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A PRELIMINARY ANALYSIS OF UNDERGRADUATE BUSINESS STUDENTS' BASIC MATH SKILLS

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Standards set forth by The Association to Advance Collegiate Schools of Business (AACSB) specify that business schools' curricula should contain a number of quantitative courses, including management science and statistics. Consequently, the management science/operations research (MS/OR) course is a core requirement in most undergraduate business degree programs nationally and is often a prerequisite for such courses as Computer Simulation and Inventory Management, and Operations Management (POM).

Unfortunately, undergraduate students often regard mathematically-oriented operations management courses as the most difficult in the business school curriculum, frequently thwarting their academic degree process. *Why is this?* Is it due to deficient math skills or math-related anxieties? And if so, what specific areas of math present the greatest challenges? Finding answers to these questions can assist in designing/developing remedial programs and instructional methods to help students hone their quantitative skills, and, ultimately, their success in their upper-level courses, grade-point-averages, degree persistence, and completion of academic studies.

The purpose of this research was to investigate students' basic math competencies as they enter into the MS/OR and POM courses. A 16-question math skills survey containing the types of problems that most students would have been exposed to in high school or earlier (e.g., order of operations, understanding of fractions, decimal and percent conversions, and algebra) mini-problems was used to assess 737 business students' math skills. The data revealed that problems involving a fraction, exponentials, or the ability to apply the order of operations pose the greatest difficulties. Overall, students' level of performance was at a "D/D-plus" level ($\bar{x} = 10.84/16 = 67.75\%$, $SD = 3.030$).

Business students also appear to demonstrate varying abilities to perform basic mathematical operations, with accounting and finance majors performing better and marketing and general management majors doing the worst. Students who had taken a prior university-level course in either algebra or calculus fared better than those who had not ($p < .001$). A significant effect was found for gender, with men achieving a higher number of correct answers than women ($p < .01$). There was not a significant effect of race on basic math skills proficiency.

Nevertheless, students – regardless of their academic major – hold lofty grade expectations; a large majority (70.2%) indicated that they planned to earn a grade of either "A" (45.4%) or "A-" (24.8%) in their MS/OR or POM courses. And, despite demonstrating a barely passing level of basic math skills, only four students (0.7%) indicated that they expected to earn

a grade below a “B-minus.” This seems to suggest that a perceptual gap exists between students’ self-opinions about their mathematical skills (as reflected in their grade expectations) and their actual basic math skills.

To what extent are these students representative of those at other colleges/universities across the United States? A larger study conducted across different types of colleges and universities – or across different geographies – would help to enhance the generalizability of the findings. Another potentially fruitful area for research might be to compare students who are majoring in business topics students majoring in other disciplines; are business majors more or less proficient in their math skills?

Ultimately, this modest study poses questions related to how to facilitate student learning (and academic achievement) in the MS/OR and POM courses. Do weaknesses in students’ incoming math skills and abilities suggest that remediation strategies are appropriate interventions? If so, which remediation strategies are the best to pursue? For example, what is the role of textbook authors and publishers? Should mathematical formulas and calculations be relocated from appendices back into the chapters themselves? Or, what is the role of other support structures within the institution, such as tutoring facilities? Finally, what is the role of the instructor in helping students to master the basic math skills that they should have learned in high school (or earlier)? Remediation should be beneficial in terms of: (1) students’ performance in MS/OR and POM courses; (2) preparation for more advanced courses; (3) fostering critical thinking skills; and (4) positively impacting their grade-point-averages, persistence, and eventual completion of academic studies.

The issue is important because the MS/OR and POM courses hold the potential to be extremely valuable courses in the business school curriculum. And the payoffs associated with possessing adequate quantitative skills appear to be immense.

Assessing E-learning Readiness of Instructors and Students

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ABSTRACT

As more and more universities worldwide have been offering e-learning environments for their course and program delivery, researchers in e-learning subjects are interested to examine whether instructors and students are ready for the new e-learning environment. E-learning readiness (e-readiness) is a critical component in evaluating the effectiveness of online course delivery at the institutional and the instructor and students level. E-readiness is already well covered in the literature and several models are suggested. This study aims to measure e-learning readiness of instructors and students. This research study adopted a survey method to conduct the study of e-learning readiness of instructors and students in a university. A questionnaire was sent to 150 instructors and 300 students. All items were measured on a five-point Likert scale, with 5 as strongly agree and 1 as strongly disagree. Descriptive statistics, one-way analysis of variance (ANOVA), Independent-Samples T Test, and multinomial logistic regression will be applied to analyze the data.

Although universities have made investments in e-learning environment of one or the other kinds, however, majority of instructors and students are still at the initial stage of employing e-learning in their daily teaching and learning activities. The preliminary findings suggest that although instructors and students have been using electronic gadgets for their day-to-day activities and have been comfortable in using technology, they still lack of requisite formal training for e-learning thus affecting their e-readiness.

Business in the Engineering Curriculum: What if you only get one course?

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ABSTRACT

Based on a study that identified the business competencies needed by entry-level engineers, this presentation will provide a roadmap for integrating your business courses with the engineering program. A number of examples will be given demonstrating curriculum design, integrating courses between the two programs, and implementing interdisciplinary projects.

The author takes an interdisciplinary approach, defining various stakeholders, and how one can satisfy each of the interests and concerns.

ERPSim for High Schools: an Event Guide

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Abstract

ERPSim is recognized as an important pedagogical tool. Its use in post-secondary education has been, and continues to be, well documented (Léger et al. 2016, 2011, 2007). However, via SAP's Young Thinkers program, opportunities exist to expose students outside of traditional post-secondary education to the benefits of ERPSim. Based on our own experiences, we offer a guide for the successful execution of ERPSim for high-school students.

The targeting of high-school students changes what has been an in-class activity into a full blown 'event'. As such, many new variables are introduced that will influence the ultimate success of the event. An 'ERPSim Event' is an exercise in project management. This is especially true for novice faculty who have had little or no experience coordinating such activities before.

Our experience has shown that there are 5 critical success factors for a fruitful and productive 'ERPSim Event': event planning, simulation coaching, well defined event materials, clearly defined team roles, and a nurturing learning environment. We have captured and documented the steps/deliverables necessary to adequately address these critical success factors; along with example deliverables, this document prescribes the steps for a successful Young Thinkers ERPSim event.

Keywords: ERPSim, Young Thinkers, Pedagogy, Secondary Education

Introduction

The ERP program at Grand Valley is well known and regarded for graduating students with strong business process, ERP and analytics skills. The demand for graduates with these skills exceeds supply. One of the challenges is that there are not enough students interested in pursuing careers that require these skills. When brainstorming ways to address this challenge with our industry advisory board, it was determined that the problem is more a lack of awareness of the program and the tremendous career opportunities that follow. Instead of waiting for students to find the program, a decision was made to proactively promote the program and encourage students to investigate if it fit their career goals. Additionally, a decision was made to reach further back into the talent supply chain and target high school students who had a general interest in business and technology.

Historically, high school students interested in business are guided towards majors in accounting and marketing and those interested in technology, towards computer science and engineering. It is rare for these students to be even aware of majors such as MIS which merge business and technology. Indeed, most high school counselors are unaware of such programs.

The fun, gamified environment of ERPSim was deemed well suited for to provide high school students with a meaningful introduction to business processes, technology and decision making. In addition, it was considered essential to have corporate executives to provide a “real world” perspective to augment the academic exercise while promoting future opportunities for students in their organizations.

Is this right for you?

There are several considerations in determining if a similar event is appropriate in your university. The following questions will guide your decision:

1. Is there a need to grow your ERP program?
2. Are there executives from local companies willing to sponsor and participate in the event?
3. Do you have faculty with the skills to execute an ERPSim event with students that are younger and less experienced than typical college students?
4. Do you have college students who can serve as mentors to the high school students?
5. Do you have the support of college administrators?

What we've learned

A High School ERPSim Event is an exercise in project management. Time is both a friend and an enemy. Plan early, in good detail, and build in ‘buffers’ to address the hic-ups along the way. While explicit detailed activities may seem like overkill, they will illustrate the complexity of some tasks and help to better estimate the time needed. There are five critical success factors: Event Planning, Simulation Coaching, Well Defined Event materials, Clearly Defined Team Roles, and a Nurturing Environment.

Event Planning

One needs to look at an ERPSIM event as an exercise in project management. The actual competition/event is analogous to the ‘go-live’ of an information system. Most of the effort will happen before anyone takes a seat. One must first scope out the project with the various stake holders, manage the technical infrastructure needs, establish documentation and training protocols, test the product, and then practice the go-live event to smooth out the rough spots. Logistics involving the venue must also be well planned. Lunch, snacks, drinks, parking, seating etc... require close attention.

Simulation Coaching

Novice ERPSIM users need support to succeed. Nuances of the software, data, processes, people, and even the event ‘procedures’ may be overwhelming to the uninitiated. A dedicated coach for each team is essential. The bespoke mentor for each team helps to: adhere to event scheduling, facilitate student learning, and provide business and ‘technical’ support. For high school students, strategy and communication require a little more attention; while some non-ERP college students maybe little intimidated by the technology being used.

These mentors can be upper division students, industry partners, or faculty. In our experience, the ‘closer’ the mentor is to the target student, the more relaxed the simulation environment is. For high school students, we used college students currently taking ERP coursework. Mentors receive targeted training in how the simulation works, business strategy and effective communication.

Well Defined Event Materials

The ERPSIM Job Aids are the foundation for event materials. Each Student/role needs documentation that reinforces their duties within the simulation. However, additional documentation focused on the event itself is also needed. Facility maps, chaperone/observer materials, as well as publicity materials are just a few examples.

Clearly Defined Team Roles

In addition to the students, mentors, and the ‘Master of Ceremonies’, there are a wide range of roles needed to properly execute the event itself. For example, a VIP facilitator provides structure and communications for the chaperones and observers in attendance. This helps to prevent interruptions in the simulation activities. The facilitator can answer logistical questions, comment on the execution of the simulation, and discuss strategy separate from the student events. Timekeepers and runners help the MC in the execution of the simulation. Media coordinators, photographers, help promote and document the event while it happens. Facilities personnel help manage food/environment needs. This does not imply you need a small army, people can hold multiple roles; those roles however, just need to be explicitly identified.

Nurturing Learning Environment

ERPSim, especially for novice participants, needs a nurturing environment that supports the student’s questions and discovery. More attitude rather than a ‘thing’, this type of environment needs to provide students with the opportunity to discover, execute, and possibly fail. Learning from their success and controlled failure is what provides students with experience. Pre-round strategy discussions, post-round debriefing sessions (lead by the mentor) help teams/students identify what “works and doesn’t work”. Explicit goal setting before the first round (e.g. what is the measure of success) provides the framework that students use to assess their progress.

Contributed Materials

We have developed a ‘How To’ document that contains the necessary checklists, deliverables and overviews for a successful ERPSim Event. The current deliverable directly supports the water bottle distribution game, but can be easily adapted to other ERPSim games. Topics include: Overview of the ERPSim Event, Initial Planning, Pre-Event Preparation, ‘Day of’ Execution, and Post Event review. For each topic, a number of supporting files are provided: project plans, slide decks, communication material, ERPSim material, and various template documents. Everything from project plans to table tents are provided or referenced.

We trust that these deliverables help to reduce the effort needed to execute an ERPSim event, and that they improve the quality of the learning that will take place. Our hope is that the UA community continues to add and refine these deliverables to advance the value that our students (secondary and post-secondary) will derive from ERPSim.

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Experiential Learning With SPC

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ABSTRACT

A core operations management course is typically taught as a survey of several key decision areas, making it a challenge for students to master any one topic in depth. One subject that students tend to struggle with is statistical process control (SPC). Although the students should already have a foundation with normal probability distributions, they have difficulty with this practical application. The first challenge is dealing with two ways for calculating process control limits. The confusion is heightened by introducing specification limits in addition to the control limits. To address this challenge, a variety of hands-on activities can provide an integrated link between raw data and the use of SPC. Students gain insight through their involvement in setting up the charts with their own measurements, understanding the inherent variation. Challenges of utilizing this method of learning include monitoring inconsistent data, dedicating class time, facilitating a large class, providing sufficient samples, and avoiding chaos. Benefits include increased student interest, a deeper understanding in a short amount of time, development of team skills, and a start-to-finish experience. This paper presents ideas for increasing students' retention of statistical process control through participation in a comprehensive hands-on example, including specific activities and a measure of impact to demonstrate the potential value.

IS and Economic Virtual and Traditional Learning Environments: Millennials, Social Climate and Student Motivation

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ABSTRACT

As the Internet continues to evolve, the types of students, courses and the methods and procedures for teaching have also continued to grow and change. There many courses that are now taught online and in traditional face-to-face classrooms. Student success in attaining knowledge in the classroom is an important outcome for employers, instructors and teaching institutions. Are students more motivated and more successful in performing in certain classrooms with certain instructors more than others? Does the type of social climate and generational type of student play a role in student outcomes/success in terms of motivation and performance in an online versus traditional learning environment?

“Students are not only intellectual but also social and emotional beings, and these dimensions interact within the classroom climate to influence learning and performance.” (Ambrose et al., 2010).

“Course climate is the intellectual, social, emotional, and physical environments in which our students learn. Climate is determined by a constellation of interacting factors that include faculty-student interaction, the tone instructors set, instances of stereotyping or tokenism, the courses demographics, student-student interaction, and the range of perspectives represented in the course content and materials”. (Ambrose et al., 2010).

Previous research on face-to-face learning environments shows that students are more motivated, involved and content when there is a focus on developing a positive social climate (Chan and Rapman, 1999; Wegerif, 1998).

This paper explores the various generations including the millennial generation and the role of social climate in different learning environments for different courses.

Scanning Millennials in Five Items or less: An innovative way to continue to incorporate technology into the classroom.

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ABSTRACT

The session will provide an overview of the new technologies being used in the classroom, while specifically showing how to incorporate the technology of clickers on a humble budget.

Millennials want immediate feedback. They also want the latest and greatest technology (toys). Plickers brings technology into the classroom with the use of a smart cell phone. Immediate feedback shows students to be impressed and discussing the class with their peers. Because the technology is so new, students know the class has been prepared for them and is not the same power point lecture year after year.

This workshop is designed for instructors who desire to use technology as a form of assessment or to assist with the class. The participants will work with the facilitator from downloading the app to interpreting the data.

Teaching Quantitative Analysis Through Repeated Business Simulations

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Abstract

Teaching quantitative analysis is a major challenge in business education. We suggest there are three major factors that contribute to this challenge—lack of context, segmentation of business functions and lack of repetition. Business education is difficult because, unlike fields like chemistry or the arts, application of the knowledge and skills being taught usually happen outside of the academic environment. This is similar to fields like medicine and education, where the education program requires a period of practical application to complete the education program. Because the knowledge and skills being taught in business schools can not be directly applied, students and professors struggle with providing a surrogate to the business environment. With undergraduate students, the lack of an effective surrogate environment leaves students without the proper context to appreciate the material being taught.

To be effective in business, it is important to evaluate business decisions by considering the interaction and impact of multiple disciplines: marketing, operations, accounting, finance, etc. Yet almost all business education segments the teaching of these topics so that only one topic is taught in a class with very little consideration of the interaction of these disciplines. In fact, most academic units are organized in such a way that there is little interaction between business disciplines.

Finally, most classroom pedagogy is structured to provide instruction on a topic, test students on how well they have learned that topic, then move on to study a new topic with little opportunity to correct any gaps in knowledge or skills uncovered by testing.

Quantitative tools are becoming more complex. At the same time it can be argued that the quantitative skills of students are generally declining. This, combined with the three factors describe above, make teaching quantitative analysis a challenging task. To address these challenges, the authors have developed a curriculum for an undergraduate quantitative course—Analytic Foundations—at Western Michigan University that uses repeated runs of a business simulation to provide motivation, context and the opportunity (and requirement) to address gaps in knowledge or skills uncovered during the operation of the simulation.

The SAP HANA Challenge

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ABSTRACT

Grand Valley students from the Undergraduate and MBA programs came together to participate in the university's entry into the SAP HANA Challenge. The ten students, all pursuing a degree or having a focus in Management Information Systems, were joined by several faculty advisers, who each brought their own area of management and expertise to the project. The group challenge was to develop an application using SAP HANA Express Edition technology. The app was to be designed to solve a problem or address an issue that was pertinent to the general public. The participants had the ability to work with two expert SAP developers, who provided them a crash course in writing a HANA XSC (Extended Application Services Classic) application server, the basis for an application development platform. During that first meeting it was presented on how to create a schema and table, import data with a CSV file and then prepare and execute an SQL query on the table. While terms like OData(Open Data Protocol), metatag(coding statement), bootstrap(framework for developing mobile web sites) and JSON(JavaScript Object Notation) may have at first been foreign to members of the group, over the next several weeks they became very well known. After brainstorming numerous ideas, the group decided on an app that would rate the Grand Rapids night-life scene using Twitter feeds to help people find out where to find the best place to have fun. The students were divided into five functional teams of two members. One team worked on sourcing and how to collect data from the Twitter. Another team was responsible for the storage data in tables to keep the information and compile the necessary calculation and statistics. The third team handled the sentiment analysis, while the fourth team created the app design and user interface. The fifth team acted as project managers to oversee the direction, assist as needed and ensure that deliverables were ready in a timely manner. During and after the completion of the challenge the participants learned how to pick up on new technologies, find solutions to problems quickly, how to step out of their comfort zone and how to take an action to get done what needed to be accomplished.

The Effects of Response Rate in Teaching Evaluation: Implications from A Monte Carlo Simulation

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ABSTRACT

Web-based teaching evaluation has replaced in-class teaching evaluation as the new norms for assessing teaching performance among institutions of higher education. Faculty in general are reluctant to adopt the online method of teaching evaluation, and raise concerns centering on lower response rates in comparison to that of the traditional in-class evaluation. A low response rate implies an underrepresentation of the target student population, and threatens the validity of the evaluation. Existing literature of comparing online with in-class evaluations emphasizes on the average evaluation ratings and concludes with few exceptions that the two methods produce statistically indifferent results. The reliability of an evaluation, however, is not addressed. An individual evaluation may generate a result that deviates from the true average rating if not every student participate in the evaluation. This study employs Monte Carlo simulation to investigate the effects of response rates on teaching evaluation. The complex distribution of evaluation ratings are carefully simulated based on real data. Response rates are found to be the main factor causing variance among average evaluation ratings, although its effect on the aggregated average can be ignored. Other factors, including class size and the scale of the true average evaluation rating, also contributes to the variance but in a much smaller magnitude. Implications for assessing teaching performance will be discussed.

Video Blogs: Preparing Millennials for the Job Market

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ABSTRACT

In response to an article in Forbes concerning the top ten desired skills of college graduates, the author has introduced a technology into the classroom that directly addresses eight of the top ten skills.

Video blogs take the group presentation out of the class. In the classroom setting, your better students tend to dominate the presentation and carry the rest of the group along. The blogs incent students for their preparation time outside of class. Attention to detail and division of labor are rewarded as students are able to record their presentation multiple times, if desired.

Teamwork, decision making skills, technology, and communication skills are all critical components to the educational process of video blogs

Student Led Events: Using a 5K Walk/Run Event to Teach Service Operations and Supply Chain Management

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ABSTRACT

Using a 5K walk and run event, eight MBA students supported by their professor created a learning opportunity to gather hands-on experience related to their course in operations and supply chain management during the spring 2017. In the preparation and delivery of the event, students were able to apply concepts from project management and learn how to deal with the triple constraints of scope, budget and time. They also learned about resource planning and scheduling while defining the racetrack location, number of volunteers, and their respective schedule needs. Each student had different responsibilities, which included selection of vendors, the understanding of the tradeoffs, quality management considerations, and how to use operations to create value to their class, community, and university. Forecasting and capacity planning were also required to determine the size and scope of the event. Since this was one of their last semesters of their MBA program, students were also able to apply concepts from their previous courses to include leadership, team function, finance, budget consideration, contracts, insurance, waiver, logo, copyright, and several marketing concepts.

Keywords: 5K-MBA, Student Led Events, Experiential Learning, Teaching OM&SCM, Service Operations.

How Differently Do We Approach Problems? A Proposal of Cognition-Decision Fit Theory:

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ABSTRACT

Researchers have long noticed that people approach different problems in distinct ways. In search for individual differences in cognition that are stable over time, value free, and related to personality and social relationships, cognitive style research has attracted persistent interests especially in the field of MIS. Design researchers have called for the consideration of cognitive styles in the design of information systems. Albeit numerous research endeavors, however, the effects of cognitive style remain inconclusive with fragmented findings and a lack of a coherent and practically useful theory, not to mention operational design guidelines that stands the test of various situations. This research argues that the effects of cognitive style exist but can be altered by cognitive flexibility, a general ability that people have to cope with different situations. A cognition-decision fit theory is proposed to explain how a manager adjusts his/her cognitive style to match with the task and the tools at hand. A field study that surveys managers of small-to-midsized business is conducted to test the hypothesized effects. The purposes of the study are to enrich our understanding of the cognitive process of managers' decision making, to improve the measurement of cognitive styles, and to provide guidance to the design of decision making systems.

Assessments of information quality in social media

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Extended Abstract

The usefulness of information is one of the most important measurements for the quality of information from information users' perspectives. In information quality research, the 'fitness of use' of information has become the core of information quality. Research studies have developed different sets of dimensions to measure the quality of information.

As a new field of study, there is lack of theory in social media in general and for the assessments of information from social media in particular. Unlike organizational information systems, the source of information in social media could come from anywhere and anybody, therefore, there is fundamental lack of information quality assurance in social media. Information quality in social media is different compared to information quality from traditional information systems (Emamjome, Rabaa'i, Gable, & Bandara, 2013), due to the special nature of social media, such as: wide accessibility, global audience, recentness and ease of use (Agarwal & Yiliyasi, 2010). Therefore, there is a need to assess the quality of information in social media from users' perspective.

Earlier research in social media that studied information quality focused on content quality (Agichtein, Castillo, Donato, Gionis, & Mishne, 2008), which treated users' perceptions of information quality as secondary (Chai, Potdar, & Dillon, 2009). A more recent study in information quality in social media attempted to apply the traditional information quality dimensions into the social media context. They suggested three main dimensions: intrinsic, content and representational quality (Emamjome et al., 2013).

The usage of social media has increased rapidly in recent years. People are using social media for many purposes beyond the intended original 'social' component. There is a vast quantity of information traveling through different types of social media. The motivation of this study is derived from the disparity between widely used social media, and the large amount of information available from different types of social media, and the very limited theory development and testing of the usefulness of information from social media. Therefore, this project intends to assess information quality in social media from users' perspective.

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The Evolution of Management Support Systems

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ABSTRACT

This paper reviewed the management support system literature aiming to examine the evolution of MSS. The classification results presented a comprehensive picture of MSS evolution since its start solely with DSS, passing through the emergence of EIS, and ending with the development of KMS and BI. This paper identified the gap in the MSS literature, and highlighted the areas where scholars and practitioners can focus on to improve the design, processes and outcome of MSS. This paper also classified the MSS studies under empirical and non-empirical type of studies to evaluate the theoretical and methodological aspects of the MSS literature.

KEYWORDS: Management Support Systems, Decision Support Systems, Executive Information Systems, Knowledge Management Systems, Business Intelligence, Empirical.

INTRODUCTION

In contemporary business environment, decision making at different levels plays important roles in the operation, management and development of all organizations (Mintzberg 1973). The performance, survival and growth of organizations depend on the quality of decisions. Thus, decision-making is regarded as the principle function of organizations (Simon 1977). However, many of the business problems that are emerging are complex and/or unstructured, and they are not easy to handle by decision makers from their previous experiences due limitations of human cognitive abilities (Taylor 1975).

For more than half a century, information system researchers and practitioners have investigated the design, implementation and use of systems to support decision making and business planning (Alter 2004; Clark et al. 2007; Power 2007; Scott 1983). Such effort started in the 1960s when a class of information systems called decision support system (DSS) was designed to support organizational decision making. This marks the start of systemic studies on the use of information technology to assist decision making (Turban 1967; Urban 1966). DSS became an area of research of its own in the middle of 1970, and has been extensively discussed during few decades. DSS research primarily focused on how to design and use DSSs to improve the effectiveness and efficiency of business decision making and organizational performance (Cats-Baril and Huber 1987; Clements 1993; Todd and Benbasat 1999). EIS were also developed to support unstructured decision making at the executive level. However, in recent times, there has been increasing need for organizations to respond to challenging customer demands that requires different kinds of knowledge and availability of such information to the right decision maker at the right time.

Knowledge management systems have been deployed to allow organizations to manage both tacit and explicit knowledge. Watson and Wixom (2007) noted that a new class of management support systems, Business Intelligence is the top on the list of CIOs' priorities. BI is defined as "a broad category of applications, technologies, and processes for gathering, storing, accessing and analyzing data to help business users make better decisions"

Although the classes of management support systems described seem to have different purposes, from a design science perspective, some researchers have argued that integrating these systems would provide enormous benefits for organizations (Bolloju et al. 2002; Nemati et al. 2002). Such efforts would require redesigning existing systems to incorporate needs for the additional features that are missing. It may also require that new systems are developed to integrate functional features of the various support systems.

From a more theoretical perspective, it has been argued that all these classes of systems are designed to “reduce uncertainty in the decision making process and as such, research about them focuses largely on efficient and effective support of the decision maker” (Clark et al. 2007). Specifically, Clark et al. (2007) suggests that a new umbrella term, management support systems (MSS) can be used to identify all these systems.

Studies shows that MSSs provide the organizations needed decision-support capabilities to process the information for a wide variety of problems (Vandenbosch and Huff 1997). Such capabilities reduce the uncertainty in decision making and facilitate the structuring of a decision (Kahneman et al. 1982). The useful tools and platforms of MSSs also enable organizations to obtain, combine, create and retrieve knowledge from multi sources (Lee and Hong 2002). In addition, the appropriate use of MSSs may enhance the strategic decision-making of companies and their long-term competitiveness (King and Rodriguez 1981). Clark et al. (2007) prescribe 20 constructs that IS researchers should examine in relation to design, processes and outcome of this new class of management support systems. These constructs can assist researchers to develop theoretical understanding of MSS implementation and use in organizations.

The understanding of evolutionary trend in MSS research in the top IS journals can enable the field develop cumulative study in this critical domain. However, there is lack of research on this area. For this reason we seek to answer the following three questions: 1) What is the evolution of MSS research? 2) What are the most studied factors or constructs in the literature? 3) What are the proportions of empirical versus conceptual MSS research in top IS journals? First, we review MSS literature in the top six IS journals to identify the evolution of MSS theories. The review will help us understand the history of MSS evolution but also predict its future trend. Then, we investigate the state-of-art of MSS research in current literature. Specifically, we examine what factors contribute to the success of MSS and how they facilitate decision making and managerial activities. Finally, we examine the natures of MSS papers in terms of empirical versus non-empirical papers. Researchers report that papers with empirical support tend to yield higher impact factors than those without (Tams and Grover 2010). It is interesting finding out the proportions of the two types of MSS paper in the top six IS journals. The understanding provides guidance for researchers to optimize the selection of outlet journals for their studies.

The rest of the paper is organized as follows. In the literature review section, we briefly go through the history of MSS systems and the evolution of MSS concepts. In the methodology section, we present data collection criteria and analytical processes. The results section presents the findings with discussions. Finally, we discuss the implications for MSS implementation and further research.

LITERATURE REVIEW

For more than half a century, information system researchers and practitioners have investigated design, implementation and use of information systems to support decision making and business planning (Alter 2004). Such effort started in the 1960s when a class of information systems called decision support system was designed to support organizational decision making. This initiated systemic studies on the use of information technology to assist

decision making (Holt and Huber 1969; Raymond 1966; Turban 1967; Urban 1966). DSS became an area of research of its own in the middle of 1970, and has been extensively discussed during the few decades. Researchers focus on how to design and use DSSs to improve the effectiveness and efficiency of business decision making and companies' performance (Ariav and Ginzberg 1985; Cats-Baril and Huber 1987; Coyle 1977; Eom and Kim 2006).

However, with the ever faster evolution of information technology and increasing demand of organizational decision support, new types of systems appear and redefine the frontier of this field. For instance, business intelligence systems, knowledge management systems and web-based group decision support systems (GDSS) emerged mostly within the last 20 years. Though such systems vary in specific technologies, user bases and types of decision support, they have one common characteristic, that is: they are developed and implemented for providing more powerful decision support. These systems could fit into one broader class of information systems than traditional DSS. An umbrella term, management support system (MSS), has been proposed to encompass various kinds of systems that support decision-making directly or indirectly (Scott 1983).

The term management support systems (MSS) which emerged in 1980s refers to a class of information systems that are used to support managerial and professional activities (Geoffrion et al. 1980; Scott 1983). The scope of MSS has migrated over the years. Initial MSS include data support systems, decision support systems, executive information systems (Scott 1983). Forgionne and Kohli (2000); Forgionne and Kohli (1995) argued that these systems under MSS did not only have individual effects when they function separately, but also have the integrated impacts on decision making when they are used together. They empirically examined the integrated effects and found MSSs could significantly improve both the quality and process of strategic decision making. Later, Clark et al. (2007) encompass decision support systems (DSS), executive information systems (EIS), group decision support systems (GDSS), and intelligent decision support systems (IDSS) into the umbrella of MSS. Table 1 includes some important articles that provide definitions and scopes of MSSs.

Table 1. Definitions and Scopes of MSSs		
Authors	Definition	Systems
Scott (1983)	The use of information technologies to support management.	Data support systems, decision support systems and executive support systems
Turban (1990)	N/A	Decision support and expert systems
Zeleny (1987)	N/A	Electronic data processing, decision support systems, expert systems and artificial intelligent
Forgionne and Kohli (1995)	Systems that designed to provide comprehensive and integrated support for the decision making process	Decision support system, expert system, and executive information system
Clark et al. (2007)	Information systems that are used to support management actions	Decision support systems, executive information systems, knowledge management systems, and business intelligence

Following DeLone and McLean's system success model (1992), Clark et al. (2007) drew a comprehensive conceptual model that presents a cogently argued logic about the relationships among the components retrieved from the findings of previous research on MSS. In addition, the conceptual model includes the interactions and feedback loops among these components, which depict the dynamics of what contribute to the success or failure of MSSs. They argued that the framework provides a systemic approach for both researchers and practitioners to explore the complexity of MSS and their internal interactions. Clark and his colleagues' MSS framework (2007) provide the insight for the understanding of critical success factors related to MSS. However, its impact on MSS research still needs to be tested over time. For this purpose, we will follow their framework to systematically evaluate the development of MSS research. It mainly focuses on the managerial perspective of MSS research to investigate the impact of MSS on improving managerial decision making and business performance.

METHODOLOGY

Our research methodology involved collecting research papers on MSS from the premiere IS journals for the period 1978 to 2012 and examining the specific categories of constructs used in those studies. The articles gathered are related to Decision Support System, Executive Information System, Knowledge Management System, and Business Intelligence – which are the four systems that constitute MSS (Clark et al. 2007). The journals included in our study are the top six in the senior scholars' basket of journals: MISQ, ISR, JMIS, EJIS, JAIS, and ISJ. We used the ABI EBSCO Database, which has been used in prior relevant study for our search (Eom and Kim 2006). The keyword for the search include: “DSS”, “Decision Support System”, “EIS”, “Executive Information System”, “KMS”, “Knowledge Management System”, “BI”, “Business Intelligence” and “data warehouse”.

Our initial search generated 800 articles published in the top six journals: MISQ, ISR, ISJ, EJIS, JMIS, and JAIS. However, some articles were eliminated because they did not satisfy the criteria for inclusion in the study. Specifically, we exclude any article that did not mention any of the four categories of MSS as specified by Clark et al. (2007). In order to eliminate articles that were not relevant to our research objective, the full text of each article was reviewed. After elimination, the total number of MSS articles identified was 87. Table 2 is a list of the journals included in the study and the starting date of publication.

#	Journal title	Acronym	Publication start year
1	MIS Quarterly	MISQ	1975
2	Information Systems Research	ISR	1990
3	Journal of Management Information Systems	JMIS	1984
4	European Journal of Information Systems	EJIS	1991
5	Journal of the Association of Information Systems	JAIS	2000
6	Information Systems Journal	ISJ	1991

RESULTS

Following the search criteria presented in the methodology section we classified 87 journals as relating to MSS systems in the period 1978 to 2012 (Table 3). MSS has been a topic

researched in major IS journals since the early 70s with the pioneering work of Scott Morton (1971). However, it was not until 1978 when a publication appeared in our basket of top journals. This first publication appeared in MIS Quarterly which is a journal that was founded in 1975. The research published in the MSS context has increased gradually as the computer industry has matured. Between 1980 and 1994, the publishing of MSS research doubled approximately every five years. We believe that this increase in publications is related to the emergence of additional IS journals such as JMIS, EJIS, and ISJ (Table 2). During the early years of MSS publications DSS systems were the only type of MSS systems available. Then, at the beginning of the 90s EIS emerged as a new type of system available for practitioners and scholars. Further, by the beginning of the 2000s the new global business environment posed challenges on businesses that went beyond to what the regular DSS could offer. Hence, KMS and BI appeared as way to provide organizations with better knowledge and advanced tools for gathering, storing, accessing, and analyzing data.

Table 3 also presents important information depicting the shift of MSS research interest from DSS during the first 30 years in our study's review time frame (1975-2004) to KMS and BI in the last 8 years (2005-2012). In addition, EIS seems to be a forgotten area of research as its publications seem to be limited to a period of ten years (1990-1999) and to have the least interest of MSS research.

Table 3. MSS IS Research Evolution					
Period	DSS	EIS	KMS	BI	MSS
1975-1979	1				1
1980-1984	3				3
1985-1989	6				6
1990-1994	8	6			14
1995-1999	8	5			13
2000-2004	4	1	4	3	12
2005-2010	7		13	3	23
2011-2012	7		7	1	15
Total	44	12	24	7	87

The MSS framework presented by Clark et al. (2007) consisted of 20 constructs listed in table 4. Based on that classification table we identified the constructs that were most applied and used in the top six journals' publications. The most studied constructs are perceived MSS benefits, management decision quality, and level of MSS use, while the least studied constructs are MSS training, development effort, level of MSS desired, and technology gap. Within the literature of our DSS sample, management decision quality dominates the rest of the constructs, which makes sense as DSS main purpose is to help users take the best decision. Perceived MSS benefits is most studied in EIS and KMS literature of our journal basket, which explains the trend of those studies investigating the benefits of these two systems to convince practitioners to implement or adopt these systems. Also, EIS and KMS are used to compliment DSS via facilitating generating the right knowledge to help decision makers take the best decisions. In addition, MSS quality, problem space complexity, and MSS to problem space match seem to be the most constructs studied in BI research in our journal basket. This shows that BI's main purpose was to improve the quality of MSS systems using the tools and techniques within. Also, BI was mainly needed in organizations with complex problems with large databases where customers' data is stored and the only way to learn about their customers is by using BI tools

and techniques that assist on accessing and analyzing the data. In addition, BI allows users to convert unstructured data to structured data facilitating at the same time capabilities to store, access, and analyze information.

