Boyle, E. H., VanEpps, E. M., Pollack, J. M., & Finkel, E. J. (2013). Mind-sets matter: A meta-analytic review of implicit theories and self-regulation. *Psychological Bulletin*, 139(3), 655-701.
- Caluori, N. (2014). Mindset and Motivation. Retrieved from USMA: http://www.usma.edu/cfe/Literature/Caluori_14.pdf
- Claro, S., Paunesku, D., & Dweck, C. S. (2016). Growth mindset tempers the effects of poverty on academic achievement. *Proceedings of the National Academy of Sciences*, 113(31), 8664-8668.
- Dweck, C. S. (2009). Mindsets: Developing Talent Through A Growth Mindset. Retrieved from http://garyhorvath.com: http://garyhorvath.com/wp-content/uploads/2016/11/usocmindsets-by-Carol-Dweck-2.09.pdf
- Dweck, c. s. (2016). Mindset: the new psychology of success. New York: Random House.
- Gallup Employee Engagement Center. (n.d.). Retrieved November 27, 2017, from https://q12.gallup.com/Public/en-us/Features
- Grant, H., & Dweck, C. S. (2003). Clarifying achievement goals and their impact. *Journal of Personality and Social Psychology*, 85(3), 541-553.
- Hise, P. (n.d.). The motivational employee-satisfaction questionnaire. Retrieved November 27, 2017, from https://www.inc.com/magazine/19940201/2768.html
- Hoppock, R. (1935). Job Satisfaction. New York and London: Harper and Brothers.
- Janssen, Simon; Backes-Zellner, Uschi (2011). Occupational stereotypes, gender segregation and job satisfaction. In: EALE, Cypress, 22 September 2011 - 24 September 2011. http://www.zora.uzh.ch/id/eprint/55598/1/add157019_9lRJt1x379.pdf
- Kamins, M. L., & Dweck, C. S. (1999). Person versus process praise and criticism: Implications for contingent self-worth and coping. *Developmental Psychology*, 35(3), 835-847.

Keating, L. A., & Heslin, P. A. (2015). The potential role of mindsets in unleashing employee engagement. *Human Resource Management Review*, 25(4), 329-341.

Lange, P. A. (2012). Handbook of Theories of Social Psychology. doi:10.4135/9781446201022

- Mafini, C. (2014). The relationship between job satisfaction and life satisfaction. *International Business and Economics Research Journal*, 13(3), 453-462.
- Mitchell, R. K., Mitchell, J. R., & Smith, J. B. (2008). Inside opportunity formation: enterprise failure, cognition, and the creation of opportunities. Strategic Entrepreneurship Journal, 2(3), 225-242.
- Myers, C. A., Wang, C., Black, J. M., Bugescu, N., & Hoeft, F. (2016). The matter of motivation: Striatal resting-state connectivity is dissociable between grit and growth mindset. Social Cognitive and Affective Neuroscience, 11(10), 1521-1527.
- Rastgar, A. A., Ebrahimi, E., & Hessan, M. (2014). The effects of personality on protean and boundaryless career attitudes. *International Journal of Business Management and Economics*, 1(1), 1-5
- Reid, K. J., & Ferguson, D. M. (2014). Assessing Changes in Mindset of Freshman Engineers. Retrieved from American Society for Engineering Education: http://people.cst.cmich.edu/yelam1k/asee/proceedings/2014/Paper%20files/aseencs2014_ sSubmission_20.pdf
- Ryan, R. M., & Deci, E. L. (1989). Bridging the research traditions of task/ego involvement and intrinsic/extrinsic motivation: Comment on Butler (1987). *Journal of Educational Psychology*, 81(2), 265-268.
- Saif-Ud-Din Khan, Dr. Allah Nawaz & Dr. Farzand Ali Jan. (2012). Impact of demographic diversities on the job satisfaction and its consequences: case of academicians in higher learning institutions of Pakistan. *Global Journal of Management and Business Research*, 12(19), 35-43.
- Stangeland, N. K., & Thoresen, K. (2016). A cross-sectional study on the interplay between motivational climate and employee mindset in a work context: Why the focus on effort

might be beneficial for Organizations. *BI Norwegian Business School*. Retrieved from: https://brage.bibsys.no/xmlui/handle/11250/2444121

Robert P. French II (2016). The fuzziness of mindsets: Divergent conceptualizations and characterizations of mindset theory and praxis. *International Journal of Organizational Analysis*, 24(4), 673-691.

ON THE EFFECT OF COMPUTER INTELLIGENCE ON COMPUTER RESEARCH ITSELF

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Abstract

This article explores the effect of fast and intelligent computers on developing faster and more intelligent computers. Same as computers enhance human's intellectual capabilities in doing researches in almost all fields, computers also enhance the human's intellectual capabilities in developing computer itself, which forms a positive or regenerative feedback in the process of computing research. We use Moore's Law as an example to show the effect of the positive feedback. Moore's Law, which claims that computing speed doubles in every two years, does not assume the effect of feedback. With faster and more intelligence computers as we have now, the effect of the positive feedback should no longer be ignored. We add the factor of positive feedback into the process of computing speed would increase quadratic-exponentially, and number of years needed for a doubling of computing speed would keep decreasing. Computer is the only man-made thing that will play a direct role in improving itself. With the effect of positive feedback, computer and its intelligence are bound to progress at a pace faster than what people has predicted.

Key Words: Information Technology, MIS, Computing speed, Moore's Law, Artificial Intelligence

I. Introduction

The capability of a computer has progressed tremendously in the past seventy decades. Computers extend our brains as machine tools extend our muscles. With the help of computers, we have achieved amazing accomplishments in almost all fields in science and engineering. Our life has been significantly changed by computers.

Computing speed has increased billions of times in the past 70 years since the first electronic computer in 1940's. It is continuing the trend of increasing. Computer's "intelligence" relies on computer's speed. Recent achievements of "smart machines" in artificial intelligence, such as IBM Watson (2012) and Alpha Go (2016), are all reliant on super-faster computers. Fast computers pave a way for machine smartness.

There is one thing missed in numerous books and articles debating the power of future computers and machine intelligence, which is the feedback-effect of fast and intelligent computers on developing computer itself. Since the first industrial revolution in eighteenth century, machines and electricity have extended human's muscle and achieved countlessly many engineering wonders and built up our modern life. Since 1940's, computers have extended our brains, which speeded up calculations, enhanced memories, and revolutionized communications. The process of developing computers has been so far relied on, and only relied on, the intelligence of humans. No intelligence from anything other than our brains has been utilized to assist that process. Things are changing. Computers are becoming powerful and intelligent sufficiently so that they can assist the process of researching themselves. The process of developing new computers will no longer purely rely on the intelligence of humans, but on the joint intelligence of humans and computers!

There is no doubt that computer intelligence will help the research of computer itself. But how much will it help? In this article, we elaborate the effect of positive feedback of computer capabilities on developing faster computer itself by using "Moore's Law" as an illustrative example

II. Moore's Law and Computer Intelligence

Gordon Moore, co-founder of Intel, predicted in 1965 that number of transistors packed on an area of integrated circuit would double every two years [Moore 1965]. As one packs more transistors on a nail-sized integrated circuit, the distances among transistors get closer, which reduces the traveling time of signals among transistors and therefore increases the speed of processing those signals. If the average distance of transistors on a circuit is reduced by 50%, then the time required for signals being processed to travel would be reduced by half, and the

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processing speed would double. Therefore, Moore's Law amounts to saying that computing speed would increase exponentially on relate to the time, particularly, it doubles every two years.

Amazingly, Moore's hypothesis has proved to be almost accurate in the past 50 years. Intel Processor 4004 in 1971 carried out up to 0.092 MIPS (million instructions per second), By 2016, Intel Core i7 6950 executed up to 317,900 MIPS, a 3,460,000- time increase [Irfan 2014] [Wikipedia 2017]. The speed in 1971, 0.092 MIPS, needs to double 21.7 times in order to reach 317,900 MIPS. If it doubled every two years, then it requires 43.4 years which is close to the elapsed time of 45 years from 1971 to 2016.

Data showed that even before electronic computers, computing speed of humanity was approximately doubled twice a year, going back to as early as 120 years ago [Kurzweil 2015]. Some scholars argue that even after Moore's Law expires, computing speed will continue its exponential increase, since new techniques will relay to make it happen [Kurzweil 2012], although some do not agree [Sneed 2015].

People in the field of artificial intelligence (AI) are interested in computing speed because computing speed is directly related to intelligence. An example of human intelligence is the capability of making decisions in sophisticated circumstances where billions of alternatives for a decision need to be evaluated, as in chess playing. To make a good decision, one is required to evaluate and compare alternatives quickly. IBM Watson and Alpha Go are amazingly "smart" because they can evaluate alternatives at an amazing speed. So, high computing speed is necessary for computer intelligence; and the higher the speed, the more intelligent a computer could be.

Speed leads to intelligence. Intelligence emerges when computer speed reaches a certain level. Although software and algorithms are also important for computing speed, circuitry speed of a computer plays a fundamental role of the power of computing.

Moore's Law assumes, by default, a constant intelligence level of researchers in the process of developing faster computers. That would be true if the researchers rely on the intelligence in their brains only. That would not be true when computers were used in the research of developing better computers, as computers are used to help researchers in other fields. At the time when computers are fast and more intelligent, their role of helping research in developing the better computer itself would become no longer negligible. The recent accomplishments of artificial intelligence (AI), IBM Watson and Alpha Go for example, showed

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machines could be as intelligent as, or more intelligent than, humans in some aspects. When such intelligent machines were used in research for improving computing speed, it would have a considerable effect of elevating the overall intellectual level of the research force.

In the next section, we will add the factor of feedback of increased computing speed into Moore's Law to see how Moore's Law would change.

III. Effect of the Positive Feedback on Moore's Law

We use Moore's Law, as an example, to explore the effect of the positive feedback of computers on developing the computer itself. Recall that Moore's Law assumes a constant capability of doing research on improving computer speed, as we discussed in Section II. We now add the factor of the feedback and show how it would change the Moore's Law.

Let S_n denote the computer's computing speed at the end of year n.

Let *m* be the index of annual improvement of computing speed. By Moore's Law, computer speed doubles every two years. So, annual increase index $m = 2^{(1/2)} = \sqrt{2} = 1.4142 =$ 141.42%. If computing speed doubles every one and half year, then $m = 2^{(1/1.5)} = \sqrt[1.5]{2} = 1.5874$ = 158.75%.

With these symbols, the computing speed at the beginning of year one (i.e., end of year 0) is S₀. At the end of year one, $S_1 = mS_0$. At the end of year two, $S_2 = mS_1 = m^2S_0$. And in general, at the end of year n, $S_n = m^nS_0$ for n = 1, 2, 3, 4, ...

Let *i* denote the percent of annual progress of integrated man-machine research capability due to the feedback of increased computing speed. If i=0, then it means a constant integrated man-machine capability as assumed in Moore's Law. If i>0, it shows the percent of the enhancement of intellectual level of doing research of computing speed due to the computer capability. For example, i=0.01=1% means that research capability is improved 1% annually which is credited to using computers in researching computer itself.

Let capacity index *I*, I=i+1, denote the *annual multiplier of research capability on computing speed*. Let *AIMMM*_k denote *annual integrated man-machine multiplier* at the end of year k, for k = 0, 1, 2, 3, 4, ... AIMMM_k is the ratio between S_k and S_{k-1}, i.e., AIMMM_k = S_k/S_{k-1}, where S_k is the computing speed at the end of year k. AIMMM represents the capability of research of the integrated man-machine team. If at the beginning of year 1 (i.e., end of year 0), AIMMM₀ is m, then at the end of year 1, AIMMM₁= mI. At the end of year 2, AIMMM₂ = $(AIMMM_1)I = mI^2$, and at the end of year k, the annual integrated man-machine annual improvement multiplier $AIMMM_k = mI^k$.

Look at the computing speed. It is S_0 at the beginning of the first year. At the end of year 1, $S_1 = S_0 * AIMMM_1 = mIS_0$; at the end of year 2, $S_2 = S_1 * AIMMM_2 = mIS_0 * mI^2 = m^2I^3S_0$; at the end of year 3, $S_3 = S_2 * AIMMM_3 = m^2I^3S_0 * mI^3 = m^3I^6S_0$; etc.

In general, computing speed at the end of year k is:

$$\mathbf{S}_{k} = \mathbf{m}^{k} \mathbf{I}^{((k^{2}+k)/2)} \mathbf{S}_{0}, \text{ for } k = 1, 2, 3, \dots$$
(1)

For $m=\sqrt{2}$ as assumed in Moore's Law, formula (1) becomes:

$$\mathbf{S}_{k} = \left(\sqrt{2}\right)^{k} \mathbf{I}^{((k^{2}+k)/2)} \mathbf{S}_{0}, \text{ for } k = 1, 2, 3, \dots$$
(1a)

Formula (1) and (1a) shows that computing speed increases in a quadratic-exponential rate with year k. In Moore's Law, I=1, so the annual increasing rate is a constant m, and computing speed S_k exponentially increases on m with year k. When taking into account the positive feedback of computer speed to research capability, I, is greater than 1, and computing speed S_k increases quadratic-exponentially on I in addition to exponentially on m with year k. By formula (1), computing speed would progress with an acceleration, and the acceleration increases quadratically with year k. The annual integrated man-machine multiplier, AIMMM_k, is the ratio between S_k and S_{k-1} :

$$AIMMM_{k} = S_{k}/S_{k-1} = mI^{k}, \text{ for } k = 1, 2, 3, ...$$
(2)

When I=1, which means that integrated man-machine research capability remains unchanged, as assumed in Moore's Law, computing speed increase exponentially year by year with a constant multiplier m. As I>1, which reflects the effect of computer progress on the development of computer itself, computing speed would increase "quadratic-exponentially" year by year on I. That is, compared to S_0 , computing speed increases exponentially with m and quadratic-exponentially with I, as

$$S_k/S_0 = m^k I^{((k^2+k)/2)}, \text{ for } k = 1, 2, 3, ...$$
 (3)

Table 1 shows computing speeds, S_n , in 30 years with I=1, I=1.01, and I=1.05 respectively, and m= $\sqrt{2}$. The effects of exponential explosion and quadratic-exponential-explosion can be seen in Table 2. When I=1, as assumed in Moore's Law, computing speed increases exponentially with years. When I>1, even it is just 1.01 or 1.05, computing speeds explode quadratic-exponentially. For n=10, the ration between S_{10} (I=1.01) and S_{10} (I=1) is

55.31/32 = 1.73, and $S_{10}(I=1.05)$ and $S_{10}(I=1)$ is 468.34/32 = 14.64. For n=30, the ration between $S_{30}(I=1.01)$ and $S_{30}(I=1)$ is 3,348,769/32,768 = 102.2, while between $S_{30}(I=1.05)$ and $S_{30}(I=1)$ is 233,600,626,119,494/32,768 = 7,128,925,375. That is, after 30 years, if integrated man-machine research capability gets improved 1% annually, then computer speed would be 100 times faster than what Moore's Law predicts; and if integrated man-machine research capability gets improved 5% annually, then computer speed would be 7 billion times faster than what Moore's Law predicts!

	Moore's L	aw, I=1	Accelerated Moore's Law, I=1.01		.01 Accelerated Moore's Law, I=1.05	
Year, n	AIMMM _n	S _n	AIMMM _n	S _n	AIMMM _n	S _n
0	1.4142	1	1.414	1	1.41	1
1	1.4142	1.41	1.428	1.43	1.48	1.48
2	1.4142	2.00	1.443	2.06	1.56	2.32
3	1.4142	2.83	1.457	3.00	1.64	3.79
4	1.4142	4.00	1.472	4.42	1.72	6.52
5	1.4142	5.66	1.486	6.57	1.80	11.76
6	1.4142	8.00	1.501	9.86	1.90	22.29
7	1.4142	11.31	1.516	14.95	1.99	44.35
8	1.4142	16.00	1.531	22.89	2.09	92.67
9	1.4142	22.63	1.547	35.41	2.19	203.31
10	1.4142	32.00	1.562	55.31	2.30	468.34
11	1.4142	45.25	1.578	87.27	2.42	1,132.81
12	1.4142	64.00	1.594	139.07	2.54	2,877.04
13	1.4142	90.51	1.610	223.84	2.67	7,672.22
14	1.4142	128.00	1.626	363.88	2.80	21,482.58
15	1.4142	181.02	1.642	597.43	2.94	63,159.82
16	1.4142	256.00	1.658	990.71	3.09	194,977.56
17	1.4142	362.04	1.675	1,659.30	3.24	632,000.94
18	1.4142	512.00	1.692	2,806.89	3.40	2,150,998.47
19	1.4142	724.08	1.709	4,795.63	3.57	7,686,909.75
20	1.4142	1,024.00	1.726	8,275.39	3.75	28,843,818.98
21	1.4142	1,448.15	1.743	14,422.89	3.94	113,643,091.51
22	1.4142	2,048.00	1.760	25,388.53	4.14	470,135,035.52
23	1.4142	2,896.31	1.778	45,138.19	4.34	2,042,168,125.83
24	1.4142	4,096.00	1.796	81,053.56	4.56	9,314,288,142.76
25	1.4142	5,792.62	1.814	147,001.38	4.79	44,606,396,816.41
26	1.4142	8,192.00	1.832	269,272.59	5.03	224,302,398,290.63
27	1.4142	11,585.24	1.850	498,177.64	5.28	1,184,295,256,805.94
28	1.4142	16,384.00	1.869	930,888.56	5.54	6,565,614,230,078.43
29	1.4142	23,170.48	1.887	1,756,841.30	5.82	38,219,062,745,546.00
30	1.4142	32,768.00	1.906	3,348,796.40	6.11	233,600,626,119,494.00

Table 1. Hypothetical computing speeds S_n in 30 years, assuming current speed $S_0=1$.

By Moore's Law, computer speed doubles every two years. With annually improved integrated man-machine intellectual capability, computer speed will double in less than two years and in a decreasing trend. Formula (1) shows that computing speed in year k, $S_k = m^k I^{((k^2+k)/2)}S_0$ is $m^k I^{((k^2+k)/2)}$ times faster than S_0 . Number of times to double from S_0 to S_k , or from 1 to $m^k I^{((k^2+k)/2)}$, denoted by D, is therefore:

$$D = \log_2\left(m^k I^{\frac{k^2+k}{2}}\right) = (k \log_2 m) + \left(\frac{k^2+k}{2} \log_2 I\right).$$
(4)

Let $M = \log_2 m$, and $L = \log_2 I$, then formula (4) is written as

$$\mathbf{D} = k\mathbf{M} + \frac{k^2 + k}{2}L.$$
(5)

If I=1, L=log₂ I = 0, so formula (4) and (5) become

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$$\mathbf{D} = k\mathbf{M} = k\log_2 m; \tag{6}$$

Or:

$$k = \frac{D}{\log_2 m}.$$
(7)

Formulas (6) and (7) show the relationship between k, number of years, and D, number of times of doubling when I=1. For Moore's Law, $m=\sqrt{2}$. So, $\log_2 m = \log_2 \sqrt{2} = \frac{1}{2}$. That is, for Moore's Law, $D = \frac{1}{2}k$ and k = 2D. For example, to double one time, D=1, it takes k=2×1=2 years; to double three times, D=3, it takes k=2×3 years. We can also calculate how many times it is doubled by year k. For example, by year 18 (k=18), $D = \frac{1}{2}k = \frac{1}{2} \times 18 = 9$; that is, it will double 9 times by year 18.

If I>1 as the effect of feedback of computer speed is considered, we can derive k from formula (5), where k tells number of years needed to double D times.

Rewrite the equation in formula (5) $D = kM + \frac{k^2+k}{2}L$ as:

$$\frac{L}{2}k^2 + \left(M + \frac{L}{2}\right)k - D = 0.$$

Solve the quadratic equation for k. Of the two solutions, the positive solution is:

$$k = \frac{-\left(M + \frac{L}{2}\right) + \sqrt{\left(m + \frac{L}{2}\right)^2 + 2LD}}{L}.$$
(8)

For a particular value D, we have a value of k(D). That is, k is a function of D. Formula (8) can be written as:

$$k(D) = \frac{-(M + \frac{L}{2}) + \sqrt{(m + \frac{L}{2})^2 + 2LD}}{L}.$$
(9)

Formula (9) shows number of years needed to double D times from beginning. Table 2 shows values of k(D), D=0, 1, 2, 3, ..., 30, with I=1, I=1.01, and I=1.05 respectively.

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D	l=1	I=1.01	I=1.05
0	0.00	0.00	0.00
1	2.00	1.92	1.68
2	4.00	3.74	3.10
3	6.00	5.49	4.36
4	8.00	7.16	5.49
5	10.00	8.77	6.53
6	12.00	10.32	7.51
7	14.00	11.82	8.42
8	16.00	13.28	9.28
9	18.00	14.69	10.10
10	20.00	16.06	10.89
11	22.00	17.40	11.64
12	24.00	18.71	12.37
13	26.00	19.98	13.07
14	28.00	21.23	13.74
15	30.00	22.45	14.40
16	32.00	23.64	15.03
17	34.00	24.81	15.65
18	36.00	25.96	16.26
19	38.00	27.08	16.84
20	40.00	28.19	17.42
21	42.00	29.28	17.98
22	44.00	30.35	18.53
23	46.00	31.40	19.07
24	48.00	32.43	19.59
25	50.00	33.45	20.11
26	52.00	34.46	20.62
27	54.00	35.45	21.12
28	56.00	36.43	21.61
29	58.00	37.39	22.09
30	60.00	38.34	22.57

Table 2. k(D)'s, number of years needed to double D times

IV. Summary

When powerful and intelligent computers join the human's efforts to develop faster and smarter computers, it will keep giving a positive feedback to the overall research intellectual capability and will have a significant effect on the advancement of computing speed. We have derived formulas showing accurately the accelerating effect of such a feedback by using the example of Moore's Law, which will be a quadratic-exponential explosion, rather than just an exponential explosion as claimed in Moore's Law.

It is unprecedented in the history of humankind that something we create would play a direct role in improving itself. With that effect of feedback, computer and its intelligence are bound to progress at a pace faster than what people has predicted.

References:

- Hyder, Irfan (2014). "Computer Revolution and Moore's Law A Personal Journey", 2014 <u>http://syedirfanhyder.blogspot.com/2014/11/computer-revolution-and-moores-law.html</u>
- Kurzweil, Ray (2012). "How to Create a Mind", Penguin Books, New York, 2012
- Moore, G. E. (1965). "Cramming more components onto integrated circuits," *Electronics*, Vol. 38, No. 8
- Sneed, Annie (2015). "Moore's Law Keeps Going, Defying Expectations" https://www.scientificamerican.com/article/moore-s-law-keeps-going-defying-expectations/
- Wikipedia (2017). "Instructions per Second, 1950-2017", https://en.wikipedia.org/wiki/Instructions_per_second

Outlier Identification in Count Data Using Variance Difference

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Introduction

This article discusses the use of statistical methods to improve competitive advantage in team sports. The focus for this paper is on baseball and more particularly standard and popular metrics used in determining player performance. Baseball's popularity is steadily increasing around the world as more countries play the game. The United States, Japan, South Korea, and many Latin American countries rank baseball as the number one sport. Increasing team revenue has led the assignment of large contracts to individual team players; there is continuous pressure on the team management to find and maintain talent. Many teams have turned to Sabermetrics, a term used for a series of special statistics used in baseball. Traditionalists dislike the use of analytics for many of the decisions in the game, however, the professional teams apply analytics to gain better team positioning. An increased demand for more relevant and accurate analytics spurs research in the area among teams, however, there hasn't been a corresponding increase of academic research on the subject. Baseball statistics offer a wealth of opportunity to researchers.

In this article, we propose an examination of a single statistic, the Earned Run Average, ERA, a comparative measure for pitching success. Identifying a single bad performance, e.g. outlier, can provide a more representative measure of actual performance. Therefore, methods for defining outliers are imperative. Specifically, we provide a few alternatives for the removal of outliers, and propose a method by which to test its effectiveness.

Literature Review

Earned Run Average

Statistics, plays an integral role in the game of baseball. Through the years, measures for hitters such as batting average (AVG), On Base Percentage (OBP), and Slugging Percentage (SLG) have been used to rank hitters. Pitchers' ranking relies on total wins (W), strikeout to walk ratio (SO/BB), and Earned Run Average (ERA) rank hitters. In the 1970's, Bill James, argued that the statistics employed do not accurately reflect the nature of the game (Puerzer, 2002). The work by Bill James and others in the field led to the development of metrics such as OBP, "On Base Percentage", to include ways a hitter can get on base without a hit (Albert, 2010), and SLG, "Slugging Percentage", to adequately weight hits that have greater value such as Home Runs (Gould, 2002).

For a team to be successful, it must win, and pitchers are a critical component for a team's victory. Assessing a measure of success for pitchers should be related to wins. However, a game may have multiple pitchers, but only one pitcher can get a "win". Therefore, the Earned Run Average has traditionally been used as the measure of successful performance. Earned Run Average is calculated as the number of Earned Runs divided by the number of innings pitched, times 9. It can be interpreted as the estimated number of earned runs a pitcher would yield in a nine inning, or complete, game.

ERA = 9 * Number of earned runs / Number of innings pitched

The ERA measure has been examined by researchers as a useful analytic for examining the effect of pay for performance (Sommers and Quinten, 1982), Discrimination (Andersen and LaCroix, 1991), and a comparative measure to psychological performance (Smith and Christensen, 1995). The flaw in the Earned Run Average however, is that it is not independent of team performance, nor is it a measure of the contribution made by the pitcher (Scully, 1972).

Sabermetrics attempts to alleviate the problems with the use of ERA by introducing a number of alternative statistics such as Walks and Hits per Innings Pitched (WHIP), Defense-Independent ERA (dERA), Adjusted Earned Run Average (ERA+) and Fielding Independent Pitching (FIP). The numerous available statistics suggests the difficulty in providing any single measure of performance for pitchers, however, ERA is still a widely used and quoted measure of performance.

The flaws of the ERA are fairly well documented. The arguments against ERA are rooted in the ERA's sensitivity to the negative performance of the defense, or even by how scorers attribute an earned run. Further, managers may leave a pitcher in longer to provide more experience for a young pitcher, thereby increasing the probability of more runs, earned or otherwise, which in turn increases the ERA. In addition, a single bad performance by either the pitcher or their defense could inflate the pitcher's overall ERA, and therefore, not be a respective measure of actual performance. Therefore, identifying these single performances that could possibly skew a pitcher's true overall performance could be useful, and thus we note these performances as outliers.

A number of methods are prescribed to identify outliers in a data set. One method would be to identify outliers as lying outside 3 standard deviations from the mean; however, since the distribution of earned runs is not normal, this may not be the most effective method. A common method of outlier detection is the method mentioned by Tukey (1977) whereby one uses the IQR as the principle point of reference. According to this method, observations that are 1.5 times beyond the IQR are considered mild outliers, "inside the fence" and those that are 3 times the IQR are considered extreme outliers, "outside the fence". While Tukey makes no
assumption on the distribution, it does assume the data is continuous (Tukey, 1977; Hubert and Vandervieren, 2008). Alternative, more robust measures have been made for normal distributions such as Grubbs Test (Grubbs, 1969), and an alternative for asymmetric distributions (Carling, 2000).

Grubbs (1969) provides the rationale that an outlier naturally will be a measure of the distance to the mean, and thus extreme observations are those with larger distances. An alternative method, known as the alternative box plot method (Iglewicz and Banerjee, 2007) suggest that the sample and distribution will affect the multiplier proposed by Tukey (1977). These authors noted that their method works when sample sizes are large enough. Yet, they proposed alternative multipliers for smaller data sets. Other methods such as the Variance Shift Outlier Model (VSOM) have been proposed to identify outliers in linear models (Gumedze et al., 2010, Cook and Weisberg, 1982). Research suggests that using the variance change for identification of outliers in a univariate dataset is useful and promising (Tsay, 1988).

In this article, we attempt to identify the proper distribution of the earned run, which is count based data. Furthermore, in order to provide a more representative measure of actual performance, we attempt using a popular method for outlier detection. The purpose of this paper is only to identify right tailed outliers, since it is more likely for a professional pitcher to earn zero runs in a game than giving up 10 runs in a game. Finally, we propose an alternatives method for the removal of outliers against the popular method as a comparison.

Methodology

Distribution of Earned Runs

It is important to understand the distribution of Earned Runs at the game level. It is possible that Earned Runs may follow a Poisson Distribution, Zero-Inflated Poisson Distribution, or a Negative Binomial Distribution, since the data is count based. Dolinar (2014) provided evidence that the actual distribution of runs per game might be a negative binomial distribution. Assuming that the number of Earned Runs follows any of the above distributions, then the ERA statistic used in baseball is clearly flawed as a measure of performance, since it doesn't take into account the distribution.

Using sample data obtained for the top ten pitchers in the National League, we had 301 observations, i.e. games pitched, with each pitcher pitching at least 28 games. Therefore, we had a reasonable sample of pitchers for this pilot. The ERA for these pitchers ranged from 2.33 to 3.51. A closer examination of the total Earned Runs for each pitcher showed a variance higher than the mean overall ($\mu = 62.4$, $\sigma^2 = 125.6$). Similarly, the variance exceeded the mean for earned runs per game ($\mu = 2.07$, $\sigma^2 = 3.41$).

Since the measure of Earned Run Average is used to assess a pitcher's performance, we decided to focus on the earned runs per game. The goal is to determine if the performance of a

single game should be measured, and possibly removed, as an outlier. Using the data available, we analyzed the earned runs and compared them to the described theoretical distributions (Table 1).

ER	Actual	E(X) - Poisson	E(X) - zip	E(X) - NBin
0	0.213	0.124	0.269	0.211
1	0.249	0.259	0.149	0.260
2	0.203	0.270	0.196	0.210
3	0.130	0.188	0.172	0.140
4	0.096	0.098	0.113	0.084
5	0.060	0.041	0.060	0.046
6	0.020	0.014	0.026	0.024
7	0.017	0.004	0.010	0.012
8	0.010	0.001	0.003	0.006
9	0.003	0.000	0.001	0.003
X ²		-	16.57	43.31
LogLik		-586.29	-572.92 (p<.01)	-564.64 (p<.01)

Table 1: Distribution of Earned Runs Compared to Theoretical Distributions

Examining the χ^2 against the actuals, the negative binomial distribution appears to the best fit. While there might have been a possible inflated number of zeros, the use of the zero inflated Poisson doesn't necessarily apply. The application of zero-inflated Poisson is most notable when observations or respondents in the dataset didn't have any opportunity for a treatment, such as functional decline in aging (Byers et al., 2003), insurance claims (Bouchere et al., 2008), length of hospital stay with sepsis (Yang et al., 2010). Having determined the most appropriate distribution, we next approach the issue of outliers. Identifying outliers is critical to ensuring proper predictions or estimates. Outliers are considered observations that deviate significantly from other observations, or raise concerns that the observations were a result of a different mechanism (Grubbs, 1950; Hawkins, 1980). Removal of proper outliers will provide different measures of performance in many cases (Grubbs, 1950). The impact of these removed observations should therefore yield results that are more indicative of true performance.

Specifically, our aim is to identify an approach for the removal of outliers within a univariate data set for the purposes of using the standard metrics within baseball data. Combining all of the data of earned runs we examine what data points would be potential outliers. First, we apply the Tukey method for outlier identification for the right tail. Based on our complete dataset, the inside fence, i.e. Q3+1.5(Q3-Q1) is 6, and the outside fence is Q3 + 3(Q3-Q1), is 9. The method identified 9 points out of the 301 observations for the ten pitchers as being possible outliers.

Further, we propose another method which examines the variance difference. The VSOM model described above for linear models removes observations with inflated variance (Gumedze et al., 2010, Cook and Weisberg, 1982). Our objective is to narrow the range of outliers between the inner fence, which maybe too conservative, and the outer fence, which may not pick up outliers effectively. Since negative binomial distribution is count data, the raw difference could be as little as 1 or 2, but the impact of more accurately identifying the outliers are critical to the Earned Run Average. Specifically, we propose measuring the difference in variance attributed to the removal of high right side outliers. While, it may be possible to remove left side outliers, we do not examine this particular point.

According to Cochran's theorem, under a normal distribution, the sample variance follows a chisquared distribution. In addition, it has been shown that the chi-squared distribution is a reasonable approximation for the index of dispersion (Loukas and Kemp, 1986). Thus, we combine this notion of comparing the updated variances to a Chi-squared distribution. Using this information, we calculate the right tail of the chi-squared distribution to identify which variances are beyond a certain point of the Chi-Square.

In our case, 301 observations, the variance for the data set was 3.41 ($s^2 = 3.41$). We then calculated the variance of the data when each observation is removed and calculate the difference. We compare this to a Chi-Square distribution with degrees of freedom equal to the mean of the differences. Using this method, we calculate the possible outliers and the number of outliers removed whose differences are greater than the calculated Chi-square statistic.

	97.5%	98%	98.5%	99.0%
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X ²	.0095	.0252	.0673	.1852
Outlier Range	2-9	6-9	7-9	Inf / Inf
# of outliers	94	15	9	0

Table 2: Prospective outlier values

Table 2 contains the results of prospective outlier values for the entire dataset. At 98.5% level, we remove the same number of outliers as the boxplot method, i.e. Tukey inner fence method. Since our aim is to identify possible outliers for each pitcher, we turn our attention to the removal of outliers for a given pitcher.

By using the same method, we attempt to identify outliers for possible removal for each individual pitcher. However, due to the smaller sample size, i.e. the number of games per pitcher is approximately 30. After a few examinations, it became clear that we needed to extend the significance level down to 95%. When the confidence level is reduced we end up with the following table.

Pitcher ID	95%	96%	97%	98%	99%	Tukey Outliers
1	1	0	0	0	0	1
2	1	1	0	0	0	3
3	1	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	1	1	0	0	0	1
7	1	0	0	0	0	3
8	1	1	0	0	0	2

9	0	0	0	0	0	0
10	1	0	0	0	0	1

Table 3: Number of Possible Outliers at each level

The numbers in the columns of Table 3 indicate the quantity of possible outliers at the given level. The last column contains the number of outliers identified using the Tukey, inner fence, method. It can be shown from the table above that the number of outliers identified by the proposed method matches in 6 cases. In only one case did the method, propose an outlier, when the Tukey method did not, otherwise the method was more conservative in the outlier estimation. Overall, for each individual pitcher the Tukey method identified 11 outliers, while using our proposed method, only 7 outliers were identified.

Conclusion

Our preliminary analysis shows that it is possible to identify outliers using the above proposed method. Since the Tukey multiplier of 1.5 and 3.0 are given as reasonable measures, our aim was to provide a more robust identification, that could be used for count data, which is a goal of this method. We believe this method shows promise for use in count data, specifically for baseball data, but clearly with applications in other areas such as healthcare hospital admissions or insurance claim analysis.

It is believed that the confidence level for the Chi-square statistic is related to the size of the sample. When all the data is combined, it was shown that the confidence level could be more conservative, but when the sample drops to around 30, we find that the significance level drops to around 95%. We believe this will probably be a reasonable estimate for small samples. Further, the confidence level could be proportional to the sample size.

Further research with larger sets and subsets are proposed in order to more fully examine the effect of this. While other research has been done in the identification of outliers, our purpose is to provide a simple approach, similar to Tukey, using a method based on a statistical distribution such as the Chi-Squared. In addition, this research should be extended to other count data sets to examine the differences between data from different distributions. Although the main focus of this paper was to detect right tailed outliers, further analysis should be conducted to identify left tailed outliers in the future. This analysis can be extended to the identification of false negatives and false positives on both left tail and right tail for more accuracy.

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References

Albert, J. (2010). Sabermetrics: The past, the present, and the future. *Mathematics and sports*, (43), 15.

Andersen, T., & Croix, S. J. (1991). Customer racial discrimination in major league baseball. *Economic Inquiry*, *29*(4), 665-677

Banerjee, S., & Iglewicz, B. (2007). A simple univariate outlier identification procedure designed for large samples. *Communications in Statistics—Simulation and Computation®*, *36*(2), 249-263.

Boucher, J. P., Denuit, M., & Guillén, M. (2008). Models of insurance claim counts with time dependence based on generalization of Poisson and negative binomial distributions. *Variance*, *2*(1), 135-162.

Byers, A. L., Allore, H., Gill, T. M., & Peduzzi, P. N. (2003). Application of negative binomial modeling for discrete outcomes: a case study in aging research. *Journal of clinical epidemiology*, *56*(6), 559-564.

Carling, K., 2000. Resistant outlier rules and the non-Gaussian case. Comput. Statist. Data Anal. 33 (3), 249–258. Cleveland, W.S., 1985.

Cook, R.D., Weisberg, S., 1982. Residuals and Influence in Regression. Chapman and Hall, New York.

Dolinar, S. (2014, Sept). Run Distribution Using the Negative Binomial Distribution. Retrieved From https://www.fangraphs.com/community/run-distribution-using-the-negative-binomialdistribution/, Nov 10, 2017.

Last, F. M. (Year, Month Date Published). Article title. Retrieved from URL.

Gould, S. J. (2010). *Triumph and tragedy in Mudville: A lifelong passion for baseball*. WW Norton & Company.

Grubbs, F. E. (1950). Sample criteria for testing outlying observations. *The Annals of Mathematical Statistics*, 27-58.

Grubbs, F. E. (1969). Procedures for detecting outlying

Gumedze, F. N., Welham, S. J., Gogel, B. J., & Thompson, R. (2010). A variance shift model for detection of outliers in the linear mixed model. *Computational Statistics & Data Analysis*, *54*(9), 2128-2144.

Hawkins, D. M. (1980). *Identification of outliers* (Vol. 11). London: Chapman and Hall.

Hubert, M., & Vandervieren, E. (2008). An adjusted boxplot for skewed distributions. *Computational statistics & data analysis*, *52*(12), 5186-5201.

Loukas, S., & Kemp, C. D. (1986). The index of dispersion test for the bivariate Poisson distribution. *Biometrics*, 941-948.

Puerzer, R. J. (2002). From scientific baseball to sabermetrics: Professional baseball as a reflection of engineering and management in society. *NINE: A Journal of Baseball History and Culture*, *11*(1), 34-48.

Scully, G. W. (1974). Pay and performance in major league baseball. *The American Economic Review*, *64*(6), 915-930.

Smith, R. E., & Christensen, D. S. (1995). Psychological skills as predictors of performance and survival in professional baseball. *Journal of Sport and Exercise Psychology*, *17*(4), 399-415.

Sommers, P. M., & Quinton, N. (1982). Pay and performance in major league baseball: The case of the first family of free agents. *The Journal of Human Resources*, *17*(3), 426-436.

Tukey, J. W. (1977). Exploratory data analysis.

Yang, Y., Yang, K. S., Hsann, Y. M., Lim, V., & Ong, B. C. (2010). The effect of comorbidity and age on hospital mortality and length of stay in patients with sepsis. *Journal of critical care*, *25*(3), 398-405.

Palm to Palm: Ongoing Struggles

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Abstract

2017 marked another year of existential struggle for Palm to Palm (P2P), a micro-scale sustainable operations project in Koidutown, Kono District, Sierra Leone. Having survived the 2013-2015 West African Ebola outbreak, the project experienced both successes and challenges during the year. The challenges include safety provisions and compensation packages that meet both the needs of the project and the project's employees. The successes included improving relations with and beginning to support a network of oil palm farmers in the region and achieving, in being awarded a long-term grant, a measure of financial stability. This paper provides an update on the projects' activities during 2017.

Keywords: Sustainable operations, Sierra Leone, palm oil, palm kernel soap

Palm to Palm: Ongoing Struggles

Introduction

2017 has been another challenging year for Palm to Palm, a micro-scale sustainable operations project in Koidutown, Kono District, Sierra Leone. Project management has spent significant time this year developing, or trying to develop, a compensation and benefits package that both meets the needs of the project's employees and is feasible from a financial standpoint. To date we have yet to be successful, as evidenced by half the project's workers engaging in an ongoing work stoppage. Management, however, continues work to resolve the outstanding issues with the goal of having the disgruntled workers, with whom we have good contact, return to work in the first few months of 2018. In part as a result of the work stoppage, the project has struggled to match production and sales levels of 2016. Most notably, soap production declined significantly in 2017.

Palm to Palm has also experienced some success this year. Two crucial successes are developing a support system for local farmers, providing resources and training with the goal of increasing production of the project's primary inputs, palm fruit. The project also was notified that it has been awarded a five-year grant which significantly increases the probability of future success and growth.

Project management also believes that the time is ripe for rapid development in a smallholder-based economy to flourish in West Africa in general and Sierra Leone in particular. Palm to Palm is ready, willing, and able to participate in such a change.

2017 Activities

Addressing, or beginning to address, employee concerns occupied the bulk of management's efforts concerning the project for the duration of the year. In short, management has spent significant time in 2017 starting to devise a system of compensation and benefits that is acceptable to the project's employees and that is feasible from a financial perspective. The main areas of concern for the workers in terms of compensation and benefits are salaries, employment

contracts, an employee health plan ("healthy plan") and an employee bonus system. The employees as a group believe that they have significant experience with and have contributed greatly to the project and therefore deserve higher compensation, especially in light of the increase in monthly minimum wage to SLL 500,000 (~\$67) that was effective January 1, 2015 (Remoe, 2014). In addition and since the Ebola outbreak, significant inflation has eroded the purchasing power of the compensation received by the workers. Worker dissatisfaction came to a head in July 2017. It should be noted that one source (Trading Economics, n.d.) reported inflation of 18.56 percent during that month.