Table 4. MSS Construct vs. Technique					
Construct	DSS	EIS	KMS	BI	Total
Perceived MSS Benefits	11	4	10	2	27
Management Decision Quality	21	1	4		26
Level of MSS Use	8	2	8	1	19
Problem Space Complexity	7	4	4	3	18
User Knowledge Base	8	1	9		18
Usability of MSS	9	1	6	1	17
MSS Quality	2	3	6	4	15
MSS to Problem Space Match	3	3	4	3	13
MSS Cost	6	3	2	1	12
Executive Commitment to MSS	3	3	2	2	10
MSS Functionality	5		2	2	9
User Involvement in Development	3	1	3	1	8
User Commitment to MSS	5		2	1	8
MSS Technology Base	1	1	2	2	6
Technology Available	1	1	1	2	5
User knowledge requirement	1		4		5
MSS Training	2	1			3
Development Effort		1		1	2
Level of MSS Desired	1				1
Technology Gap		1			1

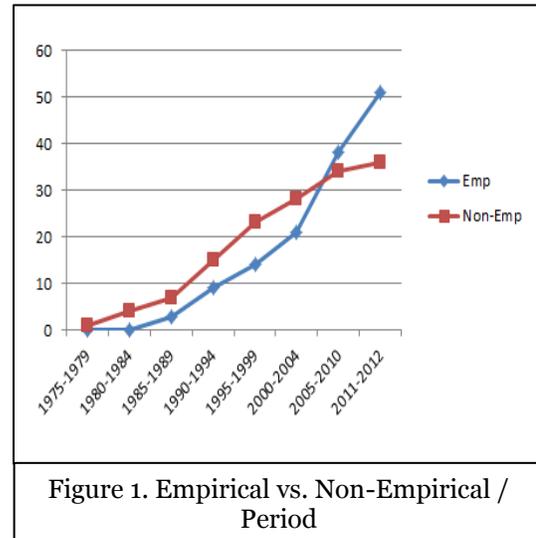
In addition, table 4 shows that there are important research opportunities that can be addressed in terms of studying MSS. Hence, by examining some of the constructs that seem to be ignored by prior studies in our journals basket the knowledge about MSS could be extended. Among the under-researched constructs are MSS training, technology gap, user knowledge requirement, development efforts, user involvement in development, and most importantly user commitment to MSS.

The MSS research classification of “Empirical vs. Non-Empirical” is based in the proposition by Tams and Grover (2010). These authors suggested that empirical papers contain a theory section presenting what is expected and why based in theory; a methodological section describing the sample and quantitative technique used to understand such sample, and a results section presenting what has been found. Hence, using this framework definition we classified papers as empirical and non-empirical.

Results from Table 5 present, that overall, there has been 51 papers published with an empirical perspective while 36 are published under the non-empirical perspective within the collected papers from the basket of top journals. From the table it can also be seen that by 2012 empirical papers represent 59% of the MSS research and non-empirical papers 41%. In addition, it can

also be seen in figure 1 that it was not until the period 2005-2010 when empirical publications overtook non-empirical papers in terms of number of publications. This seems to reflect a growing interest by scholars in considering MSS as a topic of relevance and consistent with the evolution of the IS field where more empirical papers are currently being promoted (Tams and Grover 2010).

Period	Empirical	Non-Empirical	Total
1978-1979		1	1
1980-1984		3	3
1985-1989	3	3	6
1990-1994	6	8	14
1995-1999	5	8	13
2000-2004	7	5	12
2005-2010	17	6	23
2011-2012	13	2	15
Total	51	36	
%	59%	41%	



Analyzing the empirical vs. non-empirical perspective presented in Table 6 at the journal level we observe that MISQ presents a balanced mix of empirical vs. non empirical publications (56% vs. 44%). In addition, EJIS and ISJ keep a mix more focused towards non-empirical publications whereas ISR presents mix that reflects a strong empirical focus. It is surprisingly the only two papers at JAIS are non-empirical although JAIS seeks to favor empirical papers.

Journals	Empirical	Non-Empirical	Total
EJIS	3 30%	7 70%	10
ISJ	3 33%	6 67%	9
ISR	16 73%	6 27%	22
JAIS	0 0%	2 100%	2
JMIS	14 82%	3 18%	17
MISQ	15 56%	12 44%	27
Total	51	36	87

CONCLUSION

This paper reviewed the management support system literature using the top six IS journals aiming to examine the evolution of MSS (i.e., DSS, EIS, KMS, and BI) between 1975 and 2012. The classification results presented a comprehensive picture of MSS evolution since its start solely with DSS, passing through the emergence of EIS in the 90s, and ending with the development of KMS and BI in the new millennium.

The classification of the MSS literature in the top journals also allowed us to determine the MSS constructs that took extensive amount of research in the literature, as well as the ones that were ignored or under-researched. Hence, this paper identified the gap in the MSS literature, and highlighted the areas where scholars and practitioners can focus on to improve the design, processes and outcome of MSS. We specifically name MSS training, development effort, level of MSS desired, and technology gap as potential constructs to be examined in future MSS studies.

In addition, this paper classified the MSS studies in our journal basket under empirical and non-empirical type of studies as recommended by Tam and Grover (2010) to evaluate the theoretical and methodological aspects of the MSS literature. The classifications show that the majority of MSS prior studies are empirical, which implies that MSS is a relevant literature for both scholars and practitioners (Tam and Grover, 2010) that is taking a growing interest year after year (Table 3). However, it is important to report that EIS shows to be an exception as its number of publications in the last decade reflects the least interest by the top journals as their latest interest seems to be focused on DSS, KMS, and BI. Thus, we believe that this latent finding present potential topics for future research.

There are limitations of this study. First, we only included the top six IS journals in the Senior Scholars basket of journals. Expanding of this journal may provide new insights from what is presented. Additional limitation is that the classification of articles by empirical and non-empirical is based on Tam and Grover's (2010) definition. However, there may be several ways articles can be classified as empirical or non-empirical and that using any of these frameworks may result in findings different from what is reported here. Future research should seek examining MSS research using different frameworks for Empirical vs. Non-empirical.

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Teamwork, Team Performance and Team Satisfaction: Lessons from an ERPSim Game Competition

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Abstract

Enterprise Resource Planning (ERP) systems lie at the heart of IT infrastructure that supports daily operations of modern organizations. In response, most business schools have incorporated ERP software into their curriculum. A simulation game using SAP ERP (ERPSim) was introduced over ten years ago to allow students experience first-hand how business processes are integrated. The use of ERPSim game has been shown to improve student learning of ERP concepts, however, little research has explored factors that contribute to team performance during an ERPSim game. The current study investigates teamwork as a contributor to team performance in the context of a competition. Teamwork is measured by five indicators: contributing to the team's work, interacting with teammates, keeping the team on track, expecting quality, and having relevant knowledge, skills, and abilities. Team performance is measured by net income accumulated by each team at the end of the game. Participants also rated their satisfaction with their team. Data from 32 student teams show that all five teamwork indicators have a strong positive correlation with team satisfaction. The effect of teamwork on team performance is not as profound. A weak positive correlation between having relevant knowledge, skills, and abilities and net income is observed. Implications for further research and use of ERPSim games are discussed.

Supporting Veteran Transition to Civilian Workforce through Specialized Training and Certification

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Abstract

There are many reasons to hire transitioning veterans. Military personnel are often cross-trained in multiple skills, work well in a team, and have a sense of duty. They tend to show responsibility and take accountability for job tasks and projects. Many veterans welcome challenges, are able to problem solve quickly as well as adapt to changing situation. Often their experiences and ability to work well in teams are transferable skills in the workforce. St. Michael's Learning Academy has partnered with SAP™ and their Veterans to Work Program to provide a skillset including Enterprise Systems, Enterprise Resource Planning, Configuration, Integration of Business Process and Emerging Trends and Technologies to groups of transitioning soldiers. Typical cohorts include 15-20 individuals ranging in age from 22 to 50 years. The program cultivates not only the intellectual and technical side of the soldiers, but also provides career skills training in developing resumes, cover letters, interview assistance and networking with corporate mentors. Students complete the program with a TERP10 Certification and interviews with various employers with potential placement in a new career. This program provides veterans with a specialized skillset in an effort to provide a competitive advantage when entering the civilian workforce. A description of the program with details of challenges as well as successes will be discussed along with statistics of certification and hire rates.

Supporting Veteran Transition to Civilian Workforce through Specialized Training and Certification

Introduction

Service members and military veterans transitioning into the civilian workforce encounter multiple challenges. These individuals have valuable skills which may be difficult to translate. St. Michael's Learning Academy and SAP, one of the biggest business software companies in the world, have partnered and committed to assisting these transitioning military personnel by providing training and certification in SAP technologies. In addition, this unique program provides personal assistance with career skills as well as job search and placement. Launched in 2012, SAP's Veterans to Work Program "was based on the fast growth of the company and the tremendous need for individuals trained to support its human resource needs" (Simpson, 2014).

Enterprise Systems / Business Analyst Program

The program offered by St. Michael's Learning Academy focused on the introduction of enterprise systems and business process concepts and capstones with TERP10, Integration of Business Processes in SAP ERP, Certification. Transitioning veterans participate and complete 400 contact hours of training which includes introduction to enterprise systems, business processes, enterprise resource planning systems, the integration of business processes, enterprise system configuration, advanced enterprise systems tools, emerging technologies and finally the TERP10 Certification. Throughout the program, soldiers are also immersed in training, education and mentoring with regard to career skills, interviewing, professional networking and job search/placement. Career skills also includes visits by various potential employers including HPe, GM, CapGemini, SNP Labs, Accenture, Accenture Federal, Rockwell Collins, and various recruiters to assist in placements.

NEW to Michigan

St. Michael's Learning Academy has partnered and been supporting SAP's Veterans to Work Program at various sites in Texas since its inception in 2012. In March of 2017, the first Michigan cohort began. Previous cohorts and sites catered to enlisted Army personnel, while the Michigan site is located at National Guard headquarters in Lansing, Michigan. Plans for additional sites across Michigan are in the early stages with hopes for training to begin over the next 12 months.

Program Challenges

As rewarding as this program is to administer, it does not come without its challenges. Each cohort brings about learning experiences and opportunities to improve. Challenges occur at all levels, including administration, instruction and even for the students. Some of these challenges are listed below.

Administration

- Choosing a cohort – narrowing down the student pool
- Obtaining scholarship funds
- Retaining qualified instructors (schedule)

- Accommodating schedules at various sites
- Coordinating with military, state and accreditation organizations
- Paperwork!!!

Instruction

- Varying levels of education (HS, post-secondary, graduate, etc...)
- Shuffling full-time vs part-time schedules
- Conquering the military mindset (training vs. learning)
- Assessing without accountability
- Varying technologies between sites; often struggle to access materials
- Access to sites – security, etc.
- Schedule adjustment

Students

- Coordinating with work/family
- Schedule adjustment
- Orders that interfere with course
- Difficult material
- Conquering the military mindset (training vs. learning)
- Searching for a job vs. receiving orders
- Networking tools – foreign to many (LinkedIn, Indeed, Twitter, etc.)
- Fear of failure

Positive Learning Environment

SAP, especially for new users, can be overwhelming. Military personnel are accustomed to having to make high marks. Positive mentoring is necessary throughout the program to assure students they can and will succeed. Occasionally, constructive criticism is necessary as well for students who start to get lax in their preparation. Without traditional assessment, as it typical in post-secondary education, students tend to get a false feeling of ease with course content. Assessments may serve as an awakening, so to speak, but often that realization is brief. Constant interaction, encouragement and mentoring is necessary to ensure students are consistently putting forth effort outside of the classroom which is pertinent to ensure success on the final certification exam.

Coordinating Cohorts

I have developed a course outline and schedule to be followed across cohorts, regardless of the location. This allows for a consistent program no matter what site or staff is administering. With the program encompassing 400 hours, these hours can be distributed across 4, 6 or 8 hour days to accommodate various site requirements. In addition, hands-on activities assist students in reinforcing materials with methods to provide *learning* opportunities rather than *memorizing* of course content. Career skills program and content is also coordinating across cohorts to provide

equal opportunity to all students participating in the program.

Conclusion

Graduates of this program are able to converse about course content, translate their military skills, network with business professionals, and embark upon a new career path. It truly is rewarding to assist these transitioning veterans by providing them opportunity to learn a specialized skillset and make them more competitive in the civilian job market. With cohort certification success rates ranging from 71 – 93% and employment at >75%, we are certainly making a difference.

Research is planned for the present as well as summer 2017 Michigan cohorts to collect demographic and performance data as well as success rates in an effort to promote the program and open additional sites. Program administration and instruction will be adjusted based upon the needs of our veteran community and reflective of adaptations to the various challenges. Our veterans have given so much to us individually and collectively through service to our community and country. This program is a simple way to give back to this demographic and needs to be cultivated.

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ERP in Undergraduate MIS Capstone Course

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Abstract

The objective of the undergraduate capstone course for the MIS degree program at Indiana University South Bend is to reinforce, apply, and extend knowledge and skills developed in previous coursework. In the last couple of years, we have made substantial changes in our MIS curriculum and hence we need to make changes in our undergraduate capstone course. As a member of SAP University Alliances, we offer multiple ERP related courses in our MIS curriculum. While redesigning our undergraduate capstone course, we want to ensure that the ERP is adequately integrated in this course. A description of the initial ideas about the coverage of MIS and ERP related topics in our undergraduate capstone course will be discussed.

Keywords: ERP, SAP, MIS, Education

**Women in IT:
An Exploratory Study of the Barriers that Influence
Major and Career Choices**

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Abstract

In today's knowledge-based economy, a diverse Information Technology (IT) workforce is crucial to nations' advancement and global competitiveness. Even though women make up nearly half of the U.S. workforce and half of the college graduates, they continue to be underrepresented in the IT workforce and among IT degree holders. Given the significant IT talent shortage worldwide; failure to tap half of all qualified individuals presents a major hurdle for the long term viability of the IT field and for national competitiveness.

The IT field covers a broad group of disciplines including the more technical Computer Science (CS) discipline, as well as the relatively newer and more applied disciplines such as the Management Information Systems (MIS) discipline. MIS is considered to be a more women-friendly subfield of IT, with the potential to bridge the gender gap in the IT discipline. Previous research has mostly focused on the barriers faced by women in the CS field. However, given the distinction between CS and MIS, different reasons may emerge for the underrepresentation of women between these disciplines.

In this respect, this study examined the factors that might inhibit women from pursuing MIS degrees and careers. Moreover, it explored whether gender differences existed among these factors. The data used in the study was collected through a survey of students enrolled in an MIS course at a large, public university located in the United States. The findings of the study have important implications for both practice and research. The presentation at the conference will provide a discussion of the key findings, implications, limitations, strategies for reducing barriers, and future research directions.

Dancing with WhatsApp: Small Businesses Pirouetting with Social Media

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Abstract

WhatsApp is no longer a term which is unfamiliar to users of smartphones. It has become a vital tool enabling small businesses to respond to opportunities in real time. Different geographic locations and time zones are no longer a barrier when the customer base is always active in getting WhatsApped. In this paper, we take a look at some ways that small businesses have been able to effectively use WhatsApp for commercial, business, marketing and sales management. All smartphones can send messages to each other at no cost using WhatsApp, and with almost impregnable security. This is an advantage for users in both growing and developed economies around the world. International corporations use WhatsApp to keep in touch with customers distributed globally. Small businesses do so to keep in touch locally as well. In this paper, we take a theoretical exploration at how WhatsApp provides flexibility to small businesses in their communications with their vendors and suppliers.

Key terms:

Databases, WhatsApp, Smartphone, Instant messaging, Multi-media messaging (MMM) Short message services (SMS)

Introduction

This paper discusses the increasing role of WhatsApp in providing small businesses with greater flexibility and responsiveness in dealing with their customer base. The paper is divided into four sections. The first section explains what WhatsApp is. In the second section, we take a look at selected literature on WhatsApp and related developments. We look at the role of WhatsApp as social media, and compare it to traditional SMS and MMS, as well as to most other competing messaging applications. In the third section, we look at its impact, its benefits and limitations, and see how a large number of small businesses are using it to “dance around,” meaning, to be super-responsive to the needs of their customers, and to be able to grow their business by pirouetting as per business necessity. In the fourth section, we end by discussing the way forward, based on current usage and future prospects.

What is WhatsApp?

WhatsApp, founded by Brian Acton and Jan Koum, a Ukrainian immigrant to the United States, is the fastest growing social utility used for communication and sharing information

(Olson, 2014a). WhatsApp is a versatile communication method usable on smartphones, tablets, and computers that use the internet. In January 2014, Facebook paid about US\$19 billion to purchase WhatsApp from its founders. The purchase was signed and completed at the welfare office that was once used by Koum in his youth, and evoked great interest as a rags-to-riches story (Olson, 2014b).

An overview of a selected telephony and messaging technologies literature

We have reviewed a select literature on telephony and messaging technologies. In Rouse (2016), telephony and messaging technologies are used in the design of smartphones and the special software that makes these gadgets functional. Internet protocol telephony is a general term that uses technologies which use the internet's packet-switched connections to exchange voice, fax, and other forms of information that have traditionally been carried over the dedicated circuit-switched connections of the public switched telephone network (PSTN). Rouse (2016) argues that the major challenge in internet protocol (IP) telephony is to deliver voice, fax, or video packets in a dependable flow to the user. WhatsApp technologies have been designed as messaging applications that use the internet for calls or messages that travel as packets of data on shared lines avoiding the tolls of the PSTN.

Some of the current perspectives

In Selveraj (2013), WhatsApp is not considered as a category of social media. It is viewed as a messaging system that relies on internet and telephony technology. Kleinberg (2013) concurs with Selveraj that messaging apps should not be considered as true social media unless users can make friends using the apps, and not just add existing contacts. In Schmidt (2014) however, we read that WhatsApp may be classified as a social network, since "you can make new acquaintances and friends through it (for example, if you are invited to a group where some of the participants are not in your contact list" (2014:1). We argue that Schmidt's opinion is more in line with current thinking as WhatsApp is certainly used to make new acquaintances through a discussion list. Our opinion is consistent with arguments presented by Obar & Wildman (2015) that social media services facilitate the development of social networks online by connecting a profile with those of other individuals and/or groups.

WhatsApp as a social media

WhatsApp as social media is a formidable mobile messaging application. In 2016, there were an estimated 4.6 million cellular phone users and 2.6 billion smart phone users in the world (Pawel, 2016). A huge portion of the world's active adult population uses cellular phone technology and most of these users use smartphones, which are mobile phones with the combined capabilities of two devices, a physical digital assistant that allows users to use a touch screen in order to access various functions and services, and a cellular phone which is used to make phone calls and send text messages.

One of the great innovations of smartphones is the ability to download and use different applications (or apps) for various services. WhatsApp is one of these apps and is used to complement the communication capabilities of a smart phone. It allows users to share messages as well as make phone calls without incurring the charges associated with text messages or phone calls. Since WhatsApp is a cross-platform mobile messaging application which allows mobile phone owners to exchange messages without having to pay for short message services (SMS), available globally, it becomes an attractive option for such usage (WebWise, 2016).

SMS and MMS versus WhatsApp

All mobile phones can use SMS which is a wireless standard that allows sending and receiving of short 160 character text messages to and from any mobile phone. Multimedia Messaging Service (MMS) is the next evolution of SMS and is used on smartphones. MMS is a vibrant option because it allows pictures, audio, or video to be shared. WhatsApp on the other hand, is not a default standard; it is an optional mobile instant messaging (MIM) application only available on smartphones. It requires a mobile internet connection to function and requires that the message sender and receiver both have the proprietary software installed on their devices. WhatsApp chats appear as threaded messages on a wall, using spatial position and color to distinguish between sent and received messages. WhatsApp does not have a limitation on the size of a message, unlike the 160 character limitation of SMS. It also has other features and capabilities beyond MMS or traditional SMS, such as delivery notifications that indicate if other users have seen the message, and telephone capabilities, among others.

Studies reflect a trend that among the youth, there is an increasing preference for texting over talking. One of these studies is by Church & Oliveira (2013). They postulate that text messaging or SMS have become integrated into the daily lives of young people. Church & Oliveira (2013) have produced an excellent comparison of SMS and WhatsApp by applying various research methodologies to their study. They illustrate that cost seems to have been a major consideration for using WhatsApp but in a rather selfless way. A typical user comment from the research was: "Using WhatsApp is a guarantee that the other party won't pay... I do want to participate in a messaging experience where others don't have to pay." (2013:2). The research shows that "social influence is one of the main reasons for today's migration" away from SMS (2013:3). Yet another factor behind WhatsApp's growth is that it appears more conversational in nature, more fluid and natural, when compared to SMS. It is also perceived to be more personal and informal, while SMS is perceived to be more formal. That delivery of messages is conveyed to the sender is another major difference. A typical user comment from the Church & Oliveira study is: "I never had much trust in the delivery of SMS... So this thing of WhatsApp, knowing that it was really delivered, that the person read what you sent or not, I think this kind of information is useful." (2013:4).

O'Hara, Massimi, Harper, Rubens, & Morris (2014) have given a brilliant and thought-provoking analysis of the reasons for rapid adoption of WhatsApp in preference to traditional SMS. Even though apps such as WhatsApp do not at first glance appear to offer anything new,

the informal capacity to meld multimedia into traditional messaging in a social interaction has enabled it to become an important part of people's daily lives. O'Hara et al suggest various reasons such as enacting friendships, groups, and communities, awareness and notification through media exchange. WhatsApp has impacted social behavior and improved the potential to effectively exploit online group cohesion and intimacy in varied situations.

Ahad & Lim (2014) found that WhatsApp is not used only for cost savings, and this has been the view of (O'Hara, et. al., 2014) as well. Ahad and Lim's study had 92.82% WhatsApp users in a sample population of 155. This is a significant user size, but the sample is too small to make definitive statements. The users in growing economies cannot be fully quantified. A sample size of 155 is anecdotal, and not determinative. But it did point to some trends. These trends are conclusively confirmed by the study in (TOI Tech, 2016), and we see that the use of WhatsApp is growing rapidly.

Table 1: The Percentage and Frequency of WhatsApp Use

i)	Demographic	Responses	
Gender:	Male : Female	21.02% (33)	78:98%
Age group:	18-20 : 21-23	23.57% (37)	40.76%
Faculty:	Faculty of Arts & Social Science	32.05% (50)	
	: UBD School of Business and Economics	45.51% (71)	
ii)	Appropriation		
i)	Do you currently use Mobile Instant Messaging (MIM), namely WhatsApp on your mobile phone)	92.82% (152) 3.18% (5)	
		Yes	No
ii)	Why do you use WhatsApp(you may tick more than one answer)		
	(a) Easy-to-use friendly	92.41% (146)	
	(b) Easy to communicate	92.41% (146)	
	(c) Time-saving	69.62% (110)	
	(d) Saves money	84.18% (133)	
	(e) Speed of inform. retrieval & transfer	72.15% (114)	
iii)	Incorporation		
i)	How many hours you normally spent on using WhatsApp?		
	a) 1-2 hours a day	27.7% (41)	
	b) 3-5 hours per day	31.76% (47)	
	c) 6-7 hours per day	11.49% (17)	
	d) Over 8 hours per day	29.05% (43)	
ii)	What current features of WhatsApp do you mostly use? (You may tick more than just one answer)		
	a) Sending text messages	91.1% (155)	
	b) Sending photos	94.94% (150)	
	c) Sending videos	47.47% (75)	
	d) Sending inform (news)	62.03% (98)	
	e) Sending voice messages	41.77% (66)	

WhatsApp and the Competition

WhatsApp belongs to a category of mobile communications services called mobile instant messaging (MIM). Up to now, the most popular method of mobile messaging has been traditional SMS. But applications like WhatsApp also allow real-time text messaging to individuals or groups of individuals. WhatsApp is a cross-platform instant messaging application that enables smartphone users to send and receive at no cost, “location information, images, video, audio and text messages in real-time to individuals and groups.” (Church & Oliveira, 2013:5). Its “availability across multiple mobile platforms and the fact that it has reached a critical mass of users” has given it critical momentum (2013:6). It does have competition, examples of which are similar services such as Viber, LINE, and WeChat. The chat app Viber has grown from zero to 754 million users from June 2011 to March 2016, while LINE, another provider of communication messages and phone calls, grew from zero users in December 2011 to 560 million users worldwide in October 2014 but has now shrunk to 218 million users as of March 2016. Another competitor, WeChat, has grown from zero users in April 2011 to over 700 million users today (Statista, 2017). These are all free services to consumers and have a number of similar features. In order to compete, all of these must provide a cohesive and comfortable working interface and must continue to provide a free service to the growing needy in developing economies (World Bank Report, 2012).

WhatsApp has greater momentum behind it than any of its competitors. As of January 2017, it had 1.2 billion active users, up from 700 million in April 2015. (Statista, 2017). It handled ten billion messages each day in August 2012, growing from two billion in April 2012 and one billion the previous October (Ahad and Lim, 2014). On April 1, 2014, WhatsApp created a new one-day record by processing 64 billion messages (Hong, 2014). In the words of Mark Zuckerberg, whose company Facebook now owns WhatsApp, “About 70 per cent of people who use WhatsApp use it every day, which kind of blows away everything else that's out there” (Goodwin, 2016:1). It appears that WhatsApp’s popularity is global in nature, while its competitors are popular in specific countries. According to the latest survey published on May 25, 2016, “Facebook-owned WhatsApp is installed on 94.8% of all Android devices and is used for an average of 37 minutes daily” and has “emerged as a clear leader in 109 nations, or 55.6% of the world.”(TOI Tech, 2016:1). Competing MIM services are less global in popularity and their use is popular among specific sets of users in specific countries. The study showed that “as of April 2016, Viber was installed on 65% of all Android devices in Ukraine and was used for an average of 16 minutes a day” and “Japan's obsession with Line is well documented with people in the country using it for an average of 40 minutes a day.” (TOI Tech, 2016:3). There are also other fast growing competitors like Telegram and TenChat, which have not yet established themselves on the same scale.

There are some places where WhatsApp growth has plenty of room for improvement. For example, WhatsApp’s global popularity is not reflected in China, where another similar app called WeChat has become the *modus operandi* for group communication and government-citizen interaction. In Lawrence (2016), WeChat is used by 90% of smartphone users in China

for many online activities including business transactions; WeChat is used to perform financial transactions such as pay rent, invest money, or make appointments. Shenzhen authorities even use WeChat to reward whistleblowers. The police, for example, use WeChat to reward those who report traffic violations in ShenZhen, China.

Building grounded theory

To review if WhatsApp technology can be useful for small and large scale organizations to create, diffuse and distribute effective business and social relationships in advancing economies and how the messaging can be useful in data collection which can then be analyzed to create exploitable marketing and sales, we can take a previous, related business developments. An & Harvey (2016) have built upon the work of Prahalad & Hammel (1990) to optimize the use of information systems in progressing strategy. They concur that strategy can be improved by analysis of product history, sales, and how differentiation has been applied. An & Harvey suggest that the four steps of the brand management process which include planning and brand positioning, implementing branding strategies, measuring and analyzing performance of a brand, and sustaining brand equity over time and across geographic markets, can all be enhanced with the technological tools. Smartphones with WhatsApp capability can be used as a platform to develop effective marketing and sales approaches in fast developing economies such as China, Brazil, or India, as well as countries in Africa. A strategic view on the WhatsApp approach can permeate all real-time communication strategies used by small business.

In Geringer, McNett, Minor, & Ball (2016), the forces of digital social media are ripping through international marketing. Burberry, Pepsi, and McDonalds are using WeChat, a Chinese-language version of WhatsApp with added elements of Facebook and Instagram, to communicate one-on-one with consumers in China. Geringer et al (2016) propound that China will become the world's largest market for luxury goods by 2020 and will have the largest users of social media. Businesses in China are using Whatsapp and similar technologies for real-time communications with customers. In Orth (2011), India is asserted to be the fastest growing instant messaging market. Of the world's 1.2 billion users of WhatsApp, 200 million are in India and on April 4, 2017, WhatsApp announced a peer-to-peer payment system to be launched in India by the end of this year, so that small businesses can have more flexibility in accepting payments. (Mundy, 2017) mentions that "WhatsApp is expected to take part in a flagship project of the government... which enables money to be transferred between different mobile money services as well as bank accounts." In Brazil, the Supreme Court acknowledged that "people from across Brazil, including members of the judiciary, rely on WhatsApp to communicate with others every day." (Guardian, 2016)

WhatsApp Impact

The impact of WhatsApp on business has been significant, and a look at its transformative capabilities and potential in the following selective areas will make that clear.

Security

According to a recent WhatsApp update, WhatsApp has embedded end-to-end encryption technologies inside their messaging system. Thus, its built-in encryption will not allow governments and organizations to monitor private communications of citizens or employees. According to one of the founders of WhatsApp, Brian Acton, “With encryption, anyone can conduct business or talk to a doctor without worrying about eavesdroppers.” (Metz, 2016) With the new encryption capabilities of WhatsApp, its use as a communication tool may prove to be beyond the control of countries and organizations. Many messaging apps only encrypt messages between a user and the recipient but WhatsApp's end-to-end encryption ensures only the user and the person receiving the message with can read what is sent, and nobody in between, not even WhatsApp (WhatsApp, 2017). This fact alone may make its position in social media unique in fostering social change.

Cultural Change

Even the world of finance has become wary of the tremendous potential of WhatsApp to create a cultural shift. Very recently, a banker in the UK was fined for using WhatsApp for sharing confidential data. But many finance professionals say that “the apps are crucial because they’re faster and more convenient than the monitored software their own firms provide”(Keller 2016:1) to deal with colleagues as well as with customers. In December 2016, some criminally indicted money managers were reported to use WhatsApp “in an effort to keep their communications from being monitored by law enforcement.” (2016:2)

Customer-Care

The British have invaded the Chinese market of luxury goods using WhatsApp for marketing. High-end retailers such as Harrods or Selfridges and dealerships of luxury cars have penetrated the global markets and are applying WhatsApp technology to create a network of potential customers by analyzing sales, production and economic trends to create appropriate marketing and sales databases. Geringer et al (2016) mention that local car dealers in China sell more than a hundred cars each a month; BMW, Audi, Land Rover, Jaguar, and Cadillac are some of the dealerships where WhatsApp is used as a customer-care network and for sales and marketing purposes.

Improving livelihoods and small businesses – in Asia, South America, and Europe

Burn-Callander (2015) make a presentation of small and medium businesses using WhatsApp in India, Brazil and England. ProfitBooks (2016) has demonstrated from their experience that WhatsApp can be used for small business and they have listed five ways that it has been successfully used in India:

- 1) Using WhatsApp For Internal Team Communication – There is no need for training and no resistance from employees as everybody already uses it

- 2) Using WhatsApp For Customer Communication - follow-ups on WhatsApp instead of direct phone calls get 40% more response. No one appreciates phone calls from unknown numbers but we are more likely to respond to personal messages. WhatsApp contacts only communicate to numbers that have been saved so the communication becomes more personal and more likely to be responded to. Businesses also can use WhatsApp's calling feature to talk with international customers
- 3) Using WhatsApp For Customer Support – WhatsApp can be used for customer support if customer base is not very large, otherwise this can get out of hand. This may only apply to relatively small businesses
- 4) Using WhatsApp For Marketing & Promotion - WhatsApp can be a very strong marketing tool as there is less restriction on the format of the message and delivery chances are higher. Businesses can use WhatsApp to send images, audio files, short video clips of their products and text messages to users across the world
- 5) Creative Usage Of WhatsApp For Business – concierge service, food ordering, medical consultation, government services, are just some of the areas that WhatsApp has been found helpful.

Small businesses in India, which has the second largest population in the world, have found creative ways to use WhatsApp. According to ProfitBooks (2016:6), here are some anecdotal experiences:

- My dad is in the business of Photography. WhatsApp plays a huge role in improving his efficiency in this business. If he modifies some customer's photograph, he shares the new one over WhatsApp (better than calling them or emailing them), and then prints the requested one....
- My father owns a jewelry shop. Earlier, every time he sold jewelry he had to get a photocopy of that ornament to give to the bench jeweler to make another piece of same design. Or if he found a new design on internet, then also he had to get it printed out to give the copy. This consumed a lot of time. But now what these people (in this industry) do is that they just take a pic of that ornament and WhatsApp it to the bench maker with other details. This now saves time and money to both. Also sales have increased due to efficiency and effectiveness. Now my father has started receiving orders on WhatsApp as well. WhatsApp has really revolutionized the jewelry industry (ProfitBooks, 2016:7).

Mehta (2014) has described how WhatsApp is changing how small businesses work in India. Here are some typical representative examples:

- Raman is a vegetable vendor in Vadodara, Gujarat. Not too long ago, he used to take orders on call and deliver wherever required. But now, he takes a photo of whatever he has and sends it to a group of customers on WhatsApp. Customers get to see what he has to offer and if the vegetables are fresh before they place an order.
- Bewakoof.com started making business promotions via WhatsApp, and in two months, they claim to be making 15% of their total sales through the instant messenger. Customers have to mention the product name, their name and address and send a WhatsApp message to get their delivery (Mehta, 2014:2)

Mehta explains that this is a huge behavior change and it has happened very quickly. People are buying smartphones only to use WhatsApp. WhatsApp has played a big part in getting users to buy data plans and changed their behavior from using SMS to Internet-based messaging (2014:3).

Small businesses in England are using WhatsApp extensively. The Telegraph headline “WhatsApp: the secret weapon for small businesses” (Burn-Callander, 2015), gives a good indication of its value. It describes how Nickolay Piriankov, co-founder of bespoke diamond ring maker Rare Pink, uses the app to build rapport with his customers, and to provide them customized service. Rare Pink offers online consultations to customers who are looking for unique rings and now “Every design consultant has WhatsApp on their work phone,” (2015:1) Fashion designer Roberto Revilla uses WhatsApp as a crucial communication tool at his high-end tailoring business and feels that he gets a faster response from his clients, who are mid-to-upper level executives, compared to email or voicemail. Burn-Callander posits that WhatsApp has given advantages to small business operations.

In Saboia (2016), a review of a case study of WhatsApp in Brazil indicated that 96% of the population possesses smartphones which have WhatsApp. In Brazil, WhatsApp “has become something much bigger than a chat app: a one-stop solution for everyone, from small businesses to government agencies, to manage everything, from transactions to relationships. It has changed how users expect to interact with companies and brands online, and it is forcing firms to use WhatsApp messaging to fulfill customer expectations.” (2016:1). The Brazilian case study also showed that WhatsApp has a tremendous success rate where 98% of messages are opened and read, compared to 22% emails and 7% Facebook posts which are opened and read.

Saboia (2016) also mentions some mistakes to avoid such as pushing unsolicited content (If messaging apps allow users to be spammed, it would be considered as a nuisance and would stop being an opportunity for businesses), and taking too long to answer (average response time is only 90 seconds for messages, so businesses need to keep that in mind). These experiential findings and suggestions need to be kept in mind while considering WhatsApp business use.

Improving Government-Citizen Interaction

Countries like Brazil and India which have reached a critical mass of users now provide a number of government services using WhatsApp. From managing traffic violations and reducing absenteeism among lawmakers, to providing railway tickets, to filing corruption complaints, to improving safety for women, to improving transportation efficiency, we see many innovative ways that citizens and government agencies are using WhatsApp for mutual benefit. (Srikanth, 2015).