Worker Contracts and Work Stoppage

Early in 2017, at a request from project employees, project management began negotiating with project employees to develop employment contracts to codify employee employment status and compensation. Simultaneously project management began exploring options to provide workers with health insurance ("healthy plans"). Employment contracts were finalized in late May and half the workers promptly signed their contracts. The other half of the workers (the "disgruntled workers"), however, did not sign their contracts. In early July the disgruntled workers informed the project manager (D. Somoyah, personal communication, July 7, 2017) that if P2P did not provide them sufficient compensation including benefits, they would report the project to the Labor Ministry and police. Such action could result in a shutdown of the project until the matter was resolved. The disgruntled workers' demands (D. Somoyah, personal communication, July 17, 2017) included:

- 1. Increased salaries
- 2. Back pay
- 3. Employee bonus system
- 4. Employee health plan ("Healthy plan")
- 5. Salary distributed in daily "allowances" instead of monthly
- 6. Appropriate safety materials

Project management requested that the worker named to represent the disgruntled workers negotiate with management, but this worker refused and instead the disgruntled workers began a work stoppage and went to the police with their complaints (D. Somoyah, personal communication, July 26, 2017).

Thankfully the project has continued operations, without the disgruntled workers, and has not (as of December, 2017) been shut down by the police or labor ministry.

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Employee Health Plan

Establishing a worker health plan has proven harder than implementing an employee bonus system. In July, management contacted the local clinic and inquired about the implementing a cooperative system to cover employee health-related expenses. The reply from clinic management (R. Frankfurter, personal communication, July 20, 2017) stated that limitations on how the clinic operates means that such an agreement is not possible. So P2P is forced to cover healthcare costs of its workers using the user-fee system that has been present in much of Africa since the 1980s (Riddle, 2015). As to clinic management, the clinic now charges a user fee SLL 10,000. The question of healthcare expenses took center stage when the local project manager (D. Somoyah) became seriously ill in August. Private donations from the project's two benefactors were secured to cover the cost of the manager's treatment, as well as the health-related expenses for a worker who suffered a workplace injury in September. The total bill for both cases was SLL 1,850,000 (D. Somoyah, personal communication, October 11, 2017). This left a private donation balance of SLL 242,000 that will serve as a healthcare reserve fund going forward.

Many difficulties are present for a smallholder enterprise wishing to provide employee health coverage in the presence of a user-fee system. As Palm to Palm has discovered, one primary difficulty is the large variation in cost relative to revenue from period to period. The smaller the workforce, the more significant impact these large variations in healthcare expenses have on a firm. For example, in the first two months that the project covered health expenses, the health-related costs totaled approximately one-third of the project's average monthly revenue. Coverage of user fees for workers does not appear to be a workable system in the future. Research by the authors has suggested that community-based health insurance (CBI) may be a strong option for the project if it becomes available in the region. Other researchers (De Allegri, Sanon, & Sauerborn, 2006) have demonstrated that strong interest exists in the West Africa public for CBI, so the authors of this paper (who also serve as project management) would welcome the implementation of a CBI system in Kono District.

Employee Bonus System

At the very time that the disgruntled workers went to the police, project management was trying to present a bonus plan for all employees. The plan, which all employees (disgruntled or not) eventually accepted, consists of an annual bonus equal to one month's salary for each year of employment with the project. The annual bonus is capped at six months' salary. The bonus system is both financially feasible for the project and is simple enough for the workers to understand, two requirements placed by management on any bonus system developed. Going forward, half the bonus is to be paid in July and half in December. In addition, one of our authors argued for an additional incentive system for salespeople ("sellers") that would include bonuses for exceeding a threshold amount and a minimum requirement for unit sales (J. Gomez, personal communication, May 24, 2017). The incentive sales plan has not yet been fully considered by project management.

Farmer Engagement

One very successful effort in which Palm to Palm engaged during 2017 is in the area of farmer engagement. As reported in previous works about the project, small oil palm farms in Kono District have struggled to recover from the neglect that occurred for the duration of Sierra Leone's civil war. The situation on oil palm farms in the District was not helped by the Ebola outbreak. Farmers lack the resources to repair, maintain, and upgrade their farms, so are prevented from capitalizing on the relative calm that has existed since the end of the Ebola outbreak. In order to remedy this situation, Palm to Palm began a farmer engagement program in 2017 that provides training and financial resources to District farmers in return for guaranteed access to future farm output. Contracts to this effect were signed with ten local farmers in July 2017 (D. Somoyah, personal communication, July 15, 2017). Funds were provided to allow participating farmers to purchase the necessary tools and engage in "under-brushing and pruning" on their farms.

The other component of the farmer engagement program is training. A series of three one-day training sessions began in November 2017. Topics covered in the sessions include proper management of oil palm farms and leadership training (D. Somoyah, personal communication, November 16, 2017).

Project Funding

A second significant project accomplishment for 2017 is in the area of project funding. In

August Palm to Palm's local manager was informed that the project was awarded a 5-year grant as part of The World Bank's "Smallholder Commercialization and Agribusiness Development Project" (Project ID P153437 - https://www.scadep-sl.org/) focused on Sierra Leone (D. Somoyah, personal communication, August 22, 2017). The project's goals focus on providing support for and assisting in the development of smallholder agricultural value chains (The World Bank). This award should have a significant positive impact on project survivability and growth.

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Innovation

The activities described in previous sections this paper precluded much focus on technological and process innovation during 2017. There were, however, two small process innovations that P2P management successfully instituted:

- Palm fruit processing: At the suggestion of one of the authors/project directors (A. Lucena Mir, personal communication, June 20, 2017), the sterilization of the fresh fruit bunches was split into two phases. The new process is as follows: "...make the sterilization of the Fresh Fruit Bunches for a while, it will be easier and faster to make the shaff shaff later, then after the shaff shaff, another sterilization and continue with the process". According to the author/project director, the goal of the new process is to "make easier with this method, it will be to remove the fruit from the bunches, doing the job easier for the workers" (A. Lucena Mir, personal communication, June 20, 2017). This process innovation should allow the project to process palm fruit more efficiently without the need to purchase a threshing machine.
- 2. Transportation of palm fruit: Lack of ability to transport palm fruit from farm to factory in a timely fashion has resulted in the spoiling of some palm fruit heads (D. Somoyah, personal communication, December 4, 2017). For this reason, the project continues to seek resources to address the transportation issue. In the meantime, management has developed a temporary solution: The "power tiller" (mechanical generator) used to power the project's palm oil digester is, when not being used for its original purpose in the factory, put to work as the mobile power source for a small tractor that can haul small amounts of palm fruit heads from cooperating farms to the factory. This temporary solution is far from ideal and a permanent solution must be found.

2017 Outcomes

The project's primary outputs are palm oil, soap, gari, and processed fish. Comparing the current year to 2016, palm oil output rose and soap output declined. The amount of gari and processed fish produced was not recorded, so comparisons weren't possible for these two products. The most notable outcome this year is the quantity of palm oil produced and sold: Through the first eleven months of the year, a little over 550 battas (2,750 gallons) of palm oil were produced and sold. This represents a significant increase from 2016, especially in light of the following struggles experienced by the project this year:

- 1. Half of the project's workers have been engaged in a work stoppage since late July
- 2. Lack of adequate equipment to transport palm fruit to the factory in a timely manner.

Soap production has not seen similar gains. In fact, soap production declined significantly. The project only produced and sold a little over 19,000 bars of soap through the first eleven months of the year, a decrease of approximately 25% over 2016. The drop in soap production can be attributed to two factors:

- 1. Work stoppage: The ongoing work stoppage means that fewer workers are available to produce soap.
- 2. Inflation: The significant inflation present in Sierra Leone means that soap is less profitable to produce and sell.

As mentioned earlier in this section, gari output was not recorded during the year thus preventing a comparison to 2016's gari output. Collecting information on all activities is one goal of the project. Clearly there is work to do in this area.

P2P's production and sales activities resulted in revenue of more than SLL 70M in revenues for the first eleven months of 2017. At an average exchange rate during this time of about SLL 7,500/\$, this equates to approximately \$10,000. So while the project has experienced an increase of ~5% in local currency revenues, significant inflation present during the year translates to a revenue reduction of ~10% in dollar terms. As mentioned previously, the work stoppage, lack of adequate transportation, and inflation have all negatively impacted the project during the current year, resulting in this mixed performance.

The Future

Palm to Palm stakeholders believe that technological and process innovation are the path to success in the future as a smallholder enterprise. However, over the last decade some researchers, including Hounkonnou et al. (2012, p. 78), have discussed that for many decades there has existed "a pervasive bias against the small farm sector" in Sub-Saharan Africa, especially in food production. The researchers have shown over the last number of years that this bias results, in significant part, from institutional biases against the smallholder enterprise. One example of this, as related in Hounkonnou et al. (2012, p. 79) is "…the export from the Netherlands to Ghana of chicken wings that are a cheap by-product of capital-intensive Dutch farming and market demand for filets and drumsticks". But in recent years increasing attention has been paid to institutional change to reverse bias against smallholders and to smallholder-based economic development with an "innovation systems approach" and properly-supported "participatory technology development" (PTD) or similar systems at its core (Hounkonnou et al., 2012, p. 75).

Palm to Palm stakeholders further believe that the 2013-2015 Ebola outbreak interrupted this increased focus on smallholder-based agricultural food production. But now that the Ebola epidemic is in the rearview mirror, the authors believe the time is ripe for such smallholder-based economic development to thrive in West Africa in general and Sierra Leone in particular.

Conclusion

2017 has been another challenging year for Palm to Palm, as indicated by the year's results. In addition to mixed results, the project made very little progress on its plan to use technological and process innovation to build a successful, sustainable, smallholder enterprise. The project stakeholders believe that the time is approaching when an innovation systems approach to smallholder enterprise productivity growth will change the structure of economies in West Africa in general and Sierra Leone specifically. Palm to Palm is ready to participate in such a change.

References

- De Allegri, M., Sanon, M., & Sauerborn, R. (2006). "To enroll or not to enroll?": A qualitative investigation of demand for health insurance in rural West Africa. *Social Science & Medicine 62*, 1520-1527. doi:10.1016/j.socscimed.2005.07.036
- Hounkonnou, D., Kossou, D., Kuyper, T., Leeuwis, C., Nederlof, E.S., Roling, N., Sakyi-Dawson, O., Traore, M., & van Huis, A. (2012). An innovation systems approach to institutional change: Smallholder development in West Africa. *Agricultural Systems* 108 (p.74-83). http://dx.doi.org/10.1016/j.agsy.2012.01.007
- Remoe, V. (December 11, 2014). Sierra Leone raises Minimum Wage to SLL 500,000 (\$115). SwitSalone. Retrieved from http://www.switsalone.com/20627_sierra-leone-raises-minimum-wage-to-sll-500000-115/
- Riddle, V. (November 6, 2015). From institutionalization of user fees to their abolition in West Africa: a story of pilot projects and public policies. *BMC Health Serv Res*, 15(Suppl 3), S6. doi: 10.1186/1472-6963-15-S3-S6
- Trading Economics (n.d.). *Sierra Leone | Economic Indicators*. Retrieved from https://tradingeconomics.com/sierra-leone/indicators
- The World Bank. (n.d.). Smallholder Commercialization and Agribusiness Development Project. Retrieved from <u>http://projects.worldbank.org/P153437?lang=en</u>

POST-PROJECT LEARNING IN AN MBA KNOWLEDGE MANAGEMENT COURSE

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ABSTRACT

A teaching module of post-project learning has been applied in our MBA Knowledge Management (KM) course. In the post-project learning module, MBA students' projects of real-life cases of good practices of KM for cybersecurity are collected and are used further for knowledge sharing and collaborative learning for the course. The post-project learning module allows MBA students to develop knowledge discovery skills through an iterative process of team-based qualitative data analysis of the cases. This paper provides a road-map for teaching KM by using KM methods.

Keywords: Post-project learning, knowledge management, knowledge sharing, collaborative learning, case study, joint analytical process, meta-matrix.

EXTENDED ABSTRACT*

1. INTRODUCTION

Knowledge management (KM) has become one of the important topics of study in the management literature since 1990s (Wiig 1999; Alavi and Leidner 2001; Davenport and Prusak 2000). KM is a broad concept of creating, processing, and sharing knowledge (Girard and Girard 2015). It extends into a variety of fields including business management (Buchel and Raub 2002, Koohang *et al.* 2017), information technology (IT) and information systems, (Wang and Ariguzo 2004; Imran *et al.* 2017), and artificial intelligence and data mining (Wang and Wang 2008; Ertek *et al.* 2017). Knowledge management has been an important subject in many MBA programs (Becerra-Fernandez and Sabherwal 2015).

Given the great breadth of the subject of KM and how the subject has diffused throughout many fields, it is natural that there are a variety of approaches to teaching/learning KM beyond reading to understand basic concepts. In its broadest definition KM is the process that generates value for the organization by using its intellectual and knowledge assets. Collaborative learning through knowledge sharing would provide new insights into KM practices, and is the best way to

^{*} To ensure significant differences between the present conference paper and a potential journal publication based on this study, the authors submit this extended abstract to the conference proceedings. The full-length paper submitted for the oral presentation at the 2018 NEDSI Conference is available on request for academic knowledge exchange.

teaching and learning KM (Razmerita *et al.* 2016; Pee and Kankanhalli 2016). The use of KM practices for teaching and learning is particularly relevant to a KM course. This study reports our newly developed approach to teaching and learning KM in our MBA KM course which includes a post-project module to enhance MBA students' learning of KM. Traditionally, the MBA KM course ends with a project which requires MBA students to apply the concepts of KM to the business world. The new approach adds a post-project module so that students can share knowledge to learn more about all projects of the entire class. More importantly, as explained in the subsequent sections of the paper, the post-project learning module is a KM process, and allows students to practice KM which in turn enhances students' understanding of KM.

The remainder of the paper is organized as follows. Section 2 explains the background of the post-project learning module. Section 3 presents the post-project learning process. Finally, Section 4 concludes the study.

2. COURSE PROJECTS – THE BASE OF POST-PROJECT LEARNING

2.1. Course project: Case writing

The course project in the present MBA KM course was case writing. Each student was required to investigate the role of KM for cybersecurity in her/his chosen business organization and to write a case of KM for cybersecurity. Case study has been a methodological approach used in KM for decades (Eisenhardt 1989; Dube and Pare 2003). There is little doubt that KM can be a benefit for cybersecurity in organizations when knowledge sharing is crucial for the development of cybersecurity policies and dealing with human factors in cybersecurity (Safa and Von Solms 2016; Safa *et al.* 2016).

The major tasks of the course project and post-project learning included guided case writing, selecting the most considerable cases, conducting qualitative data analysis, summarizing the findings, and formulating the model generated by the learning process. The objective of the post-project learning module is to teach MBA students to learn KM process through knowledge sharing and cross-cases analysis.

The MBA students who wrote these individual cases possessed first-hand experiences of KM for cybersecurity in their organizations. Their roles in KM for cybersecurity varied. Each participant worked in her/his case organization for at least five years. All MBA students who wrote the cases were the team of the post-project learning process, but only a set of selected cases were used for data analysis in the post-project learning process.

2.2. Guideline of case writing

The major tactic used for post-project learning process was to share multiple cases and to discover new knowledge. The general rules and procedures of case writing followed a typical structure (Jick 1979; Yin 2003).

Ten (10) KM cases were collected. All organizations of the cases are middle or large organizations in the United States. The ten cases were distributed to all participants for assessment and selection of high quality cases for the post-project learning. The following five key criteria were used for the assessment of all cases.

• The context and the theme of the case is relevant to KM for cybersecurity.

• The practices of KM for cybersecurity in the case has resulted in excellent performance of cybersecurity in the organization.

• The practices of KM for cybersecurity in the case has widely involved the knowledge workers in the organization.

• The case provides wealthy information of KM for cybersecurity.

• The case is original, is well organized, and has quality of presentation.

As a result of the assessment, five (5) cases with the overall higher ranks were considered for post-project learning.

3. POST-PROJECT LEARNING PROCESS

3.1. Qualitative data analysis and collaborative learning

Qualitative data analysis has been a central issue of knowledge discovery though cases (Tashakkori and Teddlie 1998; Yin 2003). Coding is often applied as a tool to facilitate discovery and further investigation of the qualitative data (Straus and Corbin 1998). Codes provide indications of threads and patterns of key words or phrases. However, in the present MBA post-project learning module, word-by-word or sentence-by-sentence coding the transcripts was not found to be effective because the codes do not provide the context of the words, and semantics and pragmatic meanings of those key phrases depend upon individual analysts' interpretations of the final coded files. In this post-project learning module, a meta-matrix method (Patton 1990; Miles and Huberman 1994) was used for the post-project learning process. A meta-matrix lists a set of important concepts related to the key questions of knowledge discovery, and stores the cases in a condensed form to visualize how the cases convey these concepts. The matrix offers a holistic view of cases. The meta-matrix can also support hyperlinking to uncondensed versions of the cases to preserve the associated paragraphs in their original forms.

The post-project learning process was an iterative team-based qualitative data analysis process called joint analytical process (JAP) (Wang and Wang 2011; 2016; 2017). The concept of JAP is not completely new, and can be observed in many case studies (cf. Dube and Pare 2003). JAP involves the key participants of collaborative learning. The MBA students of the ten candidate cases joined the JAP team because they have the best understanding of the context of the cases for knowledge discovery. JAP reduces risks of misinterpretation of cases to minimum because the qualitative data analysis is a product of knowledge sharing.

The objective of the JAP was set to develop a multiple-case level exploratory meta-matrix through iterations. Using meta-matrix as a tool, the JAP focused on a consolidation of the multiple cases to fully recognize the relevance of cases and to identify common patterns within the set of cases. The objective of JAP was feasible given the reasonable number of cases and the competence of participants.

The JAP sessions placed emphasis on the development of meta-matrix of the multiple cases to highlight common patterns of KM practices for cybersecurity. After four JAP sessions, the team reached a consensus on the meta-matrix.

The meta-matrix reveals key aspects of each of the case of KM for cybersecurity: new situation, three-tier organization structure of KM for cybersecurity, important knowledge flows for cybersecurity, and KM contributions to key performance indicators (KPI) of cybersecurity. The new situation in the organization provides specific background information about cybersecurity. The three-tier organization structure describes the specialized groups in the organization to practice KM for cybersecurity, and the major components of knowledge sharing for cybersecurity are described by the important knowledge flows. The development and

implementation of metrics and KPI for cybersecurity are tasks of KM for cybersecurity, and the success of KM for cybersecurity contributes to cybersecurity of the organization.

3.2. Tangible KM product of the post-project learning process

KM is a process-oriented management practice rather than decision making. It is not a static blueprint; rather, it is a course of actions that may requires varying amounts of improvisation. The design of process-oriented management practices needs models as general guides. Induction is one of numerous methods to develop tangible knowledge products for process-oriented management practices (Boland and Collopy 2004). The tangible KM product developed through an induction is a theory or model that is built on real-world cases and indicates the components and their most important relationships for consideration during the management process. Specifically, in the present post-project learning process, the selected cases have been used to develop a model to structure the components and their relationships of the KM process for cybersecurity.

The meta-matrix developed by the JAP was applied to identify the key components of KM for cybersecurity: specialized organization structure of communities and their roles of KM process for cybersecurity, and aspects of KM process for cybersecurity that are unique to KM in other areas. To develop a conceptual framework, the set of KM aspects in the meta-matrix were further elaborated and generalized.

3.3. Intangible benefit of the post-project learning process

After completing the qualitative data analysis and knowledge discovery, the MBA students of the team expressed their confidence level in learning KM. Tacit knowledge is the outcome of learning for problem structuring that recognizes the need to consider multiple perspectives, interconnectivity, and multiple objectives for complex business problems. The post-project learning process gives students' confidence in knowledge discovery by themselves as well as gaining an appreciation of qualitative data analysis. Teaching and learning KM practices needs support from a knowledge sharing environment. Unlike other hard technical subjects, KM is a subject of soft skills. Given the complicated nature of KM, a pure objective assessment method, such as the evaluation of graduates' performance in their work places, would not be feasible for teaching and learning KM in an educational environment. The observations in this trial indicate that a post-project learning process can be an effective tool for teaching and learning KM. Clearly, this trial was just one case, and positive correlation between the subjective confidence level and actual KM ability has not been established.

4. CONCLUSION

The proposed approach of post-project learning to teaching and learning KM has been applied to our MBA KM course. The tangible KM product as learning outcomes based on the student projects and the students' opinions have indicated positive learning experiences and overall satisfaction with this approach. Our observations of the knowledge sharing and collaborative learning method indicate that students like the interactive analytical process for developing KM skills. The progressive nature of post-project learning also accommodates differing levels of knowledge discovery and sets the stage for students to progress to advanced levels. We have found that the teaching and learning approach is useful for MBA students for developing KM skills. This study has made three contributions to teaching and learning KM at the MBA level. First, it has changed traditional teaching method by shifting the emphasis from teaching fundamental KM concepts to developing practical KM skills. Second, the procedure of postproject learning process has been successfully practiced. The approach of post-project learning can be applied by others. Third, the teaching of KM needs to focus continuously on KM process. The post-project learning module is a process component of knowledge development. The most compelling implication of this study for MBA education is the recognition of the synergic relation between the use of KM procedures and the learning of KM in the MBA KM course.

REFERENCES

- Alavi, M. and Leidner, D. E., Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues, *MIS Quarterly*, 25(1), 2001, 107-136.
- Anantatmula, V. and Kanungo, S., Structuring the underlying relations among the knowledge management outcomes, *Journal of Knowledge Management*, 10(4), 2006, 25-42.
- Becerra-Fernandez, I. and Sabherwal, R., *Knowledge Management: Systems and Processes*, 2nd Ed. Routledge, NY, 2015.
- Boland, R. J. and F. Collopy, F. (Ed.), *Managing as Designing*, Stanford University Press, Stanford, CA, 2004.
- Buchel, B. and Raub, S., Building knowledge creating value networks, *European Management Journal*, 20(6), 2002, 586-596.
- Chauvel, D. and Despres, C., A review of survey research in knowledge management: 1997-2001, *Journal of Knowledge Management*, 6(3), 2002, 207-223.
- Davenport, T. H. and Prusak, L., *Working Knowledge: How Organizations Manage What They Know*, Harvard Business School Press, Boston, MA, 2000.
- Dube, L. and Pare, G., Rigor in information positivist case research: Current practices, trends, and recommendations, *MIS Quarterly*, 27(4), 2003, 597-635.
- Eisenhardt, K. M., Building theories from case study research, *Academy of Management Review*, 4(4), 1989, 532-550.
- Ertek, G., Tokdemir, G., Sevinç, M., Tunç, M. M., New knowledge in strategic management through visually mining semantic networks, *Information Systems Frontiers*, 19(1), 2017, 165-185.
- Girard, J. P. and Girard, J. L., Defining knowledge management: Toward an applied compendium, Online Journal of Applied Knowledge Management, 3(1), 2015, 1-20.
- Huberman, A. M. and Miles, M. B. (Eds.). *The Qualitative Researcher's Companion*. Thousand Oakes: Sage, 2002.
- Imran, M. K., Bilal, A. R., Aslam, U., and Rahman, U., Knowledge management strategy: an organizational change prospective, *Journal of Enterprise Information Management*, 30(2), 2017, 335-351.
- Jick, T., Mixing qualitative and qualitative methods: Triangulation in action, *Administrative Science Quarterly*, 24, 1979, 602-611.
- Koohang, A., Paliszkiewicz, J., and Goluchowski, J., The impact of leadership on trust, knowledge management, and organizational performance: A research model, *Industrial Management & Data Systems*, 117(3), 2017, 521-537.

- Miles, M. B. and Huberman, A. M., *An Expanded Sourcebook: Qualitative Data Analysis*. Sage, Thousand Oakes, 1994.
- Nonaka, I., Dynamic theory of organizational knowledge creation, *Organization Science*, 5(1), 1994, 14-37.
- Nonaka, I. and Takeuchi, H., *The Knowledge-Creating Company*, Oxford University Press, New York, 1995.
- Patton, M. Q., *Qualitative evaluation and research methods*. Sage Publisher, Newbury Park, CA, 1990.
- Pee, L. G. and Kankanhalli, A., Interactions among factors influencing knowledge management in public-sector organizations: A resource-based view, *Government Information Quarterly*, 33(1), 2016, 188–199.
- Razmerita, L., Kirchner, K., and Nielsen, P., What factors influence knowledge sharing in organizations? A social dilemma perspective of social media communication, *Journal of Knowledge Management*, 20(6), 2016, 1225-1246.
- Safa, N. S. and Von Solms, R. An information security knowledge sharing model in organizations, *Computers in Human Behavior*, 57, 2016, 442–451.
- Safa, N. S., von Solms, R., and Futcher, L., Human aspects of information security in organisations, *Computer Fraud & Security*, 2016(2), 2016, Pages 15–18.
- Straus, A. and Corbin, J., Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory, Sage, Thousand Oakes, CA, 1998.
- Stroh, L. K., Northcraft, G. B., and Neale, M. A., *Organizational behavior: A management challenge*. Lawrence Erlbaum, Mahwah, NJ, 2002.
- Tashakkori, A. and Teddlie, C., *Mixed Methodology: Combining Qualitative and Quantitative Approaches*. Sage, Thousand Oakes, CA, 1998.
- Wang, H. and Wang, S., A knowledge management approach to data mining process for business intelligence, *Industrial Management & Data Systems*, 108(5), 2008, 622-634.
- Wang, S. and Ariguzo, G., Knowledge management through the development of information schema, *Information & Management*, 41(4), 2004, 445-456.
- Wang, S., and Wang, H., Teaching design thinking through case analysis: Joint analytical process, *Decision Sciences Journal of Innovative Education*, 9(1), 2011, 113-118.
- Wang, S., and Wang, H., A soft OR approach to fostering systems thinking: SODA maps plus joint analytical process, *Decision Sciences Journal of Innovative Education*, 14(3), 2016. 337-356.
- Wang, S. and Wang, H., The social dimension of knowledge management: A qualitative analysis of multiple cases of social-media-based knowledge sharing, *Proceedings of the 2017 Northeast Decision Sciences Institute Conference*, Springfield, MA, USA, March 2017, 496-500.
- Wiig, K. M., What future knowledge management users may expect, *Journal of Knowledge* Management, 3(2), 1999, 155-165.
- Yin, R. K., Case Study Research: Design and Methods (3rd ed.). Sage, Thousand Oakes, CA, 2003.

PUTTING TRADITIONAL SUPPLY CHIANS OUT OF BUSINESS: THE DISRUPTIVE IMPACT OF ADDITIVE MANUFACTURING

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PUTTING TRADITIONAL SUPPLY CHIANS OUT OF BUSINESS: THE DISRUPTIVE IMPACT OF ADDITIVE MANUFACTURING

Abstract

Additive manufacturing (AM) is the specialization of 3D printing to produce on a scale that rivals traditional mass production. AM represents the next evolution in general-purpose technologies. General-purpose technologies like the steam engine, the factory system, and semiconductors bring specialization of function with generalization of capabilities. AM will focus manufacturing in fewer companies that specialize in making things, combined with great flexibility of volume and design. The tradeoffs between AM and traditional manufacturing will transform supply chains of the future. This paper identifies the benefits of AM relation to lean and agile manufacturing strategies as illustrated by the experiences of an early adopter of AM in the aerospace industry. AM will empower rapid component design, leaning of processes as supply chain complexity reduces via disintermediation, reduction of resource use, shortened forecasting horizons, and, most importantly, the unprecedented ability to be both lean and agile—"leagile"—at the same time. The increasing pace of technological innovation and potential for widespread disruption suggest that decision-makers should consider the implications early.

Keywords: 3D printing, supply chain strategy, lean, disruptive

Putting Traditional Supply Chains Out of Business: The Disruptive Impact of Additive Manufacturing

1. Additive manufacturing is more than 3D printing

Industrial scale 3D printing—also known as additive manufacturing (AM)—has begun, and it is going to put traditional supply chains out of business. The reason is simple: AM represents the next evolution in general-purpose technologies. General-purpose technologies are disruptive by nature; like the steam engine, the factory system, and semiconductors, AM brings specialization of function with generalization of capabilities. AM on a large scale will focus manufacturing in fewer companies that specialize in making things, but with great flexibility of volume and design. This does not mean that every traditional factory will go out of business; rather, at a population level they will become less prevalent as additive manufacturing matures.

Past papers have provided insightful advice regarding 3D printing as a force in consumer markets, especially the impact of 3D printing once consumers own 3D printers at home, and the predicted substantial role of 3D printing at the retail, consumer-touching level (Berman, 2012; Kietzmann, et al., 2015). Extant articles on 3D printing focus on "mass customization" at low to medium volumes of production, especially of "one-offs". Issues such as capacity decisions, intellectual property concerns, and a shift of focus to demand management dominate much current thinking. Missing from the dialogue is an assessment of how 3D printing technology will transform the rest of the supply through its unique capabilities to combine lean and agile thinking. Traditional supply chain strategy depends on identifying the push-pull boundary as determining where lean, efficient thinking ends and agile, effective thinking begins. Large-scale 3D printing—additive manufacturing (AM)—will empower lean, efficient processes throughout the supply chain, from raw materials to final end consumer.

Like other general-purpose technologies, AM will bring impressive productivity gains across many industries. It's important to note that AM has existed for decades at a small scale and the term 3D printing often appears interchangeably. We use AM to refer specifically to 3D printing technology on a scale large enough to make it competitive with conventional manufacturing technologies for sizable markets (see Table 1 on breakeven analysis for AM). Whereas 3D printing at low and medium volumes empowers prototyping, mass customization

through "one-off" changes to product design, and inventory postponement and reduction near the consumer, AM will empower rapid component design, leaning of processes as supply chain complexity reduces via disintermediation, reduction of resource use, and, most importantly, the unprecedented ability to be both lean and agile—"leagile"—at the same time.

[insert Table 1 about here]

[insert Figure 1 about here]

AM will wreak its greatest change at the supply chain level; supply chains of the future will be unrecognizable to today's supply chain managers. The burgeoning interest in AM derives from its potential to simplify supply chains—and simplify means more efficiency, fewer processes and relationships to manage, and the decimating of the costs and lead times associated with many processes. Today's supply chains have developed a "global sprawl" because in order for traditional manufacturing techniques to fulfill demand in increasingly fragmented and competitive markets, they must seek increasingly specialized suppliers. The result is increased supply chain complexity, in turn leading to long lead times, high global inventory levels, exponential growth in purchasing transactions to manage (and pay for), relatively poor use of production capacity, low degrees of automation, and large amounts of waste due to poor product design and the intractability of matching supply with demand (Chicksand, et al., 2012; Fiksel, 2009; Kieviet and Alexander, 2015). The response has been an explosion of practitioner and academic research on integrating supply chains (Flynn, et al., 2010) and managing complexity (Bozarth, et al., 2009).

Commonly accepted legacy production takes place in batch manufacturing and due to traditional setup costs, manufacturers impose batch size production in order to reduce the price/unit and maximize production capacity during a single series run. AM requires none of the limitations imposed by minimum order quantities. AM will create new opportunities to simplify traditional supply chains while increasing capability to satisfy the ultimate customers in multiple markets—both those already served and those not currently served—more effectively and efficiently. The result will be greater flexibility to meet unique customer demand requirements, improved design quality, shorter supply chain and manufacturing lead time, reduced resource

use, and overall lower cost to suppliers, manufacturers and customers. In addition, reduced investments in working capital, decreases in warehousing costs and logistical infrastructure have also been realized. A critical but under-appreciated benefit will be the greatly shortened forecasting time horizon, thereby improving forecast accuracy and enabling postponement of final product mix decisions.

Norsk Titanium, NTi, has been planning the advent of AM for nine years. The company has developed AM technology that makes titanium parts for aerospace applications with a fraction of the lead time and material waste of conventional competitors, all while reducing the cost of titanium parts to the traditional price point for aluminum parts. NTi is planning to open the world's first industrial-scale AM plant in Plattsburgh, New York in 2017 and we document here the benefits and implications for AM on a large scale. NTi's experience is indicative of the future of the "fourth industrial revolution", and anticipates changes that will affect many industries in the decades to come. In the words of Dr. David Jarvis, former Head of New Material and Energy at the European Space Agency, "Norsk's technology is a good candidate for a manufacturing technology that will change the world." (citation for this?)

2. Development of NTi's Industrial Scale AM Technology

NTi was founded in 2007 with a goal to develop and commercialize significantly less expensive aerospace-grade titanium components. Their technology aimed to create a mass-production process capable of making aerospace grade, additive manufactured, structural titanium. Aerospace grade titanium (Ti-64) is a relatively expensive metal that costs up to \$20 per pound compared to the other common aircraft metals: aluminum at \$13 per pound and steel at \$70 per ton. Although titanium is one of the more common elements on Earth, much of the cost comes from the energy intensive refining process.

In the aerospace industry, the supply chains for the main engines and titanium components have the longest lead times to the aircraft manufacturers. The traditional titanium supply chain consists of seven stages, each potentially, but not always, carried out by a different company (see Table 2 below).

[insert Table 2 about here]

The first four steps in the traditional titanium supply chain are commodity focused. Sources of supply are managed with contracts that rely on product specifications, which are

based on industry standards. The last three steps involve putting titanium into its final product form, which requires a lot of supplier relationship management and quality assurance monitoring. The implications for titanium products in aerospace applications are abundant. Titanium makes up 14% of the weight of a Boeing 787, a typical application. Military aircraft use much more titanium, with the F-22 fighter containing 39% titanium by weight (Kopp, 2007).

The incumbent process of making titanium components has not changed since the 1950s. There are three major smelting facilities that produce titanium rods, billets and blocks in large quantities. The inflexibilities of these large furnaces are such that the time between order and delivery is typically 6-12 months. The titanium feedstock then enter into an extremely fragmented machining sector, where individual/independent machining companies, each of which hold different credentials, clients and minor process specializations, use CNC machine processes to convert the feedstock into final components.

The typical subtractive manufacturing processes means up to 90% of the titanium ends up as scrap, to be returned to the furnaces for recovery at a very low rate. Titanium parts on average exhibit a buy-to-fly ratio of 6:1, meaning that 6 times as much titanium gets purchased as required for the final part, with the rest lost to scrap, and some parts commonly exceeding a 10:1 to 15:1 ratio. The result of the typical subtractive process makes titanium production expensive, inflexible, very time consuming and wasteful. With many steps and players to coordinate, newly designed aerospace titanium parts typically exhibit lead times of 55 to 75 weeks. Some parts can have much longer lead times, such as the engine bracket for one business jet manufacturer which requires 36 months from purchase order to arrival at the customer. Forecasting and making contracts so far in advance of actual demand calls for as much guesswork as applied management science.

The typical subtractive manufacturing plant that turns blocks of titanium into aircraft parts represents a substantial investment in capital in the form of a large building full of expensive milling, drilling, and other types of sophisticated machines, each of which requires ample amounts of skilled and unskilled labor, coordination, maintenance, electricity, and other investments. Not only is the lead time long for titanium components, the capital equipment necessary to create a typical subtractive manufacturing plant is expensive.

Using traditional subtractive manufacturing methods, large costs are generated from machining and scrap (scrap material contaminated with cutting fluids is expensive to dispose of).

In one extreme case, a 31 pound (13.9 kg) block of titanium metal that cost \$500 (\$16.13 per pound) was milled down to a 2.5 pound (1.15 kg) component. In other words, 28.5 pounds of scrap was produced from a 31 pound block to make a 2.5 pound intricate component. With machining costs at \$72 per pound (\$159/kg), the part's cost of raw material (\$500) plus labor (\$2,052) is \$2,552. That's 92% of the titanium going to waste - about \$460 worth of the \$500 block can get sold as scrap at 5% of the original purchase price per pound (scrap recovery ~\$23). In the final analysis of this extreme case, the buy-to-fly ratio is 12.4 (31 lbs./2.5 lbs.) with a total variable cost of \$2,552 (scrap recovery value is not considered). To think about it another way, 12.4 times as much material was purchased than was actually required for the part delivered to the customer. The traditional methods of subtractive manufacturing needed to be challenged as the current process is both expensive, time consuming and wasteful.

With the rise of the middle class in many countries around the globe comes increased demand for air travel; global air fleets are projected to grow 58% over the next two decades, a time period when 42% of existing fleets will also needs to be replaced, meaning that total aircraft demand will double (Airbus, 2015; Boeing, 2015). Currently, Boeing and Airbus have a record backlog of over 12,000 aircraft, and over 61% of the backlog consists of high titanium content aircraft platforms. On the military side, over 3,000 Joint Strike Fighter aircraft are projected to be ordered, in addition to other military needs. And, despite the huge costs and waste associated with current production methods, projections indicate a greater need for aerospace titanium parts in the future. Clearly there is a need for a <u>leaner and more agile</u> method to manufacture aerospace grade titanium products.

In sum, NTi found itself on the brink of rapidly expanding market demand that relied on a time-consuming, wasteful and expensive production process. If NTi could find a way to turn the titanium product supply chain from the longest lead time to one of the shortest lead times in aerospace, and do it in a cost efficient manner, it could change the industry. This is what motivated the company to invest in industrial scale AM processes and technology.

3. Additive manufacturing means a new way to design supply chains

Like many companies, NTi was nearing the practical limits of traditional lean manufacturing practices; further improvements would require a fundamental change across the supply chain. Traditional supply chains have long been a "compromise" model. In order to gain

flexibility of product design or production volume, supply chains would search the globe for suppliers with the right specialized capabilities, or would have to invest in developing those capabilities in-house. The cost of investing in efficient manufacturing capacity meant large scale manufacturing to achieve economies of scale, which meant more capital, which meant more exposure to demand risk (excessive holding costs, stockouts and obsolescence). Adding flexibility of scale or product design to conventional manufacturing traditionally has been costly and risky as break even points were often calculated in years.

NTi realized that any cure for the titanium supply chain's inefficiencies would have to address not just the waste on the production floor, but also the costly complexity of managing the titanium supply chain. A fundamental paradigm shift from "lean" to "ultra-lean" was needed. NTi created a shorter AM supply chain that offered a competitive advantage with their AM method of producing aerospace-grade, structural titanium components:

- Direct savings from reduction of production labor and scrap
- Design flexibility which allows design changes from customers to be incorporated in hours
- Indirect savings from reduction of supply chain cycle time and complexity.

Converting from subtractive to additive manufacturing will change the competitive landscape. Over 9 years, and more than a \$100 million investment, NTi has developed four generations of AM machines. The fourth generation AM machine has been operational since September, 2015 and a single AM machine is capable of producing 22 metric tons of aerospace grade titanium parts annually, taking into account machine down time and switch over time. A proprietary process called Rapid Plasma DepositionTM (RPDTM) delivers significant reductions in material costs, lead time, and manufacturing steps. To support RPDTM, NTi also had to develop control systems and processes that were capable of producing products for aerospace applications (Table 3).

[insert Table 3 about here]

The AM process's direct savings relate to reduced material waste. The process produces a near-net-shape part, with relatively little machining required to finish the product. The buy-to-fly

ratio for AM typically ranges from 1.5 to 3.1, meaning that 1.5 to 3.1 times as much raw material must be purchased than ends up in the final finished product. In the previously described example of the 2.5 pound (1.15 kg) part that required a 31 pound block of titanium, the buy-to-fly ratio was 12.4 and the total cost was \$2,552. The same part produced via AM requires 7.7 pounds (3.5 kg) of titanium to produce, a 75% material reduction resulting in a buy-to-fly ratio of 2.75. The titanium wire costs more, \$29.48/lb. vs. \$16.13/lb. for the titanium block, but with so much less material purchased, total raw material cost is \$227 compared to \$500 for the titanium block. Machining costs the same at \$72/lb., but with 75% less material to remove, machining costs total \$375 and takes about 75% less time. The total variable cost to produce the part: \$602 compared to subtractive manufacturing's \$2,552, a savings of \$1,950 (76.4%). Additionally, the work for a single part can be done in less than 24 hours (Table 4). A recent article (Air Insight, 2016) supports the drastically reduced estimate for part production by NTi:

"Small firms like Norsk Titanium are attracting attention. Using titanium wire the firm can build up any part overnight. Yes, overnight. I was shown a 787 bracket that holds a 787 galley wall. If Boeing were to order this part by 8 am today, the part can be delivered by 8 am tomorrow. This takes JIT to a new level."

[insert Table 4 about here]

AM also requires a simpler supply chain (Table 5), with fewer stages and less complexity. As wire is now the only feedstock material used in production, raw material inventory is greatly reduced. This readily available material replaces the need for various sized bar stock and sheet material, all of which had long lead times and complex inventories. Compared to the 55 to 75 week average lead time for the subtractive manufacturing supply chain, the AM production supply chain takes 4 to 6 weeks. In the previously cited example of the engine bracket that required a 36 month lead time for the business jet manufacturer, NTi's new AM technology produces a higher quality part with a predicted lead time of 1 month. Once established, forecasting and demand management in the AM supply chain will go from intractable to statistically feasible. The result will be greater responsiveness at a lower total cost.

[insert Table 5 about here]

Viewed through the traditional lens of economic order quantity (EOQ) modeling, AM technology empowers an EOQ of 1. Shorter cycle times and greater responsiveness have many benefits. Design flexibility is foremost, with no punitive cost to the customers. Pipeline inventory can be reduced. Also, many aircraft parts—particularly structural parts that often use titanium— have sporadic, unpredictable demand patterns, leading to high holding costs for parts that may not be required for years. A 4-6 week lead time (or less) provides the option of relying on supply chain responsiveness to replace costly safety stocks of slow moving and hard to predict parts. This level of responsiveness facilitates new product innovation, particularly important in the critical design review stage of aircraft development.

Traditional 3D printing companies produce and sell printers, and leave the production of components to their customers, who develop the production processes and process controls independently. The result is that there has been little to no development by the 3D printing companies to the core technology of their printers, no qualification trajectory, and with use limited to prototyping, low-rate production and design aids. NTi aims to use their machines to develop qualified parts for the aerospace industry as a tier-1 or tier-2 supplier, and the technology and the components will be pre-qualified for the respective end users. On-going process controls, technology development and intellectual property associated with the AM machines will therefore remain under NTi control. With the NTi AM process, a part could go from raw wire to an aircraft-worthy component in 120 linear feet of manufacturing floor length, the ultimate lean manufacturing cell. The AM equipment is dimensionally small enough that it can be transported relatively easily, although once it is installed it is not mobile (the U.S. Army has had a mobile 3D printing unit since 2012—but it does not produce aerospace grade titanium parts (Asclipiadis, 2014)). Clearly, AM is going to impact traditional manufacturing processes and the supporting supply chains.

The aerospace industry has taken notice. The fourth generation AM machine has been operational since September 2015, supplying titanium parts to customers for testing. Boeing qualified NTi as an approved supplier in December 2015, and Premium Aerotec, an Airbus subsidiary, began qualification in January, 2016. In addition, Airbus qualified NTi as an approved supplier in June, 2016. Boeing and Thales Alenia Space began the approval process with NTi by signing contracts for test articles in July, 2016. Even Alcoa - a company with a long

history and large capital investments in legacy technology - has invested with NTi to form a Joint Technology & Industrialization Collaboration program. Clearly, traditional commodity metal suppliers are cognizant of how AM can impact their traditional supply chains.

4. AM and the *leagile* supply chain

Utilizing lean and agile manufacturing concepts, Naylor et al. (1999) proposed two supply chain strategies: lean and agile. They defined these strategies as follows: Leanness means developing a value stream to eliminate all waste, including time, and to ensure a level schedule. Agility means using market knowledge and a virtual corporation to exploit profitable opportunities in a volatile market place (Naylor, et al., p. 108). Depending on the manufacturing process (make-to-order, assemble-to-order, and make-to-stock) a decoupling point will separate the supply chain into a planning part (lean) and a customer facing part (agile). The decoupling point can also be considered the location along the supply chain where the customer places their order for a product. They noted that material and information lead time and quality were key performance metrics for both lean and agile supply chains. Cost reduction was key to a lean supply chain, while customer service was critical for an agile supply chain. Based on two case studies, Naylor et al. determined that companies should seek to create a leagile supply chain where lean principles are practiced upstream from the decoupling point, while agile practices are applied downstream after the decoupling point. Distinguishing characteristics of a lean and agile supply chains were presented by Mason-Jones et al. (2000) as shown in Table 6. They concluded that the lean and agile paradigms could be integrated through information enrichment at the decoupling point to design a *leagile* supply chain.

[insert Table 6 about here]

Due to the significant differences between AM and traditional subtractive manufacturing, we conceptualize that AM will enable companies to create a *leagile* supply chain for their products. In AM, we consider the decoupling point to be the machine used for the RPDTM process in a make-to-order production strategy with a batch size of one with a minimal set-up time. AM requires none of the limitations imposed by minimum order quantities. Because the supply chain for AM will have fewer entities, both material and information lead times will be shorter. Since the primary raw material for the RPDTM process only requires a spool of commercial grade

titanium wire (feedstock product variety is low - lean), it will be easier for the supplier to maintain stock and fulfill orders on time. This is in contrast to the subtractive method which requires the supplier to hold a large variety of variously shaped bars and blocks. This large variety increases the probability of a stockout, which could create backorders at all downstream entities in the supply chain. Processing lead time is shorter with AM and a batch size of one minimizes throughput, allowing a single finished part to be shipped directly to the customer rather than waiting for a batch to be completed. Hence, the material aspect of the supply chain will be reduced, meeting the key performance metrics for both lean and agile supply chains.

Information lead time will also be shortened as the reduction in supply chain entities enables a faster flow of information to all vested parties. In addition, a batch size of one facilitates expediting since the order change can be conveyed directly to the machine and the required part placed in the appropriate queue location for processing. And, the expediting of a part will not adversely impact overall operations since the processing times of downstream tasks are shorter than those in subtractive manufacturing.

Quality should be improved through the use of computer controls to make the initial build of the part and since parts require fewer downstream processing steps, the probability of a defect occurring is reduced. Cost will be reduced in several areas including raw materials purchasing, processing labor, energy utilized, inventory holding and waste disposal. Finally, customer service will be improved in several ways. Changes in demand will be easier to accommodate, parts can be delivered faster due to the batch size of one, and new product development time should also be reduced.

5. Advent of industrial scale additive manufacturing

Although much attention has been paid to 3D printing's ability to empower mass customization, hitherto virtually no examples of real-life industrial scale applications have been assessed. Assessing the expected benefits of the world's first industrial scale AM plant reveals that the implications for manufacturing and global supply chains go far beyond customizing the product.

5.1. Low Product Cost

Counter to many expectations, industrial scale AM means lower total costs for many products. Savings accrue to both direct and indirect costs. Direct cost savings result from reduced

material and labor requirements. Indirect savings result from lower total system costs from reductions in pipeline inventory, salvage, capital, and transaction costs associated with finding and monitoring suppliers. We described one example of a titanium aerospace part with a 75% savings in material and labor, exclusive of the pipeline and transaction costs savings. With projected average savings of 40-80% just for material and labor, titanium becomes cost-competitive with aluminum, which additionally opens up entire new markets.

Titanium part production has one of the longest lead times in the aerospace industry. Industrial scale AM reduces the 55-75 week lead time to 4-6 weeks. Such a reduction means that forecasting accuracy increases greatly, ameliorating problems such as the bullwhip effect, reducing unnecessary investments in inventory, obsolescence and informing costly manufacturing and capacity investment decisions. Such a significant reduction in lead time to effectively create an economic order quantity of one also makes possible new inventory management strategies for customers—rather than stocking expensive, slow moving "mission critical" parts, short lead times mean that customers can order the part when needed with a minimal impact on customer service levels, avoiding holding, and obsolescence costs.

5.3. Low Scrap and Emissions

Industrial scale AM avoids much of the energy costs associated with traditional machining and finishing in subtractive manufacturing. Energy use and generated scrap correlate closely with machining time: average "buy-to-fly" ratios of 6:1 to 15:1 for subtractive manufacturing vs. 1.5:1 to 3.1:1 for AM indicate AM results in at least a 50% reduction to scrap, with a 75% average reduction likely, with commensurate reductions to energy use and the labor costs incurred to generate the scrap. Additional savings accrue from reduced building footprint requirements due to the smaller manufacturing floor space for the AM machine and diminished downstream machining, as well as less storage space required, and less unsold product produced due to the reduced lead times. As noted in Table 1, for all but the greatest economies of scale, industrial scale AM will present significant opportunities for cost savings.

5.4. Increased Flexibility

With its reliance on advanced AM technologies like Rapid Plasma Deposition, industrial scale AM represents an unprecedented flexibility in both volume and product design. Previous generations of 3D printing offered highly variable product flexibility at low volumes; next
generation AM capabilities offer low per unit cost to produce from low to medium volumes. Surprisingly, AM also proves price competitive at high volumes. Figure 1 shows that at higher volumes, it is possible for the difference in per unit costs to be negligible relative to the costs of distribution, marketing, financing, and other business costs. Interestingly in the case of NTi, they can even use AM to print bar stock of titanium more quickly and cheaply than it can be bought through traditional means of manufacturing. Smart leaders will find additional value and savings by leveraging the combination of volume and product flexibility unique to AM.

5.5. Greater Innovative Capacity

Innovation has long been hampered by dependence on either the large, slow capital investments of traditional manufacturing, or on the profits generated by larger companies. This is a resource constraint that gives the advantage to develop innovations to larger corporations when it comes to producing enough product for a substantially-sized market. AM equalizes the playing field, empowering small and medium size businesses to produce at a per unit cost near or equal to larger firms. On the other hand, smaller organizations already enjoy advantages of adapting quickly to feedback from markets in order to rapidly innovate (Bower and Christensen, 1995); AM will empower larger firms to adapt products rapidly without investing in capital upgrades that are very costly to traditional manufacturers.

5.6. Disruptive Technology

In their seminal article, Bower and Christenson (1995) defined a disruptive technology as an innovation that creates a new value and eventually displaces an established technology and shakes up an industry. They discussed the importance of disruptive technologies and the impact they have on industry (p. 51), "Small, hungry organizations are good at placing economical bets, rolling with the punches, and agilely changing product and market strategies in response to feedback from initial forays into the market." Companies like NTi are using AM to create value by replacing titanium components with long established legacy production techniques with those of their newly proven AM processes.

6. Conclusion

Industrial scale additive manufacturing is a disruptive technology that is going to redefine supply chain management. As more and more companies switch to products manufactured by AM processes, many previously accepted subtractive manufacturing practices will be abandoned

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and replaced. The advent of AM represents the next logical progression of traditional manufacturing and supply chain practices. The ultimate lean manufacturing cell can greatly reduce product cost and supply chain lead time, and design flexibility is increased. AM enables a leagile supply chain that is more efficient, responsive, and greener. The resulting supply chain generates great savings and efficiencies in upstream processes by having a simpler raw material and inventory system (long lead time bar stock and sheet material are replaced by very short lead time commercial grade wire) and downstream processes as production time and material needed is greatly reduced. In short, AM transforms many of the upstream and downstream processes in the supply chain to be leagile. In addition, the final product more exactly meets individual customer demand needs.

AM's greatest impacts will concur in conjunction with a variety of other technologies just appearing, such as artificial intelligence, robots and drones, big data, and the Internet of Things. AM continues the blurring of the physical and virtual worlds, and will enhance the interchangeability of information and matter. While the example used in this article is that of an aerospace supplier of titanium products, the lessons learned are transferable across many industries and products. AM has the potential to be used in multiple industries by OEMs and their suppliers. Those manufacturers that can adapt to AM will be able to compete more cost effectively, and in a timelier manner, all the while providing increased levels of design flexibility. Legacy manufacturers and traditional supply chains take notice: change is coming as industry is just starting to realize the competitive advantages that AM can offer.

REFERENCES

- Air Insight (2016). After Farnborough. Retrieved July 28, 2016, from http://seekingalpha.com/article/3990730-farnborough
- Airbus (2015). Flying by numbers. Retrieved July 14, 2016, from <u>http://www.airbus.com/company/market/forecast/?eID=maglisting_push&tx_maglisting_pi1</u> <u>%5BdocID%5D=89373</u>
- Asclipiadis, A. (2014). Rapid equipping force uses 3-d printing on the frontline. *Army Technology Magazine* 2(4), 12-13.
- Berman, B. (2012). 3-D printing: The new industrial revolution. *Business Horizons*, 55(2), 155-162.
- Boeing (2015), Current market outlook, 2015-2034. Retrieved July 14, 2016, from http://www.boeing.com/resources/boeingdotcom/commercial/about-our-market/assets/downloads/Boeing_Current_Market_Outlook_2015.pdf
- Bower, J. & Christensen, C. (1995). Disruptive technologies: catching the wave. *Harvard Business Review* 73(1), 43-53.
- Bozarth, C. C., Warsing, D. P., Flynn, B. B., & Flynn, E. J. (2009). The Impact of Supply Chain Complexity on Manufacturing Plant Performance. *Journal of Operations Management* 27(1): 78-93.
- Chicksand, D., Watson, G., Walker, H., Radnor, Z., & Johnston, R. (2012). Theoretical perspectives in purchasing and supply chain management: an analysis of the literature. *Supply Chain Management: An International Journal*, 17(4), 454-472
- Fiksel, J. (2009). *Design for Environment: A Guide to Sustainable Product Development*, 2nd ed. McGraw-Hill Professional.
- Flynn, B. B., Barbara B., Huo, B., & Zhao, X. (2010). The impact of supply chain integration on performance: a contingency and configuration approach. *Journal of Operations Management* 28(1), 58-71.
- Kietzmann, J., Pitt, L., & Berthon, P. (2015). Disruptions, decisions, and destinations: Enter the age of 3-D printing and additive manufacturing. *Business Horizons*, *58*(2), 209-215.
- Kieviet, A. & Alexander, S.M. (2015). Is your supply chain additive? *Supply Chain Management Review, May/June*, 34-39.

- Kopp, C. (2007). *Assessing the F-22A Raptor*. Technical Report APA-TR-2007-0105, Air Power, Australia.
- Mason-Jones, R., Naylor, B., & Towill, D.R. (2000). Engineering the leagile supply chain. International Journal of Agile Management Systems 2(1), 54-61.
- Naylor, J. B., Naim, M.M., & Berry, D. (1999). Leagility: integrating the lean and agile manufacturing paradigms in the total supply chain. *International Journal of Production Economics* 62(1/2), 107-118.



Figure 1. Economies of scale for additive vs. conventional manufacturing

Based upon Atzeni and Salmi, 2012

Table 1. Breakeven comparison for AM vs. conventional manufacturing

Compared to conventional manufacturing processes, AM has the same set up costs regardless of number of units produced, which can provide a huge advantage on per unit costs at low volumes. The figure below portrays the breakeven point for AM vs. conventional manufacturing based upon extant studies¹. AM additionally allows a savings of weeks (or months) compared to traditional conventional manufacturing that requires designing and fabricating of tooling and fixtures, with resulting benefits for forecasting, responsiveness, and adaptability. Additional benefits accrue at the supply chain level after considering inventory savings—occurring simultaneously with increased product and parts variability—and other costs.

Step	Company	Purchasing	Description	
		Strategy		
1	Titanium ore extractor		Typical total heavy metal content is	
			2.5%-7%, meaning that 100 tons of raw	
			material must be processed to extract 5	
			tons of titanium ore.	
2	Material Manufacturer	Product	Converts titanium ore into sponge.	
3	Rolling Mill/Metal	Specification	Converts sponge into ingots, bar stock	
	Manufacturer		or sheets.	
4	Distributor		Distributes bar stock and sheet	
			materials.	
5	Part Manufacturer		Rough and finish machining of blocks	
			or bar stock into aerospace part. This is	
			where coating and/or painting occurs,	
		Active	and the part gets put into a sub-	
		Management /	assembly.	
6	(Sub-)Assembly	Quality	Value added supplier adds finished part	
		Assurance	into higher order partial assembly.	
7	End Customer (e.g.,	1	Part gets assembled into airframe.	
	Boeing, Airbus)			

Table 2. Traditional titanium supply chain

Table 3. Rapid Plasma DepositionTM

Because titanium reacts rapidly with oxygen, Rapid Plasma DepositionTM (RPDTM) occurs in an inert gas setting. A spool of titanium wire is fed into an argon gas pressure controlled chamber. The chamber has features that facilitate continuous flow for high volume manufacturing, such as separated load/lock doors and maintenance access portals.

The plasma torch system consists of two plasma welding torches, the wire feedstock nozzle, and an argon cooling system for the plasma welding torches and the deposited titanium, as well as the machine's inverters, cables and hoses, and plasma system controls. A CNC controlled, 4 axis geometry programming methodology controls the RPDTM positioning system.

Table 4. AM process

The entire process for a single component typically takes less than 24 hours (range 9-24 hours):

Time (hours)	Step
1-2	Rapid Plasma Deposition – printing part from computer file
2-6	Stress relief – component is heated in a furnace
2-6	Rough machining
2-6	Ultrasonic inspection
1-2	Finish machining
1-2	Coating

Table 5. New AM Supply Chain

- 1. Titanium ore extractor
- 2. Wire manufacturer
- 3. $NTi RPD^{TM}$ production of part.
- 4. Tier 1 Integrator/Finish Machining Finish machining, coating, sub-assembly and delivery to final customer.
- 5. Final Customer Part gets assembled into mainframe for Boeing, Airbus, etc.

Distinguishing Attributes	Lean Supply Chain	Agile Supply Chain		
Typical products	Commodities	Fashion goods		
Marketplace demand	Predictable	Volatile		
Product Variety	Low	High		
Product life cycle	Long	Short		
Customer drivers	Cost	Availability		
Profit margin	Low	High		
Dominant costs	Physical costs	Marketability costs		
Stockout penalties	Long-term contractual	Immediate and volatile		
Purchasing policy	Buy materials	Assign capacity		
Information enrichment	Highly desirable	Obligatory		
Forecasting mechanism	Algorithmic	Consultative		

Table 6. Distinguishing attributes of lean and agile supply chains

Source: Mason-Jones et al. (2000)

RATIONING INVENTORY OVER MULTIPLE DEMAND CLASSES WITH BACKORDERS

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RATIONING INVENTORY OVER MULTIPLE DEMAND CLASSES WITH BACKORDERS

Abstract

We develop an inventory model that addresses inventory rationing based on customer priority. Similar to recent literature, we use the framework of a multi-echelon inventory system to describe the physics of a critical level policy. However, instead of considering fill rates as in the previous work, we seek to minimize a cost objective. Under a similar framework other research has considered 2 demand-classes, and we extend to multiple demand classes. We assume an (r, Q) ordering policy with the supplier, and present an efficient algorithm and heuristic search procedure that solves to near optimality in the (S-1, S) case for three demand classes. **Keywords:** inventory rationing, heuristics, multiple demand classes

1. Introduction

Many of the inventory policies discussed in the literature and used in practice assume that all customers are equally important and thus, demand is met on a first-come, first-served basis. In practice, however, an inventory manager might have a set of customers who receive preferential treatment. Reasons to differentiate customers might include personal relationships, differing backorder costs, contractual agreements, differing dollar volumes, or other cost and revenue-related issues. When customers are differentiated for any reason, a more involved inventory policy may be needed to meet the different customer needs while minimizing inventory-related costs.

One method from the literature is to choose a "critical level" for on-hand inventory, also called a threshold level. Low priority customer demand is backordered once inventory levels fall to the critical level, while high priority customer demand is consistently filled as long as on-hand stock remains. Once inventory is replenished, backorders are filled, and inventory levels exceed the critical level, orders from low priority customers are again filled as usual. This method of inventory control has been called a threshold inventory rationing policy (or critical level rationing policy) in the literature, and we adhere to the same terminology in this research as we model a critical level rationing policy.

In industry, there are many cases where inventory rationing might be usefully applied. Deshpande et al. (2003) cite the case where the same spare part for an equipment component is needed by different branches of the military but is stored in a single location. Suppose that for a particular component the Air Force requires an 85% fill rate, and the Navy requires a 95% fill rate. The Defense Logistics Agency (DLA) might decide to "round-up" the fill rate to hold enough components in inventory to meet the higher fill rate of 95%. They might also physically separate the inventory with separate replenishment policies for each "pile" of inventory. One pile would be large enough to meet the Air Force fill rate, while the other pile would be sized to meet the Navy fill rate. In either case, the inventory held may be more than necessary to meet both fill rates while minimizing costs.

Deshpande et al (2003) show that with a critical level policy, DLA might be able to reduce inventory-related costs while still meeting the different service expectations. They assign priorities to each branch of the military (i.e. classify Navy demand as high priority, and Air Force demand as low-priority). Then, by setting a critical inventory level at which to backorder low priority demand, the procedures would be in place to ensure Navy's higher fill rate would be met while inventory costs are reduced.

Another example comes from industry, where customers are prioritized based on differing shortage costs. Some suppliers to auto manufacturers incur steep fines for delayed shipments to certain customers, and other manufacturers incur similar backorder costs with different contractual customers. Similarly, when a firm seeks to segment customers based on a price for higher service, critical rationing of inventory is again applicable. Or, a firm that uses the same inventory stockpile to fill demand on two fronts, for instance, internet sales in addition to retail sales.

The premise of this paper is to develop a multiple demand-class inventory model, where customers are prioritized base on backorder costs and inventory is rationed to the different customer classes using a critical level rationing policy.

This paper is organized with section 2 covering the related literature and defining some of the basic elements of demand class inventory models. Section 3 introduces the demand class model as studied in this paper, with section 4 equating our demand class model to a serial-stage system. Section 5 defines our model notation and the equations for performance measures. In section 6 we develop our objective cost function, one of the unique elements of our research. Section 7 gives the numerical results of some test cases, and explores some of the structural

properties of the cost function. Section 8 summarizes the managerial insights found through the analysis of the test cases, and section 9 gives the conclusion and plans for future research.

2. Literature Review

In the literature there have been several contributions on multiple demand class inventory models, and Table 1 outlines some of the research more similar to our own. The following describes each of the categories found in Table 1 and how our research fits into the current literature.

• *Critical Level Rationing Policy* – As explained in the introduction, we assume a critical level rationing policy, which defines the way we ration inventory for the different classes of customers. Most of the literature assumes a *static* critical level policy, while some consider *dynamic* rationing policies where critical levels may change over time. Here we are developing a static critical level rationing policy.

• Number of Demand Classes – This refers to how many groups, or classes, of customers are defined. The classes of customers are then prioritized and demand from each class is met based on the priority assigned to that customer class. In the literature either 2 demand classes are defined, or the model is generalized with N customer classes. Here, we develop a model of N demand classes and analyze a set of test cases for a three, four, and five-demand class formulation.

• *Treatment of Shortages* – Shortages are treated as either backorders or as lost sales. The penalty cost associated with the shortage is often how customer classes are prioritized. In this paper we assume shortages are backordered, and we assign priorities based on backorder costs.

• *Formulation Objective* – Though not always optimized, models typically are formulated around an objective to minimize inventory-related costs, or to minimize inventory levels. When the objective is to minimize inventory levels, the model includes constraints that enforce the desired fill rates for each class of customers. In a few cases, cost is minimized with fill rate constraints,

and in other cases the model may be formulated only to analyze expected fill rates. In this paper, we are attempting to minimize the inventory-related costs, and we do not specify any constraints.

• *Replenishment Policy* – This refers to the way inventory is replenished from the supplier. The replenishment policies considered in multiple demand class literature are the same as seen in other inventory literature. Common policies include the reorder point / order quantity policy (r, Q), the one-for-one base-stock policy (S-1, S), or the reorder point / order-up-to level policy (s, S). While the replenishment policy parameters are often included as decision variables in the model, sometimes the replenishment policy is only discussed and the parameters predetermined. In this paper we analyze a (S-1, S) replenishment policy, and include the policy parameters as decision variables in the model. We later hope to extend to an (r, Q) or (r, S) model.

• *Model Tools* –Initially, multiple demand class models used dynamic programming to formulate and solve the model, such as Veinott (1965), Topkis (1968). Dekker et al (1998), Moon and Kang (1998) use simulation to estimate the performance measures and the effects of the different model parameters. Continuous-time models from such papers as Dekker et al (2002), Deshpande et al (2003) and Arslan et al (2007) require an analytical approach, finding the distributions of the performance measures based on some or all of the unknown parameters. After the relationships are defined in the analytical model, algorithms are developed in an attempt to optimize the system. Some later papers such as Vicil and Jackson (2006) and Teunter and Klein Haneveld (2008) have been using Markov Chains to describe the inventory system, and then they seek to optimize the system based on steady-state probabilities.

The first literature on a single-item, multiple demand class inventory model was by Arthur Veinott (1965), who first introduced the notion of rationing inventory differently for different types of customers. He assumed discrete time, periodic review, and a base-stock replenishment policy. He did not define a specific cost function, but proved the base-stock replenishment policy was optimal when rationing inventory among several classes of customers.

Author(s)	Rationin g Policy	No. of Classes	Treatment of Shortages	Formulation Objective	Replenish Policy	Model Tools	Special
Veinott (1965)	*None	Ν	Backorders Lost Sales	Min cost	Periodic Base-stock	Dynamic Programming	Introduced critical levels
Topkis (1968)	Static / Dynamic	N	Backorders Lost Sales	Min cost	Periodic Base-stock	Dynamic Programming	Argued / proved critical levels opt.
Kaplan (1969)	Dynamic	2	Backorders	Min cost	None	Dynamic Programming	First numerical results
Nahmias and Demmy (1981)	Static	2	Backorders	Fill rate analysis	(<i>r</i> , <i>Q</i>)	Analytical / Algorithmic	First continuous- time model
Dekker et al. (1998)	Static	Ν	Backorders	Fill rate analysis	(<i>S</i> -1, <i>S</i>)	Simulation	Numerically verified fill rates
Moon and Kang (1998)	Static	2	Backorders	Estimate Fill rates	(<i>r</i> , <i>Q</i>)	Simulation	Offered several formulations
Dekker et al. (2002)	Static	Ν	Lost Sales	Min cost w/fill rate constraints	(S-1,S)	Analytical / Algorithmic	First to use fill rates as constraint
Deshpande et al. (2003)	Static	2	Backorders	Min cost	(<i>r</i> , <i>Q</i>)	Analytical / Algorithmic	Studied different <i>clearing</i> policies
Vicil and Jackson (2006)	Static	N	Backorders	Min inv. w/fill rate const.	(<i>S</i> -1, <i>S</i>)	Markov Chain	Proved optimal solution
Arslan et al. (2007)	Static	Ν	Backorders	Min inv. w/fill rate const.	(<i>r</i> , <i>Q</i>)	Analytical / Algorithmic	Used Serial Stage framework
Teunter and Klein Haneveld (2008)	Dynamic	2	Lost Sales	Min cost	None	Analytical	First to consider rationing <i>times</i>
Fadiloğlu and Bulut (2010)	Static / Dynamic	2	Backorders Lost Sales	Min cost	(Q, r, k, n)	Simulation	RERF policy developed
Hung et al. (2012)	Dynamic	N	Backorders	Min cost	Periodic Base-stock	Analytical / Heuristic	Also explores single period case
Pang et al. (2014)	Static	N	Lost Sales	Max discounted profit	(<i>r</i> , <i>nQ</i>)	Analytical	Batch production w/make-to-stock
Liu and Zhang (2015)	Dynamic	2	Backorders	Min cost	Fulfillment policy	Discrete-time Markov proc.	Continuous on- hand inventory
Liu et al. (2015)	Dynamic	N	Backorders	Min cost	Base stock, no lead time	Analytical	No backorder clearing policy
Ding et al. (2016)	Static	N	Partial Backorders	Max average profit	(S-1, S)	Dynamic Programming	Used zero lead- time case to study
Schulte and Pibernik (2016)	Static	N	Lost Sales	Min inv. w/fill rate const.	Starting inv. For 1- period	Analytical	Single-period service level differentiation
Our contribution	Static	N	Backorders	Min cost	(<i>S</i> -1, <i>S</i>)	Analytical / Algorithmic	Use Serial Stage framework with cost objective

Extending Veinott's work, Donald Topkis (1968) later showed that under his assumptions that using a critical level policy was optimal when assuming either total backorders, partial backorders, or only lost sales. He simplified the situation by assuming that demand in a particular period was known before deciding how to ration the inventory, and he also considered the case when the replenishment lead time was zero.

Kaplan (1969) was the first to attempt a numerical example and claimed to have the same model results as Topkis (1968), though Kaplan only considered 2 demand classes. His computational results showed promising benefits for adopting a critical level policy under his assumed conditions.

The literature more similar to our model begins with Nahmias and Demmy (1981), who first considered a continuous review replenishment policy. Like our model, they analyzed an (r, Q) policy with Poisson demand, backordering, a fixed lead time from the supplier, continuous inventory review, and critical rationing levels. However, they restrict their model to only allow for a single replenishment to be on-order at any given time, and they only consider 2 demand classes. Also, they did not attempt an optimization of their model, but instead formulated their model based on fill rates and developed numerical examples to describe the performance characteristics.

Dekker et al. (1998) considered a continuous review, base-stock model similar to Nahmias & Demmy (1981) but removed the restriction of only one outstanding replenishment order. However, they also only considered a 2-demand class inventory system and used simulation to derive the numerical results. A later paper by many of the same authors is Dekker et al. (2002) that again looked at the base-stock replenishment policy, but instead added a cost objective using fill rates as the constraints. They considered lost-sales instead of backorders. Dekker et al. (2002) may be the first paper to have used fill rates as the constraints in a cost objective formulation in multiple demand class literature.

With some similar assumptions to our own model, Moon and Kang (1998) used simulation to explore a few different cases of multiple demand class inventory models. They mainly consider 2 demand classes, backordering, and a cost objective, but they restrict their models to known demand with random inter-arrival times. They also propose a model for Ndemand classes, but fail to explore it fully. A paper more similar to our research is from Deshpande et al. (2003) which assumes continuous review (r, Q) replenishment, a static critical level rationing policy, a similar cost objective, and Poisson demand. They only consider two demand classes, however, and use a different approach to finding the steady-state distributions of the performance measures than our research. They include both r and Q as decision variables in addition to the critical level, and they describe the performance measures similar to the approach in Zipkin (2000).

Vicil and Jackson (2006) use a multi-dimensional continuous-time Markov chain to describe the different states in a multiple demand class inventory model with critical levels. They assume an (S-1, S) base-stock policy with N demand classes with an inventory minimization objective, and find an exact optimal solution. They attempt to minimize the inventory levels while meeting fill rate constraints. Their assumed backorder clearing mechanism is different from the method considered here.

The main motivation for our model framework is from Arslan et al. (2007) who consider a single product, continuous review, (r, Q) policy, for N demand classes. It has all the assumptions of our model, but does not use a cost objective, as we do. Rather, it seeks to minimize the expected inventory level with fill rate constraints. We follow their method of developing the inventory model as a multiple demand class system by equating it to a serial stage inventory system. They use the serial-stage model structure to help derive the performance measures of the model, and use a single pass algorithm to come to a near-optimal solution.

Also similar to our paper is Hung et al. (2012), where they consider *N* demand classes under cost minimization and backorders. However, they focus on the periodic base-stock case, rather than the continuous-time case that we consider here. Also, Hung et al. (2012) does not utilize a serial stage system for their inventory modeling structure.

Teunter and Klein Haneveld (2008) develop a dynamic critical level policy based on what they call rationing times. Rationing times are related to the amount of time remaining until a replenishment is received from the supplier. As time until a replenishment gets shorter, their policy suggests that a firm would be less-likely to reserve stock for higher-priority customer classes. While we find this stream extremely interesting and applicable, our paper goes in a different direction. This research is mentioned here to show the latest work done in the research stream of multiple demand classes. Another important element of demand class inventory systems is how to manage incoming orders from the supplier. If there are unfilled backorders and inventory is below critical inventory levels, then we must decide whether to fill backorders or refill inventory for reserve stock. This decision process is generally referred to as the backorder clearing mechanism or the replenishment allocation policy in literature.

Deshpande et al. (2003) give a thorough comparison of some common clearing mechanisms and give prominence to priority clearing, threshold clearing, and a hybrid clearing policy that is a mixture of the two. It was shown that the priority clearing mechanism is optimal, and the hybrid policy performs no worse than the threshold clearing policy and performed as well as the optimal in some cases. In our model we will assume the same clearing policy as Arslan et al. (2007), which was shown to perform similarly to a threshold clearing policy. A description of the backorder clearing mechanism is not covered in detail.

The clearing mechanism is sometimes ignored in literature, such as in Liu at al. (2015), where in an N demand-class model, they optimize cost using a discrete-time Markov process where they assume continuous on-hand inventory and develop a fulfillment policy. In our work, we also use an N demand-class model, but it is based on the continuous-time case and we are seeking an inventory rationing and replenishment policy, with a priority clearing mechanism for backorders. In another paper, Liu and Zhang (2015) make the assumption of zero lead time, whereas, we are allowing for positive lead times which adds to the complexity of our approach as it better mimics real-world operations.

Ding et al. (2016) also use a base stock policy with N demand classes, but allow for partial backorders and seek to maximize average profit. They assume a lead time of zero as a way to develop a dynamic programming model, as it simplifies the derivations of their model. Another paper that looks to maximize profit is Pang et al. (2014), where they assume lost sales, and a fixed batch size, make-to-order production environment. Similar to our paper, Pang et al. (2014) assume Poisson demand in developing their model.

In summary, after Arslan et al. (2007), this is the second example in the literature to use a serial-stage inventory system to model multiple demand classes. This is the first to develop a cost-objective model under the serial-stage framework, and thus the first serial-stage framework cost-objective minimization for N demand classes under either base-stock replenishment, or, more generally, (r, Q) replenishment. We also develop a new algorithm that is shown in several

numerical cases to find the optimal, or near optimal, base-stock policy under the assumptions of this model. We hope to later modify this base-stock policy algorithm to solve the more general case.

3. General Framework

We develop our framework in the same manner as Arslan et al. (2007), describing the framework of a general multiple demand class system (DCS) and then equating it to a serial-stage inventory system (SSS). In our demand class inventory system, we use the example of a finished goods warehouse stocking a single product in anticipation of future demand.

Demand Classes

Customers are assigned to one of the *N* demand classes based on backorder cost, where b_i is the backorder cost for customers in demand class *i*, and $b_1 > b_2 > ... > b_{N-1} > b_N \ge 0$. As implied by the descending order of the backorder costs, we prioritize the demand classes with class 1 having the highest priority, and class *N* having the lowest priority. Simply put – the greater the customer backorder cost, the higher the priority demand class to which the customer is assigned.

Customer Demand Distribution

We are assuming that customer demand follows a Poisson process, where one item is ordered at a time and demands from different customer classes are independent. We define $\lambda_i > 0$ to be the Poisson demand rate for demand class *i*, and the aggregate, or total, demand rate is the sum of the individual class demand rates: $\lambda = \sum_{i=1}^{N} \lambda_i$.

Satisfying Demand

As demand occurs, we decide whether to fill an order, or to backorder it, based on current on-hand inventory and based on which class the demand comes from. We define a critical level rationing policy by setting rationing levels c_i for classes $i \in \{1, 2, ..., N-1\}$. We decide to fill a demand from class i only if current on-hand inventory is above the critical level of the higher priority class, c_{i-1} . If we decide to immediately fill an order then the total on-hand inventory is



DCS Inventory System



decreased. We backorder class i demand once on-hand inventory reaches or falls below the critical level, c_{i-1} .

An example of a three-class DCS is shown in Figure 1, where the warehouse is represented by its inventory "meter." The critical rationing levels, marked c_1 and c_2 on the meter, are arbitrarily set at 5 and 11 in the example, respectively – and because we are assuming a *static* critical level policy, these values do not change once they are chosen. On-hand inventory at the warehouse is represented by the height of the shaded region, with on-hand inventory level at current time *t* given by I(t). Since $I(t) \le c_2$, any orders from demand class 3 would be backordered. Similarly, demand at time *t* from class 2 will be filled since $I(t) > c_1$, and demand at time t from class 1 will be filled since I(t) > 0. The critical rationing levels work in the same manner for the general case.

Backorders

As stated previously, we are using a static critical level rationing policy, so whenever onhand inventory is equal to c_{i-1} or below, any demands from class *i* will be backordered. The total unfilled class *i* backorders at time t is given by $B_{i,i}(t)$, which we call the *external* backorders. The backorder cost, b_i , for these class *i* external backorders is incurred over time with units given in dollars per units-backordered per unit-time. The double *i*, *i* subscript will help later to distinguish external backorders from *internal* backorders.

Replenishment

We assume the outside supplier has sufficient capacity to meet all demand from the warehouse, which is why, in Figure 1, the supplier is shown with infinite on-hand inventory. Also, there is a deterministic lead-time, L > 0, after placing an order for replenishment with the supplier. Initially we model a continuous review, one-for-one, base-stock replenishment policy (*S*-1, *S*). When operating under no, or a sufficiently small, fixed ordering cost, we assume base-stock replenishment. However, under a large positive fixed order cost system, an (*r*, *Q*) or (*r*, *S*) policy would be preferred. Figure 1 is demonstrating the (*r*, *Q*) case, where r + Q is the maximum inventory.

We base our continuous review replenishment policy on the inventory position, IP(t), which includes on-hand and on-order inventory. Under an (r, Q) policy we would order Q units when the inventory position reaches the reorder point, r. Under the one-for-one base-stock policy, we place an order with our supplier each time we see a customer demand.

Allocating the Replenishment Quantity

When replenishment arrives from the supplier, we need a way to intelligently fill the outstanding backorders and refill inventory – especially when the replenishment isn't sufficient to both satisfy all backorders and refill the gaps in inventory. Like Arslan et al. (2007), we assume that we allocate the replenishment between unfilled backorders and inventory gaps on a first-come, first-served basis. This allows us to derive the performance measures directly.

But in order to fully understand the method of allocating the replenishment quantity between backorders and inventory, we need to define class *i* shortfalls, $S_i(t)$. The shortfall for class *i*, *i* $\in \{1, 2, ..., N-1\}$ is given by:

(1)
$$S_{i}(t) = (c_{i} - I(t))^{+} + \sum_{j=1}^{t} B_{j,j}(t)$$

The first term could be called the inventory gap, or the number of units needed to bring on-hand inventory back up to the critical level. The second term is the total external backorders for class



i and all higher priority classes at time *t*. For class *N*, the shortfall only includes the external

backorders.

Notice that, for each class *i*, shortfalls increase either when a backorder occurs or when on-hand inventory drops further below the critical level. So, whenever a demand causes shortfall to increase for any of the classes, the occurrence is added to an ordered list of demand-generated shortfalls. Arslan et al (2007) present an algorithm, iterating over the demand classes, that basically allocates the incoming replenishment to the shortfall occurrences as recorded in the ordered list. For an in-depth explanation of the algorithm, see Arslan et al (2007).

Now that the demand class model has been introduced, we will now use the serial-stage system framework as the modeling structure for the DCS.

4. SSS Framework

To make the derivations of performance measures easier, and possibly more understandable, we follow the lead of Arslan et al (2007) and use the framework of a serial-stage system to model the demand class system. This works well because there is already a body of literature that covers serial-stage systems and their performance measures that we can use for our calculations.

Inventory for Each Demand Class

Looking at Figure 2, we see the same DCS example from Figure 1 re-modeled as a SSS. The transformation of policy variables from the DCS model to the SSS model is shown in Figure 3, as relating to the warehouse. In the new modeling approach, demand classes are still generated by backorder costs and ordered with class 1 having the highest priority, and class N having the lowest priority. But in the SSS, we *imagine* separating the warehouse inventory into stages within the warehouse – one stage for each demand class. Mathematically, we treat the system as if it were a multi-echelon, or serial-stage, inventory system. We call the inventory at stage *i* the *local* class *i* inventory, with the local class *i* on-hand inventory given by $I_i(t)$. Under the DCS we only considered I(t), which is the *total* on-hand inventory, and here it has the same meaning and is the sum of the local on-hand inventories for each class.

As shown on the respective inventory meters in the SSS example in figure 2: $I_3(t) = 0$; $I_2(t) = 4$; $I_1(t) = 5$. The total on hand inventory is the same as the DCS in figure 1, I(t) = 9.

Critical Levels to Base-Stock Levels

Under the DCS we used a critical level rationing policy where the level of on-hand inventory determined whether or not we filled an order from a particular class. We used a critical level, c_i , for class $i, i \in \{1, 2, ..., N-1\}$, to designate the on-hand inventory levels at which to backorder demand from class i+1. Because we track on-hand inventory for each stage in the SSS, we no longer need to think of critical levels in the same manner. Instead, we decide to fill a



Transformation of Policy Variables

class *i* demand at time *t* as long as stage *i* local on hand inventory $I_i(t) > 0$, and we backorder class *i* demand otherwise.

Under the SSS framework, the critical level for each demand class is replaced by the base-stock level for its associated inventory stage. As shown in Figure 3, the base-stock level for stage 1 is $s_1 = c_1$, and $s_i = c_i - c_{i-1}$, is the base-stock level for stage *i*, *i* $\in \{2, 3, ..., N-1\}$. You can see how this relationship changes the system model by comparing the critical levels in figure 1 with the base-stock levels in figure 2. Using the base-stock levels defined in the SSS, we follow continuous review, one-for-one base-stock replenishment policies at each internal stage within the system. To accurately mimic the performance under the DCS framework, we set the lead time between the internal stages to $L_i = 0$, $i \in \{1, 2, ..., N-1\}$

Demand and Replenishment

Under this SSS framework we say *external* demand is demand from actual customers in class *i*, and it follows the same Poisson rate, $\lambda_i > 0$, as in the DCS. Stage 1 serves external demand from class 1 customers (as long as $I_1(t) > 0$) and follows a continuous review base-stock replenishment policy – where stage 2 is the "supplier" to stage 1. For the other internal stages *i*, *i* $\in \{2, 3, ..., N\}$, each sees external demand from its own class *i* customers, but also *internal* demand in the form of replenishment requests from stage *i*-1. Still, each stage *i* follows a

continuous review base-stock replenishment policy, with stage i+1 as the supplier, where stage N+1 is the external supplier to the warehouse.

In Figure 2 for example, stage 2 of the SSS model sees external demand from class 2 customers, and internal replenishment requests from stage 1. Stage 2 inventory is replenished according to a base-stock policy, with stage 3 as its supplier.