Enhancing communications for corporations

WhatsApp has a good balance between robust features and ease-of-use. Small businesses find it appealing because they can communicate with their customers without spending money on SMS text messaging. WhatsApp has already been successfully adopted for use by many small businesses. WhatsApp is now targeting larger businesses with a set of tools that would allow business communication and group communication to thrive. In January 2016, Jan Koum, the founder of WhatsApp announced that “Starting this year, we will test tools that allow you to use WhatsApp to communicate with businesses and organizations that you want to hear from. That could mean communicating with your bank about whether a recent transaction was fraudulent, or with an airline about a delayed flight. We all get these messages elsewhere today – through text messages and phone calls – so we want to test new tools to make this easier to do on WhatsApp, while still giving you an experience without third-party ads and spam.” (Olson, 2016).

It is expected that WhatsApp will in the near future assist larger businesses by providing them with greater capabilities such as “analytics, infrastructure for sending messages to large numbers of customers at once, managing payments, advertising and automated bots for responding to questions” (Olson, 2016).

Weinberg & Efrati (2016) mention that WhatsApp is planning to offer banks, airlines and other businesses the ability to send one-way messages to customers. It will be WhatsApp’s first official move to lure businesses onto the messaging app.”(2016:1).

WhatsApp now provides end-to-end encryption to every form of communication on its service, that is, all messages, phone calls, photos, and videos shared with WhatsApp. This means that communication is so secure that not even WhatsApp employees can read the data that’s sent across their network (Metz, 2016).

At the same time, according to Olsen (2015), WhatsApp has disrupted the business regular communication companies because it offers free phone calling using their service. This has led to some countries banning the use of WhatsApp telephony since they started to lose revenue from long distance calling.

The limitations of the arguments presented

WhatsApp is not very organized. Group chats are ordered by last time of activity. It is not considered helpful for business order, unless the majority of the group chats are related to business activity and knowledge management. Some users of WhatsApp have experienced difficulties with its quick search functionality while attempting to find foci by relevance. Unless groups are really specialized, this can be an impediment for effective exploitation of available organizational knowledge.

In addition, WhatsApp has restrictions on the number (256) of users in a chat group. It should be noted that the limit was initially 30 members for a chat group, increased to 100, and is at 256 as of now. Research and development at WhatsApp is an on-going exercise therefore this number may change. Although the current 256 user limit may appear to be a disadvantage, this can lead to more cohesive groups. It is easier to agree on tasks and to share work, when the number is relatively small. This size limitation has support in the literature (Boundless, 2015). Dunbar's number is a suggested cognitive limit to the number of people that can form a stable social relationship. It is estimated to be at around 150 (Boundless, 2015). This ties in very well with WhatsApp limits on group users, as most groups are fewer than 150. Observers have increasingly noticed a specialized segmentation by content or expertise areas.

However, the fact that WhatsApp does not as yet provide "compartmentalization" for private communication and for business communication, is an area that needs to be addressed as the great success of personal activities using WhatsApp cannot be replicated for an enterprise unless there is a distinct way to distinguish business activities and personal activities as: "people value a separation of private and business communication" (Stepan 2016:3). This is an area for additional research and needs additional services from WhatsApp in future.

WhatsApp does not provide businesses the ability to administer and deploy their WhatsApp messaging and communications centrally in a customized manner. This lack of enterprise administration capability is currently a limitation for larger businesses. (Stepan, 2016:4). But it is not a limitation for smaller businesses as it provides greater flexibility.

WhatsApp does not provide customer support or maintenance agreements or company-administered backups that give enterprises peace-of-mind regarding their technical communication infrastructure. Again, this is not a limitation for smaller businesses.

The way forward: A model to advance small and large enterprises

From our review, we propose that WhatsApp can be used for effective group communication in varied settings as long as businesses take the following into consideration:

- **Competitive Advantage** - The strategic use of WhatsApp is to facilitate business communications in establishing market share in fast growing economies around the world to gain competitive advantage
- **Rapid Customer Response**– Businesses should have a text ready phone number that they can share with customers and can respond to quickly.
- **Meet Customer Needs** – Provide Customers with a limited group interaction for products and services they care about. For example, India Market, a local ethnic grocery store in Grand Rapids, uses WhatsApp to provide customers with a safe interaction environment, and with interactive updates on new products and services and customers can also request products or services.
- **Group Dynamics** - Foster discussion, group activity, sharing bonding topics with customers that can lead to conversation and activity through your organization. For example, the Southern African Diaspora Network in North America employs WhatsApp to update members regarding events, activities, services such as scholarships, and job opportunities. OYO Rooms, a hotel room aggregator in India has operations in over 100 cities; its founder Ritesh Agarwal has a WhatsApp group for every city to stay in touch with his sales and operation executives. (Kashyap, 2016)
- **Sales Alerts** – Opportunity to build a sales experience by sharing pictures of new products, designs, foods, etc. with customers to allow them to choose an item and place orders through a WhatsApp message. This is done by India Market and other local and international organizations around the world. Examples have been discussed previously.
- **Engage** - Brands that truly understand the ways users communicate and create funny and messaging-ready content have a great opportunity in their hands. It is immensely powerful to have your brand be part of a private conversation between friends.
- **Trust** - Online privacy of users is protected against surveillance or eavesdropping of all kinds. This can create an element of trust and faith regarding collaboration and communication, thus leading to better cohesion and intimacy among groups in different social or business environments.

WhatsApp has democratized technology for the least technically proficient individuals. It has made technology unthreatening for the least experienced smartphone user. The application

makes it easier to form cohesive groups and can be used to implement proven knowledge management approaches such as communities of practice, lessons learned, and transfer of best practices. The development of WhatsApp in this respect parallels the rapid growth of Netscape, the first publicly available Web browser, taking into consideration the fact that it only requires the user to do a few simple, easily remembered things to use the application.

The application facilitates knowledge sharing using different multimedia formats. Since WhatsApp is a mobile multimedia messaging application, it can be used to send text, photos, audio and video to other users. It's also a cross-platform application meaning that it works on various interfaces including iPhone, Android, Windows, and Blackberry platforms. Moreover, its recent evolution as a communication application for Windows PCs has increased its potential for use in business teams and collaborations. WhatsApp makes it easy to create a communication repository because it has the capability to centralize the information shared and can, to some extent, allow its users to form smaller, more customized groups depending of the subjects of interest, even if users are spread across geographical locations in different time zones.

Conclusion

Applying the WhatsApp technology will help both small and large organizations to better communicate with their internal and external customers and stakeholders in a more timely and cost-efficient manner. WhatsApp has positioned itself as a powerful tool useful in advancing productivity. On the community side, it has plenty of potential but some of the limitations still need additional work-abounds. The backing of a company such as Facebook, the most widely used social media utility in the world, will be helpful in removing the rough edges. There are plenty of success stories to serve as inspiration and caution in the use of WhatsApp for small businesses to employ this for rapidly responsive customer communications.

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Key Terms

Instant Messaging - the ability to exchange text messages on an electronic device through a software application in real-time

MMS – Multimedia Messaging Service. It refers to the capability of mobile phones to send media such as photos or videos to another mobile phone, or to an email address.

SMS - Short Message Service. Refers to the capability of mobile phones to send short text messages with a limit of 160 characters

Smartphone – A mobile phone with the combined capabilities of two devices, a physical digital assistant that allows users to use a touch screen in order to access various functions and services, and a cellular phone which is used to make phone calls and send text messages. A smartphone touch screen echoes the user's typing, displays text messages, contacts, pictures, and more.

Social media – application that allows people to connect to, communicate, interact, and collaborate in various ways using electronic devices.

WhatsApp – a cross-platform mobile messaging app which allows you to exchange text messages and media messages in real time without having to pay for SMS. It also allows location sharing, voice messages, internet-based long distance phone calls, and real time group chatting.

Examining System Usability and Accessibility Design Issues for University Websites-An Exploratory Study

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Abstract

The universities worldwide have been using their web sites for not only sharing their information with various constituents but also to help perform all transactions online such as online registration, admission, billing etc. Web sites are a gateway to its information, products and services. In fact, more and more universities are offering interactive web applications integrating virtual reality, virtual tours, graphics, maps, buildings and other components of campus experience. In such a realm, it becomes more important to assess whether the web sites adhere to usability and accessibility standards to provide the best experience to the users. An effective usability measures the quality and efficacy. The accessibility measures whether content is accessible by all users independent of their disabilities, including those related to vision, hearing, mobility, speech, cognition, and learning. The study is conducted to examine 100 web sites of various universities both private and public to assess whether these web sites have been adhering to standards of usability and accessibility.

Predicting Movie Ratings using Sentiment Analysis of Tweets

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Abstract

Twitter is a social media platform used by millions of people across the world to share their views, opinions, and preferences on different issues. Twitter generates a huge amount of data which are represented as limited-length text in free format known as Tweets. The tweets provide big data of public opinion about movies, products or services. It is therefore necessary to develop sentiment predication methods to better understand customers and improve service delivery. This study aims to analyze and evaluate the opinions expressed about movies on Twitter. A framework of using tweets to predicting movies' ratings is proposed in this study. A prototype based on the framework is implemented in R Studio which gives easy access to tweets used for sentiment analysis. The preliminary study sheds light on using sentiments analysis to predicting movies' ratings.

INTRODUCTION

The use of social media has grown rapidly in recent years as users on these platforms generate big data from sharing views to making comments on different subjects. This has become a medium for people to share their opinions about the happenings around them, the products they consume and also their ratings on the movies they watch. Twitter is one of the most popular

social networking websites and generates big data used for conducting research of social networking.

Users usually post short messages known as tweets about their present status and these tweets can be collected and analyzed to determine the emotion of the users. This process is known as sentiment analysis. Sentiment analysis is the use of natural language processing to identify and retrieve important information from different sources. Sentiment analysis is a classification technique used in data mining where the aim is to classify objects into positive, neutral, or negative category. This study proposes a framework for predicting movies' ratings using sentiment analysis. Text mining is used to extract relevant information from text and then process the text by making it suitable for sentiment analysis. R Studio is used to retrieve the tweets relating to the movies. It is also used for pre-processing of the tweets and conducting sentiment analysis on the text gotten from the tweets.

The remainder of this paper is organized as follows. Section 2 provides literature review on sentiment analysis using social networking sites. Section 3 presents the sentiment analysis framework for predicting movies' ratings. The results from the preliminary study are presented and discussed in Section 4. Section 5 concludes the paper.

LITERATURE REVIEW

Social media is becoming the main communication channel nowadays by online users. Examples include Twitter, Facebook, and Instagram etc. with millions of registered users. Twitter with over 190 million users is ranked as the third most popular networking site by eBizMBA (October 1, 2016). Twitter generates a large amount of data daily from tweets published by users about happenings, their activities, views, and concerns on different subjects which has the capability to reach and influence a vast majority of the world. Sentiment analysis which is a natural language processing used to discover how people feel about a particular subject can be applied on tweets published on twitter to get a better understanding of peoples' responses and feedbacks and also get actionable insights for future purposes. A lot of research work has been carried out in this area due to the frequent use of the Internet by people to share views and opinions.

Krushikanth et al., [1] used the social web for prediction of movies box office performance. They made use of data mining techniques to collect data from different sources including Twitter, YouTube, and IMDb. The experiment was conducted in three phases. The training dataset was first normalized before K-Means clustering was applied to group similar data in the same clusters and finally the predictive model was generated.

Jinan Fiaidhi et al., [2] used the R statistical software for classifying tweets. In their experiment they used the bag of words model as a method to address the difficulty in Twitter sentiment classification. They also solved the effect of negation by applying an empirical method. This method considers the negation operator and the word separately before calculating the sentiment score.

Umest Rao et al., [3] analyzed the Hollywood movies using tweets from different locations. Two machine learning methods were used in their paper namely Naïve Bayes and MaxEnt and they were tested for Unigram and Bigram. Based on the results obtained, MaxEnt classifier achieved

the best accuracy of 84%. Over a million tweets were collected and the results shows that the US and UK tweets are more consistent about the movies than Australia and India. “Django Unchained” had the highest positive sentiment score while “Les Misérables” had the highest negative score.

Nagamma et al., [4] examined the relationship between the movie box-office performance and the online reviews for the movies. Basic data mining techniques of text processing and transformation were carried out to bring the dataset in form with the algorithm to be used. Clustering was performed on the review data based on the TD-IDF (term frequency–inverse document frequency) measure. The use of clustering method improved the accuracy of the system.

Vasu Jain et al., [5] predicted if a movie is successful at the box office. The python library Tweepy was used to provide access to the Twitter API for collecting tweets relevant to the task. The LingPipe sentiment analyzer was used to perform sentiment analysis for prediction. The results of the experiment show that the box office movie success can be predicted.

Rincy Jose et al., [6] used word sense disambiguation sentiment analysis technique for prediction of election results. A streaming API tool was used to collect data from Twitter, then the data collected were processed and classified based on the polarity of the tweets. Negation handling was also carried out to improve polarity detection. SentiWordNet is also used here to assign sentiment weights to the words. The sentiment analysis technique used in their paper achieves an accuracy of 78.6%.

Niloy et al., [7] examined fuzzy sentiment analysis on microblogs for movie revenue prediction. The frequency of usage of the verbs, adverbs, and adjectives were computed in the dataset and words with low frequencies were removed. Words with positive and negative sentiments were both represented with high and low fuzzy values respectively. This technique is used to model the association between weekly box office revenue and its determining factors. They were able to build a strong regression model for more accurate prediction using the relationship that weekly box office collections are strongly dependent on the weekend collections. The regression model has a high accuracy of about 90%, which is very encouraging using data from online views and opinions. The use of fuzzication also helped to convert those sentiments expressed in words to a format which expresses user sentiment effectively.

Pragya et al., [8] used rapid miner for sentiment analysis of English tweets. In the experiment, Tokenization and Transform Cases, two text processing techniques were applied to split the text into tokens and the characters are also transformed to either upper or lower case. They used filters to remove stop words and Naïve Bayes and K-NN (K-Nearest Neighbors) are used for the classification purpose. The results of the two classifiers were compared, which shows that K-NN works better in the given situation.

Alemu et al., [9] proposed a network-based visualization of opinion mining and sentiment analysis on Twitter. About 10,000 tweets were collected from Twitter using a Twitter streaming API crawler application. The sentiment analysis was done using AlchemyAPI and NLTK applications for labelling while Naïve Bayes was used for classification.

Francis et al., [10] developed a Teachers Performance Evaluation Tool using opinion mining with sentiment analysis. This system enables school management to compile results and generate statistical information which provides actionable and useful insights for improving the quality of

education offered by schools.

Nitu et al., [11] conducted the sentiment analysis on E-commerce applications by using opinion mining. Standard parse, used as a pre-processing step drew expression structure tree from each of the review sentences. Mine association rule was used to look for affiliations among the set of things in different databases, then summarization was used to reduce the affiliation rules.

Sentiment analysis was then carried on the whole document to classify it as positive or negative.

Nirmala et al., [12] performed Twitter analysis for unemployment crisis. Twitter authentication was successfully created for collecting tweets. Then the tweets undergo pre-processing for removal of irrelevant information. The process also involves comparing the tweets to the dictionary of positive and negative words and finally gives a sentiment score. A word-cloud is also generated based on the conditions defined by the user. The results show that there is a significant correlation between public negative feelings and the unemployment rate.

Snehal et al., [13] utilized sentiment analysis and opinion mining with social networking for predicting box office collection of movies. A twitter application was created to enable access to twitter data. Due to the size of the data collected from twitter, Hadoop HDFS file system along with MapReduce technique was used. The tweets were pre-processed and unwanted data were removed before Naïve Bayes classifier was used for classifying the tweets in either positive or negative category. After the sentiment analysis, weights were assigned to factors which include the number of screens on which movie is releasing and the number of tweets. The weights of these factors are added together to get the overall success rating of movie.

Ehi et al, [14] examined the usefulness of social media in building a competitive edge in the commercial environment. Their work focused on how project managers can become more acquitted with social media as sources of information. Donald et al., [15] carried out a survey of about 1800 customers to determine the factors that influence online purchases in order to develop a model capable of analyzing online purchases by customers. Musa et al., [16] developed a decision making algorithm using r studio. Twitter API was utilized in understanding of social trends.

RESEARCH METHODOLOGY

The process of determining the feelings or views expressed by a person is known as sentiment analysis or opinion mining. It involves the process of retrieving and processing the comments of users on Twitter for prediction. The sentence level against the document level is used to analyze the tweets mined in this study since each tweet consists of one hundred and forty characters.

Figure 1 shows the framework of sentiment analysis on tweets.

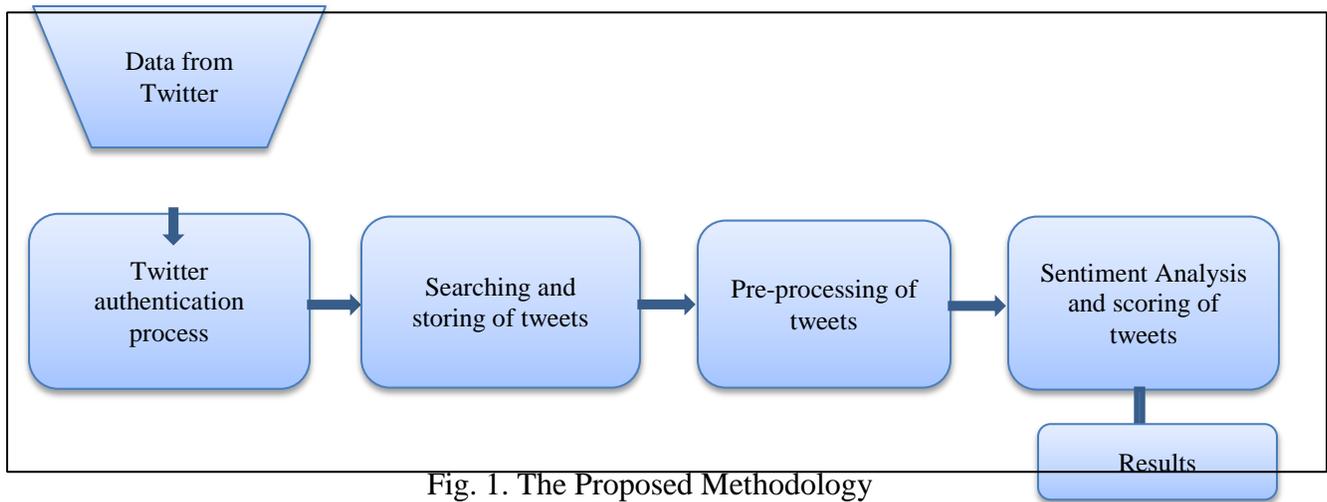


Fig. 1. The Proposed Methodology

The different stages of the methodology are discussed below in a sequential order:

1. Data Collection

Twitter generates tons of tweets daily which are stored and can be accessed for public use. The focus of this study is to develop a system that can analyze these tweets given by different people about movies and then determine the sentiment of the tweets to understand the users' feeling or opinion about the movies. In order to access the tweets of different users about the movies they watch, a Twitter application is created and used for twitter authentication. The Twitter application is created as follows:

- a. An application is created on the Twitter developer website by specifying the name, the description, the developer website, and the call back URL. Twitter then generates a consumer key, a consumer secret, an access token, and an access token secret which is used for authentication.
- b. R Twitter client is used for connecting and retrieving the tweets from Twitter. The codes below illustrate the process of collecting and storing the tweets about the movie "Sully" in the .csv format.

```

require(twitter)
require(stringr)
require(plyr)
require(ROAuth)
consumer_key <- "API key" #from dev.twitter.com
consumer_secret <- "API secret" #from dev.twitter.com
access_token <- "token" #from dev.twitter.com
  
```

```

access_token_secret <- "token secret" from dev.twitter.com
tweets_sully -> searchTwitter("sully", n=1000, lang="en", since="2016-06-12", until="2016-06-12")
tweets.df <- ldply(tweets, function(t)t$toDataFrame())
write.csv(tweets.df, file="newfile.csv")

```

The codes above installs the following packages in R: *twitteR*, *stringr*, *ROAuth*, and *plyr*. The API key, secret and token are used to authenticate with Twitter. The *searchTwitter* function is used to search for one thousand tweets that contain the word “sully” and the results are stored as *tweets_sully*. The tweets which are stored in a list format are then converted to a data frame and exported in the csv format.

This study randomly selected five current movies for sentiment analysis. The five current movies are *Sully*, *Masterminds*, *The Magnificent Seven*, *Deepwater Horizon*, and *Storks*. About seventy-five thousand tweets relating to the five current movies between 09/28/2016 to 10/12/2016 were collected and analyzed.

2. Data pre-processing

This is the stage where the tweet text is cleaned and normalized for sentiment analysis. This is done in R and includes the following steps:

- a. Removing stop words, such as a and the,
- b. Removing duplicate words,
- c. Removing emoticons and acronyms,
- d. Removing punctuation marks like period and comma,
- e. Removing URLs,
- f. Removing digits.

After the pre-processing of the tweets, the text now contains only words which are relevant to the sentiment and is used for sentiment scoring.

3. Sentiment Analysis

The text is then compared to a dictionary of positive and negative words and generates a score. A score greater than zero implies that the tweet has a positive response to the movie while a score less than zero implies that the tweet has a negative response to the movie. A movie that has a score greater than zero is classified as “HIT” while a movie that has a score less than zero is classified as “FLOP”. A score of zero means neutrality and classifies the movie as “AVERAGE”. Examples of tweets classifications are shown in Table 1.

Table 1: Tweet Sentiment Classification

Sentiment	Example	Classification
Positive Sentiment	Sully is a great movie, I loved every part of the movie.	HIT

Neutral Sentiment	I am watching masterminds with my friends now.	AVERAGE
Negative Sentiment	I feel so bad.... literally wasted two hours of my life watching Brooks.	FLOP

An example of the R sentiment score calculation is as follows:

```

score.sentiment = function(sentences, pos.words, neg.words, .progress='none'){
  scores = lapply(sentences, function(sentence, pos.words, neg.words){
    sentence = gsub("[[:punct:]]", "", sentence)
    sentence = gsub("[[:cntrl:]]", "", sentence)
    sentence = gsub("\\d+", "", sentence)
    sentence = gsub("http[[:alnum:]]*", "", sentence)
    tryTolower = function(x){
      y = NA
      try_error = tryCatch(tolower(x), error=function(e) e)
      if (!inherits(try_error, "error"))
        y = tolower(x)
      return(y) }
    sentence = sapply(sentence, tryTolower)
    word.list = str_split(sentence, "\\s+")
    words = unlist(word.list)
    pos.matches = match(words, pos.words)
    neg.matches = match(words, neg.words)
    pos.matches = !is.na(pos.matches)
    neg.matches = !is.na(neg.matches)
    score = round((sum(pos.matches) - sum(neg.matches))*100)
    return(score)},
    pos.words, neg.words, .progress=.progress)
  scores.df = data.frame(text=sentences, score=scores)
  return(scores.df)}
pos = readLines("positive-words.txt")
neg = readLines("negative-words.txt")
analysis = score.sentiment(Masterminds_2016.09.28$text, pos, neg, .progress =
'none')

```

4. Prediction

The predictions are based on the sentiment score value for each movie. A movie with a positive sentiment score is assigned the HIT category classification while a movie with a negative sentiment score is assigned the FLOP category classification.

RESULTS AND DISCUSSION

The whole process of text mining and sentiment classification was done in R which is an open source tool for data mining and processing. R was used for data collection, pre-processing, and analysis. R packages which includes stringr, plyr, and twitterR were used for authentication, text mining, and classification purposes.

The scores obtained from sentiment analysis were used to classify the movies into different categories. *The Magnificent Seven* had an overall positive sentiment score for all the fifteen days (from 09/28/2016 to 10/12/2016) and thus was classified as “HIT”. *Sully* also was classified as “HIT” while *Storks*, *Deepwater Horizon*, and *Masterminds* were classified as the average category based on the sentiment analysis. Table 2 shows the overall sentiment classification of the movies and the online ratings for the movies.

Table 2: Movies Sentiment Classification

No.	Movie Name	Budget	Classification	Online Ratings(IMDb)
1	The Magnificent Seven	\$90M	HIT	7.1
2	Sully	\$60M	HIT	7.9
3	Storks	\$70M	AVERAGE	7.0
4	Masterminds	\$25M	AVERAGE	5.8
5	Deepwater Horizon	\$110M	AVERAGE	7.5

CONCLUSION

This study has shown that a system can be developed to efficiently collect and analyze Tweets for making useful predictions from the opinions and views shared by users. The classification of movies is determined using the sentiment score calculated from comparing the tweets from the positive and negative words. The fact that the tweets are classified into positive and negative sentiments shows that the views of people on specific subjects and issues varies which gives useful insights for companies and institutions on how to adjust and make corrective actions to their products and services to better meet the expectations of their customers. In the future, a more rigorous experiment considering a larger number of movies and also the inclusion of various data mining techniques and algorithms for classification purposes should be conducted.

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Factors Influencing Individuals' Security Behaviors in Managing Organizations' Information Assets

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Abstract

Human beings have been viewed as the weakest link in securing information assets within organizations. This proposal first summarizes behavioral issues in information security management from recently published researches in major IS or IT journals and then proposes a preliminary model for helping manage information assets securely. Specially, this proposal explores the external and internal factors that influence non-technical users' security behaviors.

The Digital Board Room of the Future: a premiere trial of new SAP[®] technology

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Abstract

Simulations are recognized as important pedagogical tools. ERPSim is one such tool for the simulation of Enterprise Resource Planning (ERP) software. Its use in post-secondary education has been, and continues to be, well documented (Léger et al. 2016, 2011, 2007). ERP systems are optimized to create and manage the transactional data generated by an organizations business processes. They are not, however, optimized for strategic reporting; this task is best served by business intelligence (BI) tools such as dashboards and predictive analytics. Yet, organizations want new hires to be exposed to both sides of this ‘data coin’.

One approach to satisfy this ‘operational’ and ‘strategic’ need is to take the output of the simulations and use BI to create compelling data visualizations and ad hoc reporting. This provides an end-to-end context of the data that students do not often receive. SAP’s BusinessObjects Cloud (BOC) is well-known in the business intelligence space and offers tools that blend data from varying sources, to create required visualizations and reporting.

When transactional data and visualizations are brought together, a unique education opportunity is created. Students can use the visualizations for both strategic and operational decision making that can then influences their actions in the simulation. The impact of these decisions is then reflected in the generation of new transactional data, and reported back to students through their visualizations. This iterative process reinforces the importance of proper visualizations and reporting in operational and strategic decision making.

As one of the first universities to trial the integration of these ERP simulations and BI toolsets, we offer an overview of the preparation for and the execution of an event that showcases an integrated operational simulation with strategic reporting that c-level executives would use.

The process used a combination of best practices from Design Thinking, BusinessObjects Cloud (BOC) and the Extended Logistics ERPSim game. Over several weeks, students integrated design thinking techniques and visualization design preparation to provide design dashboards that could then be used to help in their simulation decision making. The culmination of this preparation was the real-time use of high-level dashboards created in BOC to make decisions in the Extended Logistics ERPSim game.

AN ANALYTICS SOLUTION FOR RETAIL EMPLOYEE TURNOVER WORKFORCE MANAGEMENT

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ABSTRACT

This study integrates the three domain of business analytics: descriptive, predictive, and prescriptive to develop a workforce management turnover solution that could be used by retailers. First, we investigate and summarize relationships among features to identify potential cause-and-effect relationships. Second, we build and evaluate predictive models to estimate the probability that a team member will leave a retailer within a future planning horizon. Lastly, a theoretical decision model is formulated that provides guidance in how a practitioner might use the prediction outputs for future decision or policy making (e.g. raise decisions, firing decision, etc.). This study is novel in the framework we propose in how to integrate analytics to support the retail employee turnover problem. Most research we have studied discuss employee turnover on theoretical grounds, rather than providing analytical decision-support solutions which are vast in other business verticals. Using data from a local retailer we develop a working framework that provides guidance to human resource professionals in how descriptive, predictive, and prescriptive analytics can be aligned to address employee turnover.

INTRODUCTION

Retailers can achieve success when they retain and reward their best people. Employee turnover is costly if the employee who is leaving the company is a high performer. High performers in the company are those people whom have been recognized or evaluated by their superior's or peers as contributors towards the success of the company. Nowadays, the big challenge for HR Managers is to retain the best people by developing policies that keep them market competitive, and employees incentivized not to leave, while having the ability to meet or exceed the expectations of their customers.

The purpose of the retailer is to provide consumers a convenient avenue to acquire the products they desire from many manufacturing and service providers. Studies have shown that countries having the greatest economic and social progress have been those having a strong retail footprint (Miller 2009). In the United States, approximately 15% of all jobs are in retailing (Dunne, Lusch et al. 2013). Walmart, the world's largest retailer employs more than two million people worldwide (Dunne, Lusch et al. 2013).

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Most industry work on retail analytics comes from a supply chain perspective, which focuses on the various stages of getting and presenting products directly to their customers. The key here is knowing your customer. For example, retailers invest much time identifying consumer buying patterns which can provide assortment and pricing insights, but also provide guidance in which coupons to offer customers with the goal of gaining more of their business. Marketing departments will regularly analyze transaction log data, in-store checkout wait times, and store foot traffic to develop modified marketing strategies to better serve their customers (Brust 2013). Some consumers are willing to provide personal details about themselves if it provides them some benefit. Some claim that employing personalized marketing to such individuals can boost sales by ten percent and provide five to eight times the return on investment (Hoffman and Fodor 2010).

Retailers use point-of-sale (PoS) systems frequently to capture and store precise information about what was purchased, when it was purchased and whom purchased it. Many retailers will also have customer loyalty programs to help increase the transparency of these purchases by having a unique customer profile id associated with each purchase. PoS data contain transaction data such as time and place of transaction, products purchased, if coupons were used, and type of payment, such as cash or credit card. Some interesting case studies investigating PoS data can be found by (Cadez and Smyth 2001, Mladenec, Eddy et al. 2001, Shashanka and Giering 2009).

This remarkable amount of data collected and analyzed are also often used for category planning decisions such as shelf layout and supplier selection decisions. Category planning entail a series of hierarchical decisions such as category sales planning, assortment planning, shelf space planning, and in-store logistics planning encompass master category planning (Hübner and Kuhn 2012). We found there is a tremendous amount of analysis here to decide how to lay out a store and fill it with the best possible set of products. These problems also lead to the literature rich area of pricing.

If the retailer is doing all these correctly, the next thing a retailer might want to know is which stores are performing better than others. For example, clustering stores with similar profiles may be used by management to identify “underperforming” stores in their respective cluster to identify possible underperformance causes and potentially provide those stores additional resources or employee training.

The interesting thing in all this data collection and analysis is this is where the advanced analytics seem to stop. We have found that a retailer will invest much to understand their customers, but little to understand their employees. Per Deloitte’s Global Human Capital Trends 2014 report, just 14% of the Human Resource departments use data analytics to perform their jobs (Feffer 2014). Employee centric analytics is negligible compared to operations (77%), sales (58%), and marketing (56%) as shown in Figure 1.

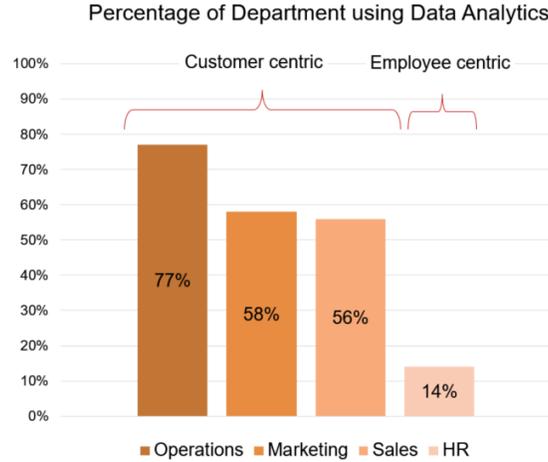


Figure 1: Percentage of departments using data analytics

We posit that the reason for a lack of data analytics among professionals in Human Resource (HR) departments has to do with a deficiency of training in analytical skills compared to other functional business units. We believe HR areas could collaborate with other units within their organization to help better them better utilize the information about their employees as depicted in Figure 2. This motivation led us to develop an analytical framework that HR areas could build upon to better understand and support their decision and policy making within the firm. This solution could be modified and used by HR decision makers using their own employee data, having their own drivers of turnover, and own specific business constraints.

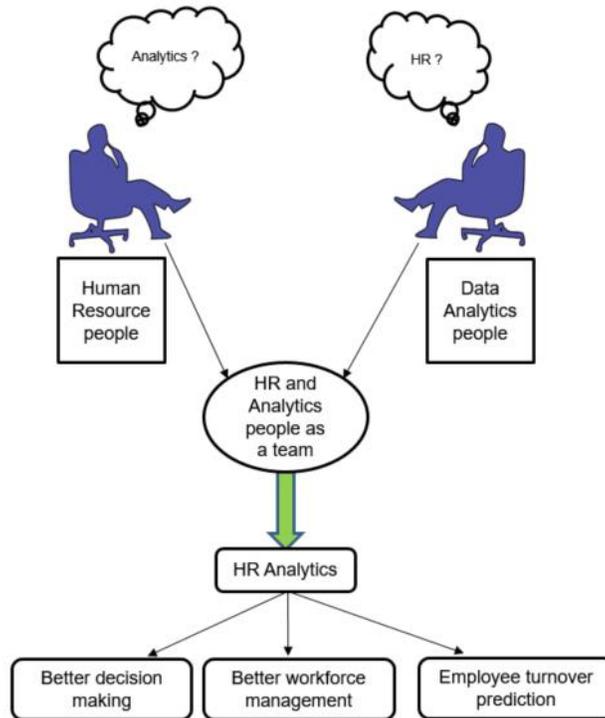


Figure 2: Bringing HR together with other functional units that regularly use data analytics

We organize this paper by first reviewing and organizing the academic literature on various topics relating to employee turnover. Second, we discuss the data used in our study to help guide the development of a prototype framework. Third, we outline the methodology employed to gather insight from data. Fourth, we explain the predictive models we explored to estimate the probability that a team member will leave over some future planning window. Fifth, we discuss the results of our predictive models. Lastly, we develop a decision model that incorporates information gained from our predictive models with the objective of helping a human resource team manage their retail workforce.

LITERATURE REVIEW

We critically reviewed prior research to provide a solid foundation and clear perspective to guide our research in the area of employee turnover. Strategic HR researchers are investing much effort to understand if it is the HR policies themselves or the performance of the company which affects employee turnover (Collins and Clark 2003, Hatch and Dyer 2004).

Employee turnover studies in the 1970s and early 1980s have the basic tenet that job satisfaction was the main reason for the employee turnover, but later on it became other job alternatives. Graen, Liden et al. (1982) found that the quality of the leader–member exchange relationship predicted employee turnover, and (Pfeffer 1985) argued for the importance of demographic fit. During this time, researchers also attempted to identify the consequences of turnover, these early studies primarily focused on increased costs and organizational performance decrements

following turnover (Mirvis and Lawler 1977, Price 1977, Dalton and Todor 1979, Staw 1980, Mobley 1982).