The lowest priority stage, *N*, sees internal replenishment demand from stage *N*-1 and external customer demand from class *N* customers, but it is replenished by the outside Supplier. Lead time from the Supplier to stage *N* is identical to the lead time in the DCS, $L_N = L > 0$, and total system replenishment from the supplier is also identical to the DCS policy. For the SSS we define stage *N* reorder point $s_N = r - c_{N-1}$, and use the same order quantity, *Q*. Under base-stock system replenishment with base-stock level *S*, we have Q = 1 and r = S-1, giving base-stock level $S = s_1 + s_2 + ... + s_N + 1$.

Internal and External Backorders

For any stage *i*, external backorders, $B_{i,i}(t)$, have already been defined in our discussion of the DCS model. They are the total, unsatisfied class *i* customer demand by time *t*, and we incur a cost b_i for each unit backordered.

Internal backorders were also introduced with the DCS model as equation (1), but they were called class *i* shortfall. In the SSS case, we define $B_{i,i-1}(t)$ to be the internal backorders for stage *i*, where the subscript is used as follows: $B_{i,i-1}(t)$ is the number of replenishment requests from stage *i*-1 that have yet to be filled by stage *i* by time *t*. Thus, the number of internal backorders at stage *i* is equivalent to the number of class *i*-1 shortfall, giving the following relationship:

(2)
$$B_{i,i-1}(t) = S_{i-1}(t) = (c_{i-1} - I(t))^{+} + \sum_{j=1}^{i-1} B_{j,j}(t)$$

Arslan et al. (2007) showed how the SSS formulation approach operates identically to the DCS formulation. We assume the results from the previous work are valid and move forward to the development of the SSS-based mathematical model.

5. The N-Demand Class Inventory Model

Now that we have defined the physics of our DCS in the guise of a SSS, we frequently refer to Arslan et al. (2007) in calculating the performance measures based on the SSS framework. Much of what is shown here is a small variation from the structure defined in previous literature, where we use a base stock policy but Arslan et al. (2007) focuses on an (r, Q) policy. First we will present the relationships for each of the performance measures, and then develop the steady-state versions of the relationships. From there we discuss a sequential process to derive the steady-state distributions for each of the performance measures. We then develop the cost function using the performance measures. We begin by introducing some additional notation.

For *i* \in {1, 2, ..., *N*}:

 $D_i(s, t)$ = total external demand at stage *i* during the time interval (s, t] – we assume t > s. Under Poisson demand for each class, by definition, the distribution of the random variable $D_i(s, t)$ is Poisson with rate $(t-s)\cdot\lambda_i$.

 $B_i(t)$ = total number of unfilled internal and external backorders at stage *i* by time *t*, given by:

(3)
$$B_i(t) = B_{i,i-1}(t) + B_{i,i}(t)$$

 $IN_i(t)$ = net inventory level for stage *i* at time *t*

 $IP_i(t)$ = inventory position for stage *i* at time *t*, which is the net inventory plus on-order inventory.

Net inventory is the key performance measure, as it is used to derive the on-hand inventory and backorders. Net inventory for stage *i* after a lead time, $L_i \ge 0$, is given by:

(4)
$$IN_{i}(t+L_{i}) = IP_{i}(t) - B_{i+1,i}(t) - D_{i}(t,t+L_{i}) - \sum_{j=1}^{i-1} D_{j}(t,t+L_{i})$$

The first term, inventory position at time t, represents on-hand inventory at time t plus the inventory that is on-order at time t – all of which becomes on-hand inventory by time $t + L_i$, at the latest. The second term is the internal backorders unfilled by stage i+1 at time t (meaning, the replenishment requests by stage i, to stage i+1, that are still unfilled at time t), which by definition cannot be filled during the replenishment lead time. The third term simply represents the stage i external demand during the lead time, directly from class i customers. The fourth term represents the *internal* demand from all downstream (higher priority) stages, as we are

assuming a one-for-one, base-stock replenishment within the system. To shorten the expression we simply combine the third and fourth terms into one summation:

(5)
$$IN_{i}(t+L_{i}) = IP_{i}(t) - B_{i+1,i}(t) - \sum_{j=1}^{i} D_{j}(t,t+L_{i})$$

We will now use $IN_i(t)$ to describe the on-hand inventory and total backorders at stage *i*. The following relationships will be used in our calculations:

$$I_i(t) = [IN_i(t)]$$

(7)
$$B_i(t) = \left[-IN_i(t)\right]$$

For stage $i, i \in \{1, 2, ..., N\}$, equation (6) shows how the positive part of net inventory is the onhand inventory at time t, and (7) shows how the negative part of net inventory is the total backorders at time t.

Steady-State Equations

Now, we want to rewrite our equations in steady-state, in much the same manner as Arslan et al. (2007). We do this in order to develop probability distributions for the performance measures, which we will then use in our cost objective. First, for each stage N we rewrite equation (5) to define net inventory in steady state:

(8)
$$IN_N = IP_N - \sum_{j=1}^N D_j^L \quad \text{for stage } N$$

Equation (8) gives the steady-state form for net inventory at stage *N*. The backorder term from equation (5) was dropped due to our assumption that the external supplier always has sufficient capacity to meet our replenishment requests. The new notation for lead time demand (independent of *t*), D_i^L , represents the random variable of total external class i demand during lead time $L_N = L > 0$. Class *i* lead time demand is a Poisson process with rate $\lambda_i \cdot L$. The steadystate inventory position at stage *N* can be shown to vary uniformly between $s_N + 1$ and $s_N + Q$, as stage *N* has the same assumptions used in an (*r*, *Q*) single-stage model from Zipkin (2000). We initially assume a one-for-one base-stock policy with the external supplier, where Q = 1, so the inventory position in steady state stays constant at the base-stock level, $s_N + 1$, giving steady-state net inventory at stage *N* with new notation for stage *N* lead-time demand:

(9)
$$IN_N = s_N + 1 - D^L$$
; where $D^L = \sum_{j=1}^N D_j^L$ and $D^L \sim Poisson(\lambda L)$

(10)
$$IN_i = s_i - B_{i+1,i}$$
 for stages $i, i \in \{1, 2, ..., N-1\}$

Equation (10) gives the steady-state net inventory for stages $i, i \in \{1, 2, ..., N-1\}$. The demand term is dropped from equation (5) since lead time between each stage i is $L_i = 0$, giving Poisson rate $0 \cdot \lambda_i$. Under one-for-one, base-stock replenishment between stages, the inventory position, IP_i , remains constant over time and equals the base-stock level, s_i . The random variable in equation (10) is the stage i+1 internal backorders, and its distribution which will be discussed shortly.

With these steady-state equations defined, we can now find the distribution of net inventory for any stage *i*, given the associated reserve stock level s_i and given the distribution of the applicable random variable. Later, we will treat the s_i 's as decision variables and define a policy, $\mathbf{s} = (s_1, s_2, ..., s_N)$, which will effect the probability distributions of the SSS performance measures as well as the total inventory and backorder costs.

Now that we have the steady-state form for net inventory, we can write the steady-state forms for on-hand inventory and backorders for stages *i*, *i* \in {1, 2, ..., *N*}:

(11)
$$I_i = [IN_i]^{\dagger}$$

$$B_i = \left[-IN_i\right]^+$$

(13)
$$B_i = B_{i,i-1} + B_{i,i} \quad (where \ B_{1,0} = 0)$$

Equations (11), (12), and (13) are simply the steady-state form of equations (6), (7), and (3), respectively. However, we define the internal backorders at stage 1 to be zero, as there are no downstream stages below stage 1. In fact, *total* stage 1 backorders is simply equal to stage 1 *external* backorders, that is, $B_1 = B_{1,1}$.

Generally speaking, once we have the steady-state distribution for total stage i backorders, B_i , we must condition on values of B_i to obtain the distribution of either external

back orders, $B_{i,i}$, or internal backorders, $B_{i,i-1}$. Again extending slightly from Arslan et al. (2007) we use a binomial distribution to describe *both* the internal and external backorders by conditioning on total backorders. That is,

(14)
$$\Pr(B_{i,i-1} = x | B_i = n) = \binom{n}{x} p_i^x (1 - p_i^x)^{n-x}$$

(15)
$$p_i = \frac{\sum_{j=1}^{n-1} \lambda_j}{\sum_{i=1}^{i} \lambda_j}$$

(16)
$$\Pr(B_{i,i} = x | B_i = n) = \binom{n}{x} q_i^x (1 - q_i^x)^{n-x}$$

(17)
$$q_i = \frac{\lambda_i}{\sum_{j=1}^i \lambda_j}$$

where (14) gives the binomial distribution for internal stage *i* backorders, and (16) gives the binomial distribution for stage *i* external backorders. The probability of an internal backorder at stage *i* (once stage *i* inventory falls to zero) is given by (15). Similarly, (17) is the probability of an external backorder at stage *i* when the current on-hand inventory is zero. Like Arslan et al. (2007), we argue the conditional distribution is binomial because stage *i* internal backorders are generated randomly at the Poisson rate of *internal* demand (the sum of all higher-priority class demand rates), and external backorders are generated randomly according to the stage *i* Poisson demand rate. So, if we know the total backorders, we can use the probability of an internal backorder for the binomial probability, as each arriving backorder is either internal or external.

Deriving the Steady-State Distributions

Now that we have the equations for the performance measures, we use a sequential process to derive the steady-state performance measure distributions for all stages of the SSS. Initially, we are assuming a continuous review, one-for-one base-stock replenishment with our external supplier. The following steps of the derivation process are similar to those in Arslan et al. (2007), though we initially focus our efforts on the base-stock replenishment model.

• First, we use equation (9) to derive the steady-state distribution of stage N net inventory, given s_N , the Poisson demand rates λ_i from all stages i $\in \{1, 2, ..., N\}$, and the lead time to the supplier L > 0.

• Second, we use the stage N net inventory distribution to develop the distribution for total stage N backorders, B_N .

• Third, using (14) we condition on B_N to derive the steady state distribution of stage N internal backorders.

• Fourth, we use equation (10) and the given value for s_{N-1} to derive the steady-state distribution of net inventory for stage N-1.

After the fourth step, our sequential derivation process starts over again at the second step. We continue in this manner, iterating down through all the stages until we have found the steady-state distributions for the performance measures for every stage of the SSS.

6. The Cost-Based Objective Function

We now introduce a cost objective that is new to the literature, and it is based on a multiple demand class inventory model with backorders, stochastic demand, and a continuous review base-stock inventory policy for replenishment. We also introduce an enumeration technique that finds the optimal base-stock policy under the assumptions of the 3 demand class instance of this model. We also present a heuristic that performs well, finding the optimal solution in half of the test cases.

First, our expected total system cost for *N* demand classes under an SSS framework is given by:

(18)
$$C(s_1, s_2, ..., s_N) = E\left[\sum_{j=1}^N \left(h \cdot I_j + b_j \cdot B_{j,j}\right)\right]$$

where *h* is the inventory holding cost in dollars per unit, per unit time, and b_i is the cost in dollars per unit backordered at stage *i* per unit time. I_i and $B_{i,i}$ are the steady-state distributions of stage *i* on-hand inventory and external backorders, respectively. Because the expected cost is a

function of the reserve stock levels, we will minimize the expected total cost by choosing the best reserve stock level s_i for each stage *i*.

For *N* classes, we use substitution and basic algebra to manipulate equation (18) to reveal the basic probability functions needed for actual calculation – the final result is given below.

(19)
$$C(s_{1}, s_{2}, ..., s_{N}) = h \cdot s_{1} - h \cdot E \Big[B_{2,1} \Big] + h \cdot G_{B_{2,1}}^{1}(s_{1}) + b_{1} \cdot G_{B_{2,1}}^{1}(s_{1}) \\ + \sum_{j=2}^{N-1} \Big(h \cdot s_{j} - h \cdot E \Big[B_{j+1,j} \Big] + h \cdot G_{B_{j+1,j}}^{1}(s_{j}) + b_{j} \cdot G_{B_{j+1,j}}^{1}(s_{j}) - b_{j} \cdot E \Big[B_{j,j-1} \Big] \Big) \\ + h \cdot (s_{N} + 1) - h \cdot E \Big[D^{L} \Big] + h \cdot G_{D^{L}}^{1}(s_{N} + 1) + b_{N} \cdot G_{D^{L}}^{1}(s_{N} + 1) - b_{N} \cdot E \Big[B_{N,N-1} \Big]$$

Here, the first-order loss function for a particular distribution is given by $G_x^{-1}(y)$, where the subscript, *x*, represents the distribution of the random variable *X*, and *y* is the function variable. The superscript, 1, designates that it is a First-Order loss function. So $G_x^{-1}(y) = E[(X - y)^+]$ is the first-order loss function for the distribution of *X*. The derivations of these probability functions for a three-demand class model will be given later.

Three Demand Classes

For our analysis of the *N*-demand class model under the SSS framework, we will use a 3-demand class example where we assume one-for-one, base-stock replenishment with the supplier. Using (19), we can write the three-demand class cost objective:

(20)
$$C(s_{1}, s_{2}, s_{3}) = h \cdot s_{1} - h \cdot E[B_{2,1}] + h \cdot G_{B_{2,1}}^{1}(s_{1}) + b_{1} \cdot G_{B_{2,1}}^{1}(s_{1})$$
$$+ h \cdot s_{2} - h \cdot E[B_{3,2}] + h \cdot G_{B_{3,2}}^{1}(s_{2}) + b_{2} \cdot G_{B_{3,2}}^{1}(s_{2}) - b_{2} \cdot E[B_{2,1}]$$
$$+ h \cdot (s_{3} + 1) - h \cdot E[D^{L}] + h \cdot G_{D^{L}}^{1}(s_{3} + 1) + b_{3} \cdot G_{D^{L}}^{1}(s_{3} + 1) - b_{3} \cdot E[B_{3,2}]$$

where decision variables $s_1, s_2 \ge 0$ (non-negative because of how they are determined from the critical levels c_1, c_2), represent the base-stock levels for stages 1 and 2. The decision variable $s_3 = r - c_3$ is the reorder point for stage 3, and can be positive or negative since $r - c_3$ unrestricted in sign. Because we are assuming base-stock replenishment, $s_3 + 1$ is the basestock level at stage 3 – it can be negative or positive. The inventory holding cost is $h \ge 0$, and the backorder costs for the different classes are given by: $b_1 > b_2 > b_3 \ge 0$. Generally, the cost to backorder is more than the cost to hold inventory, so as we introduce our example model, we consider holding costs that are strictly less than stage 1 backorder costs, $h < b_1$.

Calculating Cost

We hope to minimize (20) using s_1 , s_2 , and s_3 as decision variables, but in order to just compute the cost for a particular set of parameters, we need to derive the associated probability functions. Namely, we need to calculate the following:

First-order loss functions: $G^1_{B_{2,1}}(s_1)$ $G^1_{B_{3,2}}(s_2)$ $G^1_{D^L}(s_3+1)$ Expectations: $E[B_{2,1}]$ $E[B_{3,2}]$ $E[D^L]$

Because of the way these loss functions and expectations are interrelated, we must derive them sequentially. We do not include the complete derivation sequence for our three-demand class analysis. For the actual computation we used the programming capabilities of Maple® 9.5.

6.1 Enumeration Procedure for Three Demand Classes

For our cost calculations we consider 24 distinct variations of parameter values, and all instances have been numbered according the order they have been computed. The parameter values we consider are:

Two levels for holding costs, h = 0.5; 0.1

Four possible combinations of backorder costs, $(b_1, b_2, b_3) = (*1.0, 0.8, 0.4); (1.0, 0.8, 0.2); (1.0, 0.2, 0.1); (1.0, 0.2, 0.05)$

Three possible combinations of demand rates, $(\lambda_1, \lambda_2, \lambda_3) = (5.0, 3.0, 1.0); (3.0, 3.0, 3.0); (1.0, 3.0, 5.0)$

Lead time to supplier is fixed at L = *1.

*We assume both the time units and the monetary units can be chosen, so we set $b_1 = 1.0$ and L=1.0 in all of our problem instances.



In our Maple code, if we choose a particular problem instance (i.e. the set of parameters: h=0.5, $(b_1, b_2, b_3)=(1.0, 0.8, 0.4)$, and $(\lambda_1, \lambda_2, \lambda_3)=(5.0, 3.0, 1.0)$) we need to compile all of the first-order loss functions and related distributions first. Then, with the probability functions in place, we can compute cost for any values of s_1 , s_2 , and s_3 .

For each instance of the problem, we computed 784 combinations of the decision variables s_1 , s_2 , and s_3 . We used Maple to compute the 18,816 different cost values needed for the 24 problem instances. Early-on in the calculation process, it was clear that the cost function, equation (20), was unimodal (had a clear minimum) over s_3 for a fixed (s_1 , s_2) pair. So for each (s_1 , s_2) pair (there were 56 pairs considered in all), we considered a range of 14 values for s_3 where the minimum was strictly inside the range boundaries. We were able to find global minimums for all 24 problem instances through this process.

Exploring the Cost Structure

Now that we have a preliminary set of numerical results, including global minimums, we utilize the cost structure to develop some definitions to aid in minimizing total expected cost. To begin with, we use the structural property mentioned above, where the cost function was seen to be unimodal over s_3 for a fixed (s_1 , s_2) pair. We define this minimum cost for a given s_1 , s_2 :

(21)
$$T^*(x, y) = \min_{s} \{ C(s_1 = x, s_2 = y, s_3) \}$$

We now hope to minimize T^* to find the global minimum of the total expected cost. Initially, we iterated over the (s_1, s_2) pairs in a weaving pattern, as shown in Figure 4. While not ideal, this weaving iteration path provides a methodical way to explore the structure of T^* .

The graphs in Figure 5 show the landscape of the T^* values in the direction of the weave iteration (with the global minimum marked) for three problem instances. Instance **A** sees its global minimum in the second "valley," **B** sees its minimum within two iterations, and **C** sees its global minimum in the third valley. Because the nature of T^* is similar for our problem instances, to minimize in the direction of the weaving iteration may require a complex heuristic, especially for more difficult problem instances not considered here.



minimize T^* over a subset of (s_1, s_2) pairs, called **Figurani** *d levels*. We define a *pyramid level*, based on the weave iteration path in figure 3, to be the set of all (s_1, s_2) pairs on a single diagonal line. For example, pyramid level 0 is simply the pair (0, 0), pyramid level 1 is the set of pairs $\{(1, 0); (0, 1)\}$, pyramid level 2 is the set $\{(2, 0); (1, 1); (0, 2)\}$, and pyramid level *m* is given by the set: $\{(m, 0); (m-1, 1); (m-2, 2); ...; (1, m-1); (0, m)\}$. We define $V^*(m)$ to be the minimum T^* over all (s_1, s_2) pairs in a pyramid level *m*:

(22)
$$V^*(m) = \min \left\{ T^*(m,0), T^*(m-1,1), T^*(m-2,2), \dots, T^*(1,m-1), T^*(0,m) \right\}$$

Now, if we graph V^* over iterations of the pyramid levels, we see that it is simpler to find the global minimum using V^* than by just using the weave iteration with T^* . Figure 6 gives the graphs of V^* for the same problem instances as in Figure 4, and we see that the minimum costs over each iteration of the pyramid level appears unimodal. The global minimums for the three problem instances are marked in Figure 6. The structural findings are similar for all of the 24 problem instances we enumerated, so we proceed to the development of a faster enumeration technique based on this structure.

We seek to minimize equation (20), or in other words, to find the global minimum of expected total cost for a *three* demand class inventory model with backordering, Poisson demand, and one-for-one base-stock replenishment. We use an enumeration algorithm to find the minimum total expected cost, C^* , and the related demand-class inventory policy, (s_1^*, s_2^*, s_3^*) . We break this minimization procedure down into two sub-algorithms to find T^* and V^* , and then our global enumeration algorithm uses the sub-algorithms to come to the optimal solution.



V^* vs. Pyramid Level Iteration

While this paper does not prove the convexity of Ψ^* , we have seen that for every test case we explored, including those not reported in this paper, V^* appeared to have a clear global minimum and to be unimodal over iterations of the pyramid levels. However, proving such things as the convexity V^* may be extremely difficult or impossible, and we leave the full analysis of the structure of V^* to later research. We expect that there is a clear way to show that, to the left of the minimum, the cost is non-increasing, and to the right of the minimum it is nondecreasing.

6.2 Heuristic Development

Here we develop another approach to solving the model, because the enumeration approach outlined above is both computationally intensive and only useful for the 3-demand class model.

So, we present a heuristic to find optimal, or near-optimal, solutions to the multiple demand class inventory model when assuming a base-stock (S-1, S) replenishment policy.

The idea behind the heuristic is to find the base-stock inventory level at each stage *i* that balances the complimentary cumulative distribution function of available class *i* local stock against the ratio of holding cost over total cost per unit time. This means, for each stage *i* we want to choose the smallest reserve stock level s_i that ensures that the likelihood of running out of stock The heuristic results in a solution policy that can be described by the decision variables $(s_1^*, s_2^*, ..., s_N^*)$.

Heuristic for minimizing cost of N demand class base-stock policy

```
Step 0 (initialize):

Set i = N

Set s_1 = s_2 =, ..., = s_N = 0

Step 1 (find s_N^*):

While G_{D^L}^0(s_N) > h/(h+b_N), set s_N = s_N + 1

Go to Step 2

Step 2 (update):

Set s_i^* = s_i

If i = 1, Stop. Have solution: (s_1^*, s_2^*, ..., s_N^*).

Else, Set i = i-1

Go to Step 3

Step 3 (find s_i^*):

While G_{B_{i+1,i}}^0(s_i) > h/(h+b_i), set s_i = s_i + 1

Go to Step 2.
```

8. Optimal Solutions for 3 Demand Classes

We now wish to glean some managerial insight from the results of our computations and algorithmic solutions. The algorithmic procedure we developed found the exact optimal solution in all 24 problem instances, and so we ran 24 additional test cases – changing the parameters for class demand rates. We will be basing our discussion on the resulting solutions for all 48 test cases.

Holding Costs

In our 24 test cases, we considered a holding cost of either h = 0.5 or 0.1. Generally, in relation to backorder costs, holding cost is lower. Here, we only looked at cases where the holding cost is strictly lower than class 1 backorder costs – half the cost and one-tenth the cost to be specific, since $b_1 = 1.0$ for all test cases.

To minimize the total expected cost, we are looking for a balance between the expected total holding cost and the expected total backorder costs. When holding cost is high (h = 0.5 vs. h = 0.1), this leads to lower overall inventory held – in the form of smaller base-stock levels (s_1 , s_2 , s_3+1). With smaller base-stock levels, we would be more likely to benefit from rationing, as it would help to curb costs from increased backorders. The results show evidence that the above properties hold in most cases.

Backorder Costs

Because differing backorder costs are the source of customer differentiation, we want to see how the optimal solution changes based on the magnitude of backorder costs between high priority and lower priority customers. Four sets of backorder coast were considered: $(b_1, b_2, b_3) = (1.0, 0.8, 0.4)$; (1.0, 0.8, 0.2); (1.0, 0.2, 0.1); (1.0, 0.2, 0.05).

The first set, (1.0, 0.8, 0.4), is used to represent cases where there is little variation of backorder costs between the three demand classes. Variation between costs increases respectively over the four sets to the last set of backorder costs, (1.0, 0.2, 0.05), which is used to represent cases with the highest variation of backorder costs between the three demand classes.

We expect that little or no inventory rationing is needed for problem instances where there is low variation between the backorder costs. This makes sense because if the costs were the same, there would have to be a different way to differentiate between low and high priority customers, or all customers would be treated the same. The full results show this to be true in the 8 cases with $(b_1, b_2, b_3) = (1.0, 0.8, 0.4)$; in fact, all 8 low-cost-variation cases never see an optimal solution where $s_1 > 0$, and 5 out 8 of these cases reduce to a solution, i.e. $(s_1, s_2, s_3) =$ (0, 0, 8), for a model with no demand classes.

As expected, the high-cost-variation cases, $(b_1, b_2, b_3) = (1.0, 0.2, 0.05)$, have optimal solutions with a broader range of values found for (s_1, s_2, s_3) . The other two cases have ranges of optimal solutions that vary as similarly expected.
Overall, as the variation in backorder costs increases, the base-stock level solution values are "shifted" from low priority classes to high priority classes, while inventory level remains the same.

In Table 1, showing four cases, the backorder costs start in Case No. 21 with low variation between classes and increase to high variation in Case No. 24. You can see in the optimal solutions that while the total of the values for (s_1, s_2, s_3) remain the same, the values are being spread out to the higher priority classes as the variation in cost becomes greater.

Case											
No.	Holding cost	Backorder costs		Demand rates		Optimal Solution					
-	h	b 1	b ₂	b 3	lam1	lam2	lam3	<i>S</i> ₁	<i>S</i> 2	S 3	Total Cost
21	0.1	1	0.8	0.4	5	3	1	0	1	11	0.5498
22	0.1	1	0.8	0.2	5	3	1	0	2	10	0.542644
23	0.1	1	0.2	0.1	5	3	1	1	1	9	0.47047
24	0.1	1	0.2	0.05	5	3	1	1	2	8	0.465061

Table 1

Demand Rates

The last set of factors that affect the optimal solution for our three demand class model is the class demand rates. For each demand class, demand for goods follows a Poisson process with mean λ_i , also called the class *i* demand rate. In our original 24 test cases, we considered three sets of demand rates, where $(\lambda_1, \lambda_2, \lambda_3) = (5.0, 3.0, 1.0)$; (1.0, 3.0, 5.0); (3.0, 3.0, 3.0). Basically, we wanted to see cases where demand was more likely from the highest priority class and less likely from the lowest priority class, and vice-versa. We also looked at the case when demand rates were the same for each class.

The optimal solution acted similarly to when we were looking at different levels of variation in the backorder costs. However, when the demand rates were higher for the low priority customers, the optimal solution was generally closer to the optimal policy for an inventory model without demand classes.

Conversely, when the high priority class had the higher demand rates, the optimal solution was generally more varied in its base-stock values – validating the need to use a multiple-demand class model to minimize costs.

When demand rates were even across the demand classes, the optimal policy seemed to be more affected by other policy parameters such as variation between backorder costs. Similar results were found in the additional 24 cases where only the algorithm was used to determine the optimal solution. The additional cases included the following demand rates (λ_1 , λ_2 , λ_3) = (3.0, 5.0, 1.0); (1.0, 5.0, 3.0); (13.0, 7.0, 1.0).

9. Conclusions & Future Research

We have introduced an *N*-demand class inventory model with backordering, Poisson demand, and continuous review base-stock replenishment. We assume the use of critical rationing levels to ration inventory between the classes of customers based on priority. We develop the demand class model using the framework of a serial-stage inventory system, and we are the first to do so in an attempt to minimize a cost-based objective.

We analyzed an example model with three demand classes, enumerating over the total expected cost objective to find the global minimums of 24 problem instances. We developed an enumeration algorithm based on the structure of the cost objective, and it has successfully found the optimal value for all of our 24 problem instances. A heuristic was also developed that performed much faster than the enumeration approach, and it was able to find the optimal solution in half of the test cases.

We have seen that the when the backorder costs at each stage are significantly different, the demand class model is more applicable. Also, the solution to the demand class model can validate the need to reserve stock. If, for instance, the solution to the demand class model sets the base-stock levels to zero for all but the lowest priority stage, the demand class model is not necessary, and it reduces to a regular base-stock model.

If there are significant differences in the demand rates between different customer classes, and the highest priority class has the highest demand rate, it is more useful to use a multiple demand class model. Different holding costs affect the model, as well.

Future research might include a model where joint decisions for critical levels and product price are included, as this is where revenue management seems to intersect with inventory management in the literature. There may also be some use for a multi-echelon inventory model where both external and internal demand is allowed at each stage, as some supply chains are structured in this way. Research in the area of contract pricing might also benefit from applying a demand-class modeling approach to compute the cost of including a particular customer in a pre-defined class.

References

- Arslan, H., S. C. Graves, T.A. Roemer. (2007). A single-product inventory model for multiple demand classes. *Management Sci.* 53(9) 1486-1500.
- Cohen, M. A., Kleindorfer, P.R., Lee, H.L. (1988). Service constrained (s, S) inventory systems with priority demand classes and lost sales. *Management Sci.* **34** 593-499.
- Deshpande, V., M. A. Cohen, K. Donohue. (2003). A threshold inventory rationing policy for service-differentiated demand classes. *Management Sci.* **49**(6) 683-703.
- Ding, Q., Kouvelis, P., & Milner, J. (2016). Inventory Rationing for Multiple Class Demand under Continuous Review. *Production and Operations Management*, 25(8), 1344–1362.
- Fadiloğlu, M. M., & Bulut, Ö. (2010). A dynamic rationing policy for continuous-review inventory systems. *European Journal of Operational Research*, 202(3), 675–685.
- Hung, H. C., Chew, E. P., Lee, L. H., & Liu, S. (2012). Dynamic inventory rationing for systems with multiple demand classes and general demand processes. *International Journal of Production Economics*, *139*(1), 351–358.
- Kaplan, A. (1969). Stock rationing. *Management Sci.* 15 (5) 260-267.
- Kleign, M. J., R. Dekker. (1998). An overview of inventory systems with several demand classes. Econometric Institute Report 9838/A, Erasmus University, Rotterdam, The Netherlands.
- Liu, S., & Zhang, C. (2015). An efficient inventory rationing strategy for systems with two demand classes and backordering. *International Journal of Production Research*, *53*(20), 6136–6142.
- Moon, I., S. Kang. (1998). Rationing policies for some inventory systems. *Journal of the Operations Research Society*. **49** 509-518.
- Nahmias, S., S. Demmy. (1981). Operating characteristics of an inventory system with rationing. *Management Sci.* **27**(11) 1235-1245.
- Pang, Z., Shen, H., & Cheng, T. C. E. (2014). Inventory rationing in a make-to-stock system with batch production and lost sales. *Production and Operations Management*, 23(7), 1243–1257.
- Schulte, B., & Pibernik, R. (2016). Service differentiation in a single-period inventory model with numerous customer classes. *OR Spectrum*, *38*(4), 921–948.

Topkis, D.M. (1968). Optimal ordering and rationing policies in a nonstationary dynamic

inventory model with *n* demand classes. *Management Sci.* **15**(3) 160-176.

- Teunter, R.H., W.K. Klein Haneveld. 2008. Dynamic inventory rationing strategies for inventory systems with two demand classes, Poisson demand and backordering. *European Journal of Operational Research*. **190** 156-178
- Vicil, O., P. Jackson. (2006). An exact optimal solution to a threshold inventory rationing model for multiple priority demand classes. *Cornell U. School of ORIE Technical Report No.* 1450
- Veinott, A. F. (1965). Optimal policy in a dynamic, single product, nonstationary inventory model with several demand classes. *Oper. Res.* **13**(5) 761-778.

Zipkin, P.H. (2000). Foundations of Inventory Management. McGraw-Hill, New York.

RESOURCE ALLOCATION DECISION IN IMPROVING MULTIPLE MARKETING CHANNELS

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RESOURCE ALLOCATION DECISION IN IMPROVING MULTIPLE MARKETING CHANNELS

Abstract

A supply chain employing multiple marketing channels, needs to continually enhance these channels for achieving competitive advantage. The purpose of this paper is to investigate the issue of selecting and investing in specific channel structures for improving overall supply chain profitability. This study is motivated by many existing firms that typically utilize four channel structures, viz. (i) online, (ii) company-owned store, (iii) third-party retailer, and (iv) online-to-store configurations. In pursuing our objective, an analytic network process (ANP), that considers both customer priorities and demand correlations among channels, is developed. Utilizing a proposed benefit-cost ratio metric, which incorporates customer input data, as well as relevant operating costs, we outline a procedure for determining the optimal allocation of a limited investment budget among these channels. Our analysis indicates that, in terms of improving profitability, brick-and-mortar channels, in comparison with online and online-to-store structures, are more sensitive to the service level offered by management. Under relatively high service level specifications, investments in online and online-to-store channels appear to be more desirable than those in company-owned store and third-party retailer structures. In addition, relatively high uncertainty in market demand appears to affect the investment decisions in a similar manner.

Keywords

Operations research in marketing, Supply chain channel structure improvement, Multi-criteria investment decisions, Multi-channel retailing

Introduction

In recent years, rapid growth in information technology and increasing internet access for consumers in various market segments within the United States, have drastically changed the purchasing behavior of consumers. These developments make it imperative for many firms to provide more than one way for customer demand fulfillment, to maintain and grow their market shares.

Although establishing multiple channel structures tend to attract more customers (Hitt & Frei, 2002; Venkatesan, Kumar, & Ravishanker, 2007), businesses and companies still need to continually improve these channels in order to be competitive in the marketplace. Nevertheless, the process of existing channel structure improvement is regarded as more complex for companies with multiple sales channels. In order to achieve increasing profitability, such companies need to address the strategic issue of effective allocation of their limited budgetary resources among already established, alternate sales channels. The extant body

of literature, however, is deficient in this respect and does not adequately deal with this important problem area. This research gap provides the major impetus and motivation for undertaking this study, which is focused on firms that provide four commonly employed options to their customers in making their purchases. These are: (i) the customer places an order online and receives it at home, (ii) the customer travels to and purchases directly from a company-owned store, (iii) the purchase is made from a third-party retail facility, and (iv) the order is placed online and is picked up by the customer from a company-owned store.

Methodology

In this paper, we introduce a model for budgetary resource allocation among the various competing channels. The basic model consists of an ANP methodology for measuring the interrelationships among the channel structures and a cost model for considering the operational costs associated with each channel function. We develop an ANP framework for quantifying the customer preference priorities which are incorporated in the channel investment problem.

Although customers' inputs are critically important, they are not adequate in making budgetary allocation decisions among the various channel structures. Wang et al. (2016) emphasize the role of relevant operating costs in channel structures. They believe that some companies have failed in implementing successful multiple distribution channels as a result of disregarding the importance of the respective operating costs associated with these channels. To develop the operating cost function for each channel structure in our model, we include all relevant costs related to the firm's products, in a multi-product multichannel setting. To develop the operating cost function for each channel structure, we include all per unit costs of product including shipment, packaging, ordering, inventory, employee costs. In doing so, we will find demand and costs, respective to each channel structures in a multi-channel construction. It should be noted that price can be different in various channels (Gao et al., 2016; Liu et al., 2010; Vogel & Paul, 2015; Wolk & Ebling, 2010; Zhang et al., 2012). Finally, we allocate the limited budget based on a linear programming model.

Discussion and conclusions

In this paper, we propose a novel analytical approach to allocate an investment budget to a firm's retail distribution channels for enhancing its competitive position through improvements in the performance of these channels. The model relies on customers inputs, which are explicitly quantified, in conjunction with quantifiable relevant operating costs. The suggested procedure outlines a broad framework for arriving at customer-driven investment decisions in the various sales channels, employed by many multichannel retailing organizations. To the best of our knowledge, this paper is the first to provide a thorough analysis of the main determinants for investment towards improving channel structures. More specifically, we explicitly resolve a major issue that most manufacturers encounter in multichannel retailing. This involves

possible demand correlation between different sales channels. In fact, having multiple channels can either enhance overall demand across all channels or may result in some degree of demand cannibalization among the channels.

In the eventual channel investment decision, trade-offs between customer criteria and the firm's expenditures need to be examined directly and explicitly. Moreover, budgetary constraints and other limitations imposed on decision makers have been largely ignored in the relevant literature. To remedy this shortcoming of current research, we determine the operational costs associated with the various channel structures and propose a benefit-to-cost metric. Consequently, these benefit-over-cost ratios, derived from our analyses, are utilized to optimize the budget allocation decision for competing channel improvement proposals, subject to the firm's limited budget.

References

References available upon request.

SUPPLIERS' LEARNING: AGGREGATE AND INDIVIDUAL LEVELS

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ABSTRACT

This research uses the results of laboratory experiments in which subjects playing the role of suppliers compete for the business of a buyer outsourcing the production of a commodity product. Prior studies show that these experimental results significantly deviate from theoretical predictions. This study uses the quantal response equilibrium to consider whether bounded rationality and learning effects can offer some explanation for these variances. Moreover, we conduct individual level analysis and employ K-means clustering method to explore the main prevalent learning patterns within the subjects. Our findings show that subjects, based on their learning behavior, can be categorized in (a) Randomizer Learners, who do not learn as the model predicts; (b) Strong Learners, who learn in a way that model explains and learn faster than randomizer learners, (c) Non-Learners, who do not learn. We also discuss these learning behaviors in three different competition setups and compare the aggregate and individual level analyses.

Keywords: Behavioral Operations Management, Learning, Individual Level, Heterogeneity, Bounded Rationality.

1. INTRODUCTION

Behavioral operations management (BOM) research explores the theoretical and practical implications of incorporating behavioral and cognitive factors into operations models to understand how operations management (OM) decisions are made in reality, and how different behavioral factors affect them. Although the study of behavioral issues is relatively new in OM, many researches have adopted the behavioral operations perspective. One of the main findings of these studies is the deviation of actual behaviors from theoretical predictions. To explain this deviation, various behavioral models have been proposed. One of the well-studied models in this domain is bounded rationality of the individuals, in which people make random errors in their aim to make the best decision. To study this phenomenon in competition models, quantal response

equilibrium (QRE) is the most employed model in the literature. Based on the assumption of occurring random errors in the decision-making process, the QRE considers that decisions follow a probability distribution in which the most probable decision is the one with the highest payoff. This approach has been used in this study to investigate the decision-makers' behaviors.

In BOM literature, many studies are based on newsvendor problem, in which a decision-maker orders inventory before a selling season to meet her stochastic demand. Here, the main challenge is matching the supply (order quantity) with the uncertain demand. Despite the perceived simplicity of this problem, subjects cannot make the optimal decision. Experimental studies show that newsvendors make systematic errors. In the business world, decision-makers are faced with far more complicated situations. For instance, there is usually more than one retailer in a supply chain. These retailers and their fulfilled order quantities are not independent of each other. Price, ordered quantities, and relationship with suppliers are examples of parameters affecting retailers' payoffs. Therefore, people face a more complicated problem to solve. Consequently, the influencing behavioral factors and even their effects might be different in different contexts. Thus, this study contributes to BOM literature by investigating learning behavior of the subjects in a simultaneous competition, in which two suppliers compete for the demand of a single buyer. This paper, to the best of our knowledge, is the first study that looks at trends in subjects' decisions over time to investigate learning behavior of the suppliers in a supply chain competition.

Another contribution of this study is exploring the subjects' behavior at the individual level. In literature, most of the behavioral studies have reported the results based on the aggregated behavior of all subjects. However, it is easy to observe that decision-makers behave differently. Hence, looking only at aggregate level analyses could be quite misleading (Lau et al. 2014; Wu and Chen 2014). In fact, "what was thought to be a single phenomenon is in reality composed of assorted heterogeneous elements" (Lau et al. 2014, p. 72). Thus, besides the aggregated level study of learning behavior, we analyze the data at the individual level to explore the heterogeneity of learning behavior and find the most prevalent behaviors. This helps us to categorize the subjects based on their learning behaviors.

The rest of this paper is organized as follows. Section 2 briefly reviews the prior studies in bounded rationality, learning behavior, and heterogeneity of decision-makers in BOM. Section 3

explains our model formulation and experimental design. In section 4, we present the results. Discussions are presented in section 5. Finally, we offer the concluding remarks in section 6.

2. RELATED LITERATURE

Behavioral decision-making is a well-established research area in many disciplines (e.g. economics, marketing, psychology). In contrast to the normative research that examines "what a decision-maker should rationally do", research in this area focuses on explaining "how real decisions are made" (Loch and Wu 2007). In recent years, researchers in OM have started exploring the theoretical and practical implications of incorporating behavioral and cognitive factors into operations models. Review of behavioral studies in OM can be found in Bendoly et al. (2006), Loch and Wu (2007), Gino and Pisano (2008), Wachtel and Dexter (2010), and Kundu et al. (2015). Review of the BOM literature shows that most of the prior studies focus on newsvendor problem and its variations. However, this research focuses on competition in an outsourcing setup (see Elahi (2013) for a comprehensive review). Although many theoretical studies have been done in this area, there are very few experimental studies to examine the existing models (Ahmadian et al. Unpublished). This paper studies suppliers' learning behavior in a simultaneous competition, in which suppliers compete for a higher share of a buyer's demand. For this purpose, we use the bounded rationality model. The idea here is that in decision-making, the rationality of individuals is limited by the information they have, the cognitive limitations of their minds, and the finite amount of time they have to make a decision. Bounded rationality has been investigated in many BOM studies. However, there are a few studies of it in a simultaneous game (e.g., Chen et al. 2012; Chen and Zhao 2015; and Elahi and Blake 2015). In this study, we use the QRE framework to model bounded rationality at both aggregate and individual level. Employing the proposed model by Chen et al. (2012), we explore the leaning behavior in our setting.

2.1. Learning

People usually make fewer mistakes when they become more experienced. As a result, they can overcome their behavioral biases more effectively. Indeed, getting experienced helps people to behave more rational which leads to making better decisions. In behavioral studies, this phenomenon can be observed in a repetitive process where the subjects make their decisions on the same problem over several rounds. This observation has been studied as learning in the behavioral literature. For instance, Wu and Katok (2006) in the beer distribution game, Bolton and

Katok (2008), Bostian et al. (2008), Benzion et al. (2008), and Rudi and Drake (2014) in newsvendor problem, Kalkanci et al. (2011), Chen et al. (2012), and Chen and Zhao (2015) in supply chain literature, and Song and Zhao (2016) in a study of customers' behavior in a monopolistic seller system, have investigated the learning behavior and have found support for its presence in their experimental results. Chen et al. (2012) examine a competition between retailers for the limited capacity of a common supplier. They investigate the decisions of the retailers, and by comparing the experimental results with theory find that the subjects' average order is lower than what the Nash equilibrium predicts. They explain that in the real world, the two strong assumptions that underlie the Nash equilibrium (subjects are perfect profit maximizers, and they have complete information) do not hold. By using the QRE model, they show that subjects in a supply chain competition become more rational through repeated decisions, and their decisions approach theoretical predictions as the experiment proceeds. The paper by Chen et al. (2012) is similar to our paper since both study simultaneous competition in the supply chain. However, our study differs in several ways. First, the experimental setup of our study is different from the former study. In this paper, we investigate the learning behavior of suppliers in a supply chain competition. We actually extend the previous work by Elahi and Blake (2015), in which two suppliers compete for the demand of a single buyer. Second, this study, besides the aggregate level result, analyzes the data at the individual level and explores the heterogeneity in subjects' learning behavior.

2.2. Heterogeneous Decision-Makers

Heterogeneity of the decision-makers has attracted the attention of behavioral researchers in both economics and OM studies. Findings of these studies show that no single pattern fits all the subjects (e.g., Engelbrecht-Wiggans and Katok 2006; Moritz et al. 2013; Lau et al. 2014). Hence, they emphasize the importance of the analysis at individual level and call for theories to explain individual variances in behavioral studies (e.g. Doerr et al. 2002; Croson and Donohue 2002& 2006; Bendoly et al. 2006; Bolton and Katok 2008; Su 2008; Kremer et al. 2010; Lau et al. 2014). Recently, in a newsvendor study, Wu and Chen (2014) model various forms of non-optimizing behavior and observe that individuals behave differently. To classify the subjects, the authors use an adaptive learning model consisting behavioral parameters for memory, reinforcement, demand-chasing, forward-looking, mean demand anchoring, threshold anchoring, and random error. Results show that the overall population is a combination of various groups behaving differently. In this paper, we analyze our data at aggregate and individual level to explore the subjects' learning

behavior at both levels. Individual-level analysis helps us to find the most prevalent behaviors of the subjects, and categorize them.

3. MODEL FORMULATION AND EXPERIMENTS

In our study, we are using experimental results from the supply chain setup presented in Elahi (2013), which consists of a single buyer who outsources the production of a product among N potential make-to-stock suppliers. Demand from the buyer is generated according to a Poisson process and is allocated to suppliers proportional to a competition criterion. The allocation can be based on the suppliers' fill-rates (termed here as a service competition), suppliers' base-stock level (termed here as an inventory competition), or a combined performance measure (termed here as optimal competition), which intensifies the competition to its highest level and can result in the best outcome for the buyer. For more details see Elahi (2013).

To investigate the performance of the decision-makers under the competition and compare the results with theory, we conducted a series of experiments using nine different treatments. In addition to three competition types (i.e., service, inventory, and optimal competitions), we considered three treatments for each of them consisting suppliers with identical cost structures, suppliers with different production costs, and suppliers with different inventory holding costs. Each experiment consists of 30 independent rounds in which subjects make a decision. The model formulation and details of our experiments can be found in Elahi and Blake (2015).

To model randomness in subjects' decisions, we use the concept of QRE, which assumes that each subject's decisions follow a probability distribution, in which the best decision (the decision that maximizes the subject's expected profit) has the highest probability of occurrence. The equilibrium probability distribution is a fixed point. That is, at the equilibrium, the belief distribution of each subject about the opponent's decisions is the same as the choice distribution of the opponent. The belief distributions determine a subject's expected profit for each decision the subject makes, while the choice distribution is determined by the expected profit. Chen et al. (1997) show the existence and uniqueness of this equilibrium when the subjects' set of choices is discrete and the choice probabilities are described by a logit distribution. The suppliers' decisions in our experiments are considered to be their base-stock levels, z_i . Let Ω_i be the set of possible decisions for supplier *i*. Using a logit form, the choice probabilities can then be defined as

$$\Pr(z_i) = \frac{exp\left[\frac{E\pi_i(z_i)}{\beta(t)}\right]}{\sum_{\omega_i \in \Omega_i} exp\left[\frac{E\pi_i(\omega_i)}{\beta(t)}\right]}, \quad \forall z_i \in \Omega_i$$
(1)

In this equation, $E\pi_i(z_i)$ is the expected profit of supplier *i* over all possible random decisions that can be made by their competitors (according to the belief distribution) when supplier *i* chooses a base-stock level of z_i . Therefore, the probability of each decision increases with the expected profit of that decision. Parameter β , bounded rationality parameter, shows the supplier's limitation in choosing the best decision, and we consider it to be a function of time (decision round number), as shown in the following equation:

$$\beta(t) = \gamma + (\alpha - \gamma) \times e^{-\delta \times (t-1)}$$
(2)

in which α is the initial value of β , γ is the eventual value of β , δ is the rate of learning, and t is decision round of the experiment. It is easy to see that when $\beta \rightarrow \infty$ then all possible decisions will have the same probability (uniform distribution). In other words, when $\beta \rightarrow \infty$ the supplier has no tendency toward the best decisions (the decisions are made in a completely random fashion). On the other hand, $\beta = 0$ means that the supplier is perfectly rational, and the best decision will always be chosen with a probability of one. Figure 1 shows, for example, the equilibrium distributions for different values of β under the service competitions when the suppliers are identical. As we can see, the equilibrium distribution becomes flatter as β increases.



Figure 1. Equilibrium probability distribution of decisions

We use the Maximum Likelihood Estimation (MLE) method to find the values of the parameters in equation (2), that best explain the subjects' behavior under each type of competition. More specifically, in this method, we find the values that maximize the likelihood of the

occurrence of the observed decisions under each type of competition. Let *T* be the total number of decisions made by each subject (T = 30 in our experiments), and *m* be the number of subjects. The set of all base-stock decisions made by subjects during an experiment can then be defined as $\mathbb{Z} = \{z_{it} | i = 1, ..., m \text{ and } t = 1, ..., T\}$. Hence, the logarithmic form of our likelihood function can be written as:

$$L(\alpha, \gamma, \delta, \epsilon | \mathbb{Z}) = \sum_{i=1}^{m} \sum_{t=1}^{T} \ln[(1-\epsilon) \cdot \Pr(z_{it}) + \epsilon \cdot \frac{1}{|\Omega|}]$$
(3)

where $Pr(z_{it})$ is calculated by equation (1). In this model, to capture the effect of other factors not included in the utility function, we modify the likelihood function by adopting a unified error term, ϵ , which shows the probability of choosing the base-stock level in a completely random fashion. This means that the QRE model is followed with a probability of $(1 - \epsilon)$, while, with a probability of ϵ , subjects choose their base-stock levels from a uniformly distributed decision set.

We model the randomness in subjects' decisions by considering two models, static and learning model. In the static model, $\alpha = \gamma$ and $\delta = 0$, hence there is no learning effect and $\beta(t)$ is constant over all rounds. However, in the learning model, β varies over time to explore the learning effect. Moreover, we consider the Nash equilibrium as well to compare its performance in predicting the decisions with the two other models. At Nash equilibrium, $\alpha = \gamma = \delta = 0$, and $\beta(t) = 0$ over all rounds. Furthermore, since different types of competition impose different levels of decision complexity to the subjects, we have considered a different value of β for each type of competition and have analyzed each competition type separately.

4. AGGREGATE LEVEL ANALYSIS

In the aggregate level analysis, we use the average decision of all subjects in each round to analyze our data. Indeed, we assume all participants of each treatment in our experiment are homogeneous and behave in the same way.

4.1. RESULTS

Table 1 shows the best values of β parameters that maximize the likelihood function under different types of competition and for each model.

Table 1. Results of the likelihood model analysis							
Competition Type	Parameters	Nash	Static	Learning			
	α	-	-	3.92			
	γ	-	3.49	3.45			
	δ	_	_	0.15			
Service	E	96.7%	6.5%	6.1%			
Competition	Log-Likelihood	-4899.68	-4462.95	-4462.83			
	Likelihood ratio test against prior model	-	$\chi^2 = 873.45$ p = 0.0000	$\chi^2 = 0.25$ p = 0.8819			
	α	_	-	10.06			
	γ	-	10.12	10.13			
	δ	_	_	2.76			
Inventory	E	98.5%	5.2%	5.1%			
Competition	Log-Likelihood	-8096.52	-7406.64	-7404.65			
	Likelihood ratio test against prior model	-	$\chi^2 = 1379.77$ p = 0.0000	$\chi^2 = 3.98$ p = 0.1366			
	α	_	_	26.78			
	γ	-	6.47	4.59			
Ontimal	δ	-	-	0.21			
Competition	E	99.2%	19.2%	12.8%			
competition	Log-Likelihood	-6259.17	-5997.72	-5970.09			
	Likelihood ratio test		$\chi^2 = 522.88$	$\chi^2 = 55.27$			
	against prior model	_	p = 0.0000	p = 0.0000			

Here, we want to attract the readers' attention to three points. First, our results show that the log-likelihood score of the Nash equilibrium is significantly smaller than two other ones in all competition types. This result indicates that the bounded rationality models, both static and learning, fit our experimental data better than the model of perfect rationality. Moreover, the estimation of the noise parameter in all competition types is much larger than the corresponding

estimates of other models. This suggests a poor fit of the Nash equilibrium model, which results in a large noise parameter (Chen et al. 2012).

Second, comparing the static model and learning model shows that only in the optimal competition the learning model significantly better fits our data ($\chi^2 = 55.27, p < 0.0001$). These results indicate that the learning model is a better predictor of our subjects' behaviors in the optimal competition. We will discuss these results in more detail in the next subsection.

Third, our results show that the level of rationality and learning behavior of the subjects differs in three competition types. We can see in service competition, the value of β is small from the beginning to the end of the competition. This shows that subjects make more rational decisions in this competition. However, the learning effect is weak here. In inventory competition, subjects' decisions show a larger value of β indicating more random errors in decisions than service competition. Moreover, there is no evidence of learning in this competition. In contrast, the results of optimal competition indicate a strong learning behavior in subjects' decisions. The eventual value of β ($\gamma = 4.59$) is much smaller than its initial value ($\alpha = 26.78$). These results indicate that the subjects in optimal competition make more random errors at the beginning of the experiment, but as the competition proceeds, they learn (rate of learning: $\delta = 0.21$) and make decisions closer to the rational one (the predicted value by Nash model).

4.2. DISCUSSION

The results show that the learning model based on bounded rationality fits our experimental data more accurately than Nash model in all three competition types. However, subjects show different learning behaviors in different competition types. In fact, the allocation rule selected by the buyer affects not only the performance of the subjects (Elahi and Blake 2015) but also their learning behavior. To explain this finding, it is useful to have a look at these competitions' differences. Elahi and Blake (2015) show that subjects experience different profit functions in different competitions (Figure 2), and it seems that it affects their level of rationality as well.



Figure 2. Suppliers' profit in identical cost structure (Elahi and Blake 2015)

The sharper slope of the profit function under service competition makes it easier for the subjects to choose base-stock levels closer to the optimal value (behave more rationally), so the subjects in service competition behave close to rational from the first rounds. Since there is a small change in the value of β indicating weak learning effect. In comparison to other two competitions, the sharper profit function of the service competition helps the subjects in making more rational decisions, which results in smaller value of β . We can extend this type of argument to the optimal competition in explaining the initial β . The bounded rationality parameter at the beginning of the competition under optimal allocation rule is greater than its value under both service and inventory competitions. Figure 2 shows that shape of the profit function under optimal competition is flatter than other two types. Therefore, it is more difficult for the subjects to find the decision leading to a higher profit, and they choose their decisions more randomly. However, these random errors decrease over time, and the subjects learn to make better decisions. One explanation for this behavior could be the existence of other factors such as loss-aversion, rival-chasing and gamesmanship behavior that influence subjects' decisions, and random error is no longer the only major factor affecting them (Elahi and Blake 2015). Apart from these factors, competition pressure could be another explanation for this behavior. As shown in profit diagrams, subjects under optimal competition not only gain less profit than other two competition types but also face the negative profit in most of the inventory levels. Hence, the pressure in this competition is higher than other two competition types, and it is more probable that subjects' decisions eventuate in negative profit. Based on prospect theory (Kahneman and Tversky 1979), these losses hurt the subjects more than good feeling of gains. As a result, they try harder to make better decisions, even though it is more difficult than both service and inventory competitions. Consequently, stronger learning effects can be seen in optimal competition. The conclusion that subjects under higher pressure show stronger learning behavior is consistent with the findings of Chen et al. (2012) that subjects under high-cost condition (higher competition pressure) show stronger learning behavior than low-cost subjects. Influence of the competition pressure (or cost of mistake) on the learning behavior has been discussed in an all-pay auction study by Gneezy and Smorodinsky (2006) as well. The authors find that the learning behavior is different as the number of subjects varies. They employ the reinforcement learning model to explain their finding. Based on the reinforcement learning model (e.g., Erev and Roth 1998; Camerer and Ho 1999), the speed of learning is responsive to the cost of mistakes. Gneezy and Smorodinsky (2006) argue that the larger number of the participants leads to the higher cost of mistakes perception, hence, the participants learn faster. Here, as we discussed, making a mistake in optimal competition results in a negative profit (loss), and based on the subjects' loss-aversion behavior (prospect theory), perception of this cost is higher than the cost of making a non-optimal decision in two other competition types. Therefore, based on the reinforcement learning model, subjects in optimal competition learn faster.

5. INDIVIDUAL LEVEL ANALYSIS

What we have discussed up to now are all based on aggregate-level analysis. However, different people behave differently in reality. Therefore, to investigate learning behavior in our setup in more detail and more precisely, we analyze our experimental data at the individual level. For this purpose, we conduct the same process we did at the aggregate level, but for each subject to find the best estimates of the learning model for them. In fact, we find the best values of bounded rationality parameters describing each subject's behavior more accurately. Then, we use K-means clustering technique to identify most common behaviors and group the subjects based on the parameters of our model (i.e., α , γ , δ , and ϵ). Considering within cluster sum of squared errors (SSE), and dissimilarity of clusters, we found K = 3 as the best cluster number categorizing our subjects.

5.1. RESULTS

Table 2 shows the clustering results. Based on this result, we can categorize our subjects into three groups based on their learning behaviors. The first group contains the subjects whose bounded rationality parameter is high at the first rounds ($\alpha = 43.5074$), but its value decreases as

the competition proceeds ($\gamma = 3.3276$). However, the average error term of this group is too high ($\epsilon = 0.69678$), which can be an indication that the decisions are strongly affected by factors not

Table 2. Results of the clustering analysis									
Cluster		Cluster	Centroid		Title	Member Percentage			
	α	γ	δ	ε	The				
1	43.5074	3.3276	0.29441	0.69678	Randomizer Learners	7%			
2	45.8039	6.48405	0.47294	0.0716	Strong Learner	48%			
3 2.6801		12.755	0.59592	0.0238	Non-Learners	45%			
SSE = 5.318									

considered in our learning model. Since the error term is large for this group, we call them "Randomizer Learners". The change in the value of bounded rationality parameter in the second group is similar to the first group. Nevertheless, there are two differences. First, the error term is considerably smaller here ($\epsilon = 0.0716$), which shows that our learning model is a good predictor of these subjects' decisions. Second, the learning rate indicates that the learning in this group is almost 1.61 times faster than the first one. Therefore, we call this group "Strong Learners". Behavior of the subjects in the third group is different from two other ones. Based on the average value of β parameters, subjects in this group are more rational at the beginning of the competition, but they make more irrational decisions (larger values of beta) as the competition proceeds. Looking at each individual's behavior suggests that this group includes two types of decisionmakers. The first type contains the subjects who make less random errors at the beginning, but as the competition proceeds, they make more random errors. This type of subjects is prevalent in the third group. The second type contains subjects whose bounded rationality parameter is very low and almost constant at most of the rounds. Indeed, these subjects make very few random errors from the first rounds to the last ones. Based on these two observed learning behaviors in this group, we call it "Non-Learners". The last column of table 4 presents the percentage of the subjects in each group.

5.2. DISCUSSION

Individual-level analysis shows that all subjects do not behave similarly. We can identify Three dominant learning behaviors: Randomized Learning, Strong Learning, and Non-Learning. In addition, the results of the aggregate level analysis showed earlier that the allocation rule (competition type) affects subjects' behavior. Hence, to test this argument at the individual level, we extend the clustering results to our competition types. Figure 3 shows the results of this analysis.



Figure 3. Distribution of the subjects in three competition types

As we can see, distribution of the subject types is almost the same in service and inventory competitions, but different in optimal competition. There is a higher percentage of randomizers in the optimal competition. What has been discussed about the differences between these competition types can explain this observation. The subjects in the optimal competition are faced with a flatter profit function than other two competitions, which makes it more difficult to find the optimal decision. Inventory competition in comparison to service competition has the same situation. Hence, the percentage of randomizer learners is the highest in optimal competition, and it is higher in inventory competition than service one.

Besides that, the percentage of strong learners in optimal competition is significantly higher than other two competitions. As we discussed earlier, although finding the optimal decision is more difficult in optimal competition, subjects try harder to avoid loss. As a result, these subjects learn stronger and make more rational decisions as the competition proceeds. Interestingly, we can see that the individual level results support our findings at aggregate level analysis.

6. CONCLUDING REMARKS

In this paper, we experimentally investigated the learning behavior of the subjects playing the role of the suppliers in a simultaneous competition in three different competition types. To explore the learning behavior in more detail and finding more accurate results, we analyzed our data at both aggregate and individual level. The aggregate level results show that subjects' learning behavior is different in three competition types. The subjects learn significantly in the optimal competition, however, there is no strong learning effect in service and inventory competitions. We explain these observations by considering different profit functions of these competitions, loss aversion (prospect theory), and competition intensity (reinforcement learning theory). Then, we analyzed our data at the individual level, which supports our aggregate level findings. Individuallevel analysis demonstrates that subjects show different learning behaviors. By using K-means clustering method, we recognized the prevalent learning behaviors and categorized the subjects in three groups: Randomizer Learners, Strong Learners, and Non-Learners. Doing so helps researchers to categorize the subjects based on their behaviors first, and then conduct the aggregated level analysis for each category to have more accurate results. This paper can be extended in several ways. First, we have studied three different competition types and explored subjects' behaviors in them. However, learning behavior in different cost structures has not been studied. The cost structure of the competitions could be another parameter affecting subjects' behavior and causes different levels of irrationality. As we discussed and findings of the prior studies (e.g., Gneezy and Smorodinsky 2006; Chen et al. 2012) show, cost of the making mistakes affects subjects' behavior, especially learning behavior. Hence, future research can investigate the influence of cost structure on subjects' behavior in each of these competition types. Moreover, we assumed that profit is the only factor in subjects' utility function and defined the learning as making closer decisions to the Nash equilibrium point, which is based on perfect rationality assumption. However, people might follow different goals other than profit maximizing and have various factors in their utility function. In fact, people might learn but not in the way we have studied. Therefore, the study of other learning models, which consider different learning behaviors can be helpful in exploring the learning behavior in more detail.

REFERENCES

- [1] Ahmadian, M., Elahi, E., & Blake, R. (Unpublished). Decision-Making in Simultaneous Games: Reviewing the Past for the Future.
- [2] Bendoly, E., Donohue, K., & Schultz, K. L. (2006). Behavior in operations management: Assessing recent findings and revisiting old assumptions. Journal of operations management, 24(6), 737-752.
- [3] Benzion, U., Cohen, Y., Peled, R., & Shavit, T. (2008). Decision-making and the newsvendor problem: an experimental study. Journal of the Operational Research Society, 59(9), 1281-1287.
- [4] Bolton, G. E., & Katok, E. (2008). Learning by doing in the newsvendor problem: A laboratory investigation of the role of experience and feedback. Manufacturing & Service Operations Management, 10(3), 519-538.
- [5] Bostian, A. A., Holt, C. A., & Smith, A. M. (2008). Newsvendor "pull-to-center" effect: Adaptive learning in a laboratory experiment. Manufacturing & Service Operations Management, 10(4), 590-608.
- [6] Camerer, C., & Hua Ho, T. (1999). Experience-weighted attraction learning in normal form games. Econometrica, 67(4), 827-874.
- [7] Chen, H. C., Friedman, J. W., & Thisse, J. F. (1997). Boundedly rational Nash equilibrium: a probabilistic choice approach. Games and Economic Behavior, 18(1), 32-54.
- [8] Chen, Y., & Zhao, X. (2015). Decision bias in capacity allocation games with uncertain demand. Production and Operations Management, 24(4), 634-646.
- [9] Chen, Y., Su, X., & Zhao, X. (2012). Modeling bounded rationality in capacity allocation games with the quantal response equilibrium. Management Science, 58(10), 1952-1962.
- [10] Croson, R., & Donohue, K. (2002). Experimental economics and supply-chain management. Interfaces, 32(5), 74-82.
- [11] Croson, R., & Donohue, K. (2006). Behavioral causes of the bullwhip effect and the observed value of inventory information. Management science, 52(3), 323-336.
- [12] Doerr, K. H., Mitchell, T. R., Schriesheim, C. A., Freed, T., & Zhou, X. T. (2002). Note: Heterogeneity and Variability in the Context of Flow Lines. Academy of Management Review, 27(4), 594-607.

- [13] Elahi, E. (2013). Outsourcing through competition: what is the best competition parameter?. International Journal of Production Economics, 144(1), 370-382.
- [14] Elahi, E., & Blake, R. (2015). Do Competing Suppliers Maximize Profits as Theory Suggests? An Empirical Evaluation. Trends and Research in the Decision Sciences: Best Papers from the 2014 Annual Conference.
- [15] Engelbrecht-Wiggans, R., & Katok, E. (2006). E-sourcing in procurement: Theory and behavior in reverse auctions with noncompetitive contracts. Management Science, 52(4), 581-596.
- [16] Erev, I., & Roth, A. E. (1998). Predicting how people play games: Reinforcement learning in experimental games with unique, mixed strategy equilibria. American economic review, 848-881.
- [17] Gino, F., & Pisano, G. (2008). Toward a theory of behavioral operations. Manufacturing & Service Operations Management, 10(4), 676-691.
- [18] Gneezy, U., & Smorodinsky, R. (2006). All-pay auctions—an experimental study. Journal of Economic Behavior & Organization, 61(2), 255-275.
- [19] Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. Econometrica: Journal of the econometric society, 263-291.
- [20] Kalkanci, B., Chen, K. Y., & Erhun, F. (2011). Contract complexity and performance under asymmetric demand information: An experimental evaluation. Management science, 57(4), 689-704.
- [21] Kremer, M., Minner, S., & Van Wassenhove, L. N. (2010). Do random errors explain newsvendor behavior?. Manufacturing & Service Operations Management, 12(4), 673-681.
- [22] Kundu, A., Jain, V., Kumar, S., & Chandra, C. (2015). A journey from normative to behavioral operations in supply chain management: A review using Latent Semantic Analysis. Expert Systems with Applications, 42(2), 796-809.
- [23] Lau, N., Hasija, S., & Bearden, J. N. (2014). Newsvendor pull-to-center reconsidered. Decision Support Systems, 58, 68-73.
- [24] Loch, C. H., & Wu, Y. (2007). Behavioral operations management. Foundations and Trends® in Technology, Information and Operations Management, 1(3), 121-232.

- [25] Moritz, B. B., Hill, A. V., & Donohue, K. L. (2013). Individual differences in the newsvendor problem: Behavior and cognitive reflection. Journal of Operations Management, 31(1), 72-85.
- [26] Rudi, N., & Drake, D. (2014). Observation bias: The impact of demand censoring on newsvendor level and adjustment behavior. Management Science, 60(5), 1334-1345.
- [27] Song, Y., & Zhao, X. (2016). Strategic customer behavior facing possible stockout: An experimental study. International Journal of Production Economics, 180, 57-67.
- [28] Su, X. (2008). Bounded rationality in newsvendor models. Manufacturing & Service Operations Management, 10(4), 566-589.
- [29] Wachtel, R. E., & Dexter, F. (2010). Review of behavioral operations experimental studies of newsvendor problems for operating room management. Anesthesia & Analgesia, 110(6), 1698-1710.
- [30] Wu, D. Y., & Chen, K. Y. (2014). Supply chain contract design: Impact of bounded rationality and individual heterogeneity. Production and Operations Management, 23(2), 253-268.
- [31] Wu, D. Y., & Katok, E. (2006). Learning, communication, and the bullwhip effect. Journal of Operations Management, 24(6), 839-850.

TEACHING STATISTICS WITH SCENARIOS TO FOSTER CRITICAL THINKING

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ABSTRACT

The knowledge economy and the digital age have changed the nature of work and management. More people than ever before need to master critical thinking skills. This paper proposes a set of 15 scenarios and where they may be used in the context of a one-semester course in statistics. Scenarios are chosen for their relevance, are from the fields of medicine, school admissions, institutional rankings, criminology, business, quality control and pharmaceutical research. Individuals who wish to sharpen their critical thinking skills may benefit from this paper.

Keywords: critical thinking, teaching with scenarios, assessment, loaded questions, correlation and causality.

INTRODUCTION

Increasingly, critical thinking is considered an essential skill for employees to have. Those who lack this ability are of limited value to their employers in the knowledge economy (Ungar, 2010; Selingo,

2012). This, of course, begs the question – what exactly do we mean by critical thinking? It is not easy to define critical thinking. To add to this difficulty, scholars in different areas such as philosophy, education, and psychology may see it somewhat differently. The definition we shall use is based on the work of Robert H. Ennis. Briefly, critical thinking is "reasonable reflective thinking focused on deciding what to believe or do" (Ennis, 2010). Further, Ennis posits that a critical thinker:

- 1. Is open-minded and mindful of alternatives
- 2. Desires to be, and is, well-informed
- 3. Judges well the credibility of sources
- 4. Identifies reasons, assumptions, and conclusions
- 5. Asks appropriate clarifying questions
- 6. Judges well the quality of an argument, including its reasons, assumptions, evidence, and their degree of support for the conclusion
- 7. Can well develop and defend a reasonable position regarding a belief or an action, doing justice to challenges
- 8. Formulates plausible hypotheses
- 9. Plans and conducts experiments well

10. Defines terms in a way appropriate for the context

- 11. Draws conclusions when warranted but with caution
- 12. Integrates all of the above aspects of critical thinking

Dyer (2011: 2) states that "critical thinking is an approach to reading, thinking, and learning that involves asking questions, examining our assumptions, and weighing the validity of arguments." She adds that critical thinkers are "self-aware, curious, and independent. They introspect on their own thinking processes; they work at knowing their own biases and can name the strategies they are using when they make judgments (self-aware).

Employers want to hire people who are critical thinkers and can make good decisions based on available information. Society also wants people to be critical thinkers and make the right decisions. Democracy can only thrive if the public can make the right decisions when it comes to voting. Many childhood diseases that were virtually eliminated have come back because parents accept the discredited belief that there is a significant correlation between autism and the MMR (measles, mumps, and rubella) vaccine (Bruni, 2015). As more and more parents refuse to vaccinate their children, the danger increases for everyone. Before 1963, when vaccinations became the norm, millions of people got infected with measles and 400 to 500 died each year (Bruni, 2015).

How well do college graduates do when it comes to critical thinking? According to Arum and Roksa (2011) a significant number of college students only barely improve their skills in the vital areas of critical thinking, writing, and problem solving/critical reasoning. After four years of higher education,

36% of college students made no significant gains in those three areas.

Ennis (1997) discusses the "curriculum question": "Should we have a separate course, or should we embed critical thinking in the standard courses we are teaching anyway... or both?" Another question discussed by Ennis (1997) is whether critical thinking is domain/discipline specific, i.e., critical thinking learned in say, sociology, will not transfer over to, say, economics. He also considers that critical thinking is "epistemologically domain specific" which suggests that critical thinking in one discipline is not the same as the critical thinking in other discipline. This may certainly seem true when comparing quantitative with qualitative courses.

The authors believe that critical thinking can be taught in almost any course; it does not have to be a quantitative course. This is how Ferlazzo (2011) teaches critical thinking in a history course:

For example, when I am teaching history to students, I tell them we will not be spending most of our time looking at the what, where, when, and who. Those facts might be important but they are only the basic building blocks used to reach critical thinking. Instead I focus on questions that look at the why and how.

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I remember one time I was writing an assessment with a very traditional Social Studies teacher and I suggested the question, "How would the United States be different had the British won the American Revolution?" He was flabbergasted by this and responded, "But I can't prove or disprove their answer." My response to him was, "That's the point." If students can back up their answer using the who, what, when, or where, then they have taken that learning to a higher level.

In many ethics courses, cases and ethical dilemmas are used to enhance critical thinking skills. One of the more famous of ethical dilemmas is the "runaway trolley." A trolley is out of control and is about to kill 5 people who are tied to the tracks. You can save the five by pulling a signal lever which will divert the trolley to another track. This will save the 5 people but one person who is tied to the other track will be killed. Would you pull the signal lever? Approximately 90% answer yes to that question taking a utilitarian approach – the greatest good for the greatest number (Bakewell, 2013). The scenario is changed slightly. Now you are on a bridge and you see the runaway trolley that is about to kill the five people. There is a very heavy man next to you on the bridge. You know that if you throw him off the bridge onto the track will be saved. Would you throw the man over the bridge? With this scenario, which also involves killing one person to save five, about 90% of respondents say they would not do it (Bakewell, 2013). The question, of course, is why. In any case, these type of scenarios are perfect for developing critical thinking skills.

It seems that it is much easier to deceive people when using data to support one's conclusions. Many people are too insecure in their own abilities to challenge findings based on statistical evidence. This is why it is extremely important to teach students critical thinking skills – especially in the introductory statistics course. While it is not totally unheard of it is still unusual to see instructors

making use of the introductory statistics course as a vehicle for imbuing critical thinking skills and enhancing students' critical thinking abilities. There has not as yet been a lot of scholarly research in this particular area of pedagogy (see, for example, Ferris et al., 2014; Cokluk-Bokeoglu, 2009).

The purpose of this paper is to approach the introductory statistics course as a vehicle for enhancing students' critical thinking skills and to take a critical thinking approach to evaluating data-based conclusions and arguments. In the next sections we examine some possible problems to incorporate into course materials for this purpose, in much the same way that the scenario approach has been used to teach critical thinking in courses in ethics and philosophy.

STATISTICAL "SCENARIOS" FOR FOSTERING CRITICAL THINKING

Each of the following cases presents one or more interesting dilemmas that can be useful in fostering critical thinking as an integral element of the introductory statistics course.

The Case of the Loaded Marijuana Question

You are asked to decide on the wording of a question that will appear on a ballot asking voters whether they would allow marijuana to be legalized and taxed as a way to promote job growth, increase funding to colleges, and to lower the sales tax. Is this a fair question? (Course topic: Data Collection, Survey Construction)

Actually, this is similar to a question that caused a great deal of controversy in New York State. There was a question on the November 5, 2013 ballot asking voters if they would allow the legislature to authorize up to seven casinos in New York State for the "purposes of promoting job growth, increasing aid to schools, and permitting local governments to lower property taxes through revenues generated." Many people felt the question was loaded by adding the purpose. Almost nobody is against job growth, more aid for schools, and lower taxes (Harding, 2013). A good researcher always looks at the wording of the question. Words have different connotations. The use of loaded words such as "ban" as opposed to "make illegal" may affect results.

THE CASE OF THE QUESTIONABLE CEO

You are asked to decide whether a question used in a survey was fair. The question asked

respondents to rate the overall performance of the CEO of a particular company. You notice that the preceding questions asked respondents about how they felt about downsizing at the company. Is this question about CEO performance fair or biased? (Course topic: Data Collection, Survey Construction)

This is actually discussed in the literature and is known as context effects, i.e., "predisposing questions" that help prime subjects so that they answer the question in a certain way. One study cited by Friedman & Amoo (1999) found that subjects, who were first primed by asking them to answer questions dealing with fraud and waste in government programs, were more likely to oppose welfare in a subsequent question. Friedman & Amoo (1999) cite a study that demonstrates that with mail (or Internet) surveys, it does not matter whether the predisposing questions come before or after the critical overall evaluation question since respondents often read many of the questions before actually completing the survey.

THE CASE OF EARLY DETECTION AND LONGER LIFE

A pharmaceutical company claims that thanks to new technology that it has introduced for early diagnosis of colon cancer, people with the disease now live much longer. Is this statement accurate? (Course topic: Descriptive Statistics)

Does early diagnosis of a disease automatically mean that people with the illness will live longer? Suppose people with a certain disease live on average to the age of 65. If the disease is discovered when people are 60, then we can say that the average person with the disease lives for five years (survival time is 5 years). Suppose with better technology we discover the disease when the typical person is 50. Even if patients live to 65, we can state that the survival rate is 15 years from the time the disease has been diagnosed. Early diagnosis may not result in a longer life but simply increase the time the disease is discovered until death. Thus, it is "true that patients diagnosed early have better survival statistics than those diagnosed late." We still may not know whether early diagnosis helps (Welch, Schwartz, and Woloshin, 2011: 187).

THE CASE OF THE SELECTIVE FRONT DOOR

You are a marketing consultant for a large university. Your college president wants you to promote the college based on its reputation for selecting only high-scoring applicants for its

student body. Given the average SAT scores reported below, is College A (your employer) more selective in admitting students than College B? After all, the average SAT score of its freshman is 95 points higher than that of College B. (Course topic: Descriptive statistics)

	College A	College B
Average SAT Score of Freshmen	620	525

There are many lists that rank colleges. For example, *U.S. News and World Report (USNWR)* has been ranking colleges for a number of years. According to Nocera (2012), these lists "imbue these rankings with an authority that is largely unjustified." It is too easy to game the rankings and many colleges do just that. To improve one's ranking, you have to simply spend more money on faculty, on better facilities, on small classes, etc. The school also has to be more selective in its admissions process; that is no problem if they spend money on encouraging students – even weak students – to apply and then reject them to demonstrate the selectiveness of the college.

It is possible, by exploiting various loopholes, for schools to manipulate the rankings. One commonly used method to boost average SAT and high school GPAs is by placing low scorers into "special admission" categories which are usually not reported (Bush and Peterson, 2013). A college may, for example, be extremely selective with admission of high school seniors making sure these students have the high scores but allow weaker students in the backdoor as transfer students. Some students may be advised to take a few credits at another school and then reapply as a transfer student.

College A may be admitting 1,000 students a year but only 100 freshmen. The 900 transfer students might be very weak students; only the 100 admitted freshmen had high SAT scores.

THE CASE OF THE BELOW-AVERAGE AVERAGE

Given the happiness data below, based on a happiness score on a scale of 1 (extremely unhappy) to 10 (extremely happy), can you conclude that "if you want to be happy, get married"? (Course topic: Descriptive Statistics)

	Married People($n = 600$)	Single People($n = 400$)
Average Happiness Score	Mean = 7.80	Mean = 7.10

The average is a very useful metric. However, it can be skewed by a relatively small number of extreme values and should therefore be used with caution. Coontz (2013) provides several examples where focusing on averages can result in an unsuitable response. Same is true with the marriage example above. Examining the means would result in the conclusion that married people are happier than unmarried people. Marriage does cure the unhappiness of about 10% of people. With approximately 80% of people, those who are for the most part quite content, marriage does not add to their happiness (Coontz, 2013). This is one reason that it is important for people to understand the concept of conditional probabilities. Suppose that the happiness of only men is increased by marriage

and the happiness of women goes down slightly. For example:

Average Happiness Score	Married Men	Married Women	Single Men	Single Women
Before Marriage	Mean = 6.50	Mean= 7.90	Mean = 7.10	Mean = 7.10
After Marriage	Mean = 7.80	Mean= 7.80		

Examining only the overall average in this case might provide misleading information.

Many therapists will tell people they need time to heal after the loss of a loved one and should therefore wait about a year before making decisions. This is good advice for about 20% of people

who need time to recover from a loss (Coontz, 2013). This is probably very true for parents who have lost a child. However, the overwhelming majority of people — about 60% —recover quite rapidly from a tragic loss. With many people, such as caregivers, death of a chronically ill loved one

produces a sense of relief and happiness actually goes up. Note how the mean has resulted in bad advice for the majority of people.

Did you realize that the average person in the United States has fewer than 2 legs? Think about that statistic.

THE CASE OF THE USELESS AVERAGE

Your firm is interested in purchasing a crucial component for its smart phone. The company wants this crucial part to have a life of at least 5 years; few people keep their smart phones for more than 5 years. Two companies that supply this component have made bids. Supplier A claims that the average life of this component is about 10 years; Supplier B claims that the average life is more than 20 years. Which supplier should the company select, A or B? (Course topic: Descriptive Statistics). Question cannot be answered without knowing anything about the variation in the life of the components supplied by each of the two suppliers. Suppose a random sample of 20 components made by the two suppliers is taken with the following results (units are in years of life):

Supplier B: 20, 0, 20, 25, 0, 30, 20, 20, 22, 28, 0, 30, 0, 25, 28, 28, 30, 30, 32, 24

Examination of the data reveals the following: The mean life of Supplier A's part is 9.95 years (this is a sample mean); the sample standard deviation is 0.39 years. The mean life of Supplier B's part is

20.60 years with a sample standard deviation of 11.24 years. There is no question that Supplier A should be selected. In fact, if Supplier B is selected, we can expect that about 4 out of 20 (20%) smart phones made by the company will not work. Supplier B has to work on improving its quality so that the standard deviation, a key measure of dispersion, is reduced

considerably. This is another example of why the mean is not the only measure of importance.

THE CASE OF THE TINY DEFECTS

Your company manufactures a motorcycle consisting of 1,158 components. Each component is made in a different factory in Asia. After purchasing the components, the company assembles the motorcycle, puts its brand name on the product, and markets the motorcycles all over the world. The company has discovered that the return rate on the motorcycles is 11%. This is way too high and the company is in danger of bankruptcy. You have been hired as a consultant to solve the problem. You determine that the defect rate for each of the 1,158 components is .0001 and the assembly is done perfectly. You have been talking to the various factories in Asia but they insist that they cannot bring the defect rate below .0001 (1 in 10,000) for their component without dramatically increasing costs. Can anything be done to

This problem involves the binomial distribution. When a product consists of many components, the chance that one or more will not work properly increases. The simplest solution is to redesign the motorcycle so that the number of components is reduced. For example, a circuit board is one component but actually consists of many smaller parts. The consultant figures out a way for the motorcycle to consist of 98 components. Even with a .0001 defect rate for each component, the probably of a defective motorcycle (1 or more defective components) has dropped to 1%. There are other savings when the number of components is reduced. These include inventory costs, warehousing costs, and transportation costs. It is much easier to keep track of 98 components than 1,158 components.

THE CASE OF MURDER BY THE NUMBERS

improve quality and reduce returns? (Course topic: Probability)

A mother is arrested for murdering her children after a second baby died of crib death. The prosecutor brought the charges because research showed that the probability of two crib deaths occurring in one family were estimated to be 1 in 73,000,000 in a particular country. The prosecutor used the above statistic as part of his case. Should the woman go to prison? (Course topic: Probability)

Sally Clark, a British lawyer, was wrongfully convicted of killing her two children
when the prosecution claimed that the probability of two crib deaths occurring in one family were 1/73,000,000. The conviction was eventually overturned when it was learned that double crib deaths are indeed rare but do occur every few years in Britain. Certainly, there was no reason to convict someone for this (Schneps and Colmez, 2013). Similarly, prosecutors in the Netherlands used flawed probability to convict a Dutch nurse, Lucia de Berk, of killing sick elderly patients and children.

They came up with a probability that the deaths were natural was equal to 1 / 342,000,000. The number may have been impressive but wrong. A team of statisticians demonstrated that the poor nurse was only guilty of bad luck, not murder.

To understand this one only has to consider that events with very low probabilities will occur if the population is large. Thus, the chance of being killed by a shark in a certain country might be 1 in 50 million. However, if the country has a population of 50 million, then we can expect, on average, one person to die this way. It is the same with a lottery, say, Powerball Lottery. The probability might be 1 in 175 million of winning, but millions of tickets are sold and someone wins.

We have examined several ways statistics can purposely be used to manipulate results. The worst misuse of statistics can result in miscarriages of justice where innocent people end up in prison and/or murderers go free (Schneps and Colmez, 2013).

THE CASE OF THE SUCCESSFUL COLLEGE GRAD

Your friend is considering going to one of the two local colleges, A or B. In the following data, we see the average earnings of students graduating from two different colleges. Can you conclude that College B is more effective in boosting the earnings potential of students. (Course topic: Sampling)

	College A	College B
Average Earnings of Graduates	\$50,000	\$90,000

Think again. Suppose College B is an Ivy League school and many of the parents are extremely wealthy with their own businesses. In fact, many of the graduating students expect to go into the family business. These parents are also part of a huge network so that they can use personal connections to find their children high-paying jobs. School A is

located in a poor city and many of the parents of students work at low-paying jobs or are unemployed. Is average earnings of graduates a meaningful measure?