In the mid-1980s into the early 1990s, most of the employee turnover research was based on exhaustion and stress factors that are related to organizational culture, employee relationships in the environment, organizational reward system, group cohesion, gender composition and demography. In one study, pay dispersion defined as “*the amount of pay inequality within an organization’s pay system*”, predicted turnover among university administrators such that turnover was lower at institutions with more compressed pay structures (Pfeffer and Davis-Blake 1992). O’Reilly, Chatman et al. (1991) found that variables such as coworkers and boss were also factors, and that employees whose personal values did not align with the organization’s values (e.g. low person–organization fit) had a greater likelihood to turn over after 20 months of tenure. Further, the establishment of mentoring relationships was shown to reduce employee turnover intentions (Viator and Scandura 1991, Payne and Huffman 2005). McPherson, Popielarz et al. (1992) investigated employee turnover from a social network perspective and identified that employees with more connections within an organization’s social network were less likely to leave. For example, emotional exhaustion and job insecurity were found to be positively related to turnover intentions (Jackson, Schwab et al. 1986, Ashford, Lee et al. 1989). Lee and Mitchell (1994) developed a new theory and model regarding the turnover process. Drawing from image theory, they proposed that turnover decisions are not always the result of accumulated job dissatisfaction and may sometimes occur without much deliberation at all. In other words, sometimes things just happen such as an unexpected new job opportunity.

Different types of organizations and industries face very different average turnover rates. Even across firms in the same industry, turnover rates can vary widely. Thus, it is important for firms to differentiate between avoidable (i.e. understanding the causes) and unavoidable turnover (Barrick and Zimmerman 2005). In retail for example, turnover rates can average around 30% over any planning horizon. This will affect the individual store level performance in terms of both sales and profit (Kacmar, Andrews et al. 2006).

Employee turnover has more implication on the employee than the company which he/she left, because the employee must get accustomed to new situations, new working styles, and new people. Some items these studies found were that employee turnover depends on various factors like demographics and opportunities (Hom, Roberson et al. 2008).

In response, managers have implemented human resources policies and practices to actively reduce avoidable and undesirable turnover (Michaels, Handfield-Jones et al. 2001, Fulmer, Gerhart et al. 2003, Kacmar, Andrews et al. 2006, Hom, Roberson et al. 2008).

Today, employee turnover problem can be analyzed with the help of data analytics. Measuring and collecting the right employee data can provide better insights about what drives people to decide if they should leave an organization. As business analytics continues to be incorporated in other business domains such as Marketing, Operations, and Strategy policy making, we posit

empirical-based models can also be used to better support HR policy making.

Studies	Motivation for the research	Result of the research
(Mirvis and Lawler 1977)	To Study factors for the employee turnover	Decrease in the organizational performance is a major factor for employee turnover
(Price 1977)	To study how can employee turnover be positive	To categorize the turnover as a positive or negative phenomenon seems somewhat short-sighted. It certainly has both positive and negative effects on the organization's performance
(Dalton and Todor 1979)	To study whether employee turnover can be positive	It depends on the level of turnover and the employees who are turning out. It can be positive if they lose unproductive employees
(Staw 1980)	To analyze the post-effects of the employee turnover	Consequences of the turnover will vary from company to company and it should be evaluated using descriptive inquiry
(Pfeffer 1985)	To study the effect of organization demography's implications on management	The organizational demography helps us to manage careers of the individuals and their needs based on their demographic characteristics
(Jackson, Schwab et al. 1986)	To understand the employee burnout phenomenon	Emotional exhaustion is the predominant employee burnout component
(Lee, Ashford et al. 1990)	To study the workers' satisfaction, performance and somatic complaints	The performance of the employees increases when they have a high degree of perceived control
(Viator and Scandura 1991)	To study the mentor-protégé relationship	It is difficult to measure the variation of quality done between mentored and non-mentored employees over the long time
(Mobley 1992)	To understand the causes, consequences of the turnover	Workplace atmosphere changes when employees frequently turnout and it affects the performance of the organization
(McPherson, Popielarz et al. 1992)	To study the dynamic behavior of the voluntary groups	More contacts a person has inside the group then more is the probability that he will stay as the long-term member.
(Pfeffer and Davis-Blake 1992)	To study the turnover among the college administration	An individual's position in the salary structure and level of dispersion in the structure jointly affects the turnover
(Handfield-Jones, Michaels et al. 2001)	To study role of leader in American retail organizations	Establishing talent standards and managing the talent of the employment is the crucial trait for a leader in retail organization in America
(Fulmer, Gerhart et al. 2003)	To study the relationship between the <i>Great place to work</i> and firm performance	The performance of a company varies as per the variation of employee attitudes and management change
(Hatch and Dyer 2004)	To study the human capital management as a competitive management	The cost advantages that can be attributed to human capital are sustainable because human capital is costly to imitate
(Payne and Huffman 2005)	To study the impact of organizational commitment on the employee turnover	The affective commitment and continuance commitment would mediate the relationship between mentoring and turnover behavior
(Barrick and Zimmerman 2005)	To study effective selection to avoid the voluntary turnover	It concludes that relevant bio-data and work-related dispositions assessed prior hiring any candidate can predict the voluntary turnover
(Kacmar, Andrews et al. 2006)	To study how costly is the turnover	Turnover will affect the individual store level performance in terms of both sales and profit
(Huselid and Becker 2006)	To study the human resources analytical literacy	If organizations can increase the analytical literacy of their HR professionals, then it can help them take strategic decisions on managing their workforce
(Holtom, Mitchell et al. 2008)	To study the turnover and retention of the employees	Turnover and retention can be positive and negative depending on the efficiency of the employee who left or who didn't leave the company

(Hom, Roberson et al. 2008)	To predict the employee turnover in corporate America	The employee turnover depends on various factors like demographics, opportunities, etc.
(Fidalgo and Gouveia 2012)	To measure the employee turnover impact on the organizational knowledge management	Conceptual map was created to demonstrate the prominence of the Knowledge management in the company and what are the organizational changes that are required

Table 1: Review of employee turnover studies

In Table 2 we identify studies where predictive modeling was performed to predict employee turnover. The studies showed that data mining techniques will help the human resource practitioners to speed up their process with much better efficiency. Several propose the idea of using data mining techniques in human resource practices by demonstrating its prominence in leveraging decision making with their frameworks. However, most do not provide any empirical investigation. In our study, we use data mining techniques (i.e. descriptive and predictive analytics) on employee data, but then integrate those insights into an optimization model which considers many practical constraints of the real world.

Studies	Motivation behind research	Methodologies used/proposed to use	Results/ Proposed Frameworks
(Mishra, Lama et al. 2016)	Existing huge amount of data about employees and HR practices	Descriptive Analytics, Predictive Analytics, Prescriptive Analytics	Generalized decision making model without testing
(Fatima and Rahaman 2014)	A problem to manage faculty staffing in their university	C 4.5 Algorithm, Association rule, K-Nearest Neighbor, Apriori Algorithm.	Cyclic decision model but without testing
(Sadath 2013)	Connecting Human Resource Management to Knowledge Management	Association rule, Clustering, Prediction, Classification	Implement knowledge management programs for competitive advantage
(Mishra and Lama 2016)	To optimize performance and practice better return on investment for optimizations	-	-
(Feffer 2014)	HR typically lags in using data analytics	-	HR professionals should be comfortable in using data tools
(SEBT and YOUSEFI 2015)	Data mining being just limited to statistical analysis in HR	Statistical analysis using regression method, CART (ordered), CART (Towing), C 5.0	Data mining can give deep insights than simple statistical analysis

Table 2: Summary of studies using predictive modeling for employee turnover

Table 3 summarizes the studies suggesting which data predictive modeling methodologies could be used for better decision making. We implement some of these in our study as well as others that are popular in classification-type problems.

	Linear Regression Method	Logistic Regression	CART	Association rule	Apriori Algorithm	K-Nearest Neighbor	Random Forest	Support Vector Machines
(Mishra and Lama 2016)	-		-	-	-	-	-	-
(Fatima and Rahaman 2014)	-		✓	✓	✓	✓	-	-

(Sadath 2013)	-		-	✓	-	-	-	-
(Mishra, Lama et al. 2016)	-		-	-	-	-	-	-
(Feffer 2014)	-		-	-	-	-	-	-
(SEBT and YOUSEFI 2015)	✓		✓	-	-	-	-	-
Our Study	-	✓	✓	-	-	✓	✓	✓

Table 3: Comparison of methods used in the literature to predictive employee turnover

DATA

The data investigated in this study came from a regional retailer in the United States. There were certain store employees that began realizing a higher turnover than planned. We refer to these position titles as Job A, Job B, Job C, and Job D. These positions have similar hourly rates pay distributions and do not necessarily report hierarchically to each other. All jobs were present in each region of the 14 regions provided. In addition to these features, we obtained other variables that measured employee performance, store performance, wage information, and market information as displayed in Table 4. The data set consisted of 1000 observations of employees whom have worked for the company for at least two years, where half the records indicated the employee left while the other employees were still employed.

Variable	Type	Description
Region	Categorical	Region id
Position Title	Categorical	Job title of that employee (Job A, Job B, Job C, Job D)
Market Group	Categorical	Market group the employee is associated to based on the store they work at
Pflag	Categorical	Hourly rate less than the market group range = -1, Hourly rate within the market class range = 0, Hourly rate more than the market class range = 1,
Pflag_below	Categorical	If hourly rate less than the market group range = 1, otherwise = 0
Pflag_above	Categorical	If hourly rate more than the market group range = 1, otherwise = 0
EmployeePerfPrevYr	Categorical	Employees annual performance review indicator for the previous year (Superior, Good Performer, Needs Improvement, Unsatisfactory)
EmployeePerfCurrentYr	Categorical	Employees annual performance review indicator for the current year (Superior, Good Performer, Needs Improvement, Unsatisfactory)
Hourly Rate	Numeric	Hourly wage rate (\$)
Pnormal	Numeric	Normalized hourly rate according to the market class range given (0 indicates market average)
GroupPerfPrevYr	Numeric	Store annual performance for the previous year on a scale of 50-100
GroupPerfCurrentYr	Numeric	Store annual performance for the current year on a scale of 50-100
Left	Categorical	If employee has left = 1, If employee is still employed = 0

Table 4: Data Table

METHODOLOGY

The methodological framework we propose includes using descriptive, predictive, and prescriptive analytics together as shown in Figure 3. Retailers can obtain whatever data is available about their employees, job functions, etc. to identify and estimate cause-and-effect relationships of the drivers of employee turnover.

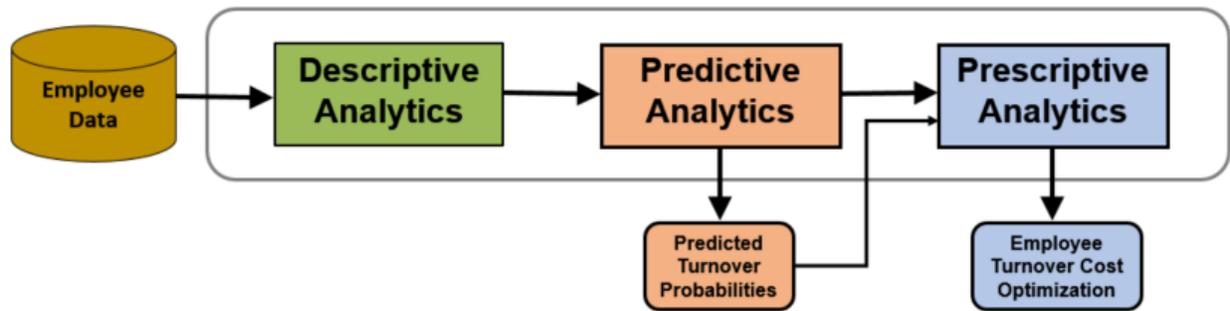


Figure 3: Methodology diagram

Descriptive analytics

Descriptive analytics refers to understanding what has happened in the past. One objective here is to try and identify cause and effect relationships of the business problem. For example, what if an employee is given a raise that is an average rate within their given market, how does this affect the likelihood of them leaving the company over the next planning horizon. Exploratory data analysis (EDA) which often entail data visualizations, statistical summaries, and correlation analysis can help in forming hypotheses about the causes of employee turnover.

Predictive analytics

Predictive analytics refers to understanding what will happen in the future. This domain helps identify and estimate the effect of each variable with regard to the response. In our study, our response is a binary variable left or not left the company. The independent variables are the remaining variables described in Table 4. We build and evaluate six different predictive models to identify these drivers and estimate their effects on turnover. The predictive models were built using a 70/30 train/test partition. The training set is used to build the model, while the test set allows us to gauge generalizability on future observations. Comparing the statistical performance measures (e.g. overall accuracy, AUC, etc.) allows one to identify if a model has overfit to the training data, and will perform poorly at identifying whom will leave or stay in the future.

Models were assessed using traditional binary classification statistical performance measures, such as area under the curve (AUC), accuracy, sensitivity, and specificity. All of these measures are generated from a confusion matrix depicted in Figure 4. First, accuracy calculates how well your model can classify those employees whom left the company versus those that did not leave the company. Those are the green colored cells in the table divided by the total observations $(TP + TN)/\text{Total}$. Specificity measures how well a model performs at identifying true leavers among the set that left the company, $TN/(FP+TN)$. Similarly, sensitivity measures how well a model performs at identifying employees that actually left the company, $TP/(TP+FN)$.

		Employee Actually Left Company		
		Yes	No	
Predicted Employee Left Company	Yes	TP	FP	TP + FP
	No	FN	TN	FN + TN
		TP + FN	FP + TN	Total

Figure 4: Confusion matrix

The accuracy, specificity, and sensitivity statistics are derived from one confusion matrix based upon a naïve predicted probability cutoff value of 0.50. The receiver operating characteristic (ROC) curve is generated from several confusion matrices with cutoff values ranging from 0 to 1. Each unique cutoff lead to a certain sensitivity and 1-specificity that is plotted against each other to form the ROC curve. The area under the curve (AUC) provides a measure of model performance for any cutoff value and is the most widely used measure to compare binary classification models. Values closer to 1 are considered better classifiers than those close to 0.50, which suggest that a model is poor learner.

Prescriptive analytics

Prescriptive analytics refers to understanding what actions to take next. Once we identified a predictive model that best estimate the reasons for leaving, we formulate a decision (i.e. optimization) model that incorporates those estimated effects to help guide the decision maker in what decisions should be taken. This provides an HR professional an analytically-based means to decide what to do next to help improve employee retention overall. Example decisions could entail increasing employee pay, separating from poor performing employees whom are likely to leave anyway, or providing educational incentives that might reduce turnover. The practical usefulness is how to make these decisions across the entire workforce while accounting for all known constraints (e.g. salary budgets, job grade benefits). The decision model we develop provides a working example of this.

PREDICTIVE MODELS

We build and evaluate the models using different binary classification algorithms. Some of these methods have been suggested or used in the literature in estimating employee turnover. We investigate those approaches as well as other popular approaches used to support other business problems as shown in Table 3 previously.

Logistic Regression

Logistic Regression is the appropriate regression analysis to conduct when the dependent variable is a binary variable. Logistic regression is one the simplest and the most widely used of all classification techniques. While estimating the coefficients of each predictor (independent variables), logistic regression is somewhat similar to the linear regression except for the fact that the response is transformed using a link function known as a “logit”, which assures that the outputs follow a logistic (sigmoid) curve. This assures that all predictions have values between 0

and 1, thus ensuring probabilities are generated as they defined. Maximum likelihood estimation is used to estimate the parameter coefficients of the model.

CART

Classification and Regression Trees (CART) is a modern, c.1984, are one of the most frequently used types of models used in business and scientific applications. Its advantage over other models is it is considered easy to interpret. In the classification tree setting, each predicted probability is derived from a set of IF-THEN rules provided by the decision tree. While trees tend to provide general understanding, they may not lead to the best predictive model performance. First, each terminal node (or leaf) in the tree is one possible probability prediction. This can lead to a small set of unique value predictions compared to other approaches such as logistic regression. Growing a tree so there is more splits can lead to more leafs, often leading to a larger set of unique probability predictions, but this often leads to overfitting the model. In our study, we tune each tree so as to optimize the tree complexity.

Random Forests

A Random Forest model consists of a collection or ensemble of decision trees, each capable of producing a response when presented with a set of predictor values. It just averages the probabilities generated by developing different decision trees. It has been shown ensembling many weak learning trees can improve overall performance. When ensembling trees one must consider how many trees to combine. This is considered a tuning parameter that one must find so as to not overfit to the training data.

Support Vector Machines

Support Vector Machines (SVM) are based on the concept of decision planes that define decision boundaries. A decision plane is one that separates between a set of objects on the basis of different values for the categorical variable. It is appropriate when most of our predictors are numerical variables instead of categorical variables. In our study, we generated dummy variables for each categorical variable predictor before applying SVM. We found that the presence of some categorical predictors did not produce better results than other models used.

K-Nearest Neighbor

K-Nearest Neighbors algorithm (KNN) is a non-parametric method used for classification and regression. Both for the classification and regression of the input consists of the k-closest training examples in the feature space. The output is dependent on whether if we are using for the regression or classification. For regression-type problems, the output is the property value for the object. This value is the average of the values of its k nearest neighbors. For classification-type problems, the output is class membership. If the value of the $k = 1$, then the object is simply assigned to the class of that single nearest neighbor.

RESULTS

Descriptive Analysis:

The features available in our study were examined to identify any potential trends or causes to employee turnover. As stated in the motivation of our paper, the retail collaborator was concerned with understanding why employee turnover had increased above expectations for certain positions. Their goal was to understand why turnover occurred and be able to take the right action to retain their employees.

The wage a person is paid can affect if a person leaves or not. The plots in Figure 5 show the distribution of hourly pay (\$) across all employees. The distribution among job types (e.g. A,B,C,D) were not statistically different. We derived a new variable called Pnormal that accounts for the market in which the position is located. This essentially serves as an index where 0 indicates that an employee is paid the average rate for that job in their particular market. Above 0 indicates an employee is paid above average, while below 0 indicates than an employee is paid below market rate.

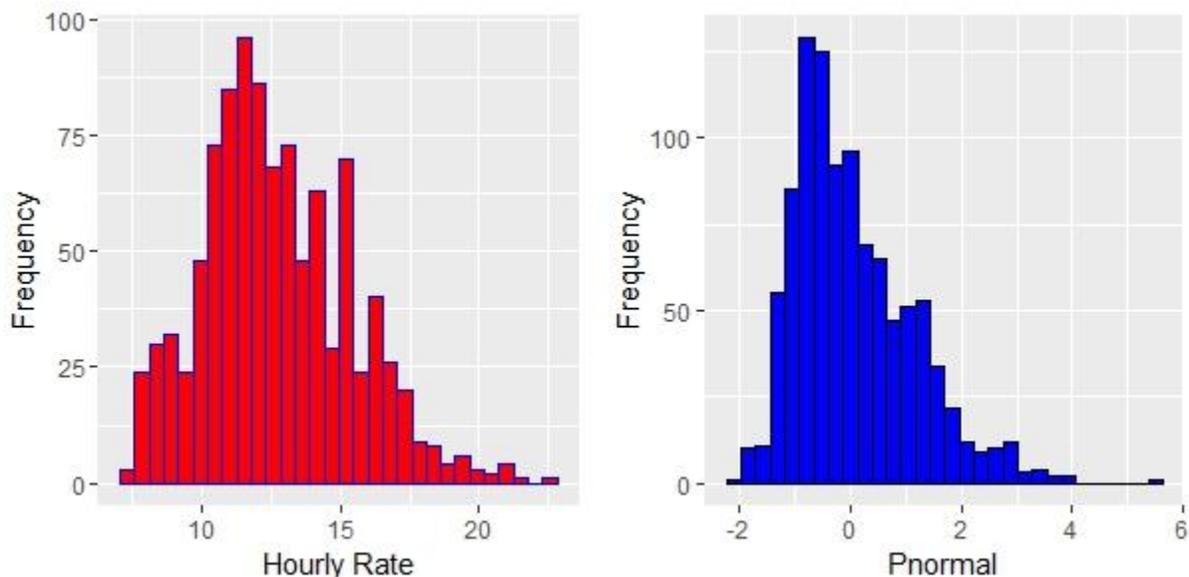


Figure 5: Distribution of hourly rate and normalized rate based on market (Pnormal)

Figure 6 provides the distribution of store performance based on the previous year to current year. We found that on average stores were performing slightly lower than the previous year based on an organizational KPI. The spread of performance had more variance in the latest year, which might or might not be due to employee turnover. We do know that employee turnover in the current year was higher than in the previous year.

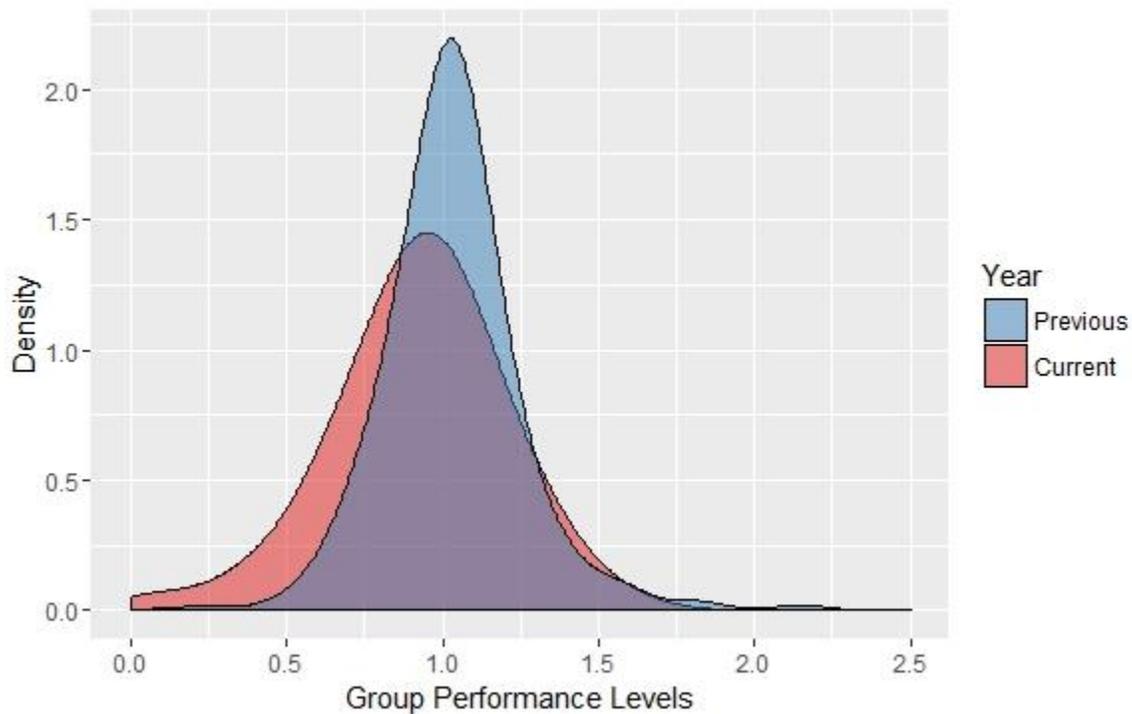


Figure 6: Group (store) performance year-on-year

The performance reviews of employees were provided based on an ordinal rank (i.e. Superior, good solid performer, needs improvement, and unsatisfactory). Those employees falling under needs improvement and unsatisfactory had HR policies in place to help improve their performance going further. These include further training and expectations over a specific future time window.

We did realize some interesting relationships in employee performance year-on-year as shown in Table 5. We found that 76% of those who moved from ‘Superior’ to ‘Needs Improvement’ left the firm. Also, the highest number of employees (187) were those who moved from ‘Good Solid Performer’ to ‘Needs Improvement’ and 46% of these employees left the firm. Overall from this table, it can be seen that the performance level of most of the employees that left the firm declined in current year as compared to the previous year. We discussed this with firm stakeholders and found that manager evaluation training for all stores was already being considered.

Employee Performance (Previous Year)	Employee Performance (Current Year)	Left	Still Employed	Total	Percent left
Superior	Superior	7	10	17	41.18%
Superior	Good Solid Performer	8	20	28	28.57%
Superior	Needs Improvement	19	6	25	76.00%
Superior	Unsatisfactory	12	6	18	66.67%
Good Solid Performer	Superior	15	43	58	25.86%

Good Solid Performer	Good Solid Performer	77	105	182	42.31%
Good Solid Performer	Needs Improvement	87	100	187	46.52%
Good Solid Performer	Unsatisfactory	37	20	57	64.91%
Needs Improvement	Superior	9	11	20	45.00%
Needs Improvement	Good Solid Performer	32	58	90	35.56%
Needs Improvement	Needs Improvement	105	75	180	58.33%
Needs Improvement	Unsatisfactory	60	28	88	68.18%
Unsatisfactory	Good Solid Performer	6	5	11	54.55%
Unsatisfactory	Needs Improvement	8	7	15	53.33%
Unsatisfactory	Unsatisfactory	17	7	24	70.83%

Table 5: Performance levels in previous year and current year

Figure 7 provides additional evidence that shows that good performers declined in the current year and needs improvement and unsatisfactory performance reviews increased.

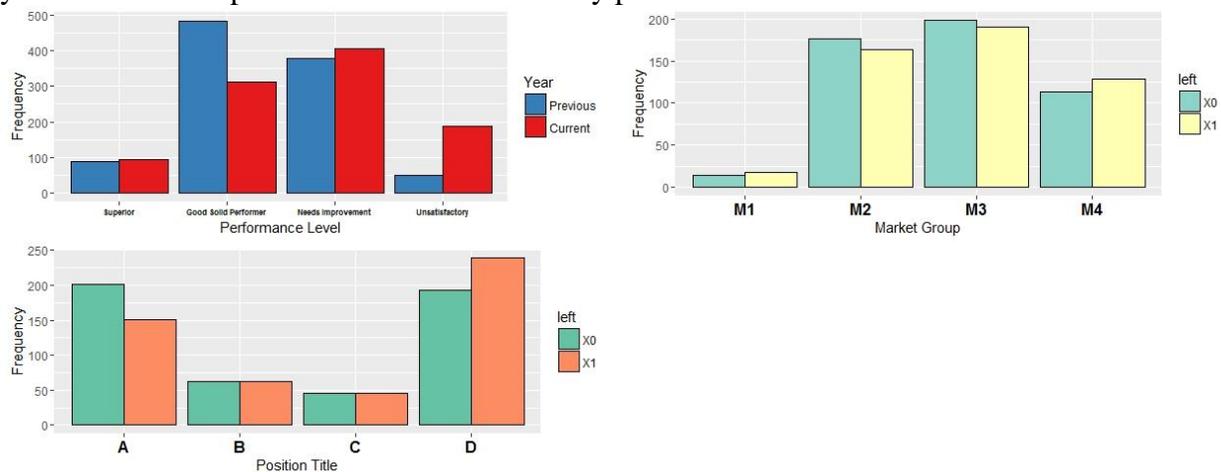


Figure 7: Examination of qualitative variables by those that left and stayed.

We explored the behavior of employees under the four job titles we considered. From Table 6 it can be clearly seen that the employees with the highest turnover rate are job D followed by job C, and then job B. Table 7 shows that 26% of the employees who resigned from the position of job A were above the salary range of their market class while only 2% of them were below salary range. The opposite trend can be seen in the case in job C and job D, where most of the employees who left were below the salary range than those above. Table 8 shows a similar overall trend across all four job titles. It can be seen that the average hourly rate of the employees left is even lower than the average hourly rate of overall employees.

Job Title	Employees left	Total Employees	%Employees left
A	151	352	43%
B	63	125	50%
C	46	91	51%
D	239	432	55%

Table 6: Turnover rate vs job title

Job Title	Employees left	%Employees above the salary range	%Employees below the salary range
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A	151	26%	2%
B	63	5%	2%
C	46	2%	20%
D	239	1%	10%

Table 7: Employees outside of the salary range that left vs. job title

Job Title	Hourly Rate of employees left	Hourly Rate of overall employees
A	14.76	15.07
B	8.79	9.15
C	11.84	12.08
D	11.66	11.89

Table 8: Average Hourly rate of employees left compared to overall employees vs. job title

Predictive Analysis:

We build various predictive models and evaluated their performance. *Table 9* shows the statistical performance we were able to achieve on this data set for each model.

Models	Training				Testing			
	Accuracy	Sensitivity	Specificity	AUC	Accuracy	Sensitivity	Specificity	AUC
Random Forest	100.00%	100.00%	100.00%	1.00	64.88%	69.13%	60.67%	0.68
k-Nearest Neighbour	63.77%	61.43%	66.10%	0.70	60.54%	57.72%	63.33%	0.67
Decision Tree (CART)	65.34%	64.86%	65.81%	0.72	62.88%	67.79%	58.00%	0.64
Logistic Regression	65.91%	62.86%	68.95%	0.72	63.21%	63.76%	62.67%	0.63
Support Vector Machines	70.90%	76.29%	65.53%	0.71	60.87%	63.09%	58.67%	0.61

Table 9: Confusion matrix metrics for different models for Testing Dataset

The drivers we found to be important using each model. For the most part, each model was suggesting that the normalized market rate index (Pnormal), hourly wage, position title, the region where an employee works, and store performance were important predictors.

To compare models, we used an ROC curve shown in Figure 8. The curve that is closest to the point $c(1,1)$. We found that the random forest led to the greatest AUC (0.68), but it was extremely overfit compared to the training set. The second best performing model was kNN having an AUC of 0.67. We decided to use the decision tree (i.e. CART) as the final model of choice. This model was interpretable to the HR practitioners and allowed us to use tree splits in our decision model to follow.

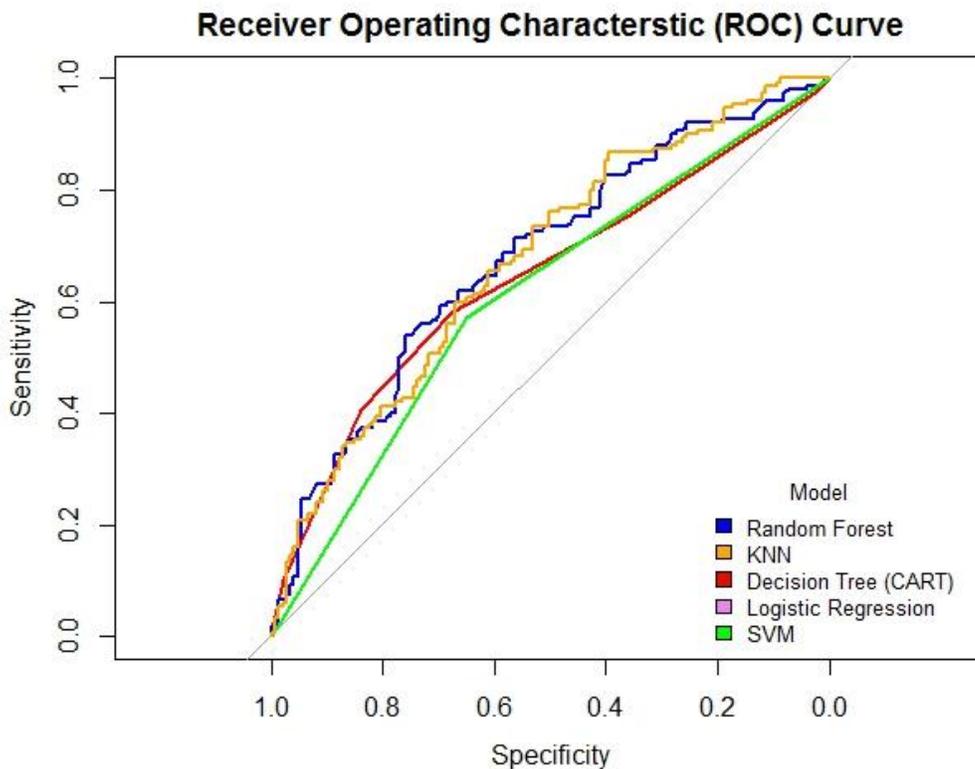


Figure 8: ROC curve showing the performance of each model

Figure 9 shows the decision tree created from CART. The performance of the store in the current year and previous year (GroupPerfCurrentYr, GroupPerfPrevYr), hourly rate, region, and normalized wage index (Pnormal) were important drivers at explaining the probability that an employee will turn. We used some of these features (hourly rate, Pnormal) as decisions in our decision model. The location of where the employee works (region and store performance) is accounted for when such decisions are made.

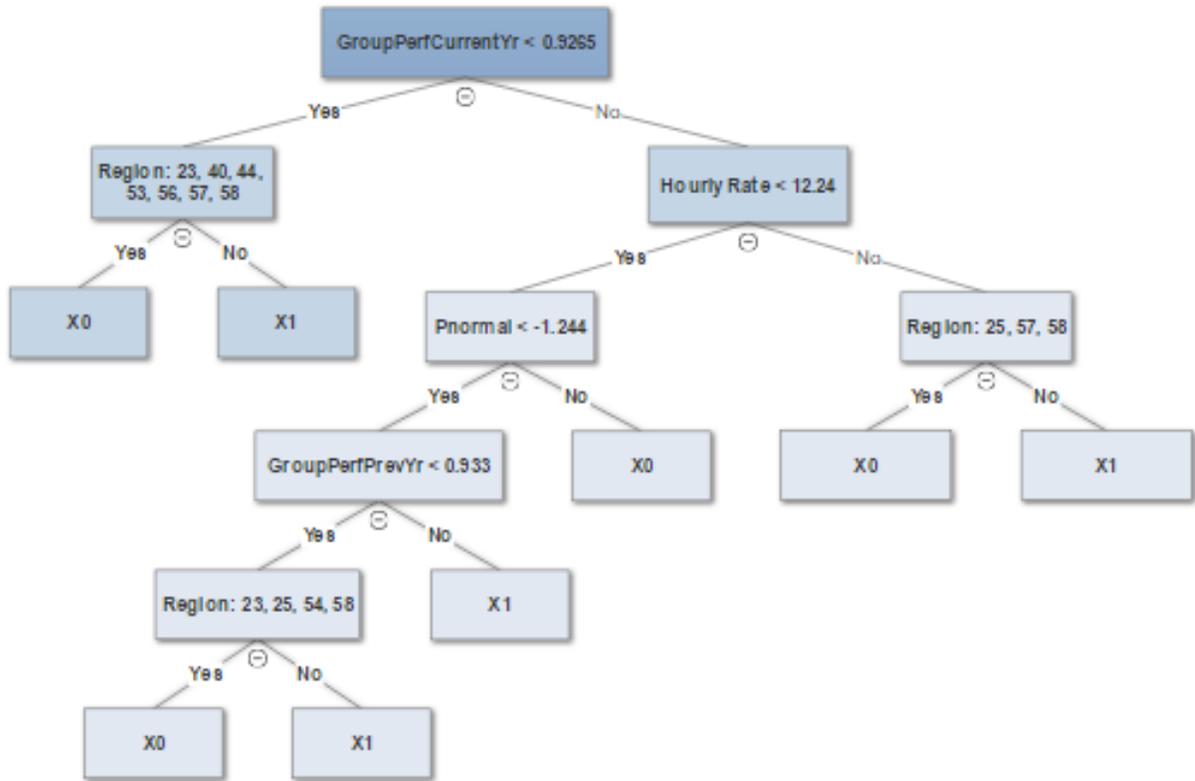


Figure 9: Decision tree (CART)

Prescriptive Analysis/Decision Model

Using the information from the decision tree we incorporate that information into a decision model to support HR decisions over the next planning horizon. The decision model describes the cause-effect relationship where controllable actions can be taken by decision-makers with the assumption that such decisions/actions will lead to an effect with respect to certain pre-defined performance measures. This is the first step in the prescriptive analysis. Next, the modeler will need to solve the problem using some optimization routine. The routine is behind the scope of this research, and is really not important. Practically we just want to know if the model can be solved, could it be solved in a reasonable amount of time so as to provide guidance to the decision-maker when they need it. We define the mathematical notation as follows:

Terms and definitions:

N = total number store employees

M = total number stores

A_{ij} = employee i in store j for job position A; $i = 1, \dots, A$; $j = 1, \dots, M$

B_{ij} = employee i in store j for job position B; $i = 1, \dots, B$; $j = 1, \dots, M$

C_{ij} = employee i in store j for job position C; $i = 1, \dots, C$; $j = 1, \dots, M$

D_{ij} = employee i in store j for job position D ; $i = 1, \dots, D$; $j = 1, \dots, M$
 e_{ij} = experience (years) of employee i in store j ; $i = 1, \dots, N$; $j = 1, \dots, M$
 τ_{ij} = latest performance review of employee i in store j ; $i = 1, \dots, N$; $j = 1, \dots, M$
 φ_{ij} = hourly rate (\$) of employee i in store j ; $i = 1, \dots, N$; $j = 1, \dots, M$
 ω_{ij} = wage index of employee i in store j ; $i = 1, \dots, N$; $j = 1, \dots, M$
 ρ_{ij} = estimated probability of turn in next 6 months of employee i in store j ; $i = 1, \dots, N$; $j = 1, \dots, M$
 ψ_{ij} = estimated class of turn in next 6 months of employee i in store j ; $i = 1, \dots, N$; $j = 1, \dots, M$;
 $\psi_{ij} \in \{0,1\}$
 φ_{ij}^* = **new** hourly rate (\$) of employee i in store j ; $i = 1, \dots, N$; $j = 1, \dots, M$
 ω_{ij}^* = **new** wage index of employee i in store j ; $i = 1, \dots, N$; $j = 1, \dots, M$
 ρ_{ij}^* = **new** estimated probability of turn in next 6 months of employee i in store j ; $i = 1, \dots, N$; $j = 1, \dots, M$
 ψ_{ij}^* = **new** estimated class of turn in next 6 months of employee i in store j ; $i = 1, \dots, N$; $j = 1, \dots, M$;
 $\psi_{ij}^* \in \{0,1\}$
 K_j = the average team performance of job A at store location j ; $j = 1, \dots, M$
 Z_j = the average team performance of job B at store location j ; $j = 1, \dots, M$
 Y_j = the average team performance of job C at store location j ; $j = 1, \dots, M$
 U_j = the average team performance of job D at store location j ; $j = 1, \dots, M$
A = the next sixth month budget (\$) for Job A
B = the next sixth month budget (\$) for Job B
C = the next sixth month budget (\$) for Job C
D = the next sixth month budget (\$) for Job D

We only consider two potential decisions. First, how much should HR increase the wage of a specific employee given their job type and market. Second, should certain employees be terminated immediately because they are already predicted with high probability to leave the company anyway.