Despite this bias, a number of MBA programs promote themselves by advertising how well graduates do after completing the MBA at their school (Friedman & Raphan, 2013a). They might assert that the average income of a student with an MBA from their school is \$90,000. What is not stated is how easy it is to manipulate this number. First, only admit students into your MBA program who have been working for several years in high-paying jobs. If you admit a few executives earning a few million dollars a year, the numbers can be easily skewed. Better yet, offer an honorary MBA to a few billionaires (or allow them to get an MBA with minimal work – something many executive MBA

programs already do). The goal is to admit as many people as you can who are already earning high salaries. As long as the advertisement does not have to state the average income of those entering the school, you should be ok. This might explain why many MBA programs do not admit students unless they already have a few years of work experience. This information can be very useful in estimating how much a student currently earns and what they will earn once they graduate. It should also be noted that salaries also depend on what a student is currently doing and where s/he lives. Normally, a student living in New York City and working for a hedge fund on Wall Street should earn

considerably more than a student residing in a small town in Alabama working as a librarian.

Average Salary (when starting MBA) at School X\$120,000Average Salary (a year after completing MBA) at School X\$124,000

Once you examine Table 6, you note that the MBA did not really offer much value. However, for advertising purposes, all the school has to report is the salary of students after receiving the degree. It should also be noted that schools that encourage students to go into relatively low-paying fields dealing with social justice as compared to those that stress high-paying fields will not do well on this measure.

THE CASE OF THE ROTTEN SCHOOL RANKINGS

You want to major in accounting. The pass rate on the CPA exam is used as a metric by many schools to measure the quality of its accounting program. Given the reported pass rates for Colleges A and B, below, should you go to College A since it clearly has the better accounting program? (Course topic: Sampling issues)

	College A	College B
Pass Rate on CPA Exam	50%	30%

The simplest way to improve outcomes is by changing the composition of the population. The only way we can do a fair comparison of outcomes is if there was a random assignment of subjects. As we observed in The Case of the Successful College Grad, a college that tends to admit graduate students from affluent families should have no problem running advertisements indicating that their MB students earn high salaries a few years after receiving their MBAs. The same approach can be used by medical centers. Hospitals that cherry-pick patients and only perform heart surgery on relatively healthy patients should have a higher survival rate than those that perform surgery on all types of patients. There are oncologists that specialize in cancer patients with very advanced tumors. But doing this and selecting the riskiest patients will of course result in relatively poor survival rates. Other doctors will purposely avoid high risk patients (e.g., elderly patients with advanced cancer) in order to improve their statistics. It is very easy to game the system if you can control the kinds of patients, students, cases, etc. you select.

As far as the pass rate on the CPA exam, there are several ways a college can ensure a high pass rate. In fact, one college gives accounting majors two screening exams at different stages to test their accounting knowledge; those that do not perform extremely well on these exams are not allowed to continue as accounting majors. This strategy guarantees that this college will have unusually high pass rates on the CPA exam.

Another approach used by some colleges is introducing special requirements for accounting majors. A college attempting to improve its pass rate on the CPA exam, might not allow a student to take an accounting course unless the student received the grade of B or better on

the prerequisite course. Alternatively, in order to ensure high scores on the CPA exam, a college can simply require accounting majors to maintain a GPA of at least 3.3 or require grades of at least B+ or better for the first four accounting courses. This issue of purposely controlling the flow of students in order to affect learning outcomes makes it unfair to compare schools with different populations.

Some Related Examples:

College rankings are misleading enough. Rankings of law schools are much more insidious; *U.S News & World Report* provides an annual ranking of law schools that is used by a large number of

students. Bush and Peterson (2013) state that the rankings are not a measure of quality: "These numbers don't reflect how well the law school faculty teaches, how cutting-edge its research is, or whether the law school community is cutthroat of supportive." Moreover, these rankings skew the results so that the wealthy schools – especially private schools – are more likely to do well. What

may be an even more serious problem is that law schools self-report and there is no easy way to know how much the truth has been bent. Law schools are not afraid to tell "creative truths" to *USNWR*.

Law schools may be afraid to be dishonest when dealing with the American Bar Association but have few computions about bending the truth when completing *USNWR* questionnaires. This is why there are allegations that law schools are gaming the system (Bush and Peterson, 2013). Perhaps the worst effect of the above is that students who have a passion for law and filled with enthusiasm and integrity might not get into a good law school if their UGPA and LSAT grades are low. The type of attorney who can be a change agent for the legal profession may be someone with a great deal of experience helping people (e.g., Peace Corps), not necessarily someone with good LSAT and UGPA scores. Stape (2006) feels that the current approach to rankings means that legal education is being "homogenized." It is becoming very difficult for law schools to "experiment with different ways of producing an extraordinary product."

Stape (2006) demonstrates some of the issues as far as law school rankings. Undergraduate GPA (UGPA) accounts for 10% of *USNWR* rankings. How do you compare, say, a 3.3 GPA

in physics from MIT with a 3.9 GPA in sailing from Podunk University? A school that wants to improve its rankings, might not admit the student with the lower GPA despite the fact that the major is much more difficult and the quality of the school is considerably better. It is no secret that there are majors that are relatively easy (Duniho, 2012). For example, in most colleges, education is the easiest college major (Duniho, 2012; O'Shaughnessy, 2011); science and mathematics are usually the most difficult majors.

Stape (2006) describes several ways that law schools can improve their rankings using various stratagems. Similar ruses are used by business schools and other institutions of higher learning. They include the following:

- Reduce the size of the first-year class since this makes it easier to achieve a higher median LSAT score. Instead of first-year students, admit more transfer students.
- □ Reject students with very high LSAT scores that are unlikely to accept admission into your school and opt for a better one. This increases the "acceptance ratio."
- □ Since employment numbers are important in the rankings. The school itself should hire students that do not have jobs to boost the employment numbers. Bush and Peterson (2013) claim that post-graduation employment is "one of the most maligned factors" in the USNWR algorithm. They claim that even students working as taxi drivers are included in the employment figures as well as students working in the college itself as librarians or research assistants.
- Reject students with a lesser probability of finding a job after graduation; only admit students with good connections that are highly likely to get jobs.
- □ Start part-time programs since only full-time students are included in the LSAT and UGPA scores. The students with the lower scores are admitted into the part-time programs.
- Teach to the test and focus on the bar exam. The goal will be to increase pass rates on the bar exam. In fact, it might be a good idea to reject students from states that have difficult bar exams and admit students from states with easier bar exams.
- □ Spend a great deal of money on public relations and producing sleek promotional publications to enhance your reputation. This makes sense since the major factor in *USNWR* rankings is "reputation among legal academics." With good advertising, a college should be able to improve its image. After all, this is what marketers of products do.

- □ In order to attract students with high LSAT and UGPA scores, provide these students with scholarships. These scholarships can be funded with higher tuition for everyone else.
- □ In order to have a high rejection rate, encourage as many people as possible to apply.
- □ Faculty/student ratios are measured during the fall semester. This means that this ratio can be manipulated by making it difficult for faculty to leave (e.g., by taking sabbaticals or leaves) during the fall semester. Of course, this will have an adverse effect on the quality of courses given during the spring semester.

□ In order to increase the number of book holdings by the library, buy truckloads of cheap books. The books can be stored in an off-site library annex or an attic.

THE CASE OF THE MARVELS OF MODERN MEDICINE

You are a wealthy person and want to live a long life. Your friends suggest that, since money is not a problem, see a doctor every month and do every possible diagnostic test. Is this a good idea? (Course topic: Type I vs. Type II Errors)

Statistics students know that there are two types of errors: Type I (alpha) and Type II (beta). A false positive can be as dangerous to a person as an undiagnosed disease. It is not always a wise move to insist on doing all kinds of tests; there is a real danger of overdiagnosis (Welch, Schwartz, and Woloshin, 2011). As our ability to see more of what is going on inside the body via the use of high- resolution scans, the likelihood that there will be an overdiagnosis increases. Welch, Schwartz, and Woloshin (2011:36) report that in people with no gallbladder disease symptoms, approximately 10% will exhibit gallstones in ultrasound scans; 40% of people without any symptoms will show damaged knee cartilage (meniscal tear) with MRI scans; MRI scans will show bulging lumbar discs in more than 50% of people with no back pain. In fact, a recent study consisting of a sample of 1,000 people with no symptoms willing to undergo a total-body CT screen, 3,000 abnormalities were found; 86% of subjects had at least one. The guidelines for prostate exams and surgery were changed when it became known

that more than 80% of radical prostatectomies performed in the United States are unnecessary. Apparently, only one out of 48 men has their life extended by this type of surgery; the others will needlessly suffer from harmful side effects that include incontinence and impotence (Blum and Scholz, 2010). Even the annual checkup when one is not sick is not necessary and is as likely to cause problems as to solve them (Palmer, 2013). Palmer states:

> The annual health exam is a venerable tradition, stretching back to the late 19th century—those heady days of medicine when doctors overestimated their own ability to cure disease, and badly underestimated their tendency to cause it. We're now in the evidencebased era of medicine, and there's little evidence that annual exams provide any benefit. So here's a free bit of advice: If you're not sick, don't go to the doctor.

THE CASE OF THE SUPERIOR SCHOOL

You are hired to determine whether a particular school, School A, should be shut down due to poor performance. A random sample of 200 high school seniors is taken from School A and also from School B; all 400 students are given a standardized learning assessment test. Given the results below, someone examining the average scores on the assessment test using Table 1 might state that School A is doing poorly and recommend that School A be shut down. Is School B doing a better job than School A? (Course topic: Two-sample tests)

	School A ($n = 200$)	School B ($n = 200$)
Average Score on Learning Assessment Test	50	80

It is quite common for organizations to compare the performance of, say, different schools or hospitals using some measure of performance (Friedman & Raphan, 2013a). In this example, we are comparing two schools using a standardized learning assessment test. It does appear that students in School A are performing very poorly on this key metric. However, this kind of reasoning is flawed because we have not determined that the two groups are equivalent. One way to ensure that two or more groups are statistically equivalent is by random assignment, i.e., randomly assigning subjects to different conditions. It is quite possible that

the students in School A are children of newly arrived immigrants and the children in School B are children from relatively affluent middle class families.

Let us reexamine the data by adding a before-measure, the test scores of students on the same metric when they started school. In other words, let us examine the changes in performance rather than the actual performance:

	School A	School B
Average 'Before' Score on Learning Assessment Test	30	85
Average 'After' Score on Learning Assessment Test	50	80

Re-examining the data provides us with a new insight. Students in School A have gained 20 points in school; those attending School B lost 5 points. Which school should be shut down? This simple example highlights the danger of not considering changes in performance when groups may be very different. When comparing institutions that admit different types of students, it is very dangerous to simply look at the results of an after test. Moreover, many institutions know how easy it is to fudge data by selecting the "right" kind of students, i.e., students who will perform well on the metric.

Some Related Examples:

Let us look at student performance in an online class as opposed to a traditional face-to-face class. All students taking statistics, whether fully online or as a traditional lecture class, take a uniform final.

The college notes that the students taking the class as a fully online course do significantly better on the final. A decision is made to only teach the class as fully online. Is this a good decision?

	Online Class $(n = 300)$	Face-to-face Class ($n = 700$)
Average Score on Final	60.7	55.7

This example shows why it is crucial to make sure that the groups used in an experiment are equivalent. Since there was no random assignment, it is quite possible that the students taking the fully online class are better students. One can assume that only very good students (or students who took the course before) would take the course online. One simple check might be to look at the overall GPAs (or SAT scores) of the two groups. With random assignment,

the overall GPAs should be statistically equivalent. Here we provide evidence that the two groups are not statistically equivalent.

	Online Class $(n = 300)$	Face-to-face Class $(n = 700)$
Average GPA	3.32	2.67
Average Score on Statistics Final	60.7	55.7

Tavernise (2015) notes that only 18% of studies dealing with how to improve the health care system in the United States have used random assignment (outside the United States, the percentage is 41%). On the other hand, 86% of American drug studies — comparing a drug with a placebo — use random assignment. Random assignment is seen as the "gold standard" of scientific research (Tavernise, 2015).

THE CASE OF THE INVISIBLE METRIC

In a long-term study of drug efficacy, a sample of 4,000 people is randomly assigned to two groups; one group takes a placebo and the other group takes an experimental drug for, say, ten years. Suppose, after 10 years, out of every 2000 people in the placebo group 60 had strokes vs. 40 out of 2000 for the experimental group, i.e., 3% vs. 2%. The difference is statistically significant at the alpha = .05 level. Would it be correct to say that the drug reduced the number of strokes by one-third (from 3% to 2%)? Should this drug be recommended? (Course topic: Two-sample tests)

	Control Group (Placebo)	Experimental Group (Drug)
	(n = 2000)	(n = 2000)
# of people having strokes	60	40

Number Needed to Treat (NNT) is a very useful measure in determining whether to take a drug or have a procedure performed (Friedman & Raphan, 2013b). Heisel (2010) defines NNT as "the number of patients that would need to undergo a particular treatment over a specific time period in order to see their health improve beyond what would have happened had they done nothing or had they undergone a different treatment." Suppose 100 people have to take a drug so that only one person gets better (the other 99 not only do not get

better but may be risking the adverse side effects

of the drug), then the NNT is 100. What is the NNT for the above drug? The NNT for the above drug is 60/2000 - 40/2000 = 20/2000. In effect, 20/2000 = 1 out of 100 (NNT = 100). Thus, only 1 out of 100 people will benefit from this drug. If the drug has awful side effects, say, incontinence, would anyone wish to take it with only a 1% chance of being helped by it? This example is not fiction. This is essentially what Pfizer did in promoting its statin, Lipitor (Heisel, 2010). Pfizer ran a campaign targeted to consumers that declared: "Lipitor reduces the risk of heart attack by 36%... in patients with multiple risk factors for heart disease." The advertisement did not mention that the NNT was 100.

This example discussed by Friedman & Raphan (2013b) shows three ways to present data from the same study.

You read that a study found that an osteoporosis drug cuts the risk of having a hip fracture in the next three years by 50%. Specifically, 10% of the untreated people had a hip fracture at three years, compared with 5% of the people who took the osteoporosis drug every day for three years. Thus 5% (10% minus 5%) less people would suffer a hip fracture if they take the drug for 3 years. In other words, 20 patients need to take the osteoporosis drug over 3 years for an additional patient to avoid a hip fracture. 'Cuts the risk of fracture by 50%' represents a relative risk reduction. 'Five per cent less would suffer a fracture' represents an absolute risk reduction. 'Twenty patients need to take the osteoporosis drug over 3 years for an additional patient to avoid a hip fracture' represents a number needed to treat" (Napoli, 2011).

The ARR (absolute risk reduction) is 5%; RRR (relative risk reduction) is 50%; and NNT is 20. Of course, advertisements and brochures would stress the 50% RRR. This may explain why we spend too much on health care and have little to show for it. "Treating the many to benefit the few" is an apt description of health care in the United States (O'Dowd, 2001).

What do you think of the following statement? "Most drugs don't work on most patients." It sounds like something an insane person might say. It was actually printed in a British medical journal. If you understand the importance of the NNT metric, a measure that is purposely not reported in most advertisements for drugs, you know that this statement is true (Napoli, 2011).

THE CASE OF THE POOR FELON

A researcher notes a significant correlation between poverty and crime. She concludes that if the government wants to reduce the crime rate, it must first reduce the poverty rate. Is this reasoning accurate? (Course topic: Correlation).

Correlation does NOT imply causality. There are four possible explanations for a significant correlation between, say, X and Y. (1) X causes Y; (2) Y causes X; (3) Z causes both X and Y; and (4) it is a spurious correlation (a fluke).

Thus, it is quite possible that crime causes poverty. People who commit crimes find it difficult to get good jobs. Alternatively, both poverty and crime may be associated with a third factor such as low intelligence. Finally, it might just be a fluke. It should also be noted that poverty is relative. There was a time when poverty meant that people were starving to death. This is rarely the case in most developed countries. Today, the poorest of families may own smart phones and computers.

Some Related Examples:

- ADHD and hours TV watched by child under age 2. Study claimed that TV viewing causes ADHD. Do you agree?
- □ Three percent of older singles suffer from chronic depression; does being single cause depression?
- Cities with more cops also have more murders. Does 'more cops' cause 'more murders'?
 (If so, get rid of the cops!)
- □ There is a strong inverse correlation between the amount of clothing people wear and the weather; people wear more clothing when the temperature is low and less clothing when it is high. Therefore, a good way to make the temperature go up during a winter cold spell is for everyone togo out wearing very little clothing. Correct?
- □ There is a strong correlation between the number of umbrellas people are carrying and the amount of rain. Thus, the way to make it rain is for all of us to go outside carrying umbrellas. A rain dance!

The U.S. Government is changing the dietary guidelines for this country. These dietary guidelines have been wrong about such issues as fat and cholesterol. In fact, it is now quite

evident that eggs and liver are good for most people. The low-fat diet which replaces fat and protein with carbohydrates is probably more dangerous than a high fat diet since it results in diabetes, obesity, and heart disease (Teicholz, 2015). Teicholz (2015) believes that the mistake dietary experts made was relying on epidemiological data. These are observational studies where large groups of people are observed over long periods of time. The problem is that these kind of studies do not prove causality, they only demonstrate associations. They should be followed up with experiments. This relates to the problem discussed above. We may find, for example, that people who eat a great deal of meat suffer more from heart disease than those who eat little meat over a long period of time. This does not necessarily mean that meat is the culprit. There may be another factor at work. It is possible that meat eaters are more affluent and do less exercise and eat more sweets than those who eat less meat. This is why an experiment is needed.

THE CASE OF THE SMOKING GUN

A researcher claims that she has found a strong negative correlation between the number of cigarettes smoked and longevity. She claims that using regression she can demonstrate that the life expectancy of non-smokers is 10 years longer than that of smokers. Someone tries to refute her claim by providing names of a dozen lifelong smokers who have each lived more than 90 years and – rather snarkily – considers these individuals a "smoking gun" that refutes the claim. Who is right? (Course topic: Regression)

One of the key measures in regression is the coefficient of determination (r^2) . This measure is the proportion of the variance in the dependent variable (life expectancy) that is explained by the independent variable (cigarettes smoked). The r^2 measure ranges from 0 to 100%. Unless the r^2 is 100% -- which indicates that the independent variable did a perfect job of explaining the dependent variable – there will always be exceptions. Say the r^2 measure in the above example was a very respectable 60%; this means that 40% of the variation of the dependent variable is due to random factors and/or other variables. This means that there should be quite a few people that are heavy smokers that live a long life. These people may have very good genes or just be lucky.

There is a significant correlation between IQ and income but this does not mean that everyone with a high IQ makes a great deal of money. There are other factors that include motivation and a willingness to work hard. There are many people with high IQs who do not make much money and there are many low IQ people who have high incomes. There is no question that, on average, men are taller than women. Yet we all know women who are quite tall and men who are quite short.

CONCLUSION

The knowledge economy and the digital age have changed the nature of work and management. More people than ever before need critical thinking skills. People with critical thinking ability will be openminded, inquisitive, fairminded, careful when making a judgment, honest in facing their own biases, and willing to reconsider their views (Facione 2015). Critical thinkers do not blindly accept what others tell them without examining the evidence for themselves and coming to a conclusion based on all the available information. Thus they are much more likely to be effective problem solvers than those who do not question the conventional wisdom.

Aristotle said, "It is the mark of an educated mind to be able to entertain a thought without accepting it." Critical thinking, one of the most important skills that employers want to see in our graduates, is also one of the most difficult to teach. This paper suggests that a course in statistics can be used to strengthen critical thinking skills, and proposes 15 scenarios for the introductory statistics course that can encourage and stimulate students to use critical thinking skills, rather than or perhaps in addition to simply, say, inserting numeric values in a formula. Additionally, of course, probability and statistics are potent tools, if used correctly, and can help managers make good decisions. Today it is particularly important for employees, much like the organization itself, to be flexible, open to change, creative, and to understand what it means to consider an issue critically and with due deliberation.

REFERENCES

Arum, R. & Roksa, J. (2011). *Academically adrift: Limited learning on college campuses*. Chicago: University of Chicago Press.

Bach, P. B. (2012, June 5). The trouble with 'doctor knows best.' *New York Times*, Health, D6. Bakewell, S. (2013, November 22).

Clang went the trolley: 'Would you Kill the Fat Man?' and 'The Trolley Problem.' Book Review.*New York Times*. Retrieved from

http://www.nytimes.com/2013/11/24/books/review/would-you-kill-the-fat-man-and-the-trolley-problem.html?pagewanted=all&_r=0

Berrett, D. (2013, November 1). States demand that colleges show how well their students learn. *Chronicle of Higher Education*, A6.

Blum, R. H. and Scholz, M. (2010). *Invasion of the prostate snatchers*. New York: Other Press. Bruni, F. (2015, February 1). The vaccine lunacy. *New York Times*, Sunday Review, SR3.

Bush, D. & Peterson, J. (2013). Jukin' the stats: The gaming of law school rankings and how to stop it. *Connecticut Law Review*, 45(4), 1235-1280.

Carey, J. (2008, January 28). Do cholesterol drugs do any good? *Business Week*, 52-59. Cokluk-Bokeoglu, O. (2009). Teaching Critical Thinking Skills by Using Introduction to Statistics Course Content Material to Social Sciences Undergraduates in Turkey. *World Applied Sciences Journal* 6 (12): 1644-1649.

Coontz, S. (2013, May 26). When numbers mislead. *New York Times*, Sunday Review, 12. Crossen, C. (1993). *Tainted truth: The manipulation of fact in America*. New York: Simon & Schuster.

DeWall, C. N. & Myers, D. G. (2013, November). How psychological science can support smarter medical decisions. *APS*. Retrieved from

http://www.psychologicalscience.org/index.php/publications/observer/2013/novemb er-2013/teaching-current-directions-in-psychological-science-7.html

Duniho, T. (2012, October 23). The five easiest college majors. Huffington Post. Retrieved from <u>http://www.huffingtonpost.com/uloop/choosing-a-</u> <u>major_b_2001012.html</u>

Dyer, L. (2011). *Critical thinking for business students*. West Concord, Ontario: Captus Press Ennis, R. H. (1997). Incorporating critical thinking into the curriculum: An introduction

to some basic issues. Inquiry: Critical Thinking Across the Disciplines, 16(3), Spring, 1-9.

Ennis, R.H. (2010). CriticalThinking.Net [website]. Retrieved April 20, 2015 from http://www.criticalthinking.net/definition.html.

Facione, P.A. (2015). Critical Thinking: What it is and why it counts. Hermosa Beach, CA: Measured Resources. www.insightassessment.com/pdf_files/what&why2006.pdf

Ferlazzo, L. (2011, November 8). Response: Several ways to teach critical thinking skills.

Education Week. Retrieved from

http://blogs.edweek.org/teachers/classroom_qa_with_larry_ferlazzo/2011/11/response_ severa l_ways_to_teach_critical_thinking_skills.html

Ferris, M., S. Cheng, F. Wang, & J. Perolio (2014). Teaching Critical Thinking through the introductory statistics class. In K. Makar, B. de Sousa, & R. Gould (Eds.), *Sustainability in statistics education. Proceedings of the Ninth International Conference on Teaching Statistics* (ICOTS9, July, 2014), Flagstaff, Arizona, USA. Voorburg, The Netherlands: International Statistical Institute. <u>http://iase-web.org/icots/9/proceedings/pdfs/ICOTS9_C290_FERRIS.pdf</u>

Flanigan, S. & Morse, R. (2013, March 11). Methodology: Best law schools rankings. U.S. News.

Retrieved from <u>http://www.usnews.com/education/best-graduate-</u> schools/top-law- schools/articles/2013/03/11/methodology-best-law-schoolsrankings

Friedman, H. H. & Amoo, T. (1999). Rating the rating scales. *Journal of Marketing Management*, 9(3), 114-123.

Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2333648

Friedman, H. H. and Raphan, M. (2013a, December 24). School rankings: Descriptive statistics or incentives to manipulate? Available at

SSRN: <u>http://ssrn.com/abstract=2371726</u> or<u>http://dx.doi.org/10.2139/ssrn.2371726</u> Friedman, H. H. and Raphan, M. (2013b, December 4). How statistics can save your life or end It: A course module. Available at

SSRN: http://ssrn.com/abstract=2363742 orhttp://dx.doi.org/10.2139/ssrn.2363742

- Goldstein, J. (2013, July 2). Audit of crime statistics finds mistakes by police. *New York Times*. Retrieved from http://www.nytimes.com/2013/07/03/nyregion/audit-of-crime-statistics-finds- mistakes-by-police.html?_r=0
- Harding, Robert (2013, October 21). Siena Poll: Wording of New York casino gambling amendment question matters, part II. *The Auburn Citizen* (AuburnPub.com). Retrieved April 27, 2015 from <u>http://auburnpub.com/blogs/eye_on_ny/siena-pollwording-of-new-york-casino- gambling-amendment-question/article_89f99a0a-3a68-11e3-bdfe-001a4bcf887a.html.</u>
- Heisel, W. (2010, May 21). NNT can be TNT for blowing up pharma marketing claims. *Reporting on Health*. Retrieved from http://www.reportingonhealth.org/blogs/nntcan-be-tnt-blowing- pharma-marketing-claims
- Kaminer, A. (2013, October 28). Lists that rank colleges' value are on the rise. *New York Times*, A1, A3.
- Kaplan, A. (2013, November 6). Expansion of gambling in New York is approved. *New York Times*, A17.

Kelchen, R. (2013, September). America's best-bang-for-the-buck colleges. *Washington Monthly*.

Retrieved from

http://www.washingtonmonthly.com/magazine/september_october_2013/features/ameri cas_bestbangforthebuck_co_1046447.php

Kolata, G. (2013, November 13). Experts reshape treatment guide for cholesterol. *New York Times*, A1, A3.

Linville, P. W., Fischer, G. W., & Fischhoff, B. (1992). AIDS risk perceptions and decision biases, in J. B. Pryor and G. D. Reeder (Eds.), *The social psychology of HIV infection*. Hillsdale, NJ: Erlbaum.

McNeil, B. J., Pauker, S. G., &. Tversky, A. (1988). On the framing of medical decisions, in D.E.Bell, H. Raiffa, and A. Tversky (Eds.), *Decision making: Descriptive, normative, and prescriptive interactions*. Cambridge, England: Cambridge University Press.

Napoli, M. (2011, May 15). Most drugs don't work... *Center for Medical Consumers*. Retrieved from <u>http://medicalconsumers.org/2011/05/15/most-drugs-dont-work/</u>
Nocera, J. (2012, September 29). The college rankings racket. *New York Times*,
A23. O'Dowd P. (2001). Treating the many to benefit the few: The modest reach of
preventative medications medicine and health. *Medicine and Health /Rhode Island*,
84, January, 4-8.

O'Shaughnessy, L. (2011, June 20). Here's the nation's easiest college major. *CBS Moneywatch*. Retrieved from <u>http://www.cbsnews.com/8301-505145_162-37245744/heres-</u> <u>the-nations-easiest-college-major/</u>

Palmer, B. (2013, August 20). The case against the annual checkup. *Slate*. Retrieved from http://www.slate.com/articles/health_and_science/medical_examiner/2013/08/annual_c hecku ps_going_to_the_doctor_when_you_re_not_sick_does_more_harm.html

Schneps, L. & Colmez, C. (2013, March 27). Justice flunks math. New York Times,

A23. Selingo, J. (2012, September 28). Colleges and employers point fingers over skills gap. *Chronicle of Higher Education*, A20.

Stake, J. E., The Interplay between Law School Rankings, Reputations, and Resource
Allocation: Ways Rankings Mislead. *Indiana Law Journal*, Symposium on the Next
Generation of Law School Rankings, Vol. 81, p. 229, 2006; Indiana University Legal
Studies Research Paper No. 5. Available at SSRN: http://ssrn.com/abstract=700862 or
http://dx.doi.org/10.2139/ssrn.700862

Tavernise, S. (2015, February 13). Few health system studies use top method, report says. *New York Times*, A27.

Teicholz, N. (2015, February 21). The government's bad diet advice. New York Times, A19.

Tomar, D. (2013, November 10). How I helped teachers cheat. *New York Times*, Sunday Review, 9. Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *Science*, 211, 453–458.

Ungar, S. J. (2010, March 5). 7 major misperceptions about the liberal arts. *Chronicle of Higher Education*, A40-A41.

Welch, H. G., Schwartz, L. M., and Woloshin, S. (2011). Overdiagnosed: Making people sick in the pursuit of health. Boston: Beaco

THE EFFECT OF ESTIMATION UNCERTAINTY IN THE QUALITY FUNCTION FOR THE CONTINUOUS TIME-COST-QUALITY TRADEOFF PROJECT SCHEDULING PROBLEM

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The Effect of Estimation Uncertainty in the Quality Function for the Continuous Time-Cost-Quality Tradeoff Project Scheduling Problem

Index terms: project management, quality management, project planning, project scheduling, stochastic, stochastic optimization

Abstract

The quality of project tasks is an important objective in managing a project, and so it should be explicitly considered in project planning and scheduling. This realization has led to a stream of research that addresses how to evaluate the tradeoffs between quality, cost and time in project decision making. Previous research incorporated a quality function into a nonlinear programming model to evaluate the tradeoffs between quality, time, and cost. In this paper we extend this research by considering how estimation uncertainty for the quality function parameters affects the tradeoffs. Through several examples we show how time parameter uncertainty can have a substantial effect on project quality and the decisions on how much time to allocate to project activities. We propose a stochastic optimization model to determine the optimal levels of time, cost and quality when the quality function parameters are uncertain.

Introduction

Project management is "the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements." (Project Management Institute 2017). It consists of five phases: initiating, planning, executing, monitoring and controlling, and closing. The three key objectives of project management are completion time, total cost, and quality of the tasks (Demeulemeester and Herroelen 2000). From the earliest days when the discipline of project management was being developed, methods were created to assist in project planning, including the development of the critical path method (CPM) for project scheduling (Kelly and Walker 1959). CPM allows managers to understand the tradeoff between project time and cost, but assumes quality is held constant. More recently, researchers have realized that since the quality of project tasks is an important objective in managing a project, it should be explicitly considered and included in project planning and scheduling modeling. This realization has led to a stream of research that addresses how to evaluate the tradeoffs between quality, cost and time

in project decision making. This approach requires that project quality is measured for each project task.

As discussed in Ghodsi et al. (2009) the research on the quality-time-cost tradeoff problem can be characterized as falling into two groups: discrete and continuous methods. In the discrete methods stream, different modes of completing a given activity are defined, and for each mode distinct values of quality, time and cost are determined. The objective is to select a specific mode for each project task. Several methods have been proposed for this problem, and have been reviewed in Tavana et al. (2014). A more recent article by Monghasemi et al. (2015) use an evidential reasoning method to find the best Pareto solution for the discrete quality-timecost tradeoff problem.

In the continuous methods stream, the relationship between time, cost and quality are defined as continuous functions. Here one or two of the three variables are allowed to vary independently, with the remaining variable(s) defined as a function of that (those) variable (s). Babu and Suresh (1996) and Kang and Myint (1999) make a direct subjective assessment of task quality. They use a linear scale for quality anchored with the normal and crash quality values for each activity. Babu and Suresh (1996) measure project quality as the arithmetic or geometric mean of the task quality values or as the minimum of the task qualities. They use the results of three mathematical programming models to evaluate the tradeoffs for quality, time and cost. Kang and Myint (1999) apply the Babu and Suresh (1996) to a cement factory example.

Similar linear scales for quality anchored at the normal and crash times are used by other authors, including Ahadian et al. (2016) and Ghodsi et al. (2009). Salmasnia et al. (2016) use a response surface methodology to find an optimal amount of resources to assign to activities so that project total time and cost are minimized while quality characteristics are maximized. Mohammadipour and Sadjadi (2016) propose a multi objective mixed integer linear programming model to minimize the extra project cost, risk enhancement and quality reduction subject to a time constraint, providing a tradeoff between the three objectives to shorten project duration. The quality reduction is a linear function of the time that an activity's duration is reduced. Liberatore and Pollack-Johnson (2013) introduce the notion of a quality function and use the functional form of the bivariate normal to model quality at the task level. The quality function is incorporated into a nonlinear programming model to evaluate the tradeoffs between quality, time, and cost. In this paper we extend the work of Liberatore and Pollack-Johnson (2013) by considering how estimation uncertainty for the quality function parameters affects the tradeoffs. We propose a stochastic optimization model to determine the optimal levels of time, cost and quality when the quality function parameters are uncertain.

Maximizing Project Quality: The Deterministic Case

Liberatore and Pollack-Johnson (2013) introduced a framework for finding cost and time values to maximize overall project quality (such as the minimum quality of the individual tasks in the project) using continuous quality functions that are increasing functions of planned cost and time. They used the following bivariate normal quality function, where *K* is the maximum quality level:

$$Q(t,c) = Ke^{-\left[\left(\frac{t-\mu_t}{\sigma_t}\right)^2 + \left(\frac{c-\mu_c}{\sigma_c}\right)^2\right]}$$

A typical shape of the quality function is shown as Figure 1. Note that the maximum quality occurs at μ_t and μ_c .



Figure 1: Bivariate Normal Quality Function

This quality function is incorporated into the following nonlinear programming model whose objective is to maximize project quality:

(1)
(2)
(3)
(4)
(5)
(6)
(7)
(8)
(9)
(10)
(11)
(12)
(13)

where

 t_i = the duration of activity i, for i = 1,...,N c_i = the cost of activity i, for i = 1,...,N q_i = the quality of activity i, for i = 1,...,N S_i = the set of activities that are immediate successors of activity i, for i = 0,...,N T_{UB} = upper bound on the total project time C_{UB} = upper bound on the total project cost s_i = the scheduled start time for activity i, for i = 0,...,N+1 t_{\min_i} = lower bound on the duration of activity i, for i = 1,...,N

This model can be modified slightly to produce time-cost trade-off curves for different quality levels. Equation (1) is can be changed to

Minimize
$$\sum c_j$$
 (14)

and equation (4) can be replaced with

$$Q_{\min} \ge Q_0 \tag{13}$$

(15)

For a given quality level, Q_0 , one can then specify a total project time, T_{UB} , and find the minimum cost possible to achieve at least a Q_0 level of quality within that amount of time. Specifying different T_{UB} values will then give a time-cost trade-off curve for that level of quality. Doing this for different Q_0 values will then essentially provide quality level curves for the overall project quality, so a project manager can decide what combination of project deadline, budget, and quality makes the most sense for their particular problem.

Maximizing Expected Overall Quality: The Stochastic Case

Liberatore and Pollack-Johnson (2013) indicated that the original model above could be used, for example, if, in the middle of a project, a certain task ended up taking much longer than expected, and so a second round of optimization is needed to adjust for the unexpected circumstances (with new estimates of the parameters of the quality function), to try to minimize the damage to time, cost, and quality for the project. Traditional analysis does not have a way to incorporate quality as a *variable* in this process, but this approach does.

This raises the question of how such an analysis might be performed in advance, with a probability distribution on the time and/or cost parameters. If we could represent this stochastic possibility using existing data or even subjective estimation to obtain a probability distribution, we could extend the approach by maximizing the *expected* overall quality of the project.

As an example, let us consider the translator problem from Liberatore and Pollack-Johnson (2013), where two translators are each working on pieces of a large translation, and the project manager at the translation agency has estimated quality functions for each of them. The data from Liberatore and Pollack-Johnson (2013) is summarized in Table 1. This time, however, let us consider that the two tasks must be done in *series*, rather than in *parallel* as in the original example, although we will use the *same* quality functions for the two tasks derived in that article.

Translator 1		Translator 2			
Deadline	Cost	Quality	Deadline	Cost	Quality
(days)	(\$)	(0-44)	(days)	(\$)	(0-44)
t	С	q	t	С	q
4	1435	41	4	653	32
3	1435	35	3.75	653	26
3	1750	41	3.75	800	32
3	2150	43	3.75	975	33
2.5	2150	37	3.5	975	26
2	2150	33			

 Table 1: Time, Cost, and Quality Estimates for Translation Project

Our stochastic problem is to now think of task 1 as having a significant chance of running over the estimated time, from the *planning* perspective, before the project begins. However, rather than conceiving of the total time for task 1 as a random variable, our approach is to think of the *parameter* μ_1 as having a probability distribution. You can think of this as something like the translator having a family emergency (or a weather anomaly in a construction project) that just shifts the quality that would be associated with the actual (clock/calendar) time that the task takes by a constant factor (Δt) of the time that they were out of commission and not able to work on the translation. This would be a horizontal shift to the *right* in the quality function in the time dimension, so $Q_1^A(t_1, c_1) = Q_1(t_1 - \Delta t, c_1)$, but this would be mathematically equivalent to $Q_1^B(t_1, c_1)$, where $Q_1^B(t_1, c_1)$ is the same as $Q_1(t_1, c_1)$, with the μ_1 parameter replaced by ($\mu_1 + \Delta t$). Thus we can think of this stochastic monkey wrench as a stochastic change to the *parameter* μ_1 . The original shape of the quality function is still the same, it is just shifted.

For a given value of Δt , this is just another variant of our original deterministic maximization of the overall quality, so can be solved as before. If you did not take this approach, you might consider two simple extreme strategies: (1) still take the original assigned time t_1 for task 1, but sustain a large drop in the quality of task 1 because of the shift in the quality function, or (2) add the Δt to the scheduled time for task 1 (accommodate the delay fully), and let task 2 suffer. In practice, option (2) is probably the most common, leading to a delay of the whole project or a major quality (or cost) disaster in rushing task 2 to get done in time before the hard deadline. These two extreme heuristics are useful benchmarks to compare the optimal solution to, in order to see the potential improvement of the optimization over the simplistic extreme heuristics.

We begin with the baseline case ($\Delta t = 0$) where we assume a constraint of \$2400 for the total cost (as in the original example), and 6.2 days for the whole project. Applying the original model above and the Lingo Global Solver, we get a solution of $t_1 = 2.345$, $c_1 = 1637.2 , $t_2 = 3.855$, $c_2 = 762.8 , and $q^* = 32.97$.

In the translator example we first then looked at the solutions for different values of Δt , and compared them to the simplistic extreme heuristics ("stick with the original schedule" and "fully accommodate the delay"). Table 2 summarizes the results, which show that, even with only a Δt of 0.5 (half a day delay), the overall quality for the optimal solution is 5% better than Heuristic 1, and about 70% better than Heuristic 2.

Table 2 Sensitivity of min Q to Delta t

		t1 as sched	adjust t1
	Opt	Heur 1	Heur 2
Delta t	min Q	min Q	min Q
0	32.97041	32.9704101	32.97041
0.1	32.27156	31.9862953	30.45901
0.2	31.56157	30.9891036	27.75165
0.3	30.84216	29.9819284	24.93696
0.4	30.11475	28.9678051	22.09937
0.5	29.38075	27.9496964	19.31514
0.6	28.64152	26.9304787	16.64936
0.7	27.89906	25.9129311	14.15399
0.8	27.15356	24.8997206	11.86702
0.9	26.40675	23.8933962	9.812647
1	25.65988	22.8963779	8.002255
1.1	24.91416	21.9109471	6.436061
1.2	24.17075	20.9392438	5.105163

1.3	23.43076	19.9832588	3.993748
1.4	22.69529	19.0448316	3.081297
1.5	21.96628	18.1256426	2.344596
1.6	21.24301	17.2272187	1.759478
1.7	20.52717	16.3509277	1.302212
1.8	19.81962	15.4979804	0.950519
1.9	19.12122	14.6694328	0.684261
2	18.43272	13.8661848	0.485808
2.1	17.75487	13.0889888	0.340164
2.2	17.08832	12.3384539	0.234906
2.3	16.43372	11.6150443	0.159986
2.4	15.79161	10.9190892	0.107461
2.5	15.16253	10.2507938	0.071187
2.6	14.54694	9.61023466	0.046509
2.7	13.94524	8.99737936	0.029967
2.8	13.3582	8.41208304	0.019043
2.9	12.78537	7.85410091	0.011935
3	12.2275	7.32309978	0.007377
3.1	11.68459	6.81865678	0.004497
3.2	11.15692	6.34027744	0.002704
3.3	10.64462	5.88739496	0.001603
3.4	10.14255	5.45938198	0.000937
3.5	9.629653	5.05556092	0.000541
3.6	9.057361	4.67520449	0.000308
3.7	8.462953	4.31755057	0.000172
3.8	7.896738	3.98180268	9.54E-05
3.9	7.358323	3.66713948	5.21E-05
4	6.847241	3.37272309	2.8E-05

Next, consider the uncertain case if Δt follows a probability distribution. The solution can be formulated perfectly in mathematical form, and, depending on the category of the probability distribution and the computer algebra system used, solved either exactly or numerically.