Decision variables

x_{ij} = amount to increase wage of employee i in store j ; $i = 1, \dots, N$; $j = 1, \dots, M$
 y_{ij} = decision to fire employee i in store j , $y_{ij} \in \{0,1\}$; $i = 1, \dots, N$; $j = 1, \dots, M$

Our objective is to maximize the percentage of expected non-turners so as to have a workforce that can complete the workload over the next planning horizon. Today is we assume that we make no changes, a retailer might estimate that 65% of their workforce will be available in the future. However, if the retailer takes action (i.e. changes their decision variables), this will reduce the probability that certain employees will leave during the next window, which should yield a higher expected workforce percentage.

Objective function:

$max[\sum_j \sum_i \psi_{ij}^*]/(N * M)$ (maximize the percentage of expected non-turners to complete workload)

Constraints:

- $\sum_i \tau_{ij}/A \geq K_j \quad \forall j$ (average job A performance should exceed some threshold)
 $\sum_i \tau_{ij}/B \geq Z_j \quad \forall j$ (average job B performance should exceed some threshold)
 $\sum_i \tau_{ij}/C \geq Y_j \quad \forall j$ (average job C performance should exceed some threshold)
 $\sum_i \tau_{ij}/D \geq U_j \quad \forall j$ (average job D performance should exceed some threshold)
 $\sum_j \sum_i A_{ij} \leq \mathbf{A}$ (budget for job-type A must be satisfied)
 $\sum_j \sum_i B_{ij} \leq \mathbf{B}$ (budget for job-type B must be satisfied)
 $\sum_j \sum_i C_{ij} \leq \mathbf{C}$ (budget for job-type C must be satisfied)
 $\sum_j \sum_i D_{ij} \leq \mathbf{D}$ (budget for job-type D must be satisfied)
 $\sum_j \sum_i \omega_{ij}^*/N \geq 0.95$ (average wage index of job A is at least 0.95; 1 would imply market avg.)
 $x_{ij} \geq 0$ (hourly wages can only increase)
 $y_{ij} \in \{0,1\}$ (it is worth the risk to fire some employees now because they are poor performers and have a high probability of leaving anyways in next six months)

CONCLUSIONS & FUTURE RESEARCH

Employee turnover is a major workforce management challenge for retailers. The retail domain has higher turnover than other industries which makes it especially important to be able to manage efficiently. The rise in data analytics has seen remarkable feats in retailer's ability to understand their customers. Unfortunately, the same investment has not been realized in better understanding your employees so as to improve a retailer's workforce.

The objective of this study was to develop an analytically-based framework that HR professionals in retail and potentially other domains (e.g. manufacturing) can use to effectively use their data to better management their workforce. We provide this by using data from a regional retailer and show how interfacing descriptive, predictive, and prescriptive analytics can provide a means to identify cause-effect relationships, predict what will happen in the future, and then how to take action so as to maximize your workforce (or minimize your turnover).

We plan to continue to develop our decision model to account for other items behavioural scientists have found important in explaining employee turnover. In our study, we could only identify potential causes and estimate effects among a limited set of features. However, we know HR areas could measure more about their employees to gain better insight about them. We posit that providing engagement survey's over time and incorporating such information into the predictive models could reveal additional causes of turnover that are not captured in our study.

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Predicting the Reuse Intention of College Students toward Distance Learning

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ABSTRACT

This study investigates to what extent college student attitudes toward acceptance of online instruction and Distance Learning could be used to predict the intention of taking another online class. Logistic Regression and Discriminant Analysis use statistically significant determinants to predict student preference of future online class. Students satisfied with their recent learning outcome tend to take more online courses in the future.

Big Data Analytics: Building their Value Model

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Abstract

Big Data Analytics is a newly developed research areas. Its applications cover a variety of areas, including information systems/IT, healthcare, business, nature sciences, social sciences, psychology, industrial technology, geography, etc. **The research question of this study is: how to create value in Big Data Analytics?**

Recent studies indicated that Big Data is shifting research methods, based on its large volume of data to be collected and used in the study. Kitchin (2014) argued that Big Data and its spawned Data Analytics are “disruptive innovations” in research fields. The traditional data analysis approach is to “extract insights from scarce, static, clean and poorly relational data sets, scientifically sampled and adhering to strict assumption, and generated and analyzed with a specific question in mind.” (Kitchin, 2014, p. 2; Miller, 2010). The Big Data based analytics, however, is “coping with abundance, exhaustivity and variety, timeliness and dynamism, messiness and uncertainty, high relationality, and the fact that most of what is generated has no specific question in mind or is a by-product of another activity.” (Kitchin, 2014, p. 2).

Big Data Analytics utilizes data that contain characteristics of huge in volume, huge in velocity, diverse in variety, exhaustive in scope, fine-grained in resolution, relational in nature, and flexible (Kitchin, 2013). Big Data itself utilized technologies such as newly developed cloud computing technology, Internet of Things (IoT), Hadoop technology, and data center operations. The value chain of Big Data, based on Chen et. al (2014), contained four phases: data generation, data acquisition, data storage, and data analysis. The last phase, data analysis, is the focus of Big Data Analytics.

The rise of Big Data and Analytics changes the paradigm of research methods. These changes brought in convenience and challenges to researchers. However, many criticism arose since the conflicts of understanding to the data sources, data population, sampling, and statistical theories. This study intends to analyze the implication of the changes while adopting Big Data Analytics in their organizations.

Chou and Chou (2012) proposed a green IT value model, in which the four stages of green IT valuation process has been suggested. They are awareness, transition, comprehension and green IT value. The final goal of this valuation process is to seek environmental sustainability. Chou (2015) also proposed a cloud computing value model. Similar to the green IT value model, four stages valuation process have been proposed to seek cloud computing value. The final goal of this valuation process is to reach to a sustainable cloud computing situation.

The purpose of this study is to develop a mechanism of creating value in Big Data Analytics practice. This paper intends to follow the value models that proposed by Chou and Chou (2012) and Chou (2015) to solve the problem in Big Data Analytics area. This paper consists of the following sections: introduction, literature review in Big Data and Analytics, value creation model, Big Data Analytics value creation process and model building, and conclusion.

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Social Media Analytics: Typology, Platforms, Challenges, and Research Opportunities

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ABSTRACT

Currently, managers are being challenged to analyze the abundance of social media data, but there is a lack of framework to categorize a large number of tools and methods for social media analytics. To help them utilize social media analytics systematically, this paper presents a typology of social media analytics for enterprises. It also gives literature review on various analytics methods for social media data. A two-stage analytics method is provided with real-world merchant review data. Finally, three challenges are discussed and research opportunities are identified in mitigating these challenges.

Keywords: social media analytics; social media; sensitivity analysis; competitive analysis; social network analysis; social media intelligence; supply chain

INTRODUCTION

Social media analytics refers to the practice of gathering data from *social media* platforms and analyzing the data to help decision makers address specific problems. Social media analytics have been used by a wide range of people including social scientists, business managers, and medical professionals. Automated social media analytics is inexpensive and fast compared to traditional media analysis where data collection is oftentimes manual and the analysis is labor-intensive. The popularity of social media analytics surged recently, since popular social media platforms allowed enterprises to access enormous amount of customer data from their sites. Social media platforms focus on idiosyncratic groups of content creators and content consumers. For example, Twitter is a real-time information network that connects users and followers to the latest stories, ideas, opinions, and news. On the other hand, Yelp is a site where customers publish unsolicited reviews and viewers to read them. According to recent statistics (wersm.com, 2015), Facebook, the most popular social networking site with over 1.4 billion active monthly

users, generates up to 250 million posts per hour. Instagram, a popular photo-sharing site with 300 million monthly users in 2015, generates over 100 million photos per hour. YouTube, a video-sharing site, generates over 300 hours of new video every minute.

Social media analytics can analyze social media data for obtaining consumers' innovative ideas and enhancing customer relationships. Many Fortune 500 companies, from McDonald's to Pepsi to Marriott, have been using social media analytics to derive a competitive advantage from it. Marriott, a multinational hospitality company, operates their social media center, called M Live, where about a dozen employees are analyzing Twitter feeds, Instagram photos, and Facebook posts in an effort to engage in social conversations with clients, increase the hotel chain's brand presence and keep up with the latest trends (CNBC, 2016). With the use of a technology called geo-fencing, Marriott is able to monitor every public posting on a social media platform done from within their properties and reach out to the customers to show that Marriott values them. The Coca-Cola Company operates a social media center called Hub Network (Coca-Cola, 2014). The Hub Network deploys a suite of social listening, analysis, and engagement tools to deliver a better, faster and more efficient response to real-time social media opportunities and issues.

Among many types of organizations, enterprises are the most active users of social media analytics. Analyzing social media data to better understand why customers buy the product plays an important role in sustaining competitive advantage (Brooks, Heffner, & Henderson, 2014). Social media analytics equipped with advanced techniques has significantly affected a company's ability to leverage otherwise unattainable social media intelligence. Enterprises can better understand customer behaviors by combining intelligence acquired by social media platforms with traditional customer intelligence (Sigala & Chalkiti, 2015). According to *marketsandmarkets.com* (2016), the global social media analytics market will grow from \$1.60 Billion in 2015 to \$5.40 Billion in 2020 at a Compound Annual Growth Rate (CAGR) of 27.6%. The North American region is a leading revenue generating region for social media analytics vendors, followed by Europe, with a high penetration of social media analytics in multiple industries such as manufacturing, healthcare, transportation, and logistics.

A recent survey of business managers shows that social media analytics brings about a huge and untapped opportunity, but there is much more to be done to fully exploit social media analytics for consumer packaged goods (CPG) companies (Accenture, 2014). The same survey shows marketing is the primary area of social media analytics. Companies recognize the value of social media analytics in innovation and product development, followed by customer service, operations, and strategy. Nearly half of the respondents indicated information technology as the department in which analytics competencies and roles are concentrated, followed by an analytic unit within departments and business units, and a centralized analytics unit at the enterprise level.

In response to the growing interest by enterprises, this paper develops a typology of enterprise social media analytics and show how its four categories of social media analytics - real-time competitive, non-real-time competitive, real-time customer, and non-real-time customer - can help companies develop social media intelligence. Next, a two-stage social media analytics is provided to analyze real-world merchant review data. Finally, this paper discusses challenges that enterprises face and research opportunities in social media analytics.

LITERATURE REVIEW

According to Zeng, Chen, Lusch, and Li (2003), social media analytics is concerned with developing and evaluating informatics tools and frameworks to collect, monitor, analyze, summarize, and visualize social media data, usually driven by specific requirements from a target application. They propose that social media analytics research serves several purposes including facilitating conversations and interaction between online communities and extracting useful patterns and intelligence to serve entities that include active contributors in ongoing dialogues. To create new value, to support decision making and to enhance competitive advantage. Therefore, the development of effective and efficient analytics techniques for social media analytics becomes essential (He et al., 2015). Social media analytics is different from traditional data analytics particularly due to the nature of its unstructured data formats such as text, images, audio and video which are characterized by heterogeneous and natural human language that is heavily context dependent (Kurniawati, Shanks & Bekmamedova, 2013). Social media analytics is a nascent field that has emerged after the advent of Web 2.0 in the early 2000s. The key characteristic of the modern social media analytics is its data-centric nature. The research on social media analytics spans across several disciplines, including psychology, sociology, anthropology, computer science, mathematics, physics, and economics (Gandomi & Haider, 2015).

Analyzing social media has become a popular research and business activity due to the user-generated content accessible through web-based APIs provided by major social media sites (Batinca & Treleaven, 2015). For example, analyzing market performance through social media sites has attracted a great deal of attention from researchers. Social media analytics utilizes an array of methods developed to derive specific metrics from social media data. Based on the survey of the existing commercial tools, we find that sentiment analysis, social network analysis, and statistical methods are most widely used. Image analysis and video analysis are in an early stage of technology development. The following is a literature review of these methods.

Sentiment Analysis

Sentiment analysis, also called opinion mining, refers to the application of computational

technologies such as natural language processing and computational linguistics to identify and extract subjective information from the vast amounts of user-generated content. Sentiment analysis mainly uses two methods: a machine-learning method with which the analytics learns to evaluate sentiment through acquisition and integration of knowledge gained from a large number of sentiment examples or a lexical-based method with which the analytics evaluates sentiment by utilizing a large dictionary of pre-scored words and phrases. Sentiment analysis has been used successfully for businesses including predicting stock market movements, determining market trends, analyzing product defects, and managing crises (Fan & Gordon, 2014). Sentiment analysis needs to be interpreted with a grain of salt due to potential sampling biases in the data (e.g., satisfied customers remain silent while those with more extreme positions express their opinions) (Fan & Gordon, 2014). For example, many online users are lurkers who join an online community with the aim of passively participating for a period of time before making a decision to actively participate in the community (Nielsen, 2006). Lurkers are more likely to post neutral messages that are not detailed enough to give up their identity (Nonnecke, Andrews, & Preece, 2006).

Lexical-based methods use a predefined set of words which carry a specific sentiment. They include simple word (or phrase) counts; the use of emoticons to detect the polarity (i.e., positive and negative emoticons used in a message) (Park, Barash, Fink, & Cha, 2013); sentiment lexicons (based on the words in the lexicon that have received specific features marking the positive or negative terms in a message) (Gayo-Avello, 2011); the use of psychometric scales to identify mood-based sentiments. Machine learning methods often rely on the use of supervised and unsupervised machine learning techniques. One advantage of machine learning methods is their ability to adapt and create trained models for specific purposes and contexts. On the other hand, it is known that labeling data might be costly or even prohibitive for some tasks. Sentiment analysis divides into the following specific subtasks (Batrinca & Treleaven, 2015):

- Sentiment context: to extract sentiment, one needs to know the context of the contents, which may vary significantly from specialty sites to general sites where contents can cover a wide spectrum of topics.
- Sentiment level: text analytics can be conducted at the word, sentence, or document level.
- Sentiment orientation/polarity: a sentiment in a text can be positive, neutral or negative.
- Sentiment strength: the strength of a sentiment in a text can be weak, moderate, or strong.
- Sentiment subjectivity: a given text may be an opinion or a fact.

Social Network Analysis

Social network analysis is the process of analyzing structures of social networks based on Social Network Theory which seeks to explain how networks work and analyze the complex set of relationships within a network of individuals or organizations (Scott, 2012; Wasserman & Faust,

1994). In the social network, nodes are the individual actors within the network and ties are the relationships between the actors. Social network analysis provides both a visual and a mathematical analysis of actor relationships within a network by modeling social network dynamics and growth (network density, network centrality, network flows, etc.). Actors and social ties are important in information dissemination and propagation, including both weak and strong ties (Brown & Reingen, 1987; Datta, Chowdhury, & Chakraborty, 2005). Weimann (1983) finds that information becomes influential due to strong ties within the group which are more likely to be used and perceived more credible than weak ties. Social network analysis uses a variety of techniques pertinent to understanding the structure of the network (Scott, 2012). These range from simpler methods (such as counting the number of edges a node has or computing path lengths) to more sophisticated methods that compute eigenvectors to determine key nodes in a network (Fan & Gordon, 2014).

Social networking sites such as Facebook, Twitter, and LinkedIn have provided fertile grounds for advancing online social network theories and practices. Social networking sites allow the establishment of links connecting family members, friends and peers (Tuten, 2008). Social networking sites provide a central point of access and bring structure in the process of personal information sharing and online socialization (Jamali & Abolhassani, 2006). Understanding the dynamics of the interactions between users can assist in identifying influencers to target in branding and ad campaigns (Chen, Wang, & Yang, 2009). Well-connected users are particularly important for social networking sites, as they can be highly relevant for the promotion of brands, products, and viral marketing campaigns (de Valck, van Bruggen, & Wierenga, 2009).

Statistical Analysis

Traditional statistical methods have also been used for advanced analytics. Some of the statistical methods include Markov chain Monte Carlo methods, regression models, logistic regression, factor analysis, and cluster analysis. These statistical methods typically require transformation of the original contents into a coded format suitable for statistical methods. Regression analysis has been widely useful for understanding causal relationship between various factors obtained from factor analysis. Xiang, Schwartz, Gerdes Jr., and Uysal (2015) apply a text analytical and statistical approach to a large quantity of consumer reviews extracted from Expedia.com to deconstruct hotel guest experience and examine its association with satisfaction ratings. First, they conducted factor analysis to identify the underlying factors of customer reviews. Then, linear regression analysis was used to examine the relationship between guest experience and satisfaction using the identified factors as independent variables and average satisfaction rating as the dependent variable. Similarly, Qu, Zhang, and Li (2008) analyze the content of review data collected from Yahoo's merchant review system. Based on the

content analysis, they selected fourteen factors and conducted regression analysis to identify factors that have major impacts on customers' evaluation of online merchants.

Image and Video Analysis

Images and videos are also significant part of social media data due to rapidly growing content-sharing platforms such as YouTube, Instagram, and Flickr. While the above-mentioned methods have been developed primarily for text mining, analytics for images and videos has been marginally exploited. Image analysis is the process of organizing images into an archive that is fully searchable and analyzable. Basic image analysis involves the statistical analysis of tag data, the demographic data, and download frequency (e.g., Instagram account's average engagement per photo, keyword analysis for comments, most active followers, and top locations). Realizing that capturing the visual features of photos to classify them is difficult, Chen and Roy (2009) use tags to classify Flickr photos. Their approach identified tags that were related to events and then subsequently identified photos corresponding to each cluster of events. Firan, Georgescu, Nejdil and Paiu (2010) analyze images using tags, titles and photo descriptions to classify them more accurately. Advanced image analysis utilizes image processing techniques, image recognition, and image tags. Image analysis enables companies to mine image data to extract valuable information such as the location of people and fashion trends. Scale-Invariant Feature Transform (SIFT) is widely used to detect and extract local discriminative features from photos. Similar to the basic image analysis, basic video analysis typically involves quantitative metrics such as the number of users, response rate, the subject, and location. More advanced techniques include accessing video clips posted to social media sites, analyzing the voice to determine the emotional state of the user, and applying a behavioral model to the spoken words to determine the personality type of the user. Facial expressions play a significant role in the identification of emotions in a video data. Supervised machine-learning-based classifiers for the sentiment classification task involving videos are a viable alternative technique for large-scale computing and machine learning in many different applications (Poria et al., 2016).

TYOLOGY OF ENTERPRISE SOCIAL MEDIA ANALYTICS

In this section, we use a typology approach to identify and systematically categorize social media analytics. Typologies are mostly generated through qualitative classifications rather than quantitative or statistical analysis (Hunt, 1991). While constructing the typology, we took five criteria into consideration: adequacy of phenomenon specification, adequacy of specification of classification characteristic, mutually exclusive categories, collectively exhaustive typology, and usefulness of topology (Hunt, 1991).

As mentioned in many studies, “timeliness” and “market orientation” are important in determining the social media analytics adopted by enterprises. Kohli and Jaworski (1990) define

a market orientation as the firm’s ability to generate, disseminate and use superior information about its customers and competitors. Our typology uses a market orientation dimension with two dichotomous values (customer and competitor) and a timeliness dimension with two dichotomous values (real-time analysis and non-real-time analysis). Utilizing these dimensions, we present a 2x2 typology of enterprise social media analytics that charts out some of the popular social media analytics used by enterprises in Table 1: real-time customer analytics, non-real-time customer analytics, real-time competitive analytics, and non-real-time competitive analytics.

Table 1. A Typology of Enterprise Social Media Analytics

		Timeliness	
		Real-Time	Non-Real-Time
Market Orientation	Customer	<u>Real-Time Customer Social Media Analytics</u> Reactive marketing efforts e.g., keyword analysis, location analysis, conversation analysis, complaint detection and alert from online review or comments	<u>Non-Real-Time Customer Social Media Analytics</u> Proactive marketing efforts e.g., identification of profitable customer groups, social network analysis, influencer analysis, web analytics, sentiment analysis
	Competitor	<u>Real-Time Competitive Social Media Analytics</u> Operational intelligence e.g., monitoring of prices and promotions, news alert, headlines, new product announcement, merger and acquisitions,	<u>Non-Real-Time Competitive Social Media Analytics</u> Strategic and tactical intelligence e.g., periodic trend analysis of competitors’ pricing, new product development, technology development, customer services, complaints, employee comments

With the advent of information technologies and social media, social media platforms became more popular than proprietary sources in seeking the information needed to blunt competitive challenges (Harrysson, Metayer, & Sarrazin, 2012). Social media analytics enables companies to rapidly collect data from social media platforms and develop an in-depth intelligence of their competitive environment (Arrigo, 2014). While the four types of social media applications can be used separately, cutting-edge companies will deploy all four types of social media

applications simultaneously. Customer analytics and competitive analytics are like two sides of the same coin, in that for a company, their customers are a target of competitive intelligence from competitors.

Customer analytics is widely supported by commercial service providers, and popular metrics include the size of social media pages, response time to complaints, posts, engagements (the number of comments, likes, or shares for each post), retweets, demographics of the people connected to a user, and followers. Competitive analytics is a method to gather and analyze data about competitors and the business environment. Competitive analysis may utilize news analytics methods as well as sentiment analysis. Tasks of competitive analysis include:

- Sentiment tone: how positive, negative or neutral the tone of the content is about the competitor.
- Relevance: how relevant or substantive the content is for the competitor.
- Keyword analysis: what and how many different keywords are used in the content about the competitor.
- Intensity analysis: how repetitively the keywords are used over time.
- Alert analysis: tracking special announcements such as technology breakthrough, product recalls, change of upper management, and financial performance.

Real-time customer analytics

Real-time customer analytics allows companies to manage conversations with customers, respond to their issues, and deliver information that is timely and relevant on social media channels in real time (or near real time) (Walters, 2013). Data that sits without analysis for a long time loses its relevance (Qualman, 2009). An empirical study shows that the more rapid the response to the consumer is, the more valuable that response is (Weiss, Lurie, & MacInnis, 2008). It is important to identify and resolve individualized incidents that may spread out quickly via word-of-mouth. Continuous monitoring of online reviews or blogs is seen as a practice for preventing personalized issues from damaging the company's reputation. Improved customer intelligence obtained through real-time customer analytics enables the company to formulate a more precise, timely response. For example, Wells Fargo set up a command center to better monitor social media sites such as Twitter, Pinterest, and Facebook, engage with consumers on topics that are trending, and respond quickly to specific customer queries (American Banker, 2014). The monitoring is also a way to quickly acknowledge the complaints and make an effort to resolve them. As part of its social media outreach, Wells Fargo has a dedicated social care unit to which it refers many of its customer complaints.

Non-real-time customer analytics

While real-time customer analytics is used to formulate reactive marketing strategies, non-real-time customer analytics focuses on developing proactive marketing strategies based on the analysis of customer data over time. Non-real-time customer analytics may produce simple

quantitative metrics such as the frequency or duration of the web page visits and demographics and geolocation of the visitors, the number and growth of the members on a social media, and the conversion rate. In addition to the simple metrics, companies collect more qualitative information about sentiment or opinion. Using accumulated historical customer comments, companies can analyze how customer behaviours evolve over time and may design marketing messages that have the higher reach and response. Starbucks launched a corporate social network site, www.mystarbucksidea.com, to inform customers about their new products and promotions and analyze customers' needs and expectations about their products and services in non-real-time as well as real-time. J.P. Morgan's media relations team also actively monitors the financial news discussed on various social media platforms such as Twitter, Snapchat, and YouTube, develops social media campaigns, and regularly reports on social media campaign performance and listening insights.

Real-time competitive analytics

Tracking competitors' business activities real-time and monitoring their online conversations with customers can provide valuable information that can be used to strengthen various business activities. To develop real-time competitive analytics effectively, a company should understand how their competitors are utilizing various social media platforms. For example, a company may continuously monitor the frequency and sentiments of customers' postings about a competitor and viewers' reactions at various social media platforms and benchmark them for comparison with their own. Real-time competitive analytics may expand to the analysis of online news about new product developments, new features of products, product recalls, cyberattacks, and mergers and acquisitions. The real-time competitive analytics will help the company effectively respond to the competitor's moves or address the customers' concerns. For example, restaurants or gyms may need to track competitors' daily online discount deals and develop a counter-promotional strategy. Real-time competitive analytics can be deployed to monitor online deal sites such as Groupon and LivingSocial and track the discount rate, duration of the discount offerings, type of discount food or services, and the number of deal purchasers for the competitors.

Non-real-time competitive analytics

While real-time analytics is valuable for many business activities, not all activities are suitable for real-time analytics. Data collection and processing can become unwieldy when a large number of social media platforms are monitored. For example, a trend analysis is more suitable for non-real time analysis, but consumer's complaints may be monitored in real-time. The trend analysis of consumers' responses to competitors' products and services may provide new or

improved product ideas. Companies can also investigate the relationship between consumer-generated contents and sales performances. These analyses can be done periodically with a sufficient amount of data for statistical analysis. Lowe's and Home Depot can easily access their best performing competitor's social media data. They can conduct a trend analysis of customer sentiment, postings on social media platforms, the number of followers, and demographics and geolocations of the customers. The competitor's metrics can serve as a benchmark in developing marketing strategies and improving their products and services.

SOCIAL MEDIA PLATFORMS AND ANALYTICS

Social media platforms are online communities where their members share and seek common interests, activities, experiences, and information. Social media platforms enable consumers to be content creators as well as content users (Hajli, 2015). Li, Bernoff, and Groot (2011) use the term "groundswell" to describe a trend in which people use social media to get the information they want from other social media users rather than professional or public sources. Social media represents a variety of dynamic and community-based web applications that place value on the power of distributed knowledge and provide users with rich interactive experiences. There is significant competition among the various social media platforms. For example, Google created Google+ in an attempt to create its own social media network. LinkedIn is a specialized social networking site focusing on professional relationships. Since the mid-2000s, social media has paved new ways of accessing customers for businesses and conducting business activities. Users who interact on social media platforms share their own experiences and activities, engage with each other, and create a much stronger sense of community (Gruzd, Wellman, & Takhteyev, 2011; Hays, Page, & Buhalis, 2013). While there is no universally agreed upon classification for social media platforms, widely categorized generic platforms include social networking services, blogs, social bookmarking sites, content sharing sites, and opinion sharing sites.

The specific information obtained from engaging in social media is highly dependent on where we listen (i.e., selectively monitoring only a single social media site or monitoring multiple sites) and how the data is analyzed (Schweidel & Moe, 2012). The selection of social media platforms depends on the impact of those platforms on their businesses (e.g., the number of customers who are using the social media platforms) and accessibility of the content on those social media platforms. Social media monitoring offers organizations quick access to valuable information about users' consumer profiles, brand awareness/interest/liking/preference and user ability to understand the brand (Lin & Rauschnabel, 2016).

The ability of decision makers to collect, filter, and interpret data, messages, and signals has a critical bearing on its strategy (Makadok & Barney, 2001). A number of analytical tools are

available to help managers conduct social media analytics. While some social media data are structured, social media data are mainly unstructured and semi-structured, leading to high diversity, ambiguity, and textual disorder. These unstructured and semi-structured data require pre-processing and cleaning before data analytics to eliminate missing data, incorrect data, and inconsistent data. The process of data cleaning may involve spell checking, removal of typographical errors or duplicates, validating and correcting values against a known list of entities, and tagging data with metadata. It is also necessary to transform the cleaned data into structured data.

TWO-STAGE CUSTOMER ANALYTICS USING MERCHANT REVIEW DATA

In this section, we present a two-stage customer analytics with real merchant review data: (1) sentiment analysis and (2) a regression model. 22 restaurants in the US were selected for the analysis of customer review data collected from Yelp, one of the most popular opinion-sharing sites. In regards to the typology of social media analytics presented earlier, this problem belongs to *non-real-time customer analytics*. We used NVivo analytics software. For the 22 restaurants, 102 customer postings were collected. Each post consists of one comment and one review score. We conducted two-stage analytics. First, sentiment analysis was used to categorize each sentence into sentiment polarity (Very positive, Moderately positive, Moderately negative, and Very negative). 224 sentences were categorized into Very positive (62 sentences), Moderately positive (84 sentences), Moderately negative (56 sentences), and Very negative (22 sentences).

Then, the 224 sentences of these 102 comments were further categorized into six factors: Price, Service (e.g., staff politeness, promptness, helpfulness), Food (e.g., food quality, taste, freshness), Atmosphere (e.g., comfort, view, quietness), Condition (e.g., cleanliness of the restaurant, accessibility), and Selection (e.g., variety of food). These six factors serve as independent variables, and the review score as a dependent variable. Note that each comment can contain multiple factors. A coding was conducted manually to convert sentiment polarity into specific numeric codes for the factors. Very positive sentence is assigned +4, Moderately positive sentence assigned +2, Moderately negative assigned -2, and Very negative assigned -4. For example, a very positive sentence commenting on price is assigned +4 for the variable, “food,” a very negative sentence commenting on food quality is assigned -4 in the variable, “food.” Through the coding process, 102 original customer postings were converted into a *sample size* of 224 for multiple regression analysis. The seven variables and their descriptive statistics are shown in Table 2 below.

Table 2. Descriptive Statistics

	Mean*	Standard Deviation	<i>n</i>
Price	-0.28	1.504	102
Service	0.20	2.040	102
Food	0.62	2.440	102
Atmosphere	0.52	1.493	102
Condition	-0.02	0.449	102
Selection	0.04	0.695	102
Review Score	3.13	1.353	102

*: The mid-point is 0

Table 3. Significant Coefficients

Variable	Unstandardized Beta	Standardized Beta	<i>p-value</i>
β_0 – Constant	2.842		.000
β_1 – Food	.298	.541	.000
β_2 – Atmosphere	.271	.343	.001
B_3 – Service	.231	.316	.002
B_4 – Condition	.458	.206	.031

As such, our regression model of the form $Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4$ is

$$Y = 2.842 + 0.298X_1 + 0.271X_2 + 0.231X_3 + 0.458X_4$$

where *Y* is the review score. This model has an *R-square* value of 0.774.

A stepwise regression was run on these seven variables. Table 3 shows the beta coefficients of these variables as well as their *p-values*. The regression was run with a 5% level of significance. Our analysis shows that the review score for the restaurants has a high correlation with (1) food, (2) atmosphere, (3) service, and (4) condition. As expected, the food was the most important factor for customers' overall satisfaction, following by atmosphere, service, and condition. However, price and selection were not significant factors.

This result shows that a powerful social media analytics model can be developed with a manageable amount of data for small and medium-sized enterprises to discover relationships between consumers' comments and review scores. While more comprehensive social media analytics might add more value to merchants, this section shows that a simple two-stage social

media analytics can give considerable marketing ideas for enterprises. The two-stage analytics demonstrates that by combining automated sentiment analysis with manually coded regression analysis, we can achieve a richer and more insightful analysis of data. Furthermore, the same method can be used to analyze their competitors' review data to gain insights into business operations of the competitors and make counter marketing efforts.

CHALLENGES AND RESEARCH OPPORTUNITIES

This section identifies three challenges: bias in social media data, noise in social media data, and unstructured social media data. Future research is needed to mitigate these challenges.

Bias in Social Media Data

Social media platforms are able to reach only a subset of customers. Therefore, social media data may suffer from unrepresentative customer population that prevents the data from being extrapolated to the general public. While some participants prefer to be active by posting comments and creating content on social media, others prefer to be reticent (Miller & Lammas, 2010). Some consumers, rather than writing something false, may write only part of what they do in real life, in order to share with others things that would only reflect a certain status, and thus information may be found to be only partially accurate or complete (Moe & Schweidel, 2014). Fake reviews are oftentimes posted by unscrupulous companies, zealous competitors, disgruntled employees, and unhappy consumers.

While many studies using social media data have focused on the content analysis, very few of these studies investigate ways to mitigate potential bias in the data. Social media users may be time-varying, demographically-biased sample of the population who respond selectively to certain phenomenon and events. Tracking and eliminating bias and non-representativeness in social media data is a promising research area. For example, developing a proper mechanism for translating the non-representative, opt-in samples into an appropriate indicator may help achieve accurate representation of the opinions of a target population (Wang, Rothschild, Goel, & Andrew, 2015).

Noise in Social Media Data

Sifting through noise in data is challenging. Managers need to recognize the possibility of noise being mixed up with the messages of value (e.g., genuine reviews mixed with fake reviews). There are many sources of noise in social media data, including spam, fake reviews, fake accounts, and duplicate content. Filtering and scrubbing data are important for the quality of social media analytics. However, current social media analytics offer limited automated filtering

and scrubbing capability. Automated procedures, combined with manual procedures, may mitigate the noise of the data.

Researchers need to develop comprehensive data filtering and scrubbing methods. It is noted that data filtering and scrubbing methods come with expensive computational cost. Algorithm development for optimal data filtering and scrubbing of massive amounts of noisy social media data is a promising research. Natural language processing techniques such as language identification, lexical normalization, and part-of-speech tagging can also be promising methods of noise reduction of data.