We now consider the case where there is a triangular distribution (minimum = 0, mode = 0, maximum = 2) assumed for Δt , the stochastic change in t_1 . We use the model equations (1) - (13) above, but instead of q_1 being equal to $Q_1(t_1,c_1)$, it is now equal to the *expected value* of $Q_1(t_1,c_1)$. Below is the result from Maple:

$$\begin{split} & \textit{NLPSolve} \Bigg\{ Qmin, \Bigg\{ Qmin \le 44 \cdot \mathrm{e}^{-\left(\frac{t2-4.376777}{1.201346}\right)^2 - \left(\frac{c2-975}{671.0976}\right)^2}, Qmin \le \int_0^2 50 \\ & \cdot \mathrm{e}^{-\left(\frac{t1-(4.50856+x)}{3.822285}\right)^2 - \left(\frac{cl-2150}{1655.086}\right)^2} \cdot \left(\frac{2-x}{2}\right) \mathrm{dx}, tl + t2 \le 6.2, cl + c2 \le 2400, 2 \\ & \le tl, tl \le 4.50856, 3 \le t2, t2 \le 4.376777, 1435 \le cl, cl \le 2150, 653 \le c2, c2 \le 975 \\ \Bigg], \\ & \textit{maximize} \Bigg]; \\ & [28.1526997064057767, [Qmin = 28.1526997064058, cl = 1649.52935551914, c2 \\ & = 750.470644480861, tl = 2.51814643413803, t2 = 3.68185356586197]] \end{split}$$

Notice that the overall quality has decreased by almost 5 points, and that t_1 has been increased by a small amount, as would be expected.

Another approach to determine the distribution of Δt is to use the results of fitting the quality function to data points (see Table 1), as described in Liberatore and Pollack-Johnson (2013). As a result of the nonlinear estimation process, the parameters and their standard errors are determined, and the distribution of the parameters is typically assumed to follow a *t* distribution. In the translator example, since the estimation process involved five data points and four parameters, there is only one degree of freedom. In this case the t-distribution is equivalent to a Cauchy distribution. As a result, we did a second example using a Cauchy distribution with a centering parameter of 1 and a spread parameter of 0.2. Maple was not able to do this numerically directly, but we were able to obtain a solution using Reimann sums with large *n* values (the Qmin value for n = 50,000 agreed with the value below, to 5 significant figures):

$$NLPSolve\left(Qmin, \left\{Qmin \le 44 \cdot e^{-\left(\frac{t^2 - 4.376777}{1.201346}\right)^2 - \left(\frac{c^2 - 975}{671.0976}\right)^2}, Qmin \le ApproximateInt\right(50)\right\}$$

$$\cdot \left(e^{-\left(\frac{t^2 - (4.50856 + x)}{3.822285}\right)^2 - \left(\frac{c^2 - 2150}{1655.086}\right)^2}\right) \cdot \left(\frac{1.085464}{.2\pi \cdot \left(1 + \left(\frac{(x-1)}{.2}\right)^2\right)}\right), x = 0..100,$$

$$partition = 5000, method = midpoint\right), t1 + t2 \le 6.2, c1 + c2 \le 2400, 2 \le t1, t1$$

$$\le 4.50856, 3 \le t2, t2 \le 4.376777, 1435 \le c1, c1 \le 2150, 653 \le c2, c2 \le 975\right],$$

$$maximize$$

$$;$$

$$\left[25.1110947040966046, \left[Qmin = 25.1110947040966, c1 = 1654.36694907366, c2 = 745.633050926341, t1 = 2.62378027036603, t2 = 3.57621972963397\right]\right]$$

Notice that the quality has decreased even more for this example, and the t_1 value has increased more, mainly because the deviations are greater with this distribution.

Conclusion

This paper has shown how activity time uncertainty can be modeled as uncertainty in quality function parameters and can thereby be incorporated into the quality-time-cost tradeoff problem. Using this modeling approach, we show how time parameter uncertainty can have a substantial effect on the project quality and the decisions on how much time to allocate to project activities. Future research will demonstrate how the standard error of the quality function parameter estimates for a specific example can be included in the analysis and how they affect the optimal quality level and tradeoffs.

References

- Ahadian, B., Veisy, O., & Azizi, V. (2016). A multi-objective stochastic programming approach for project time, cost and quality trade-off problem (TCQTP). *Jordan Journal of Civil Engineering*, 10(4), 553 – 563.
- [2] Babu, A. J., & N. Suresh, N. (1996). Project management with time, cost, and quality considerations. European Journal of Operational Research, 88 (2), 320-327.
- [3] Demeulemeester, E., De Reyck, B., & Herroelen, W. (2006). The discrete time/resource trade-off problem in project networks: A branch-and-bound approach. IIE Transactions, 32(11), 1059 – 1069.
- [4] Ghodsi, R., Skandari, M., Allahverdiloo, M., & Iranmanesh, S. (2009). A new practical model to trade-off time, cost, and quality of a project. Australian Journal of Basic and Applied Sciences, 3(4), 3741 – 3756.
- [5] Kelly, J., & Walker, M. (1959). Critical path planning and Scheduling: An Introduction. Mauchly Associates, Ambler, PA.
- [6] Khang, D., & Myint, Y. (1999). Time, cost and quality trade-off in project management: A case study. International Journal of Project Management, 17 (4) 249-256.
- [7] Liberatore, M., & Pollack-Johnson, B. (2013). Improving project management decision making by modeling quality, time, and cost continuously. IEEE Transactions on Engineering Management, 60(3), 518 – 528.
- [8] Mohammadipour, F., & Sadjadi, S. (2016). Project cost-quality-risk tradeoff analysis in a time-constrained problem. Computers & Industrial Engineering, 95, 111 – 121.
- [9] Monghasemi, S., Nikoo, M., Fasaee, M., & Adamowski, J. (2015). A novel multi criteria decision making model for optimizing time-cost-quality trade-off problems in construction projects. Expert Systems with Applications, 42(6), 3089 – 3104.
- [10] Project Management Institute (2017).What is project management? https://www.pmi.org/about/learn-about-pmi/what-is-project-management Accessed December 4, 2017.
- [11] Salmasnia, A., Mokhtari, H., & Abadi, I. (2016). A robust scheduling of projects with time, cost, and quality considerations. International Journal of Advanced Manufacturing Technology, 60, 631 - 642.

[12] Tavana, M., Abtahi, A-R, & Khalili- Damghani (2014). A new multi-objective multimode model for solving the time-cost-quality trade-off project scheduling problem. Expert Systems with Applications, 41, 1830 – 1846.

THE IMPACT OF NETWORK CENTRALITY ON KNOWLEDGE TRANSFERS IN ALLIANCES

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THE IMPACT OF NETWORK CENTRALITY ON KNOWLEDGE TRANSFERS IN ALLIANCES

ABSTRACT

Alliances promote knowledge transfer in alliance related areas (intended knowledge transfers) while also leading to spillovers of knowledge in alliance unrelated areas (unintended knowledge transfers). Drawing on the social network perspective and using patent data, we study the effect of network centrality of the partners on these two types of knowledge flows. We argue that centrality facilitates cooperation and thus increases the intended knowledge transfer. On the other side, centrality acts as a predictor of opportunistic behavior reducing the transfer of unintended knowledge in alliances.

Keywords: Alliance, Knowledge Transfer, Social Networks

INTRODUCTION

The costs and risks of innovation continue to grow and as a result firms have adopted numerous alternatives to complement their in-house R&D. One such alternative is forming R&D alliances. R&D alliances allow partner firms to have access to complementary knowledge (Teece, 1986). Evidence suggests that the number of R&D alliances continues to increase, especially in technology intensive industries.

Despite sustained interest in alliances as knowledge acquisition vehicles, few studies have empirically looked at knowledge transfers, especially at different types of knowledge flows. As Oxley and Wada (2009) note: "Extant empirical research on the scope of knowledge transfer is quite sparse, reflecting difficulties in accessing adequate data and devising measures of knowledge flows in different areas, something that bedevils all empirical work in knowledge management". In an earlier study, Mowery, Oxley and Silverman (1996) introduced a measure of knowledge flows between alliance partners based on the increase in partner cross-citations after the alliance as compared to before the alliance. Using this measure, which has since become the accepted approach to measuring knowledge flows in alliances, they find that interfirm knowledge transfers are enhanced in equity joint ventures as compared to contract-based agreements. In another study, Gomes-Casseres, Hagedoorn and Jaffe (2006), using a similar measure find that alliances promote more knowledge flows than non allied firms.

While these studies provide valuable insights and suggest substantial knowledge flows take place in alliances, in a departure from these studies more recently Oxley & Wada (2009) look at the types of knowledge flows that occur in alliances by decomposing knowledge flows into two components: knowledge flows in alliance related areas and knowledge flows in alliance unrelated areas. Knowledge flows in alliance related areas are likely to be an outcome of intentional transfers in the alliance since they directly pertain to alliance activities (Oxley and Wada, 2009). In contrast, knowledge flows in alliance unrelated areas are likely to be unintentional, and the consequence of appropriation hazards and spillovers within the alliance. Oxley and Wada (2009) find that Joint Ventures promote knowledge transfers in alliance related areas, while reducing knowledge flows in alliance unrelated areas when compared to contract based alliances.

In this paper, following Oxley and Wada (2009), our purpose is to extend research on knowledge flows in alliance related areas and alliance unrelated areas and to understand the

impact of a firm's network position on alliance related and alliance unrelated knowledge flows. The network perspective builds on the notion that the most important aspects of an organizational environment is its social network of external contacts and that economic actions are influenced by the social context in which they are embedded (Granovetter, 1985). Based on the argument that the network structure can develop a firm's ability to identify and develop opportunities, research has started looking at the role of interfirm networks in alliances. Three categories of network benefits have been identified: access, timeliness, and referrals (Burt, 1992). Stuart (2000) argues that alliances are access relationships and that the advantages a focal firm derives from a portfolio of strategic alliances depends on the resource profiles of its alliance partners. Linkages generate access in a timely manner offering advantages over those who lack comparable connections. Referrals offer the opportunity to bypass formal, impersonal channels. Thus, the cumulative effects of networks on economic outcomes can be significantly positive in alliances.

Research has long emphasized the impact of social networks on innovation and more recently studies have started looking at how the position of a firm in a network impacts the innovation output. Studies have argued that direct ties and indirect ties positively impact innovation while structural holes negatively impact innovation (Ahuja, 2000). Schilling and Phelps (2007) argue that firms that are in dense networks with high reach exhibit higher innovation than firms that are in low density networks with low reach.

In this paper, we are arguing that examining knowledge transfers in alliances is incomplete without taking into consideration the firm's network position. The economic actions can be influenced by the position of the actors in social networks. Similarly, the willingness to transfer technological capabilities can be influenced by the position of a firm in the network. The social structure can determine the spread of knowledge, new ideas and practices by shaping patterns of interaction within the network (Burt, 1992). As firms keep creating new alliances and maintaining previously created alliances, they create a network of direct and indirect ties. The position a firm holds in its network can influence the behavior of firms, and thus the actions they take regarding the transfer of technological capabilities in an alliance. Firms that have higher centrality have the ability as also as the willingness to share alliance related knowledge. These firms have access to increased knowledge and thus have the ability to share knowledge to their partners. Further, while they have formed an increased number of alliances they have developed knowledge sharing capabilities. Moreover, these firms adhere to some norms imposed by the network and collaboration becomes something they are willing to do. Depending on their position in the network, partners are different in how they behave in order to achieve their goals and may behave opportunistically, willfully extracting knowledge with intent to outlearn the partner (Hamel, 1991). Network centrality, by being a predictor of opportunistic behavior will influence the transfer of unintended knowledge by reducing it, while it promotes collaboration and thus it will increase the transfer of intended knowledge. Thus, the research question that we attempt answering in this paper is: *How is network centrality impacting the transfer of knowledge between alliance partners in alliance related areas as also as in alliance unrelated areas?*

The remainder of the paper is organized as follows. In the next section we discuss our theory and hypotheses. Following that, we move on to our analysis and describe the data sources, the sample construction, and the measures and methods used. Next we present the results. Finally, we offer concluding remarks and discuss the limitations of our study.

THEORY AND HYPOTHESES

The idea that alliances are an important source of value creation has been supported by a number of studies (Anand & Khanna, 2000; Dyer, Kale, & Singh, 2001; Kale, Singh, & Perlmutter, 2000; Williamson, 1991). Alliances provide benefits in terms of knowledge gains for the partner firms as they can learn from their complementarities and differences. When forming an alliance, the partner firms would approach issues in new and innovative ways that are less likely to be found in either of the partners in the absence of an alliance. Strategic alliances have become an important tool for achieving sustainable competitive advantage, being a fast and flexible way to access complementary resources and skills that reside in other companies (Dyer et al., 2001). Although Transaction Cost Economics is one of the traditional ways to explain alliance formation (Williamson 1991; Hennart 1988), the emphasis has been on the Resource Based View. Firms are conceptualized a bundle of resources, a unique set of tangible and intangible resource (Penrose 1959). These unique resources give the firm its competitive position and advantage (Rumelt 1984). According to RBV, the reason firms form alliances is to have access to resources that otherwise would not be available to them and to create new resources.
While R&D alliances provide various advantages, they are also prone to significant costs and hazards. Some authors argue that alliances are rarely a sustainable means for creating competitive advantage, involving costs in terms of coordination, reconciling goals with an independent entity and creating competitors. An important cost associated with alliances is that they also lead to unintended knowledge transfers to the partner, either in the form of leakage or in the form of appropriation of valuable technologies.

Unintended knowledge flows happen as alliances are organizational forms that are incomplete contracts between firms. Detailed interactions between the partners can rarely be fully pre-specified due to human's bounded rationality (Simon, 1947). Not all the skills are intended to be transferred in an alliance, only those that serve the common purpose of the alliance. And while firms are in an alliance for cooperation there is also a competition between the partners (Hamel, 1991) that creates a tension and impacts the dynamic of the learning process. If contracts could be perfect and stipulate all possible ways in which a firm could appropriate the resources of its partner in an alliance, then unintended knowledge transfer would not be a problem. However, as Williamson (1975) remarks perfect contracts are impossible to write and despite all efforts, a contract does not fully specify what each party must do under every conceivable circumstance.

For an alliance to be successful, firms have to find the right equilibrium between maintaining an open knowledge exchange to achieve the goals of the alliance while also preventing unintended leakage of knowledge. Doz (1996) also notes that firms enter collaborations with shared, explicit expectation but also private expectations. Initially, partners only have a tentative understanding of each other's private motives. Their initial expectations, implicit and explicit, will influence the behavior within and around the alliance. Firms know when they enter an alliance that there will be some unintended knowledge transfer, the question is how much and how it will affect the success of the alliance and of each firm post-alliance.

Some of the unintended knowledge transfer can be reduced if there is trust among the partners. Thus, some of the alliance literature has emphasized the importance of inter-personal relationships and trust in an alliance. Kale et al. (2000) develop the notion of relational capital defined as the level of mutual trust, respect and friendship that arises out of the close interaction at the individual level between alliance partners. Relational capital or trust is built over a long period of time and positively influences the willingness to transfer knowledge. Relational capital

is linked to alliance success, learning and it is also limiting partner's opportunism (Kale et al. 2000). If trust exists, one can expect that transferred knowledge is not exploited by the partner.

Further, intended knowledge flows in alliances is increased when communication is increased. To achieve their goal and to be able to transfer alliance related knowledge the alliance partners have to interact frequently not only formally but also informally. Increased interactions facilitate sharing of both tacit and explicit knowledge (Inkpen, 1998).

Since firms can extend their access to resources and information by partnering with other firms, the number of partners each firm has (the centrality of the firm) becomes of importance. Centrality, which is a measure of how embedded a firm is in a network and captures a firm's positional advantage and status within the network, implies greater degree of access to information and resources (Burt, 1992) which leads to the idea that network centrality is a source of power. Centrality provides the focal firm with access to network resources that provide strategic opportunities, affect firm's behavior and value (Lavie, 2007), shape alliance formation decision (Gulati, 1999) and enhance a firm's market performance. In this paper, centrality represents the total number of direct ties a firm has in its industry. An example is presented in Figure 1. United Technologies Corp has 3 direct ties while each of its partners has only one direct tie.

Insert Figure 1 about here

Economic actions are embedded in social networks of relationships and are influenced by the centrality of the actors in the social network (Granovetter, 1985). As discussed above, centrality acts as a resource but the centrality of a firm in a network is also a means of enforcing norms of behavior among individual or corporate actors and acts also as a constraint (Walker et al. 1997). These constrains in an alliance reduce the opportunistic behavior and contribute to the success of the alliance. Therefore, the level of knowledge transfer in alliance related areas (intended knowledge transfers) will be increased, knowledge that otherwise would have been hindered by the expectation that the partner would behave opportunistically. Thus, we expect that firms with higher centrality to have a higher ability to share knowledge and to expose their partners a wide variety of opportunities in terms of knowledge. Further, there are two additional reasons why we expect that higher centrality of the partners leads to greater knowledge flows within the scope of the alliance. First, as firms build their network and form alliances, and thus achieve higher centrality, they become better at cooperating with their partners and better at facilitation alliance related knowledge transfer. Second, centrality in a network facilitates common understanding and shared principles of cooperation (Powell, Koput, & Smith-Doerr, 1996). Thus we expect alliance partners that have high centrality to learn most from each other in alliance related areas. Based on the above arguments, we hypothesize that:

Hypothesis 1

The transfer of total alliance related knowledge is positively influenced by the partners' centrality in the network.

Firms are dependent on each other to learn from a new alliance (Pfeffer & Salancik, 1978) and while they want to learn, they also need to protect themselves from possible opportunistic behavior from their partner. Alliances are self-enforcing agreements and such an arrangement implies high mutual interdependence between the partners and creates exposure to a partner's potential opportunism. If one party exhibits opportunistic behavior, the other party's recourse is to limit the interactions and thus limit the transfer of knowledge that is within the scope of the alliance or terminate the alliance. Since alliances are characterized by instability that arises from uncertainty concerning a partner's future behavior, successful cooperation cannot be achieved between the partners of an alliance without constrains on the partners to perform according with each other's expectations. Embeddedness theory acknowledges that "the ongoing networks of social relations between people discourage malfeasance" (Granovetter, 1985). Network formation is path dependent and the early partner choices have a significant impact on the future collaborations (Walker et al. 1997). Firms guide their choices based on past actions with other firms and continue to deal with those they trust. Better than the statement that someone is known to be reliable is information from a trusted informant that has dealt in the past with that firm and has found it to be so. There is undoubtedly a preference for transacting with firms of known reputation. One incentive not to cheat is the cost of damage to one's reputation (Granovetter, 1985). Relational capital which is important in alliances (Kale et al. 2000) plays an important role in the context of network structure.

A firm's ability to form new relationships depends on its position in the prior network structure (Ahuja, 2000). In order words, a firm not only has to want to form an alliance but it also must be attractive to potential partners. Finding an alliance partner that is trustworthy requires access to information, information that can be obtained from the firm's network. Partnering with firms with higher centrality reduces the opportunistic behavior as firms with higher centrality can spread information about ones behavior in an alliance in its network. Damage to ones reputation may limit the opportunities to form alliances with other firms in the network. Thus, when centrality is high in the alliance, firms act less opportunistically and alliance unrelated knowledge flows are reduced. Based on the above arguments, we hypothesize that:

Hypothesis 2

The transfer of alliance unrelated knowledge is negatively influenced by the partners' centrality in the network.

METHODS

Data and Sample

To empirically test our hypotheses, we created a data set of the patenting activities of the alliances partners. We used two main sources: the Securities Data Company (SDC) Database on Joint Ventures and Alliances and the NBER patent database (Hall, Jaffe, and Tratjenberg 2001). The SDC database collects information on numerous types of alliances from public sources such as SEC filings, industry and trade journals, and news reports. However, firms are not required to report their alliance activities and as a result SDC coverage is incomplete. Despite this limitation, SDC currently represents one of the most comprehensive and reliable sources on alliances (Schilling, 2009). Our data is collected starting 1990 since SDC coverage of alliances is more comprehensive from 1988 (but we needed 3 previous years of data in order to construct the networks for the focal firms). Our sample thus consists of alliances involving collaborative R&D activities with manufacturing and/or marketing activities were eliminated since our approach toward measuring knowledge flows involves using patent data, and hence we restricted ourselves to alliances with a strong technological component. There are two reasons why we went only up to the year 1996 inclusive with our data collection. First, in constructing our knowledge flow

measures we looked at patenting activity 10 years after the alliance. Second, the last year for which we have patent data from NBER is 2006. The period 1990-1996 also has the advantage of not containing any significant technological changes, thus avoiding any events such as patent races (Valentini, 2012). Studies that have looked at knowledge flows in previous literature use a comparable time frame to our study (e.g. Oxley and Wada (2009) use the period spanning 1988-1991 in their study; Sampson (2005) uses the period 1991-1993). Our sample is restricted to two partner alliances, where both partners are US private or public firms, thus maintain consistency in patenting systems across nations. Our final sample is 613 alliances. This sample size matches well with previous studies. For example, Oxley and Wada (2009) have a sample of 536 licensor-licensee pairs and Sampson (2007) has a sample of 463 alliances.

Since patents are not always assigned by USPTO to the firm subsidiaries participating in the alliance, another step we needed to take that is widely used the patent literature was to construct a patent portfolio for firms based on patents assigned to the parent as well as all of its subsidiaries.

Further, to create the network measures, we compile a different data set with all the alliances from 1988-1996. This resulted in 11,724 alliances. Some of the alliances have more than two partners, therefore we had a final number of 14,776 dyads. Since alliance termination date is not reported, similar to previous literature, we make the assumption that each alliance lasts 3 years. Therefore, we created alliance networks based on a 3 year window (1988-1990; 1989-1991; 1990-1992; 1991-1993; 1992-1994; 1993-1995; 1994-1996), resulting in 8 snapshots for each industry (at the two digit sic level), for a total of 144 snapshots. In estimating the network measures we used UCINET 6 (these measures are described below).

Measures

We use a number of variables derived from patent data, mainly measures based on patent citations, as a proxy for knowledge flows between the partners (Gomes-Casseres *et al.*, 2006; Mowery *et al.*, 1996; Oxley and Wada, 2009). All US patents have to include citations to all existing patents that are relevant to that technology, and thus patents provide a trace of an organization's knowledge creation activities (Gittelman and Kogut, 2003; Vasudeva and Anand, 2011). Patent citations and citations in academic articles are similar since both indicate previous work on which the current work builds on (Gomes-Casseres et al. 2006). However, patent citations have the advantage of being verified by an objective examiner. Examiners are experts

"able to identify relevant prior art that the applicant misses or conceals". Therefore, examiners look at the accuracy of citations and make sure that the firm is not strategically disguising significant knowledge (Hall et al., 2001) or that excessive citations to networks and colleagues are removed (Jaffe & Tratjenberg, 2002).

Similar to Oxley and Wada (2009), in constructing our measures of related and unrelated knowledge flows, we used 118 technology classes defined in the International Patent Classification System which provide us with more fine-grained measures of knowledge flows than the 49 aggregated technological sub-categories used in Jaffe (1986). The SDC database on alliances reports a scope for the alliance at the 4 digit SIC code. According to Schilling (2009) SIC coding in SDC is highly accurate. Thus, in identifying related and unrelated knowledge flows, we have to identify knowledge flows that are within the scope of the 4 digit SIC code of the alliance (related knowledge flows) and knowledge flows outside the scope of the alliance (unrelated knowledge flows). Unfortunately, the USPTO classification of patents does not provide an SIC correspondent of each patent. We therefore use a concordance developed by Silverman, that has been used in previous literature (McGahan & Silverman, 2001), that that connects the International Patent Classification (IPC) system to the U.S. Standard Industrial Classification (SIC) system at the four-digit SIC level (http://www-2.rotman.utoronto.ca/~silverman/ipcsic/documentation_IPC-SIC_concordance.htm).

This correspondence between patent classes and SIC provides the foundation for the distinction between related and unrelated knowledge transfers in alliances. First, we established the patent classes that correspond to the SIC code of the alliance based on the patent portfolios constructed at the corporate level for each firm in the alliance. All patents that belong these technological classes are considered alliance related patents. The patents that belong to technological classes that are outside the scope of the alliance (outside the SIC code of the alliance) are considered alliance unrelated patents. For a detailed explanation of the measures for related and unrelated knowledge flows, consider the following example outlined in Table 1.

Insert Table 1 about here

In Table 1, firm *i* patents in technological classes A and B, while firm j patents in technological class A. The scope of the alliance is an SIC code that corresponds to patent class A. Therefore our related patent class is A while B is the unrelated patent classes. Before the alliance, firm *i*'s patents in the related technological class A have one citation to firm *j*'s patents that are in the related technological class A. After the alliance, firm *i* has increased the number of patent citations to firm *j* in related areas to 3. The difference of 2 partner citations in related areas after the alliance as compared to before the alliance represents the related knowledge that firm *i* receives from firm *j*. Similarly, firm *j* has increased the number of citation to firm *i* in the related areas from 2 to 5, indicating that it has received 3 units of related knowledge from firm *i* after the alliance as compared to before the alliance. Moving forward to technological class B, in which before the alliance firm *i* patents but firm *j* doesn't patent, the number of citations from firm *i* to firm *j* has not increased after the alliance. However, firm *j* has started patenting in technological class B after the alliance and its patents in this class cite firm *i*'s patents twice. Therefore these 2 units of knowledge acquired by firm *j* constitute flows in unrelated areas.

Our method for calculating related and unrelated knowledge flows builds on Oxley and Wada's (2009) study of alliance related and unrelated knowledge transfers. Using a sample of 536 licensing contracts between US and Japanese firms, Oxley and Wada (2009) examine the effect of the ownership structure governing the licensing agreement on knowledge flows in related and unrelated areas. Knowledge flows in related areas were measured as increases in citations to the licensor's patents by the licensee in those technological classes specifically covered by the licensed patents. Correspondingly, knowledge flows in unrelated areas were measured as the increase in citations to the licensor's patents by the licensee in technological classes outside those covered by the licensed patents. Based on these measures, Oxley and Wada (2009) argue that knowledge flows in alliance related areas (i.e. flows in technological classes covered by the licensed patents) are intentional flows while knowledge flows in alliance unrelated areas (i.e. flows in technological classes outside those covered by the licensed patents) are likely to be the result of leakage rather than intentional knowledge sharing. In support of this point, they find that licensing contracts governed by equity arrangements are associated with lower knowledge flows in unrelated areas and higher knowledge flows in alliance related areas compared to non equity arrangements

Variables

Prealliance Related Knowledge (Partner Pre-Citations in Alliance Related Areas). In order to implement the above measures, we have to capture Prealliance Related Knowledge and Postalliance Related Knowledge for each firm (i.e. in Table 1 - number of patents in technological class A that falls within the declared SIC scope of the alliance). We chose to look at applied for date for granted patents rather than granted date since the application date is the earliest time when we can identify a new technology (Rosenkopf and Almeida, 2003). The total number of patent citations to the partner in the alliance related areas was counted in the patents applied for in the 10 years before the alliance. This count constituted the Prealliance Related Knowledge.

Postalliance Related Knowledge. Similar to the prealliance related knowledge, we counted the postalliance citations from firm *i* to firm *j* in patents applied for 10 years after the alliance in alliance related technological classes.

Related Knowledge Flows (R_i). As $Firm_i$ acquires technological knowledge from its partner $Firm_j$ in an alliance we should see a higher rate of citation of $Firm_j$'s patents in new patents applied for by $Firm_i$ (Mowery *et al.*, 1996). Increases in the cross citations in the alliance related technological classes (i.e. patent class A in Table 1) constitute our final measure of related knowledge flows. This measure captures the extent to which one partner builds on the partner's technology in areas within the scope of the alliance.

Total Related Knowledge Flows $(TR_{ij}=R_i + R_j)$ is the related knowledge flow in the alliance that is transferred from partner *i* to partner *j* summed with the related knowledge transferred from partner *j* to partner *i*. Thus total related knowledge gives the sum of flow for both partners, and is used to test the complementarity relationship between related and unrelated knowledge flows at the dyad level.

Prealliance Unrelated Knowledge (Partner Pre-Citations in Alliance Unrelated Areas). The total number of patent citations was counted for the patents applied for in the 10 year before the alliance from firm i to firm j in the alliance unrelated technological classes (i.e. class B in Table 1).

Postalliance Unrelated Knowledge. Similar to the prealliance unrelated knowledge, we counted the postalliance citations from firm *i* to firm *j* in patents applied for 10 years after the alliance in the unrelated classes.

Unrelated Knowledge Flows (UR_i) . Increases in the cross citations in the unrelated technological classes constitute our final measure of unrelated knowledge flow for each firm. This measure captures the extent to which one firm builds on the technology of its partner, even though this is outside the scope of the alliance.

Total Unrelated Knowledge Flows $(TUR_{ij}=UR_i + UR_j)$ is the total unrelated knowledge flow in the alliance from partner *i* to partner *j* and from partner *j* to partner *i*.

Firm Centrality represents the position that a firm occupies within an alliance network. We operationalized firm's centrality locally rather than globally (Powell et al., 1996). Centrality represents the number of nodes to which a focal node is adjacent. Degree centrality has been a measure widely used in the network literature (Powell et al., 1996).Because we have 144 different network snapshots, an important step was to normalize the degree centrality by the number of maximum possible degrees in an actor's network.

Control variables

Total Number of Prealliance Patents. An essential control variable based on patent data is the total number of patents, a proxy for firm technical capabilities (Adegbesan & Higgins, 2011). We measure prealliance patents by counting both partners' patents in a 10 year window before the alliance. Corresponding to alliance pairs, we calculated total number of patents for our control sample of random pairs.

Total Number of Partner Pre-Citations in Related Areas was measured by counting both partners' Pre-Citations in Alliance Related Areas.

Total Number of Partner Pre-Citations in Unrelated Areas was measured by counting both partners' Pre-Citations in Alliance Unrelated Areas.

Technological overlap. Following prior research, we use the measure of technological overlap developed by Jaffe (1986) based on the angular separation of the patent class distribution vectors of the partner firms in the 10 years previous to the alliance announcement. The distribution vectors (F_i ; F_j) are defined over the 118 technological classes defined by the International Patent Classification. The extent of the overlap among partner firms' areas of technological expertise is then:

Technological Overlap = $\frac{F_i F_{j'}}{\sqrt{(F_i F'_i)(F_j F_{j'})}}$, where F_i is the patent class distribution vector for firm *i* and F_j is the patent class distribution vector for firm *j*.

Technological Overlap varies from zero to one. A value of zero indicates no overlap in partner firms' areas of technological expertise and the closer the value is to one, the greater the overlap. This measure is not sensitive to the total number of a firm's patents within a class.

Industry dummies. Firms in different industries have different patenting propensity due to differences in the importance of patent protection, technological advancement etc (Mansfield, 1986).

Year dummies. Since the propensity to patent may also vary across time (Pavitt, 1984), we control for the year when the alliance was announced.

Joint Venture. Since previous literature has made the point that knowledge is enhanced in Joint Ventures and related knowledge flows is enhanced in JVs while unrelated knowledge flows is reduced in JVs(Mowery et al., 1996; Oxley and Wada, 2009) we introduce a control for whether the alliance is organized as a Joint Venture or it is a contract based alliance. Thus, we created a dummy variable that equals 1 when an alliance is organized as a joint venture and 0 when it is contract-based alliance.

Alliance Experience. To capture a firm's prior alliance experience (Hoang and Rothaermel 2005) we counted from SDC the total number of formed alliances before the alliance in our sample.

Network Average Density is defined as the extent to which the actors in a firm's network are connected with each other. This measure was calculated, using UCINET, as the total number of ties divided by the total number of possible ties.

Statistical Methods

The methodology we use is a negative binomial model. Since our measures of alliance related knowledge flows and alliance unrelated knowledge flows are based on patents, there are a high number of zero values in our dependent variables. The negative binomial model takes into consideration the count nature of the dependent variable while also accounting for the overdispersion (Sampson, 2007; Stuart, 2000). To tests hypotheses 1 and 2 we ran two separate regression models with total related flows TR_{ij} and total unrelated flows TUR_{ij} as the dependent variables. This analysis is at the dyad level.

Further, we ran a robustness check at the individual firms level in the alliance rather than at the dyad level. Kenny, Kashy, and Cook (2006) recommend that when dyadic analysis is done,

firms in the dyad (i,j) should be assigned to each group based on a meaningful variable. Since we are interested in how centrality impacts alliance related and alliance unrelated knowledge flows, we decided to divide the sample of dyads (i,j) into two vectors such that *Centrality i> Centrality j*. The vector *i* thus comprises of firms drawn from each dyad which have relatively higher Centrality than their partners. The vector *j* correspondingly contains partner firms that have relatively lower Centrality than their partner. During our sample period, some firms participated in multiple alliances. Thus the disturbances for these firms are not independent. To correct for this lack of independence between observations, we clustered the errors on the focal firm.

RESULTS

Table 2 presents the descriptive statistics for the dyadic analysis. All correlations in table 1 are within the adequate range specifying slight concerns related to multicollinearity.

Insert Table 2 about here

In Table 3, column 1 presents the results for the regression at the dyadic level when the dependent variable is Total Related Knowledge Flows. The coefficient estimate for *Partners' Centrality* is positive and significant indicating overall support for our hypothesis 1 that alliance related knowledge flows are enhanced by the partners' centrality. Thus, centrality enhances collaboration leading to more knowledge flows within the scope of the alliance.

In Table 3, column 2 presents the results for the regression when the dependent variable is Total Unrelated Knowledge Flows. The coefficient estimate for *Partners' Centrality* is negative and significant indicating support for Hypothesis 2 that alliance unrelated knowledge flows are diminished by the partners' centrality. Partners' centrality acts as a predictor for opportunistic behavior and thus the higher the centrality of the partners, the lower the transfer of knowledge in areas outside the scope of the alliance.

Insert Table 3 about here

In Table 4, we present our robustness checks. Column 1 presents the results for the regression at the individual firm level when the dependent variable is Related Knowledge Flows for the firm in the dyad that has relatively lower centrality than its partner. The coefficient estimate for *Partner' Centrality* is positive and significant indicating support for the idea that related knowledge flows is enhanced by the partner' centrality that has more access to knowledge in the network.

In Table 4, column 2 presents the results for the regression when the dependent variable is Firm Unrelated Knowledge Flows. The coefficient estimate for *Partners' Centrality* is negative and significant indicating support for Hypothesis 2 that unrelated knowledge flows are diminished by the partner' centrality. Because central firms have more access to resources it becomes more desirable to form an alliance with a central firm. Being deeply embedded in the network, firms have a high number of connections with other influential firms and have access to their resources (Lavie, 2007). Most of the times, higher centrality means more access to resources. Higher centrality implies that opportunism will decrease, as this firm can sanction the opportunistic behavior more efficiently. Further, when partnering with a firm with high centrality, the benefit from opportunistic behavior will not outweigh the benefits that could result from the success of this alliance (e.g. accessing the partner's network resources), the partner will limit its opportunistic behavior, and therefore its inflows of knowledge in alliance unrelated areas.

Insert Table 4 about here

DISCUSSION

Researchers have long been interested in alliances as a mechanism for acquiring knowledge. However, there has been limited work aimed at understanding the types of knowledge flows that happen within an alliance and the factors that impede or promote these types of knowledge flows.

In this paper, similar to Oxley and Wada (2009) we decomposed knowledge transfers in alliances in knowledge flows that are within the scope of the alliance and knowledge flows that

are outside the scope of the alliance. Further, we examined whether knowledge flows inside and outside the scope of an alliance are impacted by the centrality of the partners. Prior research suggests that knowledge flows within the scope of the alliance are intentional while knowledge flows outside the scope of the alliance occur mainly due to leakage and appropriability hazards (Oxley and Wada 2009). Previous literature has suggested several mechanisms to promote knowledge flows within the scope of the alliance or to reduce the knowledge flows outside the scope of the alliance or to reduce the knowledge flows outside the scope of the alliance or to reduce the knowledge flows outside the scope of the alliance such as limiting the scope of the alliance and using equity to align partners' incentives.

Interfirm network structure and thus centrality is a predictor for cooperative, but also opportunistic behavior. The combined centrality of the partners positively impacts the knowledge in alliance related areas that both partners receive while negatively impacting the alliance unrelated knowledge flows. Partnering with a firm with high centrality can be an important basis of enforcing trust. When partners in an alliance have high centrality, it is extremely likely that these higher centrality firms have developed behavior that fosters cooperation and trust. The behavior of one partner is likely to be reported to other actors in the network. Most likely reputation will be affected and future collaboration might be compromised if opportunistic behavior is exhibited. Therefore, the higher the centrality of one firm, the higher the chances that its partner behavior will be reported in the firm's network.

Partners are different in how they act in order to accomplish their goals and may behave opportunistically. When forming an alliance, firms should expect their partner to act opportunistically and therefore should choose their partners carefully. It is always ideal to partner with a firm that has higher centrality and thus higher access to knowledge. However, firms partnering with high centrality firms should be careful in acting opportunistically and willfully extracting knowledge that is outside the scope of the alliance as firms with higher centrality can sanction this behavior. We showed here that the knowledge the firm with lower centrality receives and falls within the scope of the alliance is possibly impacted by the centrality of the firm with higher centrality in the dyad. Further, transfer of knowledge in alliance unrelated areas to the firm with lower centrality in limited by the centrality of its partner with higher centrality. Thus, when establishing the goals of an alliance, close attention should be paid to the centrality of the partner since their centrality could be a means for limiting opportunism and enhancing cooperation. This study has limitations. One of the limitations of the patent data is that the commercial importance of patents as also as the propensity to patent in each industry are different. We included industry controls in the regressions in an attempt to account for this limitation. Despite the existing limitations in patent data, patent citations continue to be an accepted measure of the knowledge flows between partners. We hope future studies explore primary sources of data collection for measuring knowledge flows.

Future research could build on this paper in various ways. First, it would be useful to reexamine our findings in alternative samples and settings. Also, it is possible that rules that reduce the risk of unintended knowledge transfer can at the same time reduce intended knowledge transfer. Other factors could impact in the same direction both alliance related and alliance unrelated knowledge. Organizations can risk low intended and unintended knowledge transfer by taking too many protective measures or can risk depreciation of knowledge assets by transferring too much. A balance between these two needs to be found in order to achieve alliance success.

References:

- Adegbesan, J. A., & Higgins, M. J. (2011). The intra-alliance division of value created through collaboration. *Strategic Management Journal*, 32(2), 187–211.
- Ahuja, G. (2000). Collaboration Networks, Structural Holes, and Innovation: A Longitudinal Study. Administrative Science Quarterly, 45(3), 425–455.
- Anand, B., & Khanna, T. (2000). Do firms learn to create value? *Strategic Management Journal*, 21, 295–316.
- Burt, R. (1992). Structural Holes. Cambridge, MA: Harvard University Press.
- Doz, Y. L. (1996). The evolution of cooperation in strategic alliances: Initial conditions or learning processes? *Strategic Management Journal*, 17(S1), 55–83.
- Dyer, J. H., Kale, P., & Singh, H. (2001). How To Make Strategic Alliances Work. MIT Sloan Management Review, 42(4), 37.
- Gittelman, M., & Kogut, B. (2003). Does Good Science Lead to Valuable Knowledge?
 Biotechnology Firms and the Evolutionary Logic of Citation Patterns. *Management Science*, 49(4), 366–382.
- Gomes-Casseres, B., Hagedoorn, J., & Jaffe, A. B. (2006). Do alliances promote knowledge flows? *Journal of Financial Economics*, 80(1), 5–33.
- Granovetter, M. (1985). Economic Action and Social Structure: The Problem of Embeddedness. *The American Journal of Sociology*, 91(3), 481–510.
- Gulati, R. (1995). Does familiarity breed trust? The implications of repeated ties for contractual choice in alliances. *Academy of Management Journal*, 38(1), 85–112.
- Hall, B. H., Jaffe, A. B., & Tratjenberg, M. (2001). The NBER Patent Citation Data File: Lessons, Insights and Methodological Tools. *NBER Working Paper 8498*.
- Hamel, G. (1991). Competition for Competence and Inter-Partner Learning Within International Strategic Alliances. *Strategic Management Journal*, 12(Summer), 83–103.
- Hoang, H., & Rothaermel, F. T. (2005). The effect of general and partner-specific alliance experience on joint R&D project performance. *Academy of Management Journal*, 48(2), 332–345.
- Inkpen, A. C. (1998). Learning and knowledge acquisition through international strategic alliances. *Academy of Management Executive*, 12(4), 69–80.

- Jaffe, A. B. (1986). Technological Opportunity and Spillovers of R&D: Evidence from Firms Patents, Profits, and Market Value. *American Economic Review*, 76(5), 984–1001.
- Janowicz-Panjaitan, M., & Noorderhaven, N. G. (2008). Formal and informal interorganizational learning within strategic alliances. *Research Policy*, 37(8), 1337–1355.
- Kale, P., Singh, H., & Perlmutter, H. (2000). Learning and protection of proprietary assets in strategic alliances: building relational capital. *Strategic Management Journal*, 21(3), 217–237.
- Kenny, D. A., Kashy, D. A., & Cook, W. L. (2006). Dyadic data analysis. New York: Guilford Press.
- Kogut, B., & Zander, U. (1996). What Firms Do? Coordination, Identity, and Learning. *Organization Science*, 7(5), 502–518.
- Kumar, R., & Nti, K. O. (1998). Differential Learning and Interaction in Alliance Dynamics: A Process and Outcome Discrepancy Model. *Organization Science*, 9(3), 356–367.
- Lavie, D. (2007). Alliance portfolios and firm performance: A study of value creation and appropriation in the U.S. software industry. *Strategic Management Journal*, 28(12), 1187–1212.
- Mansfield, E. (1986). Patents and innovation: an empirical study. *Management Science*, 32(2), 173–181.
- McGahan, A. M., & Silverman, B. S. (2001). How does innovative activity change as industries mature? *Evolution of Markets*, 19(7), 1141–1160.
- Mowery, D. C., Oxley, J. E., & Silverman, B. S. (1996). Strategic alliances and interfirm knowledge transfer. *Strategic Management Journal*, 17, 77–91.
- Nonaka, I., & Takeuchi, H. (1995). *The Knowledge Creating Company: how Japanese companies create the dynamics of innovation*. New York: Oxford University Press.
- Oxley, J., & Wada, T. (2009). Alliance structure and the scope of knowledge transfer: evidence from U.S.-Japan agreements. *Management Science*, 55(4), 635–649.
- Pavitt, K. (1984). Sectoral patterns of technical change: Towards a taxonomy and a theory. *Research Policy*, 13(6), 343–373.
- Pfeffer, J., & Salancik, G. (1978). *The External Control of Organizations: A Resource Dependence Perspective*. New York: Harper and Row.

- Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). Interorganizational Collaboration and the Locus of Innovation: Networks of Learning in Biotechnology. *Administrative Science Quarterly*, 41(1), 116–145.
- Ring, P. S., & Van De Ven, A. H. (1994). Developmental processes of cooperative interorganizational relationships. *Academy of Management Review*, 19(1), 90–118.
- Rosenkopf, L., & Almeida, P. (2003). Overcoming local search through alliances and mobility. *Management Science*, 49(6), 751–766.
- Sampson, R. C. (2005). Experience effects and collaborative returns in R&D alliances. *Strategic Management Journal*, 26(11), 1009–1031.
- Sampson, R. C. (2007). R&D alliances and firm performance: the impact of technological diversity and alliance organization on innovation. *Academy of Management Journal*, 50(2), 364–386.
- Schilling, M. A. (2009). Understanding the alliance data. *Strategic Management Journal*, 30(3), 233–260.
- Schilling, M. A., & Phelps, C. C. (2007). Interfirm collaboration networks: the impact of largescale network structure on firm innovation.(Report). *Management Science*, 53(7), 1113(14).
- Silverman, B. S. (1999). Technological Resources and the Direction of Corporate Diversification: Toward an Integration of the Resource-Based View and Transaction Cost Economics. *Management Science*, 45(8), 1109–1124.
- Simon, H. A. (1947). Administrative Behavior. New York: Macmillan.
- Stuart, T. E. (2000). Interorganizational alliances and the performance of firms: a study of growth and innovation rates in a high-technology industry. *Strategic Management Journal*, 21(8), 791–811.
- Teece, D. J. (1986). Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. *Research Policy*, 15(6), 285–305.
- Valentini, G. (2012). Measuring the effect of M&A on patenting quantity and quality. *Strategic Management Journal*, 33(3), 336–346.
- Vasudeva, G., & Anand, J. (2011). Unpacking Absorptive Capacity: A Study of Knowledge Utilization from Alliance Portfolios. *Academy of Management Journal*, 54(3), 611–623.

Walker, G., Kogut, B., & Shan, W. (1997). Social Capital, Structural Holes and the Formation of an Industry Network. *Organization Science*, 8(2), 109–125.

Williamson, O. E. (1975). Markets and Hierarchies. New York: The Free Press.

Williamson, O. E. (1991), June 1. Comparative economic organization: the analysis of discrete structural alternatives. *Administrative Science Quarterly*, 36(2), 269–296.

FIGURE 1

Snapshot 1990, Alliances formed in 2 digit sic 37



Illustration of Related and Unrelated Knowledge transfer measure

Classes	Α	В
Number of patent citations from firm	1	1
i to firm j before the alliance		
Number of patent citations from firm	3	1
i to firm j after the alliance		
Number of patent citations from firm	2	0
j to firm i before the alliance		
Number of patent citations from firm	5	2
j to firm i after the alliance		

Correlation Table and Descriptive Statistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Total related knowledge	1									
Total unrelated knowledge	0.740	1								
Degree Centrality	0.162	0.121	1							
Network Density	-0.006	-0.056	0.488	1						
Total Number Of Partner Pre-Citations in										
Related Areas	0.594	0.517	0.172	0.076	1					
Total Number Of Partner Pre-Citations in										
Unrelated Areas	0.431	0.561	0.155	0.061	0.733	1				
Total Number of Prealliance Patents	0.309	0.289	0.284	0.001	0.449	0.431	1			
Joint Venture	-0.013	-0.026	0.056	0.151	0.038	0.021	0.0002	1		
Technological Overlap	0.398	0.345	0.090	-0.098	0.365	0.268	0.171	0.024	1	
Alliance Experience	0.387	0.305	0.352	-0.047	0.424	0.375	0.713	0.017	0.269	1
Mean	101.210	14.989	.0283	.005	9.428	1.582	1558.901	.0633	.234	95.284
Standard Deviation	364.910	58.425	.051	.005	33.538	6.396	2198.302	.243	.311	140.173

Impact of Partners' Centrality on Related and Unrelated Knowledge - Dyad Level

	(1)	(2)
VARIABLES	Total Related	Total Unrelated
	Knowledge Flow	Knowledge Flow
Partners' Centrality	24.452**	-7.305*
	(7.930)	(3.560)
Network Average Density	-105.049***	46.697
	(24.403)	(30.854)
Total Number Of Partner Pre-Citations in Related Areas	0.018	0.011*
	(0.011)	(0.006)
Total Number Of Partner Pre-Citations in Unrelated Areas	0.001	0.053*
	(0.040)	(0.023)
Total Number of Prealliance Patents	0.000***	0.000***
	(0.000)	(0.000)
Year Dummies	Included***	Included***
Industry Dummies	Included***	Included***
Joint Venture	-0.706	0.518
	(0.446)	(0.425)
Technological Overlap	5.269***	5.234***
	(0.660)	(0.562)
Alliance Experience	-0.001	0.004*
	(0.002)	(0.001)
Constant	-0.103	-1.648**
	(0.679)	(0.608)
Wald Chi	1791.10***	367.73***
Df	21	21
Observations	597	613

Negative binomial estimates

Robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Impact of Partner's Centrality on Related and Unrelated Knowledge - individual firm

level	ana	vsis
10,001	ana	LYSIS

Negative binomial estimates	S
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	(1)	(2)
VARIABLES	Firm Related Knowledge	Firm Unrelated Knowledge
	Flow	Flow
Partner Centrality	44.239***	-16.416*
	(12.066)	(8.969)
Firm Centrality	71.430**	60.513**
	(27.285)	(20.812)
Network Average Density	-156.272***	-20.208+
	(25.114)	(12.097)
Total Number Of Partner Pre-Citations in Related Areas	0.002	0.011**
	(0.007)	(0.003)
Total Number Of Partner Pre-Citations in UnRelated Areas	0.038	0.002
	(0.033)	(0.015)
Firm Prealliance Patents	0.000**	0.000+
	(0.000)	(0.000)
Partner Prealliance Patents	0.000*	0.000***
	(0.000)	(0.000)
Year Dummies	Included***	Included***
Industry Dummies	Included***	Included***
Joint Venture	-0.221	1.406*
	(0.510)	(0.700)
Technological Overlap	3.899***	2.962***
	(0.530)	(0.523)
Total Alliance Experience	-0.001	0.001
-	(0.002)	(0.002)
Partner Related Knowledge Flow	0.003***	
	(0.001)	
Partner Unrelated Knowledge Flow		0.030***
		(0.006)
Constant	-2.579***	-2.951***
	(0.558)	(0.663)
Wald Chi	797.29***	370.46***
Df	22	22
Observations	457	468

Robust standard errors in parentheses with clustering on the focal firm. Robust standard errors in parentheses; *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

UNACHIEVABLE CONSCIOUSNESSES ON ELECTRONIC ROBOTS

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Abstract

Can electronic computers and robots achieve human consciousness and human mind? This article shows that computer intelligence is not unlimited and there are insurmountable obstacles for electronic robots to achieve the full range of human intelligence. Human's selfawareness cannot be programmed on a computer. We investigate self-conscious emotions (SCE) which are human consciousnesses based on self-awareness. We categorize dozens of human consciousnesses into three levels: non-SCE, weak SCE, and strong SCE, according to how much they are related to self-awareness. By doing so, we could foresee what human intelligence / consciousnesses can be, or cannot be, or to what extent can be, achieved on a robot, and have a better idea on the "robot species" we are going to deal with in the near future.

Key Words: Artificial intelligence, Information technology, Robot, Machine consciousness

1. Introduction

Thousands of robots have been developed in hundreds of universities and research institutions all over the world. The robots with human-like skins and facial expressions have begun to serve and entertain people. They are capable of autonomously moving, talking, navigating, understanding, making decisions, and learning, albeit they are still far from possessing the full range of human intelligence and capacities. IBM Watson made a significant milestone in artificial intelligence (AI). Its computer Watson successfully beat human competitors in the knowledge challenging contest "Jeopardy!" in 2011 [Kelly 2013]. IBM Watson demonstrated its vast knowledge and the capability of handling the vast knowledge, as well as its capability of 'understanding' questions in ordinary language and "tricks" in questions. In March 2016, computer AlphaGo, developed by Google, beat 18-time Go world champion Lee Se-dol 4-1 in the five-game series [Verge 2016]. Go is a board game long considered impossible for computers to play due to the presumed level of intuition required. Go's rules are simple, but it has more possible positions than number of atoms in the universe. As a milestone of Artificial Intelligence, AlphaGo showed its strong capability of self-learning.

With the exponential explosion of computer technology, it seems that computers can do anything humans are able to, - the only issue is "when". AI has become a world project of making computers like humans in all aspects, such as thinking, learning, feeling, talking, walking, and having the mind. When will the project done? The optimistic estimate is just in twenty years.

But, is it true that computers are able to, sooner or later, possess the full range of human intelligence and consciousness? In this article, we will look at some "forbidden consciousness" that are not programmable in this article. Section 2 briefly reviews the contention on whether there is a limit for computer intelligence. In Section 3, we investigate three forbidden consciousnesses: self-awareness, fear of death, and SCE, and discuss the perspective of the future society in which we have to deal with the robots which are super intelligent but do not have those forbidden consciousnesses.

2. Contention on Future of AI

How far computer intelligence can go has been debated for more than half a century among scientists and philosophers. An electronic computer's functions and "intelligence" come from programs or software built into it. The limit of computer intelligence amounts to the limit of computer programming. The issue of "how far computer intelligence can go" is thus same as "what can, and cannot, be programmed".

Wolfram put forward his hypothesis of "software of everything" in 2002, "beneath all the complex phenomena we see in physics there lies some simple program which, if run for long enough, would reproduce our universe in every detail." [Wolfram 2002] Gardner agreed with Wolfram, "Wolfram's software of everything would be the mother of all source codes, generating not only the movements of stars and planets but also the emergence and evolution of life and intelligence." "Wolfram is not the only serious scientist who believes that the universe is a kind

of vast natural computer with parallels to human-designed laptops." [Gartner 2007] Every phenomenon in the universe is programmable, as Wolfram proposed.

Hall took it as a 'clear' issue: "AI is coming. It is clear we should give consciences to our machines when we can. It also seems quite clear that we will be able to create machines that exceed us in moral as well as intellectual dimensions." [Hall 2007]

Newell and Simon depicted the future of computer intelligence when AI as a subject just set up. "There are now in the world machines that think, that learn, and that create. Moreover, their ability to do these things is going to increase rapidly until – in a visible future – the range of problems they can handle will be co-extensive with the range to which the human mind has been applied." [Newell and Simon 1958] They thereafter extended that idea into their *Physical Symbol System Hypothesis* in 1976, "A physical symbol system has the necessary and sufficient means for general intelligent action." [Newell and Simon 1976] They defined *physical symbol system (PSS)* as a physical device that contained a set of interpretable and combinable symbols and a set of processes that could operate on the symbols. A human brain and a computer are examples of PSS. Their hypothesis states that a symbol processor, as a computer, possesses all the matters for thoughts and intelligence, and that something is intelligent if and only if it is a PSS. This idea was later named as "*strong AI*" [Searle 1997]. According to strong AI, human intelligence and consciousness can be realized in a computer by programming.

Minsky never had any doubt on a conscious machine. "Most people still believe that no machine could ever be conscious, or feel ambition, jealousy, humor, or have any other mental life-experience. To be sure, we are still far from being able to create machines that do every-thing people do. But this only means that we need better theories about how thinking works." [Minsky 1986]

Kurzweil is a strong advocator of strong AI. "Even if we limit our discussion to computers that are not directly derived from a particular human brain (i.e., not by doing reverse engineering), they will increasingly appear to have their own personalities, evidencing reactions that we can only label as emotions and articulating their own goals and purposes. They will appear to have their own free will. They will claim to have spiritual experiences. And people – those still using carbon-based neurons or otherwise – will believe them." [Kurzweil 1999]

Clark agreed with Kurzweil, "How could a device made of silicon be conscious? How could it feel pain, joy, fear, pleasure, and foreboding? It certainly seems unlikely that such exot-

ic capacities should flourish in such an unusual silicon setting. But a moment's reflection should convince you that it is equally amazing that such capacities should show up in carbon-based meat." [Clark 2001] Gilder and Richards also agreed, "If we're a carbon-based complex, computational, collocation of atoms, and we're conscious, then why wouldn't the same be true for a sufficiently complex silicon-based computer?" [Gilder and Richards 2002] Minsky simply called human brain a "meat machine" [Minsky 1986]. Bainbridge predicted the possible impacts of robots on human's longevity, "in principle, and perhaps in actuality three or four decades from now, it should be possible to transfer a human personality into a robot, thereby extending the person's lifetime by the durability of the machine." [Bainbridge 2004]

Some scholars are not optimistic about the era of robots. Joy in 2000 addressed his serious concern that super-smart computers would be a disaster for the humanity [Joy 2000]. A research report of Gartner in 2013 warns "The smart machine era will be the most disruptive in the history of IT. New systems that begin to fulfill some of the earliest visions for what information technologies might accomplish — doing what we thought only people could do and machines could not —are now finally emerging." [Gartner 2013] Barrat warns in 2014 that that it will never be a rapturous picture of the future when super-intelligent machine "co-exist" with us and AI could drive mankind into extinction [Barrat 2014]. The open letter in 2015 signed by hundreds of top scientists alerted the world about the pressing threat of AI [Live Science 2015].

No matter whether the scientists mentioned above are optimistic or pessimistic about the "era of robots", they share a common assumption that all human intelligence and consciousness are programmable. There are people who do not believe that assumption.

Hofstadter did not believe emotions can be directly programmed, "Programs or machines will acquire emotions in the same way: as by-products of their structure, of the way in which they are organized – not by direct programming." [Hofstadter 1999] But he did not provide necessary or sufficient conditions for such imaginary "emergent phenomenon" to occur. Kaku hypothesizes that self-awareness is an "emergent phenomenon" of sufficiently complex programs [Kaku 2014].

Dualists do not believe machines will have spirits and souls. Dualists take it for grant that the mind is something fundamentally different and separate from the physical things. However, they did not provide evidences showing why minds were not physical, and they did not tell what minds actually were if they were not physical. Computer scientists and AI people seemed not particularly interested in refuting dualism. As Hall put, "The only refutation worth doing is simply to build the AI, and then we will see who is right." [Hall 2007]

Del Monte thinks it is difficult to argue that a machine can become self-conscious or obtain what is termed "artificial consciousness", because "we do not completely understand how the human brain processes consciousness to become self-aware." [Del Monte 2013]

Hawkins and Blakeslee held a firm attitude denying the possibility that a computer is programmed same as a human. "Can computers be intelligent? For decades, scientists in the field of artificial intelligence have claimed that computers will be intelligent when they are powerful enough. I don't think so. … Brains and computers do fundamentally different things." [Hawkins and Blakeslee 2004] Philosopher Searle argued that computers "are immensely useful devices for simulating brain process. But the simulation of mental states is no more a mental state than the simulation of an explosion is itself an explosion." [Searle 1997]

Physicist Penrose addressed his arguments, "I do my best to express, in a dispassionate way, my scientific reasons for disbelieving this perception, and arguing that the conscious minds can find no home within our present-day scientific world-view." He hypothesized that the thorough explanation of the human mind might be somewhere in the "quantum world". [Penrose 1999]

Wang showed that a robot cannot have sentience of life and death otherwise it would cause a logical contradiction. Therefore, a digital computer would never have the *full range* of human consciousness [Wang 2013]. That was the first strict proof on the un-limitedness of the capability of computers.

Wang's article in 2016 reasoned that human's subjective self-identity cannot be programmed, which provided a counter-example to Wolfram's thesis of "software of everything" and disproved the hypothesis "all human intelligence can be programmed". [Wang 2016] It showed a logical blind spot which computer intelligence can never achieve.

3. Unachievable Consciousness on Robots

By "something unachievable on robots" we mean that it cannot be programmed on the robots, or, simply, a robot cannot possess it.

Some consciousnesses are highly associated with intelligence. Non-human animals do not have sense of "shame", "guilt", sense of dignity, and sense of solemn, due to their lower lev-

el of intelligence. The full range of human intelligence includes capabilities of all mental processes of humans which include not only thoughts but also mind and spirit.

Minsky believes that one can make computers to "do all the things people do", including all human's spiritual processes. That is the assumption held by most scientists as we reviewed in Section 2, no matter whether they are optimistic or pessimistic about the future of humanity when robots are around us.

We in this section explore inabilities of future robots. Those inabilities of robots are not just for a time being. They are inherent and eternal inabilities. The assumption that "computers can do all things people do" is not true. Digital robots will differ from humans.

We start with self-awareness, which was proved to be logically impossible for a robot to have, and move to the consciousnesses dependent on self-awareness. Fear of death is a typical and most important consciousness prohibited on a robot. We then investigate "self-conscious emotions", SCEs, which are consciousnesses based on self-awareness. We enumerate human consciousnesses and categorize them so as to differentiate SCEs from non-SCEs and to have an idea about what aspects of intelligence and mind the future robots will not be able to achieve.

3.1 Self-identity or Self-awareness

"Self" in this article refers to subjective self which is the "self" from the standpoint of the first person "T". A person's subjective self is his/her ego which is the conscious mind that he/she considers his/her "self". Similarly, "*self-identity*" refers to the *subjective self-identity* from the standpoint of the first person; self-awareness refers to subjective self-awareness. Every person has one subjective self-identity. It is his/her inner "I" from which he/she recognizes and interacts with the outside world. It is not his/her name, social security number, and any other external persona.

From a person's subjective standpoint, there is only one "I" or one "myself", although there are many "himself's", "herself's" and "yourself's". Of seven billion people in the world, every person has a subjective self-identity. For a particular person, subjectively, there is one subjective self which differentiates him/her from any other objective self's. A subjective selfidentity is unique.

Any one's self-identity is unitary. It is not possible to have two or more identical subjective self-identities existing at the same time. Subjective self is always singular, while objective "self" can be plural, such as themselves and yourselves. It is a common sense for everyone that there is only one "I" in this world. No one has ever argued that subjective self and self-identity can be plural.

Self-awareness or self-consciousness is the awareness of the existence of subjective selfidentity and its uniqueness, which recognizes the subjective self as an individual separate from the environment and other individuals. The essentials of self-awareness or self-consciousness are: "'I', and only 'I', is aware of the existence of myself," "'I' is different from anything else in the world", and "If 'I' dies, then my self-identity and the world around will disappear forever." Recognizing the uniqueness of self-identity requires the intelligence capability of introspection and reflection, which is possessed by only human beings among all living beings.

Programs of electronic computers are duplicable, which is derived directly from Church-Turing Thesis [Turing 1950] [Russell 2010]. On the other hand, self-identity is unitary, which means un-duplicable. Therefore, self-identity cannot be achieved by programming. [Wang 2016]

That's a solid proof showing computer capability is limited. It also points out a blind spot of computer capability. Computer is not omnipotent. Wolfram's "software of everything" hypothesis and Minsky's assertion "computers can do all things people do" are thus untenable. Having robots with full range of human intelligence and consciousness is thus an unachievable dream. Reaching immortality through digital technology is thus an unachievable dream either.

3.2. Fear of Death

Fear of death is a fundamental fear of humans. It is based on self-awareness and understanding of death: "If I die, then everything around me and the whole world would disappear forever and I would fall into forever darkness." Becker wrote in his book <The Denial of Death>, "The idea of death, the fear of it, haunts the human animal like nothing else; it is a mainspring of human activity." [Becker 1973 p.xvii] And fear of death is a most basic psychological factor in psychoanalytic and psychodynamics created by Sigmund Freud.

If one were not self-aware, then he would have no fear of death, because reflective recognition of subjective "self" is a necessary condition to worry about "self" after death. Since self-awareness is not achievable on a digital robot, fear of death is not either.

3.3 Self-Conscious Emotions (SCEs)

Of the consciousnesses a human has, some are based on or closely related to selfawareness, which are called *self-conscious emotions (SCE)* [Tracy and Robins 2004], such as shame, pride, self-respect, and self-restraining. Since a computer cannot be programmed to be self-aware, it cannot be programmed to have SCEs, as an animal without self-awareness does not have self-respect or shame.

There have been not many researches on SCE in the literature, and almost all of the reported studies were in the field of psychology and sociology which focused on the issues like: at what age a particular SCE appeared, and the effects of SCEs on social relations [Tracy and Robins 2004] [Sturm 2006].

Since self-consciousness was not viewed as a blind spot of computer intelligence for a long time, SCE was not studied by AI people so far. Realizing the impossibility of a self-aware robot, AI people need to give a serious thought on what kind of robots we are creating in the near future. Quite a few research topics on SCE are worth to explore, such as how many SCEs are in a human's consciousness, what is the characterization of SCE, how SCEs are related to mind and spirit, whether a robot with super-intelligence but without SCEs can have free will, and how much likely they would turn against the humanity.

We next categorize human emotions according to their closeness to self-awareness. Of hundreds of human's emotions, some are definitely not self-awareness-related, such as hungry, fatigue, and pain; some are definitely self-awareness-reliant, as fear of death and self-esteem; and others are kind of, or arguably related to, self-awareness. We thus have the three categories of human emotions as follows.

Category 1. Non-SCE.

The consciousnesses in this category are not based on self-awareness. They occur on humans, as well as on animals with no self-consciousness. Here is a rundown of examples of such consciousnesses:

hunger, thirst, pain, itching, fatigue, sleepy, feeling cold / warm, joy, sense of unsafe, comfortableness, orgasm, dread. cruelness, sexual desire, sexual impulse, tasting sweet, sour, spicy, salty, impulse to compete with rivalry, sensation of pleasure after defeating the enemy, desire of controlling and dominating.

The consciousnesses in this category do not rely on self-awareness. They are not unprogrammable. Some non-SCE has already been realized on a robot. For example, Roomba, a floor mopping robot, is able to go to the charger to charge itself when its battery is low. Consider that the consciousness "hunger" refers to the feeling that we need to replenish our energy in response to our internal biological signals, we cannot reject that Roomba has consciousness of "hunger". Similarly, we can have machines with emulated consciousness of thirst, pain, anger, happiness, ... So, if such an emulated consciousness passed Turing Test on consciousness someday, one would have to acknowledge that, although arguably, the machine would be conscious in that aspect.

Category 2. Strong-SCE.

Immanuel Kant once summarized the crucial issues of humanity into three questions: "What can I know? What should I do? What can I hope for?" [Precht, 2009] It implies that as a unique species of animal that is self-aware and concerned about "who I am", we humans have our curiosity for the unknowns, our sense of moral, and pursuit for hopes. All of our consciousnesses about curiosity, moral, and hope are thus related to self-awareness.

Indeed, there are many of our emotions reliant strongly on self-awareness, which other animals do not have. The consciousnesses in this category occur only if the substrate of the consciousness is self-aware. In other word, self-awareness is a necessary condition for these consciousnesses to exist. We call them strong-SCEs.

Fear of death is doubtlessly a strong-SCE. It is the dread of the mystery and obscurity of death, as discussed in Section 3.2. Anxiety of death plays "the fundamental conscious motivation of humanity", as argued by Ernest Becker [Becker 1973].

The emotions, feelings, and motivations due to anxiety of death are strong-SCEs because they are reliant on understanding of "self" and "death". Examples are: An elder person feels urgent to accomplish something in his remaining years, Sense of urgency to buy life insurance and to set up a will, Special feelings for parents who are getting older and are closer to their death, Internal impulse for religion, to have a meaning of life and have peace in mind, Sense of inheritance, and sense of value of life.

More examples of strong-SCEs include:

guilt, conscience. sense of nobleness, embarrassment, envy, faith. shy. regret, reverence, shame, greed, pride, self-respect, self-restraining, sense of dignity, sense of solemn, sense of expectation / frustration, sense of worship, feeling being insulted / losing face, keeping up with the Joneses, sense of moral, empathy - understanding due to one's own experience.

Strong-SCEs are un-programmable, therefore cannot be achieved on a robot, since they are dependent on self-awareness and self-awareness is not programmable. A robot without self-awareness will not have the above examples of strong-SCEs. A robot may pretend to have them, but it will never actually possess them since it is logically impossible.

Category 3. Weak-SCE

This category contains consciousnesses which look equivocal between Non-SCE and Strong-SCE. We call them *weak-SCEs*. Animals without self-awareness may more or less have them, but they may become more subtle and intense on humans due to human's self-awareness. We are not sure how much self-awareness effects on them. More researches are needed to characterize them and identify to what extent each weak-SCE is programmable. Examples of weak-SCEs are as follows.

sincereness. indignation grief /sorrow, sorry, nostalgic, solitude, un-easiness, happiness, satisfaction, feeling bored complacence, curiosity, ambition. sensitivity. hatred. depressed. obsession, nervousness. supercilious, snooty, presumptuous, frivolous, flighty, fantasy bewildered resentment, bitterness, broad-minded deceitful, amazed, humility self-abased illusion, maintaining privacy, group-recognition utterly disconcerted, vexed / perturbed, absent-minded. responsibility, sense of mystery, hallucination. free will, proud. being moved, and feelings related to love: - which are deep from one's heart to think of a particular individual and desire to stay with him/her all the time and forever, such as passion of love, broken-hearted feelings with lovelorn, and eager to be loved or nurtured.

In summary, Non-SCEs can be found in many animals. They are not dependent on selfawareness. And they are not proved to be un-programmable. Strong-SCEs are not found in animals other than humans. They have been proved to be un-programmable. weak-SCEs can be found in some animals or babies which do not have self-awareness. But with self-awareness, these consciousnesses may become more intense and more subtle. We are not sure whether weak-SCEs can be programmed and to what extent they can be programmed.

3.4 Robots of Super-Intelligence with No Self-Awareness (RSINSA)

Now, we can tell a blurred picture about what the robots in the future are like: They are all-round super-intelligent but they do not have self-identity, they do not have fear of death and strong-SCEs. Let us put such a robot as *RSINSA* (robot with super-intelligence but with no self-awareness).

In the biological world, humans are at the top of the food chain and have dominating intelligence over other animals which are not self-conscious. Artificial intelligence will make a new species, RSINSA. It is super-intelligent, looks like a human, but does not have selfconsciousness and self-awareness related consciousnesses. Such a species will be different from any species ever on the earth. But it will come soon (in 20 years according to the optimistic estimate). We humanity need to get ready to deal with RSINSAs before they become popular around us. We should have answers to the questions such as:

What will RSINSA be like?

Can RSINSA reproduce itself?

Does RSINSA have free-will?

Does RSINSA have soul and spirit?

What is RSINSA's sense of morality?

Does RSINSA prefer freedom and democracy or despotism?

Is RSINSA more or less creative than humans?

Can humans control or dominate RSINSA, or the other way?

What is the chance of RSINSA's turning against humanity?

What will the society of human-RSINSA be like?

What is the legal status RSINSA?

Is RSINSA a blessing or a threat of humanity?

Those questions about RSINSA are essential and imminent for humanity. They require better understanding about self-awareness and strong-SCEs and weak-SCEs. They require the joined work of scholars in multiple disciplines, such as computer science / artificial intelligence,

biology, neurology, cytology, ergonomics, psychology, physics, chemistry, society, criminology, and philosophy.

4. Conclusion and Further Research

Computer's capability is not unlimited. Software is not everything. Human's intelligence is subtle and kind of mysterious. We have showed that self-identity, fear of death, and strong-SCEs, which are possessed by humans, are not programmable and not achievable on a digital robots. How much of weak-SCEs can be programmed requires further studies.

This article pointed out some blind spots of machine intelligence, which may discourage the people who believe AI is omnipotent. But knowing the inherent inabilities of electronic robots would help prepare us deal with them in the near future.

References

- Bainbridge, W. (2004). Progress toward Cyberimmortality, in book The Scientific Conquest of Death – Essays on Infinite Lifespans, ed. by Ivana Basset, Immortality Institute, Wausau, WI, p.117
- Barrat, J. (2013). Our Final Invention Artificial Intelligence and the End of Human Era, Thomas Dunne Books
- Becker, E. (1973). The Denial of Death, The Free Press, New York, NY
- Clark, A. (2001). Mindware In introduction to the philosophy of cognitive science, Oxford University Press, New York, p.2 and p.7
- Del Monte, L. (2013). The Artificial Intelligence Revolution Will Artificial Intelligence Serve Us or Replace Us? Louis A. Del Monte, ISBN 0988171821
- Gardner, J. (2007). The Intelligent Universe AI, ET, and the emerging Mind of the Cosmos, The career Press
- Gartner, (2013). Gartner Inc. Tom Austin. Research report The Disruptive Era of Smart Machines is Upon Us, https://www.gartner.com/doc/2598620/disruptive-era-smartmachines-
- Gilder, G. and Richards, J. (2002) Are we spiritual machines? The beginning of debate, In J. Richards (ed.) Are We Spiritual Machine? – Ray Kurzweil vs. the critics of strong AI. Discovery Institute Press, Seattle, Washington, p.11
- Hall, J. S. (2007). Beyond AI Creating the conscience of the machine, Prometheus Books, New York, p.367
- Hawkins, J. and Blakeslee, S. (2004). On Intelligence, Holt Paperback, Times Books / Henry Holt and Company, New York, p.5, 2004
- Hofstadter, D. (1999). Godel, Escher, Bach An eternal golden braid, Basic Books, Inc., New York, p.676-677, 1999
- Joy, B. (2000). Why the Future Doesn't Need Us? Wired. http://www.wired.com/2000/04/joy-2/
- Kaku, M. (2014). The Future of the Mind, Doubleday, New York
- Kelly, J. and S. Hamm, S. (2013). Smart Machines IBM Watson and the Era of Cognitive Computing, Columbia University Press, New York
- Kurzweil, R. (1999). The Age of Spiritual Machines When computers exceed human intelligence, Penguin Books, New York
- Live Science (2015). Don't Let Artificial Intelligence Take Over, Top Scientists Warn, <u>http://www.livescience.com/49419-artificial-intelligence-dangers-letter.html</u>, January 2015
- Minsky, M. (1986). The Society of Mind, Touchstone, Simon & Schuster, New York, p.19
- Newell, A. and Simon, H. (1958). "Heuristic problem-solving: The next advance in operation research," *Operations Research*, 6, 6
- Newell, A. and Simon, H. (1976). "Computer science as empirical inquiry: Symbols and search," Communications of the Association for Computing Machinery, 19, 113-126.
- Penrose, R. (1999). The Emperor's New Mind, Oxford University Press, p.xv and p.61-64
- Precht, R. (2011). Who Am I? And if so, how many? A philosophical journey, The Random House Publishing Group, New York, NY, 2011
- Russell, S. and Norvig, P. (2010). Artificial Intelligence A modern approach; 3rd edition, Prentice Hall, New Jersey
- Searle, J. (1997). The Mystery of Consciousness, The New York Review of Books, New York, NY, p.14, 1997
- Sturm, V. and Rosen, H. (2006). Self-conscious emotion deficits in frontotemporal lobar degeneration, <u>http://brain.oxfordjournals.org/cgi/content/full/129/9/2508</u>
- Tracy, J. and Robins, R. (2004). Putting the Self Into Self-Conscious Emotions: A Theoretical Model, *Psychological Inquiry*, Vol. 15, No. 2, 103–125
- Turing, A. (1950). Computing machinery and intelligence, Mind, Vol.59, pp.433-466
- The Verge, (2016). "Google's AlphaGo AI beats Lee Se-dol again to win Go series 4-1", March 15, <u>http://www.theverge.com/2016/3/15/11213518/alphago-deepmind-go-match-5-result</u>, 2016
- Wang, J. (2016). Is Subjective Self-Identity Programmable? *International Journal of Artificial Intelligence*, Vol. 14, No.1, p.41-52
- Wang, J. (2013). On the Limit of Machine Intelligence, *International Journal of Intelligence Science*, Vol. 3, p.170-175
- Wolfram, S. (2002). A New Kind of Science, Wolfram Media, Inc., Champaign, Illinois, p.35, 2002

WIDE DISPERSION OF PRICE CHANGES LIMITS THE ACCURACY OF MEASURED INFLATION

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WIDE DISPERSION OF PRICE CHANGES LIMITS THE ACCURACY OF MEASURED INFLATION

Abstract

It is generally accepted in the economics literature that there is an underlying inflation rate that raises the general price level and simultaneously degrades the value of money. This common force purportedly influences prices of all goods and services in the economy. Price changes of individual items can vary based on short-term, idiosyncratic fluctuations, but they are assumed to gravitate to the dominant underlying inflation rate over time. All government and private inflation measurements are based on this concept of inflation.

This paper takes a sectoral approach to assess this basic assumption of a common force pulling all individual prices. How strong is this underlying force relative to short-term volatility? What proportion of prices are represented by measures of inflation? This paper finds that price changes are widely diffused across sectors, and that only a small portion of price changes are approximated by standard inflation measures. This suggests that the gravitational pull from underlying inflation is weak in the short term, calling into question the accuracy of standard inflation measures. One important implication of this analysis is that monetary policymakers should aim for measured inflation to be in a target band, rather than an explicit value of 2 percent.

Keywords: inflation, consumer price index, inflation measurement, Fed inflation target

Section 1: Inflation modeling

The *concept* of inflation is fundamentally different from *measures* of inflation, such as the consumer price index (CPI) and the personal consumption expenditure (PCE) deflator.¹

¹ McCully, Moyer, and Stewart (2007) offer a thorough analysis of the differences between the CPI and the PCE deflator. These differences are based mainly on the weighting, scope, and formulas when combining the component price changes into the two indexes. Since this study examines individual component price changes and not the combined indexes, there is little difference between the data in

Conceptually, inflation is a rise in the general price level, which is tantamount to a decline in the value of money. This decline in value affects all prices in common and is expected to persist over the medium- to long-term.

In contrast, measured inflation captures all price movements regardless of whether they are common to all prices. These price movements often are shortterm in nature.

Economists have recognized for decades that standard measures of inflation, which take weighted averages of actual price changes, do not capture the true definition of underlying inflation. As a result, there have been myriad attempts to find alternative measures that come closer to the mark. These so-called core measures take out especially volatile components of inflation measures, such as food and energy. Others hone in on the central tendency of price changes by taking the median or the trimmed mean measures (Bryan & Cecchetti, 1994) (Cecchetti, 1996). All these inflation measures tend to be less volatile than the headline figures. Rich and Steindel (2007) review several of these alternatives, but are unable to find a single best version of core or underlying inflation.

These alternative approaches, as well as the factor model approach to inflation measurement,² all make the basic assumption that inflation can be modeled by a common underlying force driving up the general price level and driving down the purchasing power of money. In the model, any deviations are due to temporary noise. The model can be written as

(1) $\pi_i = \pi^* + \mu_i$

where π_i is the actual price change of product i, π^* is the underlying inflation rate, and μ_i represents short-term price fluctuations. The implicit assumption is that the idiosyncratic short-term movements (μ_i) are independent random shocks.

CPI and the PCE deflator. In fact, the CPI surveys provide the main source data for the PCE deflator. As a result, the data used in this study are components of the CPI.

² See Amstad and Potter (2017) and Khan, Morel, and Sabourin (2013) for examples of factor models of inflation.

Section 2: Dispersion of price changes

This paper studied the distribution of a cross-section of price changes across sectors in the CPI to gauge if the common force (or gravitational pull) driving inflation (π^*) is weak or strong relative to random short-term noise (μ_i). Specifically, the study analyzed year-to-year percent changes for 49 categories (accounting for 100 percent of the total CPI) for October 2017.

The actual distribution of price changes turned out to be remarkably dispersed.³ The array of price changes did not appear to gravitate to a single common inflation rate. In fact, price increases of individual sectors rarely approximated the inflation rates measured by the CPI, the PCE deflator, and their core measures.

For example, over the past 12 months, headline CPI increased by 2.1 percent, CPI excluding food and energy increased by 1.8 percent, the PCE deflator increased by 1.6 percent and core PCE increased by 1.3 percent. Yet, looking at sector changes, only 21 percent of the total CPI (using sector weights) posted price increases of between 1 percent and 3 percent (inside the gray area in the frequency histogram in Figure 1 below).^{4 5} Meanwhile, 45 percent of prices in the CPI rose by 3 percent or more, and 33 percent of prices either increased by less than 1 percent or fell outright.

³ Source data for the analysis and charts in this study are from the Bureau of Labor Statistics and Haver Analytics.

⁴ The chart displays a frequency histogram of price changes for all items in the CPI. The chart can be read as follows: The values across the horizontal axis show the full array of possible price changes. The vertical axis shows the proportion of the individual price changes that fell in those ranges. The bars give the total weight in the CPI of those price changes.

⁵ The big spike at 3-3.5 percent reflects the homeowners' equivalent rent (OER) price change. OER alone represents over 24 percent of the CPI by weight. Because this one item is such a large share of the CPI, there will always be a spike in the histogram wherever the OER price change appears.



This paper also conducted the same analysis for an alternative "core" subset of CPI, which excludes food products, energy, and the outsize OER, representing 54 percent of total CPI. Energy and food product prices were removed because those prices can have outsize effects on US *measured* inflation even though they rarely reflect *underlying* inflation, as they are set mainly in global markets. Likewise, OER was not included because no one actually pays this "equivalent rent" even though it exerts such a large influence on overall CPI.

A wide distribution of price changes occurred when these obvious sources of short-term price fluctuations were eliminated. A large subset of prices rose much faster than the inflation gauges and another large subset rose much more slowly (or actually declined). Very few prices increased at a pace near the inflation gauges – just 22 percent of all price changes in this "core" group rose between 1 percent and 3 percent. Instead, 32 percent of prices rose by more than 3 percent, and 46 percent increased at a pace less than 1 percent or fell outright (see Figure 2 below).



The current distribution of price changes is not unusual. Distributions of price changes showed similar patterns going back 20 years. There typically was a very wide dispersion of price increases or declines. Often, the distribution was bimodal.

Recent work by D'Antonio [2017] showed that divergences between individual sector price changes and standard inflation measures often persist for decades rather than representing short-term fluctuations – the differences were caused by idiosyncratic sectoral forces unrelated to underlying inflation. This paper shows that wide divergences are extremely prevalent and in fact are the norm. Together, these two papers cast doubt on the underlying assumption in Equation 1 that all prices are driven mainly by the common underlying inflation rate.

Section 3: Conclusion

The purpose of this paper was to develop a fuller understanding of the pull of the common underlying force driving inflation and its connection to the idiosyncratic price changes that are used to construct measures of inflation. By examining inflation data across sectors, this study finds that most standard inflation measures represent only a small fraction of price movements.

The wide distribution of prices raises an important question for financial markets and policymakers, which view differences of 0.5 percent or more from the Federal Reserve's explicit 2 percent inflation target as serious misses. If nearly half of the prices in the CPI (by weight) increase by more than 3 percent, and a third of the prices do not even rise by 1 percent, how sure can they be that inflation measures have identified the true underlying inflation rate common to all prices? Following that line of thinking, how sure can they be that their 2 percent target fulfills their policy objectives? This is especially problematic for policymakers if there are long-term sector-specific forces competing with the pull from underlying inflation.

The precision implied by the narrow range of inflation expectations in financial markets and policy circles seems unrealistic when individual price changes are so widely dispersed. As a result, policymakers should aim for an inflation band rather than a target of exactly 2 percent.

References

- Amstad, M., Potter, S., & Rich, R. (2014). The FRBNY Staff Underlying Inflation Gauge: UIG. Federal Reserve Bank of New York Staff Report No. 672.
- Bryan, M. F., & Cecchetti, S. G. (1994). Measuring Core Inflation. In N. G. Mankiw (Ed.), *Monetary Policy* (195-215). Chicago: University of Chicago Press.

Bureau of Labor Statistics consumer price index data.

- Cecchetti, S. G. (1996). Measuring Short-Run Inflation for Central Bankers. National Bureau of Economic Research Working Paper No. 5786.
- D'Antonio, P. L. (2018). Are Inflation Measures Really Measuring Inflation. *Journal of Business and Economic Policy*, 4 (4).

Haver Analytics Inc. consumer price index data.

- Khan, M., Morel L, & Sabourin P (2013). The Common Component of CPI: An Alternative Measure of Underlying Inflation for Canada. Bank of Canada, Working Paper No. 2013-35.
- McCully, C. P., Moyer, B. C., & Stewart, K. J. (2007). A Reconciliation Between the Consumer Price Index and the Personal Consumption Expenditure Price Index, Bureau of Economic Analysis.
- Rich, R., and Steindel, C. (2007). A Comparison of Measures of Core Inflation. Federal Reserve Bank of New York, *Economic Policy Review* 13(3). 19-38.

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