Unstructured Social Media Data

Most content in social media is unstructured. Such content may include email, news articles, letters, images, audio, and videos. Analysis of unstructured data can help companies gain invaluable insights into their customers, products, services, and competitors. Relational database management systems (RDBMS) developed to manage structured data are not suitable for managing unstructured data. Real-time analytics can be more challenging in integrating and analyzing unstructured data from multiple sources due to noise in the data and different semantics used for the same things. While numerous tools are available for companies to analyze unstructured data, managers face issues in poor data quality, integrating structured and unstructured data, and massive data volume. They need to understand the type and value of information gained from unstructured data and select the right analytics and data management tools to extract maximum value from unstructured data.

It is important to take note of the advances in the data management technologies for unstructured data such as Hadoop and NoSQL. These data management technologies will facilitate the development of new data mining methods and machine learning algorithms to deal with unstructured data in different disciplines. An interactive visual analytics method may provide aid in exploration and examination of unstructured data, but requires extensive computing resources to collect and store new data, analyze data about the movement of people and objects, and solve spatiotemporal problems in social media (Bello-Orgaz, Jung, & Camacho, 2016). It is noted that new generations of algorithms are currently being developed, but need to resolve computational time and memory issues to deal with unstructured multimodal social media data.

CONCLUSION

With the widespread adoption of social media by customers, it became imperative for businesses to leverage social media platforms to stay competitive in the global economy. Social media analytics are used to monitor and listen to the word-of mouth that spread in social media

platforms and conduct thorough analysis of consumer opinions on products and services. It is noted that along with the growth of social media platforms, the influx of big data became one of the biggest challenges (O'Reilly & Lancendorfer, 2014). Therefore, it is crucial for companies to select the right social media platforms and the right type of data to collect and analyze.

This paper presented a 2x2 typology of enterprise social media analytics that charts out some of the popular social media analytics used by enterprises: real-time customer analytics, non-real-time customer analytics, real-time competitive analytics, and non-real-time competitive analytics. Then, this paper discussed various social analytics methods including sentiment analysis, social network analysis, statistical methods, and image and video analytics. A two-stage social media analytics with real data involving sentiment analysis and a regression model was provided for managers' understanding of this important area. Finally, three challenges were identified and research opportunities in mitigating these challenges were discussed. It is also worth mentioning that while this paper focuses on the social media analytics, social media analytics is part of large business data analytics which involves non-social media data for overall business intelligence.

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Analyzing Customers Reviews for Competitive Intelligence – Text Mining Study

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Abstract

Nowadays, customer before ordering any product or services online scans through the other customers' reviews available through customer review system of the ecommerce sites. The e-commerce sites have huge wealth of textual data which contain hidden knowledge. The customers' opinions, and reviews of services and products may indicate how the products are received or how customers like to receive the products and services. The companies have started exploring ways to mine the textual data to gain competitive intelligence against their competitors or to redesign their product and services. Text mining is an emerging technology that helps to extract meaningful information from unstructured textual data. Several researchers have successfully used text mining techniques to analyze large amounts of textual data. The text mining methods include: clustering, information extraction, text summarization, and link analysis. This study reviews all the text mining approaches/tools that has been used effectively to draw competitive intelligence out of the customer review system of the ecommerce sites.

Teaching through Technology (t3): Using an interdisciplinary student, faculty and alumni organization to assist global health needs through technology and a Google Not-for-Profit Grant

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Abstract

This paper serves to inform interested readers about a group comprised of faculty, students, and alumni that make projects to be used globally. Teaching Through Technology (t3) was able to advertise and review the data analytics provided by Google to improve the effectiveness of their AdWords through data analytics. The data analytics are a key tool in improving the global diffusion of technological products made by the group. The Google grant is a Not-For-Profit grant that awards \$40,000 worth of free advertisements to the team.

A. Introduction

1. Surgical Needs in Malawi, Africa

Three years ago, a doctor who had practiced in Malawi, Africa for fifteen years came to Grand Valley State University asking for assistance in designing a solar-powered medical device. She was the only doctor for her 100,000 patients. Her name is Dr. Martha Sommers.

Over time, Dr. Sommers helped build a hospital in Ekwendeni. However, there are many times that the hospital is without power. This led to situations where patients needing electrical surgical devices would die on the operating table.

Hoping to counteract the mortality rate in cases like this in the future, Dr. Sommers came back to the United States in search of a solar-powered device that would provide powerful lighting and life-saving suction. She had been using a foot pump and sometimes she would use a pipette, but these options were often not sufficient for her surgical needs.

Dr. Sommers is the cousin of business faculty member, Star Swift. After hearing about the difficulties her cousin was experiencing, Professor Swift approached Dr. Heidi Jiao, who is a faculty member of the Padnos College of Engineering. Dr. Jiao talked with Dr. Sommers and decided that the students in her master's class could make a solar-powered device that would address some of the pressing needs at the Ekwendeni Hospital.

2. *Solar Suction Surgery System (S4)*

Under the supervision of Dr. Jiao, the students designed and built a solar suction surgery system with design assistance from Dr. Sommers and her sister Veronica Sommers Depagnier. Depagnier is an engineer and has assisted her sister in Malawi. Dr. Jiao and her class and Professor Swift often met with Dr. Sommers and Depagnier through video chat. These discussions led to the final design of the system.

B. Development and Construction of Midwife Mobile Application

Upon completion, the device, which was called the “Solar Suction Surgery System,” or S4, was sent to Malawi.

While the S4 was being constructed, an interdisciplinary team comprised of students, faculty, and alumni known as t3 was developing a mobile application called “A Midwife’s Guide.” The purpose of the mobile app is to show midwives how to deliver a baby. Dr. Sommers and her sister Mary Sommers, who is a midwife, wrote the content for the mobile application. Mary Sommers had previously been to Malawi to assist Martha in training midwives, and she was keenly aware of the need for teaching the basics of midwifery in the country. The members of t3 designed, developed and made the mobile app. The app was designed to send usage and crashes back to t3.

The mobile application may be found in the Google Play store at:

<https://play.google.com/store/apps/details?id=com.app.midwifeguide>

C. Additional Products made by t3

1. New S4 designed and delivered to Malawi, Africa

A grant from Google was awarded to t3 to allow the team to advertise “A Midwife’s Guide” app to people across the world. Each month, the team receives \$40,000.00 to spend on Google advertising on the web.

During the winter semester of 2016, Dr. Jiao, Professor Swift and Dr. Jiao’s master’s class decided to make three more S4s. The class communicated with Dr. Sommers via video chats and discussed her wishes for a new S4 design. The new S4 design included: first, a longer battery life; second, a suction system within each unit; and third, two lighting systems. The first light would be one that allowed the surgeon to see directly into a wound or the open cavity of a patient. The second light would be strong enough to illuminate the surgical suite in its entirety.

Once completed, the new S4 addressed all of Dr. Sommers’ desires. During the summer of 2016, three GVSU graduate students, who were members of t3,

delivered the systems to Malawi and installed them in the hospital in Ekwendeni and two remote clinics. Members of t3 took the three S4s to Malawi. The employees at the hospital were delighted to tell the students that the first version of the S4 had worked every day for the past three years. The new S4s are constructed to send back data about daily usage to t3.

To see more about the development and placement of the S4s, go to this site: <https://www.youtube.com/watch?v=wRWo1HIaMKo>

2. Design and Development of website called solaRescue

While the three S4s were in production, t3 simultaneously created a website. The name of the website is solaRescue. The website was designed and developed by the other students in t3. The purpose of the website is to allow groups and individuals from all over the world to see the Padnos College of Engineering's S4 designs and to provide a place for others with solar designs to make them available for free as open source documents. You may see the website at:

www.gvsu.edu/solarescue/.²

B. Google Grant, Data and Analytics

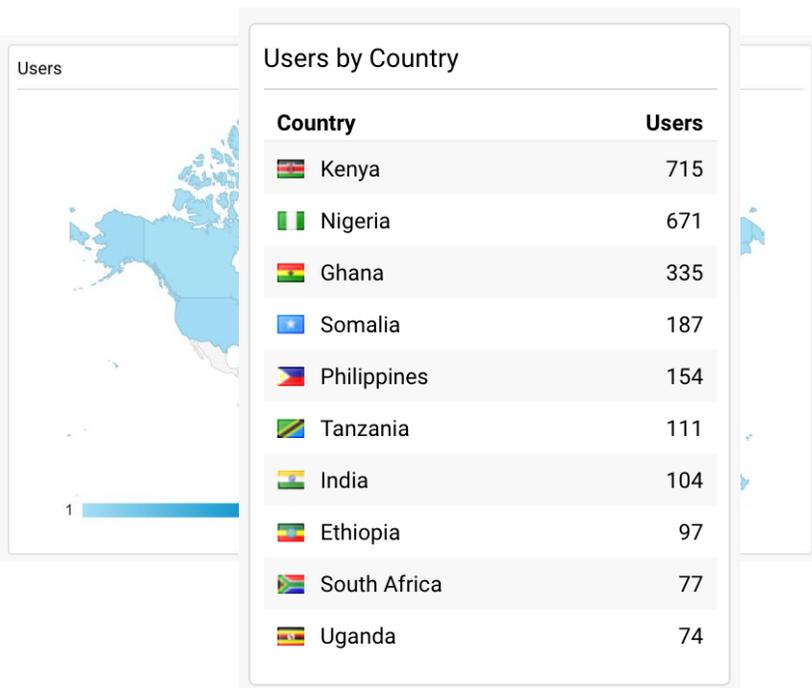
The grant from Google was awarded to t3 to allow the team to view usage on a global basis. The Google AdWords gives the team \$40,000 in free advertising on the web. This in turn, provides invaluable data for the team to review usage, trends and global reach. In fact, the team's Google ads result in the world viewing information about its products over two million times per month.

What does the data show t3? Who is using their products and how long they use the products. What advertising campaigns work and what ads fail to reach a specific audience. Which keywords reach large quantities of people as well as smaller quantities. How far the information included in our products has spread across the globe. It also shows the number of first time users versus the number of returning users. Finally, the data specifically shows how usage is the result of organic searches.

C. A basic dashboard showing data information of t3 technology

1. A MIDWIFE'S GUIDE ANALYTICS

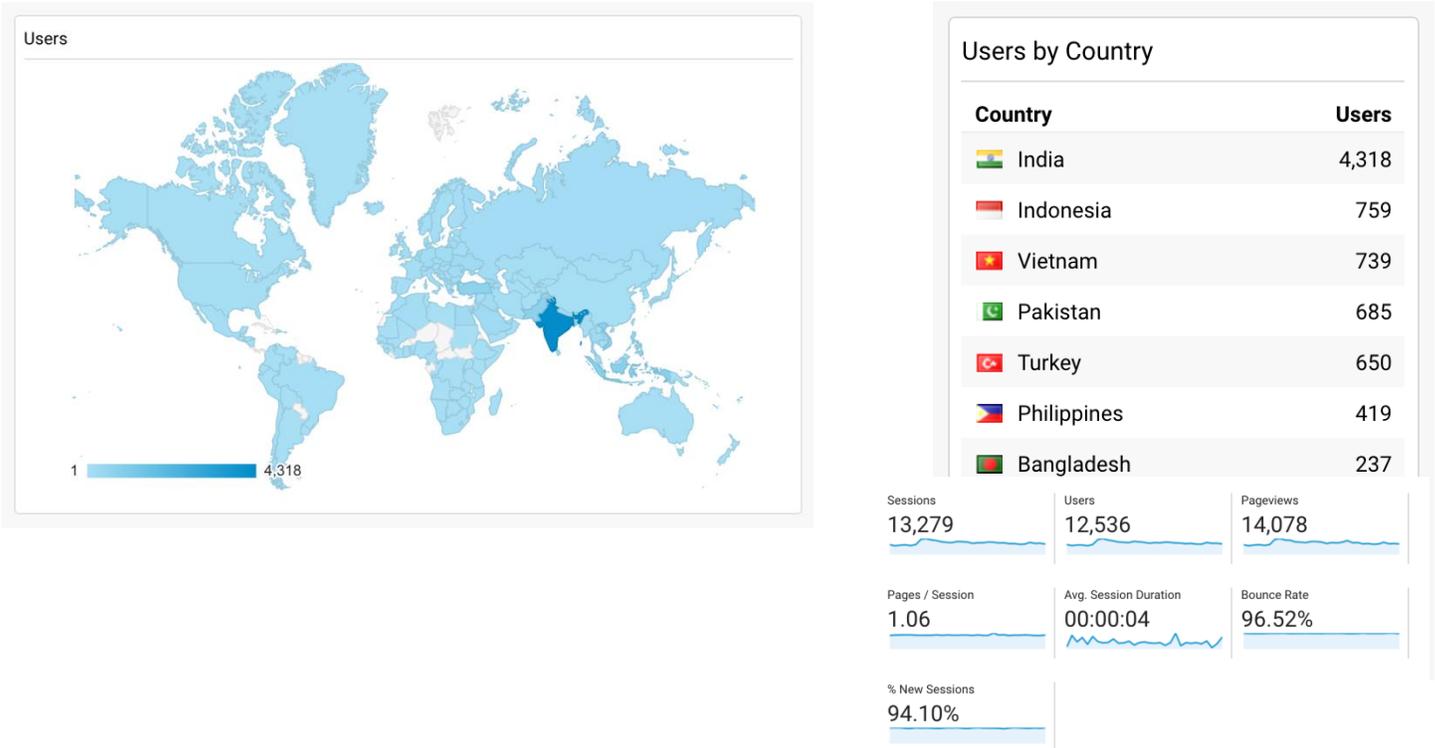
² It should be noted that these projects are strongly supported by Chair of the Management Department at Grand Valley State University, Professor Jaideep Motwani, Dean of the Seidman College of Business at Grand Valley State University, Diana Lawson and Dean of the Padnos College of Engineering, Paul Platkowski.



On this page, one is able to see charts and graphs that t3 is able to use on a regular basis. These tools tell the story about whether or not we are successful in driving the use of our technology through our ad campaigns. If the use of a product drops off, we understand the data is telling us the content of a website or mobile application needs to be updated or corrected. If the usage increases, there can be many reason and the data helps us to understand these changes too.

The data on this page are for A Midwife's Guide. The numbers are for the month of March 26, 2017 to April 25, 2017. The map allows t3 to see every country that has used A Midwife's Guide in the last month. The chart to the right of the map allows t3 to see the number of users for the top ten countries for the last month. And the table below the chart tells t3 the number of users, sessions, screen views, screens per session, average session duration, and the percentage of new sessions for a month's time.

2. solaRESCUE ANALYTICS



The data on this page are for solaRescue, which is the website which houses the instructions for constructing the Solar Suction Surgery System (S4).

The map above shows all of the countries that have accessed the solaRescue website between March 26, 2017 and April 25, 2017. Countries highlighted in any shade of blue have had at least one person in that country access the site.

As you can see, India is shaded the darkest blue, which means that they have the most people accessing our website. The exact number of users for India in this month timeframe can be seen in the figure to the right of the map. India had 4,318 people access the solaRescue website in one month. Further examination of this chart allows one to see the number of users for ten countries with the highest amount of usage of the solaRescue site.

When examining the table below the Users by Country chart, one can see that the solaRescue website has had 13,279 sessions and 12,536 users throughout the month. This makes sense since the website saw about 94% of the sessions to be with first time users for that month. The average session duration is about 4 minutes, and the pages per session are around one page.

Employing Visual Analytics to Understand Worldwide Prevalence & Impact of Diabetes Epidemic

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Abstract

International Diabetes Federation (IDF) has declared diabetes to be one of the largest global health emergencies of the 21st century (International Diabetes Federation). IDF estimates about 415 million adults to have diabetes currently and about 318 million adults having impaired glucose tolerance making them highly susceptible to develop diabetes. As per the estimate in the year 2012, 29.1 million Americans or 9.3% of population had diabetes and diabetes was the 7th leading cause of death in the United States (American Diabetes Association). Also, the United States has the 3rd largest number of confirmed cases of diabetes after China and India (Albert Einstein College of Medicine). Diabetes is dangerous because it engenders gradual long-term complications like cardiovascular disease, nerve and kidney damage, blindness, hearing loss, and Alzheimer's disease (Mayoclinic).

In this study, we employ visual analytics to analyze and understand the prevalence and impact of diabetes worldwide and the United States. Our analysis uncovers countries and the counties in the United States that are at higher risk of diabetes where preventive measures and early detection can help save lives and reduce medical expenses.

Reference:

Albert Einstein College of Medicine <https://www.einstein.yu.edu/centers/diabetesresearch/facts-statistics/>

American Diabetes Association <http://www.diabetes.org/diabetes-basics/statistics/>

International Diabetes Federation <http://www.diabetesatlas.org/resources/2015-atlas.html>

MayoClinic <http://www.mayoclinic.org/diseasesconditions/diabetes/basics/complications/con-20033091>

Examining the impact of text mining on service and product industry

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Abstract

Almost all the e-commerce companies often ask their customers to review (reviews, forum and chat discussions, blogs) the products or services that they have purchased. These customers' reviews could be in millions. This makes it difficult for a potential customer to read them all before making an informed decision. At the same time, it is also difficult for the e-commerce companies to keep track and act on customer opinions. Extracting intelligence from the reviews and monitoring them remains a formidable task. Because each site typically contains a huge volume of opinionated unstructured text data which is difficult to analyze via traditional methods. This study uses various text mining techniques to analyze the data of two industries; service and product and establish the impact of these reviews on companies' productivity.

Planning for Low End Analytics Disruptions in Business School Curricula

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Kuanchin Chen**

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ABSTRACT

Analytics is getting a great deal of attention in both industrial and academic venues. Organizations of all types are becoming more serious about transforming data from a variety of sources into insight, and analytics is the key to that transformation. Academic institutions are rapidly responding to the demand for analytics talent, with hundreds of offerings aimed at producing a broad range of analytical graduates from data scientists to data-savvy managers and functional specialists. Curricula generally provide best practice methods of tackling descriptive, predictive, and prescriptive analytics; but there has been little discussion about the disruptive nature of increasingly robust analytical tools in the academic space. The net effect of astounding tool capability is empowerment of less technically trained people to address analytical complexities heretofore only comprehensible to data scientists with in-depth knowledge of mathematics, programming, and statistics. As curricula are designed, the academy should consider where knowledge will be critical in the future to address analytical problems, given relentlessly improving tool capabilities. It is not always where knowledge was critical in the past.

This paper examines skills needed for analytics in industry, academic response, and evolving analytic needs through the lens of Christensen disruption models. Progressively sophisticated software tools are shaping the evolution of organization value chains, moving them from mathematics/programming to situational awareness of data and problem-solving maps. New processes and players are invading analytics problem spaces. The challenge for academicians is the creation of dynamic curricula that is both adaptable, and addresses multiple levels of data analyses.

Keywords: analytics, curricula, disruption, software, tools, value chain, value network

DEMAND-FOR ANALYTICS

Introduction and Industry Demand

Analytics is a hot topic in business literature. A ProQuest ABI inform database search for “analytics” since 2011 yields more than 109000 articles with almost 6800 appearing in scholarly journals, and more than 36000 in industry trade publications (ProQuest, 2016). Data science has been called the sexiest job of the 21st century (Davenport & Patil, 2012). Many organizations of every type have been collecting data in their computer systems for years, and new tools and

techniques have brought about renewed interest in extracting insight from data. SAP (2012) reports that high performing companies are 50% more likely to use analytic information strategically than their competitors, and organizations can achieve 69% higher revenue per employee when a thorough understanding of business and technical requirements for business intelligence is in place. IBM (2013) reports that best-in-class organizations have formalized data management practices that increase the value of data, and are making analytics tools available to decision makers at all levels. Data is increasingly encroaching communication roles historically performed by middle management, particularly in startups (Mims, Data Is Now the New Middle Manager, 2015). The lynchpin between data and insight is analytics.

Employment opportunities abound for people who can deal robustly with data, with thousands of listings in online job sites. Typical median salaries for newly minted business analysts range from \$50K to \$65K (salary.com, 2016), and they more than double with highly sophisticated data scientist skills (glassdoor, 2016). Indeed.com's Job Trends show that there has been a 400% growth in business analyst jobs between 2005 and 2015. The Bureau of Labor Statistics projects that management analyst jobs will grow more than 13% between 2014 and 2024, double the rate of growth for all occupations (Bureau of Labor Statistics, 2016). And the analyst ecosystem extends far beyond management. Ransbotham, Kiron, and Prentice (2015) report that a significant obstacle to gaining business value from analytics is failure on the part of managers to translate analytics into business action. The McKinsey Global Institute reports a projected talent shortage of 140,000 – 190,000 analysts by 2018, and a staggering shortage of 1.5 million managers and analysts with the know-how to use big data analytics (Manyika, et al., 2011). Projected shortages in talent insures continued industrial demand for people who can produce and interpret analytics. While demand for people with effective analytics skills is clear, the exact sets of analytics skills that are, or will be, effective in a world of rapidly improving intelligent tools are not clear. In the 1960s and 1970s IBM built its hegemony in the computing industry on design, assembly, and service. As computer chips increased in computational power through the 1980s and early 1990s, the infrastructure that provided great advantages in the previous two decades became a liability. Value chains in the computer industry shifted to processors and software. Design was standardized and assembly was outsourced to low cost labor parts of the world (Christensen, 2002). As educational institutions attempt to provide analytics talent to data hungry industries, they should be mindful of potential disruptions of current processes and skills. The challenge facing developers of curricula in higher education is a meaningful connection between course content, student analytical capacities, and an emerging and disruptive technological world powered by increasingly capable software that can assist, or even replace, segments of human knowledge. Educators must consider potential shifts in the analytics value chain, and potential effects on curricula design. Institutions of higher learning may fall into the same disruption trap as commercial organizations who diligently served worlds

that were rapidly disappearing. Beginning with *The Innovator's Dilemma*, Clayton Christiansen (2000) has published extensively about disruptive business models. Implications of analytics development in the academy are examined through the lens of his models. This paper (1) reviews current analytics skills most in demand, (2) shows the response of academic institutions to that demand, (3) examines developing patterns of analytics viewed through Christensen disruption models, and (4) proposes adaptive analytics curricula to keep course content congruent with a changing analytical landscape.

Current Analytics Skills Demand

Figure 1 shows skills required for 400 analytical jobs collected from Indeed.com in 2015. Using the Pareto principle (approximately 80% of effects come from 20% of input/features/skills) the top six skills listed (i.e., top 20% of the analytics skills shown in the figure) indicate that employers attempting to fill analytical positions are demanding robust database (1,4), spreadsheet (2), and project management (3) skills with an increasing interest in statistics related analytics (5,6). There is also considerable buzz about statistically derived insights from big data (5,6,10,15,16) with related interest in the programs and techniques employed to address them (DevX, 2016). Data visualization (14) is also experiencing a rising profile among data focused organizations. Unlike the Pareto principle, the top 6 capabilities in Figure 1 address only about 51% of cumulative total listings for analytics skills. This is reasonable since consensus for standardization of analytical tools, techniques and algorithms is difficult to reach in dynamic and evolving business problem spaces. Historic analytics constraints (such as heavy computational or mathematical knowledge) are fading from key requirements of analytical talents partially due to increasingly powerful computational tools directed by progressively sophisticated algorithms. As a result, softer analytical skills like those of project management are growing in importance. The ideal analyst must balance both soft and technical skills.

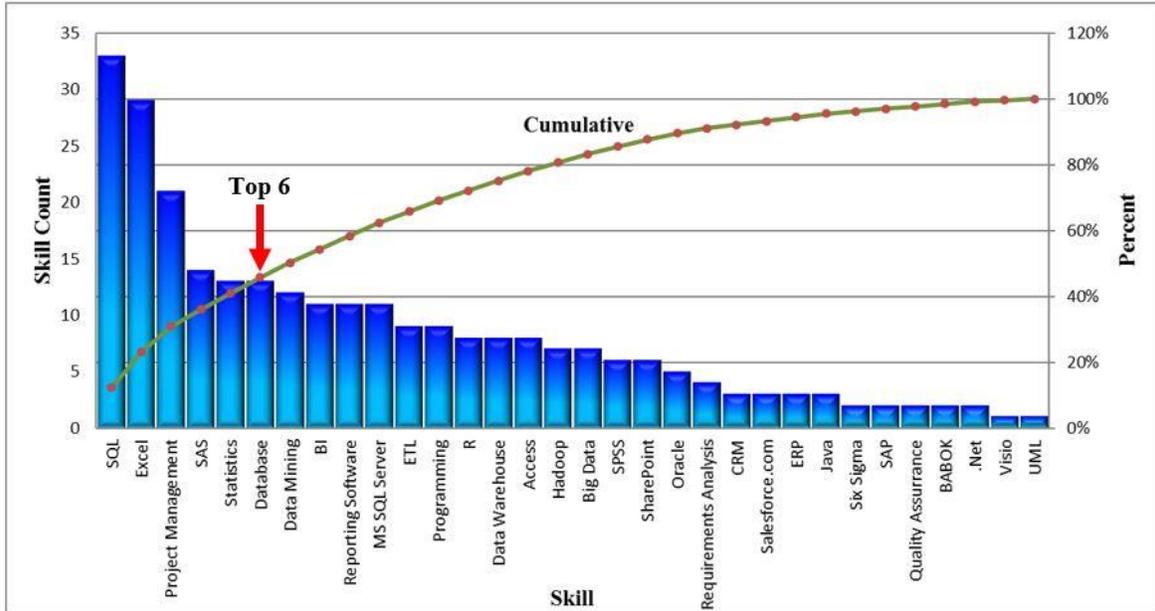


Figure 1: Analytical Job Skills

Business School Response

Business education is responding to analytics demand. AACSB, the leading international business accreditation organization, states in its most recent standard (Standard 9) that analytics, data mining, storage and reporting are key areas of focus for a Bachelor’s degree in business. Similarly, standard A7 of its Accounting accreditation echoes the same need for business analytics to strengthen accounting programs (AACSB, 2016). Demands of industrial enterprises and academic governance organizations are prompting curricula responses. In 2013, there were approximately 44 U.S. schools offering some form of formal analytics education (StatSlice, 2013). Today there are well over 100 schools offering analytics degrees, an impressive 227% growth of academic degrees in BA within a few years. And there are some signs that analytics silos are starting to disappear. The university of Pennsylvania’s Wharton School of Business is integrating analytics throughout its full time Masters of Business Administration program (Gellman, 2016).

The most popular academic analytics subjects delineated in a survey of more than 70 academic institutions are shown in Figure 2. Offerings fit well with the skills most in demand by industrial organizations: analytical core (including spreadsheets, introductory statistics, and other analytical foundation skills), databases, project management, and advanced statistics. Programming as a discipline is more popular in academic (rank #6) than industrial spaces (rank #17) but programming logic is fundamental to analytical processes and techniques, so its place in academic curricula is assured. Data visualization is also popular in both academic (rank #10) and industrial (rank #14) domains. The market for software and services supporting data

visualization is currently valued at \$4.12 billion and is expected to grow more than 9 percent per year through 2019 (Business Wire, 2014).

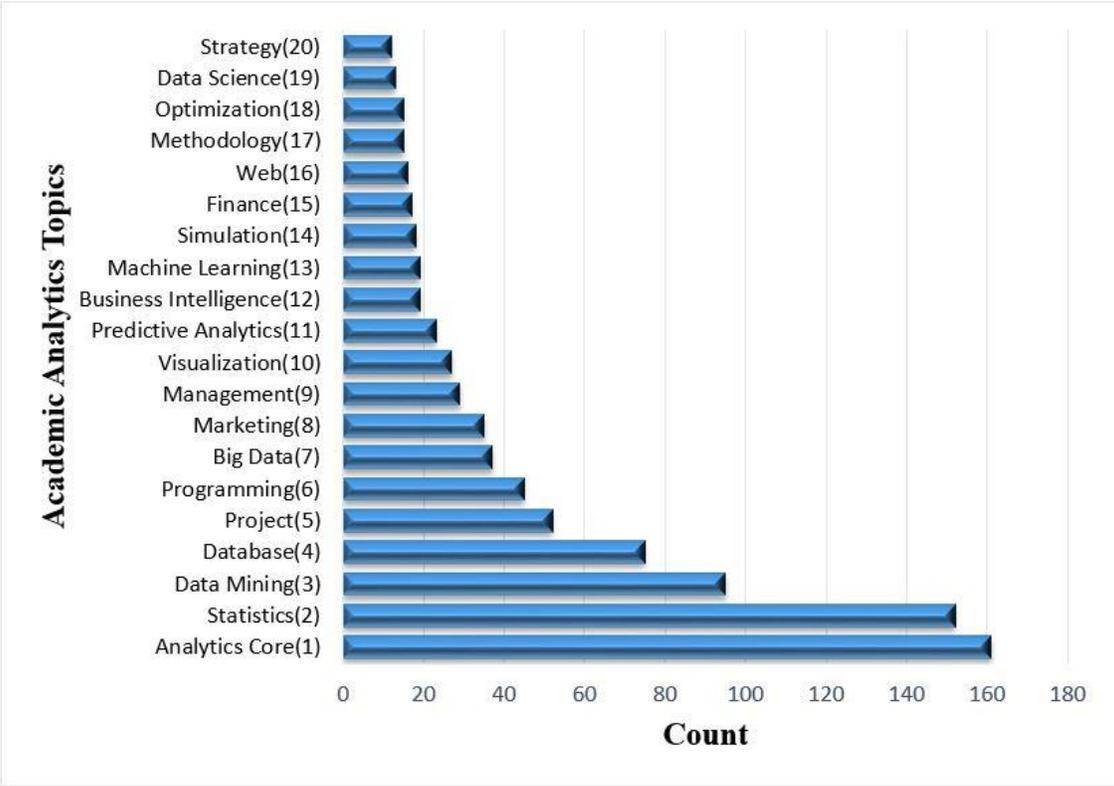


Figure 2: Academic Analytics Subjects

CURRENT ANALYTICS CURRICULA

Cegielski & Jones-Farmer (2016) conducted a multi-method study investigating knowledge, skills, and abilities (KSAs) needed for entry level analysts, and describe business school curricula components that could prepare students to fill entry-level analyst positions. Results from entry-level employer job postings during January 2014 on LinkedIn, Career-Builder, and Monster were segmented into three categories: business, analytical, and technical. Desired KSAs in business included communication, industry knowledge, self-discipline, client orientation, and project management. Analytical KSAs involved problem frameworks, integrative and predictive analysis, story telling with data models, and understanding connections between data models and business decisions. Technical KSAs incorporated analytical applications, programming languages, and technology platforms (Ibid, p. 103). A graphic model of the Cegielski and Jones-Farmer segmented KSAs is presented in Figure 3.

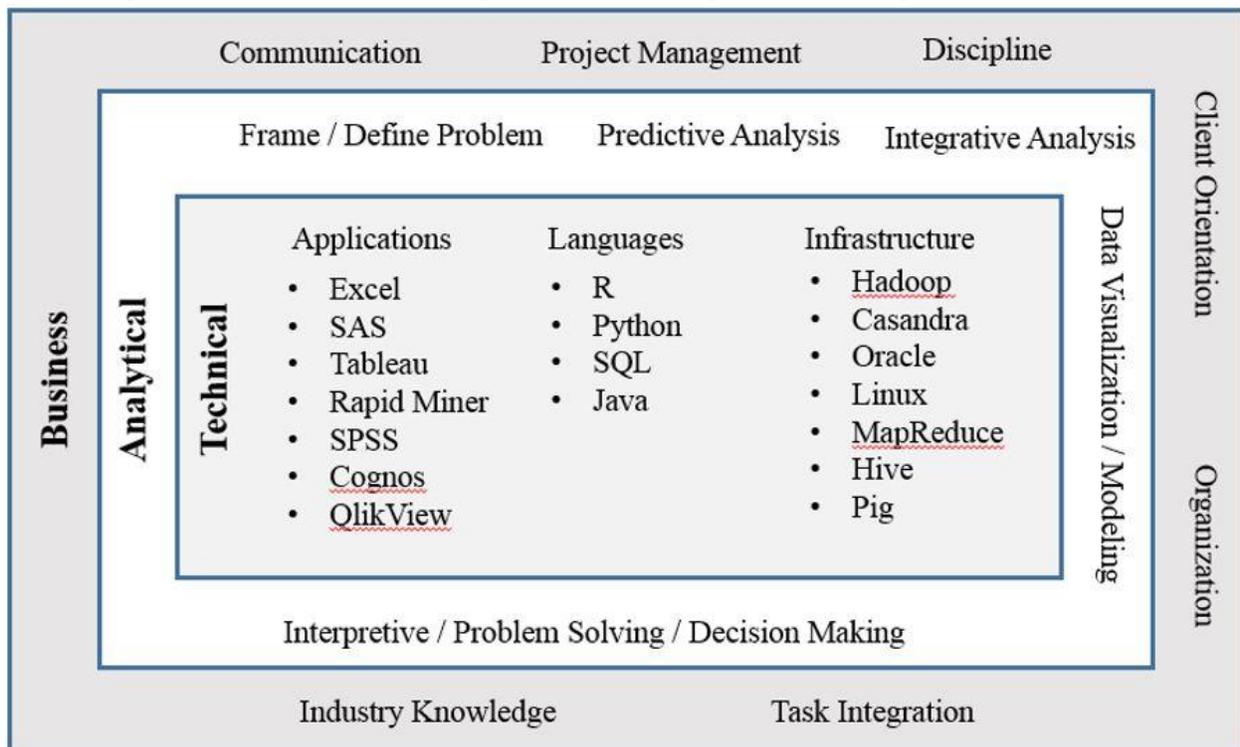


Figure 3: Segmented KSAs described by Cegielski and Jones-Farmer

Analytical and technical KSAs were complementary to the skills established from Indeed postings previously discussed. Indeed.com postings and the Cegielski and Jones-Farmer study suggest that the principal KSAs expected by employers of analysts include

- Understanding the business context of the data involved in the analysis
- Ability to appropriately frame analytical problems

- Effective application of technology tools and techniques to connect data patterns with business decisions
- Communicate insight effectively, recognizing both supplier and client perspectives

BUSINESS AND ANALYTICS KSAs IN DISRUPTIVE ENVIRONMENTS

The bullet points just described are not exclusive to analytics specialists. In data driven organizations, all high performing business people must understand the business context of data relevant to their professional responsibilities, appropriately frame problems they are attempting to address, apply technical tools and techniques to connect patterns with business decisions, and communicate insight respecting both the positions of suppliers and clients. Turel and Kapoor (2016) report that organizations expect BA tools and BA mindsets to be dispersed throughout all disciplines as they work to integrate analytics corporate-wide. They describe needed transformations in business schools to address analytics skills:

To illustrate some aspects of the needed transformation, a business student majoring in information systems ten years ago needed to have background in traditional data storage and management. In contrast, contemporary graduates... need to be familiar with data warehousing, reporting tools, real-time data transformation and loading, and perhaps even technical issues such as distributed data storage architectures (e.g. Hadoop and MapReduce).

Casting a wide analytics net means that both analytics and functional specialists will need robust data skills, although analytics specialists clearly hold a current advantage in depth of analytics process understanding. Functional specialists will not need detailed knowledge of MapReduce – a basic way to retrieve and manipulate data in a distributed big data environment. They will concentrate on mashing together data from a variety of sources for analysis, regardless of their storage characteristics and locations. Only analysts focusing on data storage and delivery will likely need a detailed understanding of MapReduce. For people who are trying to make sense of data, connections to data storage locations will be made seamlessly by technology tools employed. With time, there is reason to wonder how many people will need a granular knowledge of analytics tools and techniques. With rapid development of tool robustness, gaps between functional business specialists and analysts are narrowing, bringing new analytical capacities to business people of every discipline. Rapidly advancing technologies are creating a low-end disruption in the world of analytics, where complex problems that were once only tackled by trained analytical specialists are rapidly becoming more accessible to functional specialists.

Historic Patterns of Technology Disruptions

Historically, the products and services of emerging industries dependent on new technologies were available only to an elite group that had means of access, with delivery dependent upon

highly paid, highly trained intuitive experts capable of dealing with the complexities of rapidly evolving technologies. Early in the development of telephones, photography, automobiles, air travel, and computers only individuals or organizations of substantial wealth could afford them, but eventually these industries were made accessible to large numbers of people through innovations in technology, business models, and value networks (Christensen & Grossman, 2009). With industrial maturity, dependence upon highly trained intuitive experts gave way to dependence on processes and systems. Innovations augmenting or replacing intuitive experts improved consistency, increased prediction, and lowered costs. And multiple innovations disrupted existing systems competing on the basis of simplicity, affordability, and accessibility (ibid, p.6). An example of a highly successful process innovation is Henry Ford's assembly line, which improved productivity, reduced costs, and made automobiles available to mass markets. Development of an industry is highly reliant upon business models and value networks. Clayton Christensen (ibid, pp. 9, 180) describes both. A *business model* consists of the following components:

1. *Value proposition*: product or service that helps customers do jobs they want to get done
2. *Resources*: people, property, equipment, facilities, technologies required to deliver value propositions to customers
3. *Processes*: habitual ways of completing repeatable tasks successfully
4. *Profit Formula*: Required revenue and margins to deliver the value proposition

A *value network* is the context of a business model, linking suppliers, customers, and channels to satisfy customer needs. Industrial transformation cannot occur through technology alone. Technology innovations must be framed in business models and value networks. Christensen makes a distinction between two types of innovations: sustaining and disrupting. Advances that drive performance improvement as measured by historic customer perspectives of value are sustaining innovations. They help market-leading organizations continue to improve their products and services to their best customers. But the people and institutions that benefit most from sustaining innovations are market leaders because sustaining innovations support existing business models and value networks. Disruptive innovations are often less capable than their sustaining counterparts in delivering features and functions, but they are simpler and more affordable. When they enter an industry, they are not sufficiently robust to appeal to the main customer base, but they attract a group of new customers who are either over-served by the offerings of market leaders or cannot afford products and services of leading companies. A simplified Christiansen disruptive innovation model is shown in Figure 4 (ibid, pp. 4-7).

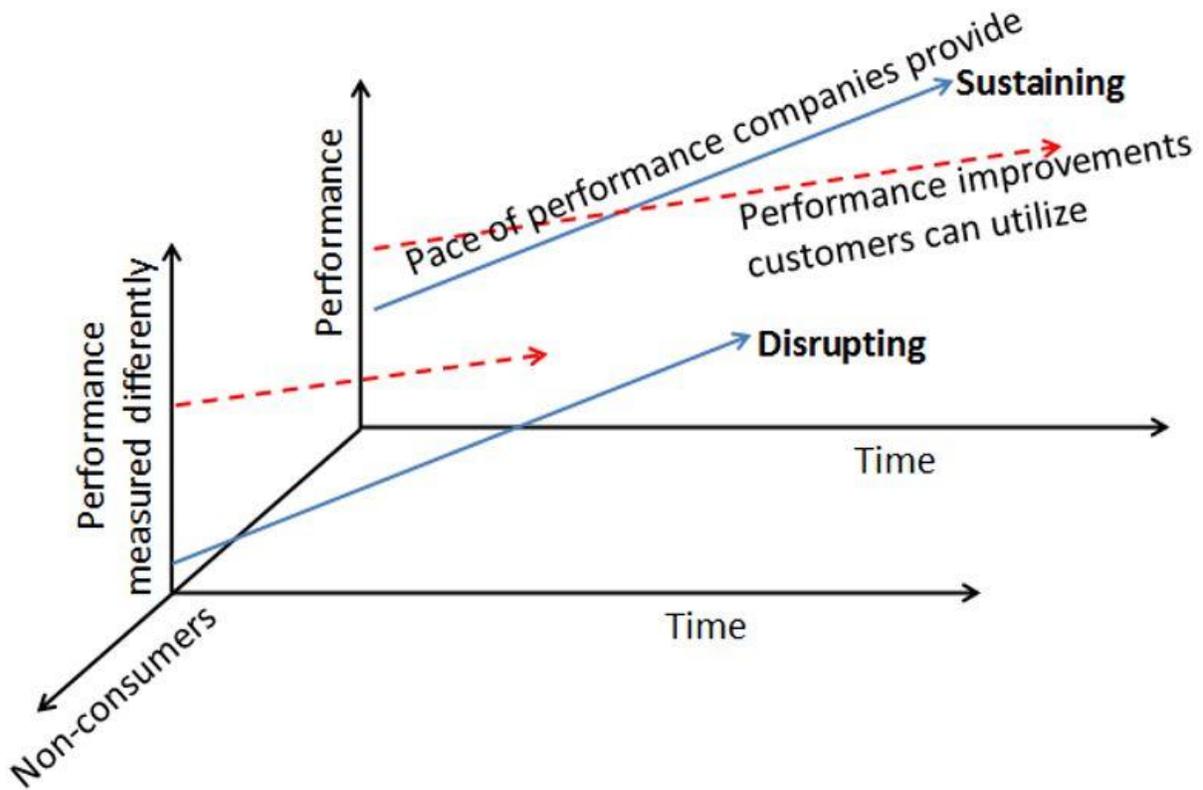


Figure 4: Simplified Christiansen Disruptive Innovation Model

Performance of products or services is plotted on the vertical axis and time on the horizontal axis. The orthogonal non-consumers' axis in the third dimension permits different customer planes for sustaining and disrupting innovations. The sustaining section of the chart contains the main customer base while the disrupting portion includes new customers who were either non-consumers or over-served former consumers of products and services offered by market leading companies. An important contention of the model is that companies can provide performance at a faster rate than customers can use for their own benefit. In other words, there is a time lag between the availability of performance features and the ability of customers to use those features to their advantage. The simplified model does not show the multiple customer segments and distribution curves of the full model, but the concepts are clear: performance outpaces understanding of how to use it, and disrupting innovations provide lower levels of performance compared to market leading products and services, but they meet expectations of a different set of customers with different business models and value networks. The performance pace of disrupting products and services also increases at a faster rate than performance utilization. If performance in the disrupting plane is capable of satisfying the needs of the main customer base of the sustaining plane, the entire industry changes.

When industries first emerge they are highly dependent upon intuitive experts who

operate on heuristic rules, based upon their experience and training, to solve problems that are either completely unknown or ill-defined. These experts are always in short supply and are highly compensated. Intuitive experts drive investigations into the systems and components of the problems they confront. With time, intuition is replaced with process understanding. As more is understood about systems involved, processes are created to deal with challenges regularly confronted in activates needed for effective system operation. The movement from intuition to process understanding is dependent upon the recognition of systemic relationships and component interactions. Often, specialized equipment is needed to reveal operational systems. Microscopes are needed to understand bacteria, x-rays reveal anatomical conditions invisible to the naked eye, and computer assisted laboratories gradually open understanding of genetics. When systems are sufficiently understood to achieve a desirable outcome, effective problem-solving measures can be incorporated into processes, and dependence upon intuitive experts is greatly reduced.

Disruption Model Adapted to Analytics

The Christensen disruption model of Figure 4 is adapted to analytics in Figure 5. Analytics solutions can be classified as descriptive, predictive, and prescriptive. Descriptive analytics aggregates data, and applies filters to show sums, averages, or counts of data segments. Spreadsheet pivot tables are examples of descriptive analytics. Predictive analytics involves probabilistic mathematical models that use historic data to predict possible future outcomes. Linear regression, logistic regression and many statistical models are available for predictive analytics. Prescriptive analytics connects predictive models with business decisions. The way IBM's Watson artificial intelligence system answers Jeopardy questions is an example of prescriptive analytics in action. After analyzing a Jeopardy question, it responds based on a series of business rules. Operation of a self-driving car is example of several forms of analytics combined, with the vehicle taking action based on both analytics and rules.

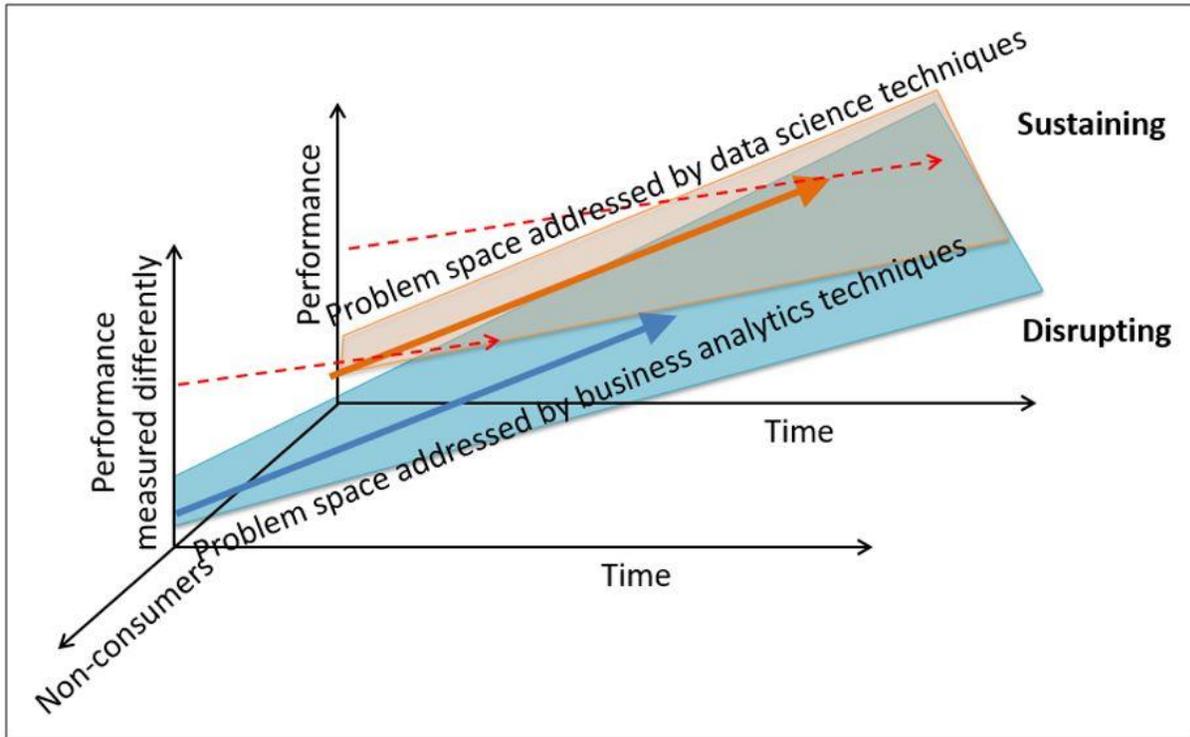


Figure 5: Christensen Disruption Model Adapted to Analytics

In the background of Figure 5, data scientists continue to push the frontiers of analytics with real time solutions for massive data sets delivered at high velocity, and frequently involving a variety of data formats. The problem space that data science addresses cuts across specialty problems and generic applications of analytics. The performance requirements of this discipline range from algorithmic efficiency to solution process alignment with problems. Although many organizations can benefit from this broad spectrum of analytics, substantial numbers of tasks are gradually being accomplished more by advancements in analytical tools than the mathematical and statistical understanding of tool users. For example, neural network problems that used to require programming with or without access to application development interfaces (API) can now be answered using software packages that require only drag-and-drop user interfaces. Problem spaces once visited only by trained data scientists with technical skills in software development, mathematics and algorithmic design are now being explored by analysts with significantly less technical training, but powered by robust software tools. As Figure 5 shows, problem spaces that business analysts are trained to handle gradually eat into problem spaces of data scientists. As a result, value propositions for business analysts are concerned less with mathematical soundness or efficiency (which is increasingly accomplished by tools), and more with problem frameworks, insights drawn from the datasets, and solution quality. The movement of mathematical wizardry from user to tool is one reason that usability and

visualization are key elements of analytics delivered through major players in the Business Intelligence (BI) market. Gartner, a leading technology research and advising company reports that business intelligence software is undergoing a new market perspective focusing on the delivery of self-service tools for business users and business analysts. Data visualization is a significant component of the new BI focus with three analytical/visualization tool organizations (Microsoft Power BI, Qlik, and Tableau) in the “Leader” section of its business intelligence and analytics “Magic Quadrant” (Parenteau, Sallam, Howson, Tapadinhas, Schlegel, & Oestreich, 2016).

There is considerable interest in data science skills as organizations of all types attempt to determine the best frameworks and processes to gain insight from data that grows exponentially in volume, variety, and velocity. Data science recruiter Alec Smith (2016) describes the data science skill set:

1. Problem solving
2. Statistics/Machine Learning
3. Computing
4. Data Wrangling
5. Tools / Technology Expertise
6. Communication and Business Acumen

With the exception of some parts of machine learning, skill sets of data scientists are nearly identical to the entry level analyst capabilities described by Cegielski and Jones-Farmer. Of course, data scientists have much greater depth of knowledge than entry level analysts. But as tools get more powerful, sophisticated, and easier to use, the statistical, programming, and problem-solving techniques of data scientists are gradually being incorporated into analytical software available to business analysts, giving them access to predictive and prescriptive tools. Complex problem spaces are opening to masses of people; however, the ability to utilize advanced tools may not synchronize with their capabilities. In many cases, business analysts must spend considerable time and effort learning the strengths and limitations of tools; and exercise care when interpreting results. Tools are new and exciting “black boxes” that demand respect of users. The down side of over reliance on tools include vendor lock-in, overdependence on third parties, application of tools in inappropriate problem spaces resulting in erroneous conclusions, and other potentially perilous outcomes.

ANALYTICS BUSINESS CURRICULA

The Analytics Divide

The vast majority of business school students study traditional business functional specialties in management, marketing, accounting, and finance. Many schools also offer majors in computer

information systems, concentrating on software applications, but lines are blurring between technology and functional specialists. We are all technologists to some degree now. All business professionals must establish competency in software that impacts processes for which they are accountable. The good news is that hardware / software systems are growing in their capacity to deal with increasingly complex tasks and, at the same time, becoming easier to use. New algorithms and tools are largely responsible for a gradually disappearing distinction between functional and technical specialists in a growing number of business environments. There remains a difference in depth of knowledge, but computer applications are being transformed from robotic slaves that require every task to be explicitly detailed, to electronic consultants capable of mathematical and statistical wizardry unknown to the computer user. An example is Amazon's Echo Dots that is capable of performing prescriptive analytics, such as asking Kayak to locate trips within \$500 of budget. Computing power, as indicated by the number of transistors on microchips, is overwhelming. The Intel 8086 processor created in 1978 had 29000 transistors. The Intel Xeon processor has 2.6 billion (Kidd, 2013). Putting together processors and distributing computation across multiple machines has enabled analytics possibilities that are nothing short of astounding. With new capacities in data processing and storage, people are now able to look at large samples or even entire populations, lessening the issue of statistical sampling errors. With so much computing power, constraints lie largely in the cleverness of the algorithms.

The concept of the "digital divide" emerged in the late 1990s, labeling the gap between people with access to technology and those without access. The gap was problematic because of a general recognition that people need the ability to effectively utilize technology tools in order to operate successfully in modern society. While the term "digital divide" may oversimplify the complexities of the consequences of human interaction with technology, it did serve as a framework for discussion for both educators and policy makers. Jan van Dijk (2006) states that between 2000 and 2005, there were thousands of conference sessions devoted to the digital divide, focusing on opportunity, resources, participation, and skills. As decision-making becomes more data driven, and lines blur between analytics and data science because of increasingly powerful tools, there is a growing awareness that successful business people must have the ability to effectively utilize analytical technology in order to operate successfully in their environments. Projected shortages of analytics talent suggest there may be a developing analytics divide.

Technology offers exciting ways to bridge that divide. Analytics conferences are flourishing. Website Kdnuggets (2016) alone lists more than 100 data analytics conferences scheduled between October 2016 and October 2017. Encroachment by functional business roles on activities previously limited to highly trained intuitive technical specialists has been relentless, as new tools and detailed processes evolve to offer beneficial technology-driven

capabilities to all business roles. The 20th century saw great inroads by computers in the tasks and actions of making and moving things. A similar fate is in store for knowledge work in the 21st century (Chui, Manyika, & Miremadi, 2016). Traditional disruptions were impeded by challenges in establishing value networks connecting producers and consumers. Internet cloud services have removed many historic potential obstacles involved in establishing value networks that leverage analytics software.

Business Analysts and Data Scientists

The role that increasing tool sophistication will play in addressing analytical business questions is shown in the disruption model of Figure 6. The most sophisticated tools will be created and used by data scientists to answer the most complex business analysis questions. Computational power will continue to grow permitting unprecedented insight from multifaceted data sets describing problem spaces in heretofore inaccessible granularity.

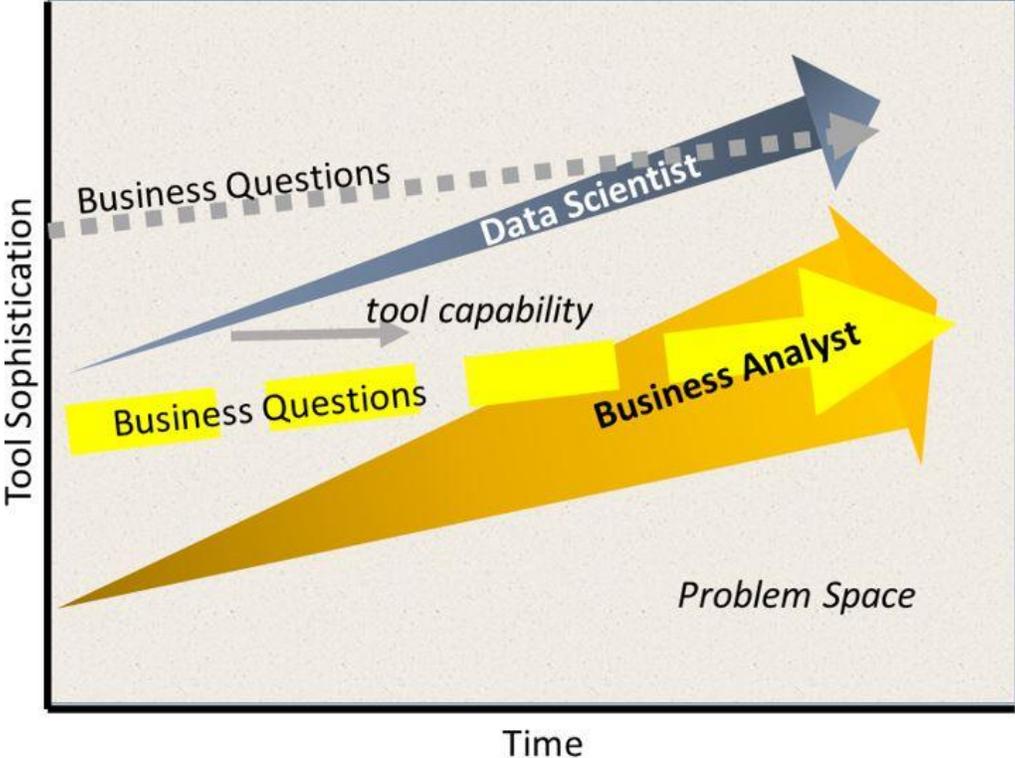


Figure 6: Increasing Role of Tool Sophistication in Analytics

This cutting edge of analytics will be occupied by an elite core of data scientists pushing the frontiers of knowledge. There will not be many participants in this rarified atmosphere. But, with time, tools developed for data scientists become available with improved ease of use to business analysts answering lower level, less complex questions or questions that were once possible to address only through deep training in mathematics or statistics. There is room for a

great many business people in this role. And there is room for a great number of questions with varying degrees of complexity. The real key in the model is the problem space. Sophisticated tools have limited utility unless they can be applied intelligently to the problem space at hand.

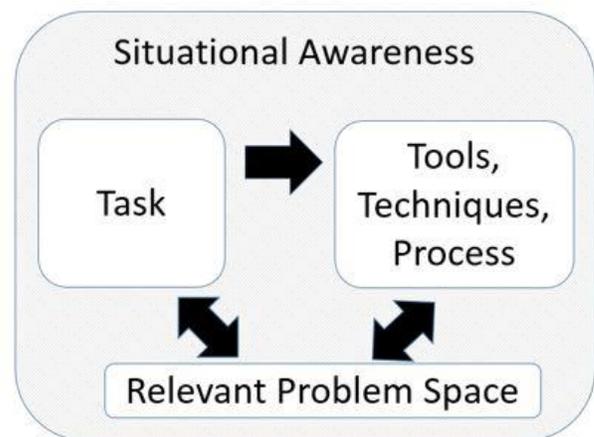
Business specialists should be a primary target market for analytics teaching in business schools as analytical skills are designed to delve into the problem spaces relevant to business professionals. Data savvy functional specialists should become increasingly capable of insightful and sophisticated analyses, as they learn more about the environments represented by their data, and the tools and techniques that can help them make sense of the circumstances that confront them. This is a major shift in focus. Previous forays into the world of analytics required detailed understanding of complex mathematics and statistics, and the ability to program that understanding into algorithms. Now software can perform mathematics and statistics easily with pre-programmed algorithms. The challenge for many analytic tasks involves understanding the context of the data subject to exploration or evaluation, appropriate methods of analysis needed to address problems or opportunities, and tool manipulation skills to successfully apply analytical methods. We are already seeing companies like JDA in supply chain and Visier in human resources offering data science as a service. This new focus of business analyst capacities is shown in Figure 7.

Figure 7: Business Analyst Focus

Functional specialists who know data context, have the skill to operate increasingly powerful software, and connect tools and processes with problem categories offer great value to their organizations.

Outcome based Course Design for Data Savvy Functional Specialists

The shift in focus from underlying mathematics to suitable tool application in relevant problem spaces plays a role in planning higher education curriculum content. Foundation courses in programming logic and statistics are required for proper comprehension of tools and techniques, but foundational understanding does not have to include granular complexities embedded in software tools. For example, the majority of traditional software systems analysis and design topics such as data flow diagrams, unified markup language, and user interface design that primarily deal with software internals do not appear in analytics curricula, industry job announcements or even AACSB standards. An appropriate analogy to analytics skill demands is the gradual detachment of automobile drivers from the mechanical operation of their vehicles. Drivers of modern transportation vehicles can perform the tasks of efficient and reliable travel to



their desired destinations without knowing anything about detailed complexities of vehicle maintenance and repair, as diagnostics become increasingly reliant on computers. Drivers must appropriately apply tools and technologies available in their vehicles to tasks of moving people and/or goods from geographic origin to end point. Business analysts must be able to understand their assigned tasks, the relevant problem space in which they operate, and possess sufficient expertise in tools, techniques and process to turn data into insight. Tools have to be understood at the application level, not the mathematical or computational levels. As tools grow more powerful and easier to use, techniques become more accessible, and processes analyzing problem space segments become more standardized, there is a reduced need for intuitive experts who understand the granular infrastructure of the mathematics employed to address analytic problems and opportunities. The need for fine granular understanding of algorithms is not eliminated, but it is more relevant to the ‘tool makers’ than than ‘tool users’. Designers of analytics courses should emphasize problem frameworks and both business and data situational awareness. Students will need guidelines about which tools are best applied in which circumstances. Connecting analytics techniques to problem spaces also provides a means to address the challenges of translating analytics to business action expressed by Ransbotham et al (2015).

The Consequences of Arrogance

Many educators in analytics have a granular and robust understanding of the mathematical and statistical infrastructure of advanced analytics, and are rightly suspicious of the dangers of careless “black box” analytics practices. But arrogant dismissal of the potential impact of increasingly robust tools in the hands of smart functional business people carries its own risks. Neither computational algorithms nor analytical tools constitute a successful solution to most business problems. Rather, they are elements of a path to peek inside problem spaces. A good balance of both presents great opportunities for business students. This is evidenced by industry data, AACSB standards, and our survey of academic programs as well as the academic literature.

Venture capitalist Anshu Sharma describes technology solutions as a stack of layers from infrastructure to end use. As an example he portrays internet technology as a stack beginning with a server, adding sequential layers above: operating system, cloud abstraction, application, and end user. He claims that companies are often blindsided when they assume the expertise they have developed on a lower layer of the stack will make it easy to deliver higher layers (Mims, *Why Big Companies Keep Getting Disrupted*, 2016). That delivery is often challenged by people lacking “firsthand empathy for what customers of the product one level above theirs in the stack actually want” (ibid.) The advantage smart functional business people have over data scientists is they understand better what users need at the top layer due to their domain knowledge or specialty function. Of course, arrogance cuts both ways. Functional specialists applying tools they do not fully understand are, indeed, dangerous. But if they become experts

with analytics tools and techniques, appropriately map them to problems, and are careful about their application, they can deliver significant value to their business teams and organizations. With time, their increasingly powerful tools will allow them to deliver the same value as low end data scientists. With technology advancing exponentially, they stand an excellent chance of eating data scientists from the bottom.

Adaptive Value Network Curricula in a Disruptive Landscape

As software tools evolve into artificial intelligence consultants, and continue to disrupt current analytics processes and methods, there is no static academic curricula that will insure that students will be appropriately prepared for analytics needs of organizations as they pursue insight from diverse and voluminous data sets. One reasonable choice for effective curricula is one that builds

1. a solid foundational understanding of the functional activities of business
2. an appreciation of supplier customer relationships,
3. understanding of problem spaces and techniques to address them, and
4. helps students apply tools appropriate to problem solutions.

What is needed is a value network for analytics curricula adaptable to new technology advances. With the rapid development of analytics tools, the real key is the connection between data scenarios and appropriate tools, recognizing constraints and potential abuses of software output. A generic planning model for value network curricula is shown in Figure 8.

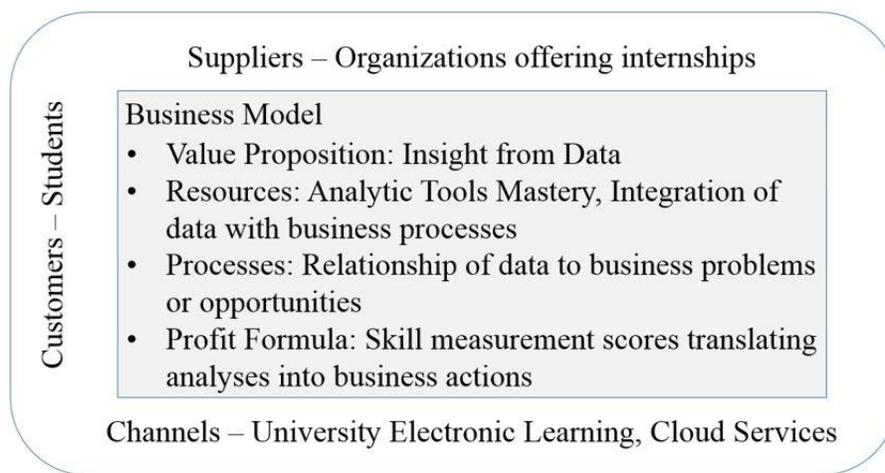


Figure 8: Value Network Curricula

The heart of the value network is an adaptable business model connecting tools and business processes, and an understanding of the role data plays in business problems or opportunities. Business domain knowledge requires a thorough understanding of traditional functional specialties of business like marketing, management, finance, and accounting. It includes a recognition of organization processes and project management, and can effectively fit into the

value network through internships. Delivery channels of academic content are readily available from electronic learning systems and cloud services. From an analytics perspective, students should recognize how to approach problems, mathematically define them; and apply appropriate analytical tools and techniques to data and business needs. Skills needed to accomplish this already appear in the literature and job postings. Robust spreadsheet and database skills create a solid analytics foundation. Cegielski & Jones-Farmer (2016, p. 105) state: “the most important prerequisites for entry-level business analytics positions are a high level of mastery of Excel and SQL followed by basic capabilities in SAS and R.” Although other statistical tools might be substituted for SAS and R, the need for Excel and SQL skills in the current world of analytics is apparent. We see a similar trend in our collection of job postings, where SQL, Excel and Project Management are among the top three skills appearing in jobs that require analytics (see Figure 1). We can expect them to continue to be important in the future as Excel connects with Power BI and cloud services; and big data tools like Cassandra, Spark, and other elements of the Hadoop ecosystem offer an SQL-like environment for people to transition from the traditional relational database world into big data. A major emphasis in courses should include ways to map powerful tools and techniques to data sets and problems spaces. With calculations becoming more autonomous, picking the right tool, and awareness of the right technique for the problem at hand take on greater importance. Students should be trained to map analytical techniques such as regression, classification, clustering, and association to types of data sets and problem spaces.

Flexibility and adaptability in course content and pedagogy are major factors of success. But the excitement emanates from the tools. Erik Brynjolfsson and Andrew McAfee (2012) of MIT tell us “The key to winning the race is not to race against machines, but to win using machines.”

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A Comparative Study of Network Modeling Using a Relational Database (e.g. Oracle, MySQL, SQL Server) vs. Neo4j

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Introduction

According to Mansaf and Kashish (2016), big data growth is very high. It is very difficult to manage due to various characteristics, which is why Hadoop and neo4j are both critical to using large datasets and applying knowledge from them to real-world scenarios. Hadoop was developed from Google’s techniques in analyzing large datasets whereas neo4j is graphical software. There are two basic functions when using Hadoop. These functions are how the program stores files and how the program processes data. Hadoop is capable of storing files larger than the disk space available on a single node in a network or server and is capable of storing multiple large files at once.

Shifting focus away from the technical language of Hadoop’s usage to its applicability to modern business problems and interests can make discussions of the software more accessible to those without data-science backgrounds. Parms (2015) states in his article that businesses need not be aware of the finer points of Hadoop’s operating protocols, only that they must understand how data are stored, removed, and processed upon Hadoop’s installation and use.

Hadoop is an open source program package, meaning that the code of the program is available to all for modifications with little to no restrictions. Thus, anyone can use the program as a platform upon which to build his or her operations. In addition to anyone being able to access Hadoop, its open source nature allows for high degrees of personal modifications to best suit specific datasets. The four most important modules of Hadoop are the Distributed File-System, MapReduce, Hadoop Common, and YARN (Dhyani & Barthwal 2014). All of these modules are necessary for a basic understanding of the program and smooth application thereof. According to Zujie, Jian, Weisong, Xianghua, and Min (2014), the inefficiency of Hadoop fair scheduler for handling small jobs motivates us to design the Fair4S, which introduces pool weights and extends job priorities to guarantee the rapid responses for small jobs.

Distributed File-System

The Distributed File System is what makes storing and accessing data from multiple locations, as well as linking said locations, work smoothly. Normally, the individual node would determine a file system, as they are typically part of a computer's OS. Hadoop, however, uses its own file system instead of the one on the node, which allows access to data from a computer using any supported OS.

MapReduce

MapReduce provides the basic data examination tools for Hadoop. It is named after the key functions it performs: reading the data from the database, putting it into a format that can be analyzed (called a map) and carrying out mathematical operations, such as sum or mean, within the dataset (reduce).

Hadoop Common

The third module is Hadoop Common. This provides the tools via Java needed for the user's OS to read the data stored in the Hadoop file system.

YARN

The fourth module is YARN, which manages the resources of the particular nodes involved in storing and analyzing data. This allows for diagnostics to be run on nodes with failures or errors as well as monitoring overall resource usage while working with large data sets.

Hadoop Inauguration

Hadoop, released in 2005 by the non-profit organization Apache Software Foundation, began development when software engineers realized that datasets necessary for smooth business operations were larger than what could practically be manipulated on a single storage device, such as a node or external hard drive. This is partially due to the fact that larger storage devices, while able to handle such datasets, are also less time efficient. The information being read out from the data takes much longer in larger devices to reach specific segments than in standard commercial hardware. Instead, using multiple devices in a parallel fashion gives efficiency without sacrificing data storage options.

The Usage of Hadoop

Hadoop's lack of rigidity in terms of both software and hardware usages means that companies are able to modify or create systems as necessary, saving money in the long run by allowing choice of vendor. It has become the most widely used analytics software for nodes that are not specially created for large data processing. This makes it popular among businesses, as it is practical as well as time and cost efficient (Dhyani & Barthwal 2014). Most large online presences use Hadoop, as anyone is able to download and modify the software (Dhyani & Barthwal 2014). These modifications made by either individuals or businesses are often shared

with Hadoop's development team (Dhyani & Barthwal 2014), allowing the product to be improved upon given real-world scenarios and concerns. This collaboration in development is critical not only to the maintenance of open-source software, but also to paving the way for innovative changes in big data analytics.

Even in its raw state and without the complicated data analysis tools, Hadoop itself can be incredibly complex and challenging to work with (Dhyani & Barthwal 2014). This is why Apache, such as Cloudera developed several commercial versions of the software (Dhyani & Barthwal 2014). These software packages make the entire process of utilizing Hadoop simpler, from installation to usage and troubleshooting. These commercial packages also include training and support to streamline the usage process (Dhyani & Barthwal 2014).

Companies are free to expand their usage of Hadoop when they strategically expand. This includes adding new software as well as reimagining the use of old packages. The support garnered from the analytics community as well as from those who use Hadoop for their own personal needs, has led to the software being accessible for everyone.

You might also want to read:

- Big Data: What is Spark - An Explanation For Anyone
- Spark Or Hadoop - Which Is The Best Big Data Framework?
- Big Data: R Explained in less than 2 Minutes, to Absolutely Anyone
- How is Big Data Used In Practice? 10 Use Cases Everyone Must Read
-

Neo4j

Despite the abundant applications of relational database management systems, the trend of usage has moved towards graph databases such as Neo4j. This goes beyond the needs of the data analytics community. Graph databases are able to perform operations on more complex data and relationships, which are not necessarily removable from the original data records. One of the desirable applications of Neo4j is its ability to do symmetric processes in a number of systems simultaneously. Adding Neo4j to the repertoire of products used by a company will combine extant Oracle relational database management systems with the computational power of a graph database to uncover previously unexplored relationships, reduce time to market, and manipulate the data in a more time-efficient manner. Neo4j is a highly scalable native graph database that leverages data relationships as first-class entities, helping enterprises build intelligent applications to meet today's evolving data challenges. This article explores the differences between relational databases, graph databases and data models. In addition, it explains how to integrate graph databases with relational databases and how to import data from a relational store. The demand for engineers with Neo4j skills is growing tremendously. Tomorrow's jobs require NoSQL and graph database skills and these technical skills are needed for career advancement. Whether evaluating a graph database for an enterprise application, growing a

startup business or even working on an afternoon project, one would not need to fully download and install the application to determine whether it is the right fit.

Neo4j has the largest and most vibrant community of graph database enthusiasts that contributes to the Neo4j ecosystem, as seen below.

- 1,000,000+ downloads, adding 50,000 downloads per month
- 20,000+ graph education registrants
- 20,000+ meet-up members
- 500+ Neo4j events per year
- 100+ technology and service partners
- 200 enterprise subscription customers, including 50+ of the Global 2000

Neo4j delivers lightning-fast read and write performances, while still protecting data integrity. It is the only enterprise-strength graph database that combines native graph storage, scalable architecture optimized for speed, and ACID compliance to ensure predictability of relationship-based queries. Neo4j makes it easier to load data into with the following capabilities:

- Staggering loading speed of huge data sizes, with very low memory footprint
- Choose how much and which data to import, without worrying about volume
- Whiteboard-friendly Data Modeling to Simplify the Development Cycle
- The logical model is the physical model
- 1/10 the time-to-production by closing the gap between the business and IT
- Make changes on-the-fly as business requirements change

Neo4j has been hardened through **years of production** deployments and rigorous ongoing testing, so you can trust it. Plus, you can engage with the **graph experts** providing world-class support, at the right level for your organization. Neo4j is the **only** graph database recognized by key analysts such as Forrester and Gartner (Agricola, 2016) to have enough production applications to warrant inclusion in reports. Clustering and data replication demanded by transactional and operational applications.

Whiteboard-friendly Data Modeling to Simplify the Development Cycle

- The logical model is the physical model
- 1/10 the time-to-production by closing the gap between the business and IT
- Make changes on-the-fly as business requirements change

Most Neo4j customers find their **total cost of ownership decreases** through optimization of the production environment and increased efficiency. With Neo4j, one can choose the [license](#) and bundle package that needed, and add clustering and data replication capabilities that make sense for your deployment and your organization. Building a graph of your data is

fairly simple as the graph structure represents the real world much better than columns and rows of data. GraphGists are teaching tools, which explore how data in a particular domain would be modeled as a graph, and see some example queries of that graph data. Any developer can create a GraphGist by visiting portal.graphgist.org.

Neo4j, the most utilized database, aids businesses by both creating products and services as well as through innovative use of extant tools. Neo4j has the advantage of providing the opportunity to build new applications, developing new techniques to be used in existing applications, committing resources to decrease the development time of new and more complex applications, and lowering the price of its tools in order to maintain affordability as compared to competitors' database services.

Customers have enjoyed recommendations for modified continued use of Neo4j's products as well as the speed at which they are able to make comments and receive information and recommendation about the latest consumer preferences and business trends. Neo4j is orders of magnitude quicker than MySQL, requiring one-tenth to one-one hundredth fewer lines of code while being versatile enough to add new functions into the software, according to Volker Pacher, Senior Developer (Dayaratna, 2014). The software is able to utilize these functions and this efficiency by making data relationships the foremost factor in its operation, making it a relational database. All of these factors combine to make Neo4j optimal when processing a variety inputs and file sizes while maintaining data integrity, regardless of whether the file is locally or globally created. Neo4j is capable of supporting large files in a multitude of languages and has support options to match the varied uses of the program.

Oracle's innovations to its cloud-based service continue to afford businesses competitive opportunities while keeping usability at the core of its design. Advances in data management make the transfer of data files of all sizes to the cloud easily and securely. The cloud's ability to scale to data files as well as to rapidly analyze them helps provide faster delivery of results, greater time for innovation, and saves not only time but money. Even if your use of the cloud is development-based rather than geared towards storage, you will have instant access to high-quality database options. Oracle Database Cloud services generate profitability and value by utilizing the hybrid development strategy to allow clients to have the same experience wherever they go.

SQL Server is a relational database management system (RDBMS) created by Microsoft. It has all the standard features of such software while still maintaining a competitive edge against Oracle Database (DB) and MySQL. Like other RDBMS programs, SQL Server supports ANSI SQL, the standard language.

Hadoop's Apache program allows multiple computers to work on large data sets at the same time via programming models. It can scale from one server up to potentially thousands of machines, offering local computation and storage at each individual computer. The library is

designed to address issues in the application rather than using hardware, to deliver a highly reliable service.

Maintaining a competitive edge during this time of increased demands and diverse software is challenging. Several functions and applications are coming together to create a new landscape of analytics. Some of these factors include diverse data or large amounts of data coming in at once, whether generated automatically or manually, and the majority of this data is not structured. This means that current software or applications are put under a large burden when attempting to analyze the rapid-fire intake of complex data. As companies attempt to find a solution to these problems, Hadoop's file system (HDFS) is able to meet their demands. It is increasingly becoming more affordable and is capable of processing low levels of structure in data, making its services a key contender in today's analytics field. Using advanced analytics, HDFS is able to find insights even within massive data files; its algorithms have developed to learn and predict trends within the data, aiding in computations for predictive analytics with large data sets. Text analytics is an up-and-coming method of explaining the data, which may decrease interpretation errors as well as a computer failure network in unstructured data clusters. Analytics within memory and databases have decreased computation times, helping businesses stay competitive as they analyze large files.

As enterprises look to embrace big data and Hadoop, they have numerous questions: "How can I deal with data preparation on Hadoop?" "How does utilizing Hadoop impact visualization and other kinds of analysis?" "What kind of analytical techniques are available to analyze Hadoop data?" "How do I use Hadoop with in-memory processing?" (Halper, 2014).

Using in-memory analytics sets runs the calculations on RAM rather than the disk, which avoids the time-consuming I/O concerns. This is a huge advantage when working with large data sets as in-memory processing can be orders of magnitude faster than accessing the data from the disk, which benefits companies and consumers by cutting down on iterations. In-memory processing can also be distributed, which means it can handle the multi-pass-through data and iterative workloads without getting bogged down, all while allowing communication among independent units to take advantage of parallel processing.

Advanced analytical techniques such as data or text mining and machine learning can benefit tremendously from in-memory processing, especially by reducing the time spent on analytics. This means that the statisticians are free to fine-tune models or explore new approaches without worrying about the potential loss of time, leading to innovative designs and ultimately increased productivity. For example, a single iteration for a predictive model can be reduced from hours to minutes, meaning more and better models can be built and utilized to examine data, giving a competitive edge.

Once data has been stored in memory, it can be accessed more efficiently. If someone is able to quickly build a model, they are also able to share and test the model with others at the

same rapid pace. The model can be adapted as suggestions arise; creating a better and faster iterative process that yields an accurate model and benefits businesses using Hadoop. These benefits are conferred whether a business relies on Hadoop for memory capabilities, processing, or single pass analytics or not. Begin with the [Single Node Setup](#), which shows you how to set up a single-node Hadoop installation. Then move on to the [Cluster Setup](#) to learn how to set up a multi-node Hadoop installation.

Ambari™

A web-based tool for provisioning, managing, and monitoring Apache Hadoop clusters which includes support for Hadoop HDFS, Hadoop MapReduce, Hive, HCatalog, HBase, ZooKeeper, Oozie, Pig and Sqoop. Ambari also provides a dashboard for viewing cluster health such as heat maps and ability to view MapReduce, Pig and Hive applications visually along with features to diagnose their performance characteristics in a user-friendly manner.

HadoopDB began as a research effort in 2008 to transform Hadoop --- a batch-oriented scalable system designed for processing unstructured data --- into a full-fledged parallel database system that can achieve real-time (interactive) query responses across both structured and unstructured data. In 2010 it was commercialized by Hadapt, a start-up that was formed to accelerate the engineering of the HadoopDB ideas, and to harden codebase for deployment in real-world, mission-critical applications.

HadoopDB

HadoopDB combines ideas from the Hadoop and database system communities even though research challenges have emerged as HadoopDB deployed in the real world. Many of these challenges involve loading data into structured storage. Although this loading of data can greatly accelerate query execution times, the upfront cost of this load is antithetical to the Hadoop premise, which is data does not need to be organized, cleaned, and pre-processed before being available for query processing. Therefore, there are two approaches to reducing these costs: (1) an invisible loading technique where data is incrementally loaded into structured storage over time, based on users' patterns of data access and (2) a queue-based locality scheduling technique that, when data had been loaded in a heterogeneous manner across the nodes in a cluster, improves upon Hadoop's greedy scheduler and more efficiently assigns tasks to nodes that have the data stored locally.

A fundamental task in data integration and data exchange is the design of schema mappings, that is, high-level declarative specifications of the relationship between two database schemas. Several research prototypes and commercial systems have been developed to facilitate schema-mapping design; a common characteristic of these systems is that they produce a schema mapping based on attribute correspondences across schemas solicited from the user via a visual

interface. This methodology, however, suffers from certain shortcomings. In the past few years, a fundamentally different methodology to designing and understanding schema mappings has emerged. This new methodology is based on the systematic use of data examples to derive, illustrate, and refine schema mappings. Example-driven schema-mapping design is currently an active area of research in which several different approaches towards using data examples in schema-mapping design have been explored. After a brief overview of the earlier methodology, this tutorial will provide a comprehensive overview of the different ways in which data examples can be used in schema-mapping design. In particular, it will cover the basic concepts, technical results, and prototype systems that have been developed in the past few years, as well as open problems and directions for further research in this area.

Trust and Reputation have become key enablers of positive interaction experiences on the Web. These systems accumulate information regarding activities of people or peers in general, to infer their reputation in some context or within a virtual community. Reputation information improves the quality of interactions between peers and reduces the effect of fraudulent members. In this tutorial we motivate the use of trust and reputation systems and survey some of the important models introduced in the past decade. Among these models, we present our work on the knot model, which deals with communities of strangers. Special attention is given to the way existing models tackle attempts to attack reputation systems. In a dynamic world, a person or a service may be a member of multiple communities and valuable information can be gained by sharing reputation of members among communities. In the second part of the tutorial, we present the CCR model for sharing reputation across virtual communities and address major privacy concerns related to it. In the third part of our talk, we discuss the use of reputation systems in other contexts, such as domain reputation for fighting malware, and outline our research directions on this subject.

High performance data analysis is a required competitive component, providing valuable insight into the behavior of customers, market trends, scientific data, business partners, and internal users. Explosive growth in the amount of data businesses must track has challenged legacy database platforms. New unstructured, text-centric, data sources, such as feeds from Facebook and Twitter do not fit into the structured data model. These unstructured datasets tend to be very big and difficult to work with. *They demand distributed (aka parallelized) processing.*

Hadoop, an open source software product, has emerged as the preferred solution for Big Data analytics. Because of its scalability, flexibility, and low cost, it has become the default choice for Web giants that are dealing with large-scale click stream analysis and ad targeting scenarios. For these reasons and more, many industries that have been struggling with the limitations of traditional database platforms are now deploying Hadoop solutions in their data centers. These industries are also looking for the economy. According to some recent research from Infineta Systems, a WAN optimization startup, traditional data storage costs \$5 per

gigabyte, but storing the same data costs roughly 25 cents per gigabyte using Hadoop.

Conclusion

This paper reviewed two of the common modern information methods that are capable of handling big data. The first is Neo4j, which is graph based data modeling software and the second is Hadoop, which goes beyond the analysis of big data. Connected information is becoming more and more common as single-user data grows in complexity and volume. Neo4j was built to efficiently store, handle, and query highly connected elements in such datasets. With powerful and flexible data models, the real-world scenarios are fairly represented without a loss of richness. The property graph model is easy to understand and manipulate, especially for object-oriented and relational database developers. Hadoop developed from a necessity to handle the explosion of Internet-originate data and grew beyond the capabilities of commercially available systems to handle its analyses. It was initially inspired by papers published by Google, which outlined its approach to handling massive data input, and has since become the de facto choice for storing and analyzing up to petabytes of data.

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Dynamics of Buyer and Supplier Coordination in Problem Resolution

Rebecca Clemons, Indiana University East

Abstract

The dynamics of business today requires a supply chain that is agile and swiftly resolves problems in order to remain competitive. A common practice and expectation is for firms to document the supplier complaint process for suppliers that are critical to firm performance. This paper explores a supplier complaint data base for a tier-one automotive parts supplier. We use firm data to explore collaborative actions taken by the buyer and supplier during problem resolution. Our analysis of the process provides support for factors that affect collaboration and the effectiveness and speed of problem resolution within a supply chain. We consider the impact of internal and external collaboration on supplier performance and time to closure. In addition we find that certain supplier and product characteristics moderate the impact of collaborative measures on supplier performance and time to closure.

Maintaining Buyer-Supplier Relationship and Improved Purchasing Performance: An Empirical Study

Birasnav Muthuraj & Rakesh Mittal, New York Institute of Technology

Abstract

Manufacturing companies strive to develop strong relationship with suppliers to reduce cost, improve quality, and ensure fast delivery so as to achieve improved supply chain performance. Studies have shown that behaviors of top level manager of manufacturing companies have huge influences over learning capabilities of these companies to improve purchasing performance. It is also shown that components of interorganizational relationships such as relational trust, relational commitment, and shared vision are the ingredients of sharing more and quality information in these relationships, and thus contribute to shared performance. However, the roles leadership behaviors of purchase manager play in these interorganizational relationships to improve purchasing performance have not been examined to date in the operations management literature. In support for this role, literature shows that leaders who exhibit strategic leadership behaviors (both transformational and transactional leadership) have significant impact on feedforward and feedback learning capabilities in the levels of individual, group, and institution.

Extending the impacts of strategic leadership behaviors further, this study has three purposes. First, it examines the direct impacts of both transformational and transactional leadership behaviors on information sharing. Second, it examines the indirect impacts of both these leadership behaviors on information sharing through relational trust and relational commitment. Third, it investigates the relationship between information sharing and improved purchasing cycle time.

In order to achieve the above purposes, data were collected from randomly selected manufacturing companies located in India. Purchase manager and an employee who reports directly to this manager of each organization are the target participants of this study. Purchase managers were requested to provide responses for the aspects of buyer-supplier relationship and purchasing performance. Employees were requested to rate how frequently these purchasing managers exhibit both transformational and transactional leadership behaviors. No incentives were offered for these participants in return of their participation. In total, 81 complete and useful responses were received from both purchase managers and their employees. This research study reveals that different leadership styles (such as transformational and transactional leadership) have differential impacts on relational trust and commitment and on information sharing. These findings have implications for improving purchasing performance by training purchasing managers for exhibiting appropriate leadership behavior.

A Sensemaking Framework for Cross-Functional Integration at the Purchasing-Logistics Interface

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Abstract

Cross-functional integration is a central concept in supply chain management and remains an area of intense interest for practitioners. However, research on CFI at the purchasing-logistics interface has been largely neglected. To aid CFI research at purchasing-logistics interface, this paper develops a theoretical framework grounded in the literature on sensemaking. Sensemaking occurs when individuals work together to create a collective understanding of “problem situations” that informs and constrains future action. A collective understanding is solidified (sensemaking) as individuals advance (sensegiving), seek out (sensedemanding), and question (sensebreaking) proposed interpretations of events. Sensemaking is critical to developing a consensual, coordinated system of action and thus represents the micro-practices that underlie CFI. The framework developed here considers business contexts in which logistics and purchasing personnel might take on different roles of sensedemanding, sensebreaking, sensegiving, and sensemaking. In particular, the framework considers the degree of supply base complexity and logistics customer service complexity faced by a business. Using these two dimensions of the business environment, the framework proposes four primary types of CFI at the purchasing-logistics interface: purchasing-led CFI, logistics-led CFI, innovation-led CFI, and efficiency-led CFI. The framework suggests that when the CFI types are appropriately matched with business conditions, performance outcomes will be improved. Theoretical propositions and suggested future research are presented.

Lean Service Simulation (LSS): A Hands-On Simulation

Jaideep Motwani, Ph.D. and William M. Mothersell, Ph.D.

Abstract

In the past two decades, both manufacturing and service organizations have successfully designed and implemented lean concepts with the goal of improving quality, lowering cost, and enhancing customer satisfaction. In a typical lecture-based classroom setting, effectively teaching lean concepts (such as one-piece flow, Kanban, quick changeover, value-stream, among others) to undergraduate business students can be challenging since majority of them have never seen a manufacturing process in action. In such cases, hands-on simulation, where the actual work floor is simulated, can be a fruitful learning tool to understand these critical concepts. The Lean Service Simulation (LSS) is designed to simulate several types service processes. Participants easily relate the simulation stations to service processes in a service-based organizational context. This hands-on simulation replicates the real-world and clearly depicts for students how a simulation can be used to visualize, analyze, and optimize a lean process in the service sector.

Bridging Foreign Inventory Availability Risk & International Logistics Costs Through the Use of Consignment Warehousing

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Abstract

One of the major risks when dealing with global material sources is the potential for delays in the logistics process. Inventory must be available when needed or businesses face stockouts, late deliveries and potential loss of revenue. The first lever of choice is typically premium transportation, which can quickly erode any deflationary material savings and international logistics costs.

This presentation will look at the role of consignment inventory warehousing through the eyes of both the foreign supplier and the domestic purchaser. Consignment warehousing will be demonstrated as a WIN-WIN for both parties and shown to be an effective tool to reduce risk and improve foreign material availability.

Supply Chain Operations Planning and Carbon Footprint

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Abstract

In this supply chain, we model the production planning and distribution of products for an OEM with manufacturing facilities in several countries and meeting global demand. The model considers varying exchange rates, carbon footprint, and variability in demand and lead times. The purpose of the study is to explore the impact of maximizing profit on the carbon footprint and minimizing the carbon footprint on the profit and how these will be affected by the variability in exchange rates, demand volatility, and uncertain lead times. The model will enable a decision maker to consider various scenarios and help arrive at better decisions.

Supply chain management, quality management, and environmental management: A conceptual model

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Abstract

The purpose of this study is to investigate the interrelationships among quality management and supply chain management concepts to predict the relationships between implementation of environmental practices and environmental performance. A conceptual model has been developed to show the relationships among charismatic leadership, continuous improvement, collaborative communication with suppliers and customers, and environmental system to predict environmental performance. Moderation role of supplier evaluation has been discussed. These relationships are focused to address environmental issues faced by the hotel industry. Implications for both theory and practice have been discussed in this study.

Introduction

Hotel industries nowadays provide high importance for implementing green practices due to the pressure escalated from both internal and external environments. For example, environment-focused changes that were introduced in the water system installed at Holiday Inn, San Antonio International Airport, Texas, helped them to save in average \$68,000 of

water, sewer, and energy costs every year (Environmental Protection Agency, 2014). Marriott Group of Hotels use highly efficient lighting, low flow showerheads, and rainwater for landscaping, recycle some of their products, and donate unused items to non-profitable organizations (Marriott, 2016). Thus, most of the hotels have started to blend ecological aspects with their business strategy. Cost saving has been yielded as a result of internal pressure arising from all the departments. At the same time, external pressures, for example government policies and regulations, are also confronted by all the hotels. Green supply chain management is a process of incorporating green initiatives throughout supply chain that ranges from green purchasing, packaging, transportation, storage, handling, and delivery to the customers (Hervani, Helms & Sarkis, 2005). These green initiatives transmute traditional economic model into a circular form through a process that generates renewable resources from wastes. These resources become a part of raw materials to the same firms or others (Zhu, Geng & Lai, 2010). Literature describing green initiatives taken by manufacturing companies are abundant. However, limited studies are carried out to describe the implementation of environmental system in the hotel industry.

Organization and employee perspectives have been focused on for the implementation of environmental practices in hotel industry. In the organizational perspective, chain hotels that have modern facilities, are large in size, perceive intense pressures from stakeholders on environmental issues, and implement operational management techniques, are more likely to implement environmental practices (Gil, Jimenez, & Lorente, 2001). In the employee perspective, at what extent individual employee's know about environment, aware of environment, and concern about environment decides the intensity of implementation of green practices at hotels (Chan et al., 2014). Customer perspective has been exercised to convert the green image of hotel into improved economic performance. For example, Kassinis and Soteriou (2003) examined how environmental practices implemented in hotels support achieving market performance through customer satisfaction. Han, Hsu, and Sheu (2010) and Lee et al. (2010) focused on how the green image of a hotel changes customers' behavioral intentions of revisiting the same hotel and providing positive feedback to others about this hotel.

The question, what operational management practices motivate hotel industry to implement environmental practices? is still unanswered in the literature. This study takes

efforts to answer this question through the concepts of total quality management and supply chain management. Following Anderson, Rungtusanatham, and Schroeder's (1994) theory of quality management, this study proposes that charismatic leadership behaviors, exhibited by the top level manager of hotels, support collaborative communication with both suppliers and customers and support implementation of continuous improvement process that would lead to implementation of environmental practices. Consequently, hotels would observe improved environmental performance. Figure 1 shows how relationships among charismatic leadership, collaborative communication with suppliers and customers, continuous improvement processes, and implementation of environmental practices predict environmental performance.

Theory and propositions

Charismatic leadership is defined as the ability of a leader, in a situation that requires tremendous change, to transform his/her behaviors, attitudes, and qualities to develop enthusiastic and well-prepared employees (Sosik, Juzbasich & Chun, 2011). It should be noted that leaders having charisma are not characterized by their personalities or the situations. It is characterized by the perceptions of their employees (Willner, 1984). According to Bass (1985) and Barling, Weber & Kelloway (1996), charismatic leaders exhibit the following three behaviors:

Attribute related idealized influence – this behavior is described by the perceptions of employees on the attributes of leaders who frequently show confidence, power, and ways of promoting idealism,

Behavior related idealized influence – this behavior is described by the perceptions of employees on the behaviors exhibited by leaders who emphasize development of mission, vision, and goals, and

Inspirational motivation – this behavior supports leaders to inspire employees to achieve a future state or challenging goals.

Supplier evaluation is a process of evaluating a supplier based on specified criteria and continuously monitoring this supplier's operational performance. As a result, companies reduce cost and probability of taking risk (Gordon, 2008). Many companies that are aiming to improve

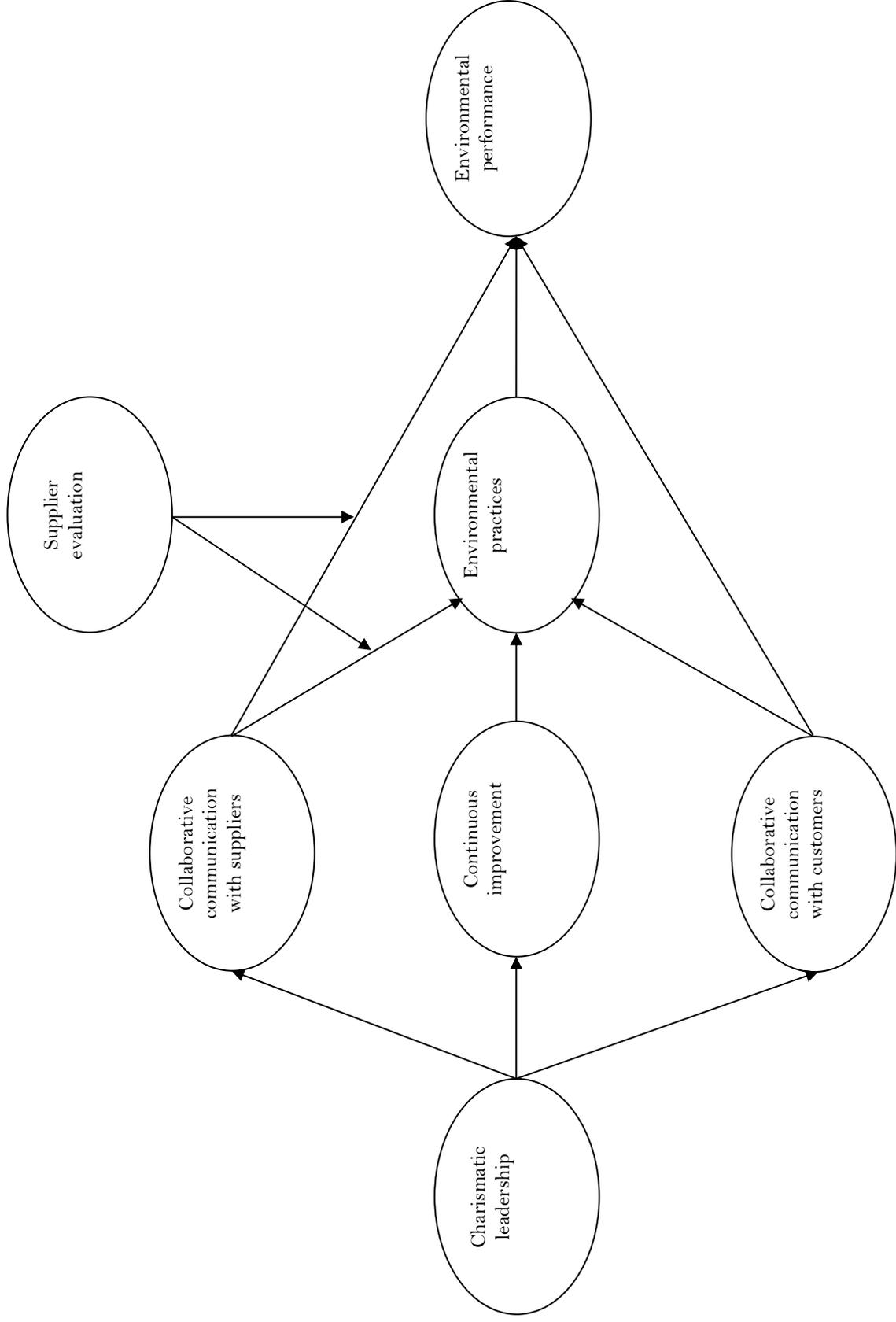


Figure 1. Conceptual model of this study

environmental performance focus on supplier capabilities such as their internal environment system, recycling process, and waste management programs, the attributes of their products, number of environmental certifications they received. In addition, they also consider at what extent suppliers comply governmental regulations (Handfield et al., 2002).

Collaborative communication is an ongoing process through which companies frequently communicate with suppliers aiming of receiving quality raw materials at faster rate and receiving feedback for new product design and production-related issues. They also frequently communicate with customers to receive feedback on quality of product and service and to address their issues so as to improve their satisfaction. Joshi (2009) described collaborative communication with four dimensions: 1) frequency – number of times both parties communicate through mail, email, fax, and telephone; 2) reciprocal feedback – feedback given by both parties are exchanged and discussed based on what is communicated; 3) formality – making the communication planned and routine, and 4) rationality – providing enough justification for complying each other.

Continuous improvement is an organizational persuasive approach to promote incremental innovativeness by continuously reviewing all activities of a process, product, or service and improve certain activities to function in an efficient way (Anderson et al., 1994). It results in high quality of products/services, less variations in the products/services, and positive learning behaviors of employees.

Proactive environmental strategy describes all the environmental practices that an organization is committed to implement to protect natural environment (Anton, Deltas & Khanna, 2004). Hotels have their own environmental policies and release environmental report every year. For example, Marriott Group of Hotels have developed environmental indicators to measure environmental performance and have benchmarked its performance. Sometimes, companies carry out both internal and external environmental audits to measure environmental performance, and they even train employees to understand natural environment and compensate them for their contribution to environment (Darnall, Henriques & Sadorsky, 2010). Environmental performance has been widely measured by the amount of reduction in wastewater, solid waste, air emission, consumption of hazardous products, and environment-

related accidents (Zhu & Sarkis, 2004).

Charismatic leadership and collaborative communication

In any supply chain network, leadership plays a vital role in maintaining buyer and supplier relationships. Leader is the one who breaks the barriers between all the employees and brings them together to work as a team to achieve a common goal. Since achieving organizational goals is the prime responsibility of charismatic leaders, they find all the creative ways to achieve the goals through encouraging interactions between employees and customers and between employees and suppliers. Ideals adopted by charismatic leaders attract both suppliers and customers to engage with the firms. Research studies show that transformational leaders, who also exhibit charismatic behaviors, have shown high commitment and strong trust in their relationship with suppliers (Hult et al., 2000). When one party believes in others and committed to comply with the conditions of the relationship, we can expect more flow of information between both parties. Waldman, Siegel, and Javidan (2006) showed that transformational leaders of North American firms have engaged in corporate social responsibility. In this direction, charismatic leaders having a vision for protecting environment, will replicate this vision during their engagement with employees, suppliers, and customers. When these leaders continuously search for new ways to promote green initiatives, they would never hesitate to seek suggestions from suppliers and customers.

Proposition 1: Charismatic leadership behaviors will be positively associated with the extent of collaborative communication with suppliers.

Proposition 2: Charismatic leadership behaviors will be positively associated with the extent of collaborative communication with customers.

Charismatic leadership, continuous improvement, and environmental system

It should also be noted that charismatic leaders are unconventional and always encourage employees to take risk to achieve set vision. If their vision is related to natural environment, it is more likely that these leaders would encourage employees to involve in activities that would strengthen ecological system. Since employees learn enormously from risk-taking activities, these leaders create jobs that invoke employees' intelligence and encourage employees to perform these kinds of jobs. Leaders who are working in green-

environment-promoting organizations are benevolent and provide high emphases for openness to change (Egri & Herman, 2000). In this direction, we expect that hotels having charismatic leaders in the top level management will encourage continuous improvement among employees to address environmental concerns. When these processes yield innovative ideas to solve environmental issues, companies would likely to accommodate environmental-related contributions in their internal system. For example, they would like to spend more resources to create awareness among their employees to understand ecological system.

Proposition 3: Charismatic leadership behaviors will be positively related to the extent of implementation of continuous improvement process.

Proposition 4: The extent of implementation of continuous improvement process will be positively related to the extent of implementation of environmental practices.

Collaborative communication and environmental system

The ideas or feedback companies receive from their suppliers would be more useful to solve environmental issues. When suppliers are sought for ideas to reduce quantity of solid waste by companies, suppliers can redesign their products or can develop new environmental friendly products according to the requirements of companies. Such redesign or development of new products has direct impact on environmental performance. For example, collaborative communication between Cayuga Sustainable Hospitality, a Costa Rica based hotel group, and its suppliers resulted in minimal packaging and the development of oxo-biodegradable bottles that degraded after three years to CO₂, water, and biomass. Some hotels have already started to use redesigned shampoo and conditioner dispensers in the bathrooms, and these initiatives support the reduction of solid waste and improve cost savings. It should be noted that when companies engage highly with suppliers with an aim of resolving environmental issues, their internal policies may also be revisited. For example, firms may concentrate environment related contributions while recruiting, appraising, and compensating employees. Collaboration with suppliers would also help companies to understand the environmental practices adopted by suppliers, and companies most likely would start to replicate the same practices at their plants. If hotels want to make such collaboration to be more fruitful, they should select their suppliers based on environment-related criteria. Environment-related discussions would yield more

benefits only when suppliers have knowledge about environmental issues or have implemented environmental practices at their plants. Therefore, the effects of collaborative communication will be strong on implementation of environmental practices at hotels only when these suppliers are evaluated based on environmental criteria set by these hotels. Similarly, the effects of collaborative communication will be strong on improved environmental performance of hotels only when these suppliers are evaluated based on environmental criteria set by these hotels.

Proposition 5: The extent of collaborative communication with suppliers will be positively associated with the extent of implementation of environmental practices.

Proposition 6: The extent of collaborative communication with suppliers will be positively related to environmental performance.

Proposition 7: The effects of collaborative communication with suppliers on the extent of implementation of environmental practices will be strong when hotels provide high emphases for green supplier evaluation.

Proposition 8: The effects of collaborative communication with suppliers on environmental performance will be strong when hotels provide high emphases for green supplier evaluation.

Ideas of development of new products or redesigning existing products are also pointed out by customers, and it is obvious that they play vital roles on transforming organizations into flexible organizations. However, it is imperative for hotels to develop mechanisms to understand customer needs and analyze the pattern of their needs. Innovativeness derived from customer-orientation would thus become the source of sustaining competitive advantage (Tajeddini, 2010). Environment-oriented innovativeness always leads to reduction of solid waste and supports ecological system. When customers forward their environment-related concerns to companies, companies would be motivated to study the current practices implemented at their plants and would make efforts to implement practices that address customers' concerns. Llach et al. (2013) found that service companies, particularly restaurants, focus highly on implementing environmental practices when they collaborate with customers to improve their products or services. Spanish hotels have made this kind of collaboration easier for customers to understand environmental concerns. As a result, these hotels witnessed high

occupancy rates and gross operative profit per available room per day (Molina-Azorin et al., 2009). Therefore, at what extent service companies collaboratively communicate with customers is important for the implementation of environmental practices and for improving environmental performance.

Proposition 9: *The extent of collaborative communication with customers will be positively related to extent of implementation of environmental practices.*

Proposition 10: *The extent of collaborative communication with customers will be positively related to environmental performance.*

It is very well proven that manufacturing companies that have adopted green supply chain management have witnessed improvement in environmental performance (Zhu & Sarkis, 2004). When companies publish environmental expenses in their report, the amount of expenditures on the activities of promoting sustainability is clearly highlighted. Thus, hotels can show improved environmental performance when they maintain a separate environmental accounting system. Hotels, such as Wyndham Hotels and Marriott Group of Hotels, annually publish environmental reports that support cost savings and report all the environmental initiatives. Since employees become aware of environmental initiatives, they make efforts to reduce environment-related accidents and carbon foot prints.

Proposition 11: *The extent of implementation of environmental practices will be positively related to environmental performance.*

Discussions

Limited studies have been conducted in the operations management literature to address environmental issues. No studies up to our knowledge have investigated the interrelationships among quality management and supply chain management concepts to improve environmental performance. Theory of quality management postulates that visionary leaders improve operational processes through their collaboration with suppliers and customers, and such process improvement leads to high customer satisfaction through continuous improvement and employee fulfilment (Anderson et al., 1994). The current study extends theory of quality management to predict improved environmental performance. It proposes that charismatic leaders support implementation of environmental practices through

strengthening infrastructure to communicate with suppliers and customers and through encouraging continuous improvement process. As a result, these leaders witness improved environmental performance.

This study has certain implications for practitioners. Hotels should organize training programs for top level manager to exhibit charismatic leadership behaviors. All employees should be trained to understand the ecological implications of the work so that they take ownership and help reduce environmental footprint. Hotels and suppliers should be well-connected electronically so that real time information can be exchanged. At the same time, hotels and customers should be electronically connected to exchange feedback and environment-related concerns. Hotels now can achieve higher customer satisfaction when they address customers' concerns with the help of well-established communication channels. Finally, suppliers should be evaluated based on certain environmental criteria such as recycling wastewater, reusing disposable items, and environmental certifications.

Various reliable and validated measures could be used to empirically test the proposed model. For example, Bass and Avolio (1995) have developed Multifactor Leadership Questionnaire, and three dimensions such as attribute- and behavior-related idealized influence and inspirational motivation of this questionnaire can be used to measure charismatic leadership behavior. The measure developed by Joshi (2009) could be adapted to assess collaborative communication between suppliers and hotels and between customers and hotels. In order to measure continuous improvement, the measure developed by Anderson et al. (1995) can be adapted to hotels. The concepts of proactive environmental strategy examined by Darnall et al. (2010) could be adapted to measure at what extent hotels provide high emphasis for the implementation of environmental practices. The criteria proposed by Handfield et al. (2002) could be used to examine at what extent hotels evaluate their suppliers. Finally, indicators used by Zhu and Sarkis (2004) can be used to measure environmental performance. This study also bounded by some limitations. For example, pressures exerted by stakeholders are not considered in this model. It should be noted that charismatic leaders are very effective to improve performance when they work under uncertain environment or under external pressure. In future, researchers can examine the moderation role of stakeholder pressure and firm characteristics to extent this model.

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Exploring a Project Management Approach to Managing Educational Programs

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Abstract

Every student enrolled in a higher educational degree program, e.g. the MBA, can be viewed as a client who has “contracted” for a *project* with an institution that is expected to deliver and facilitate the completion of a prescribed set of courses. Like any project client, each student can be expected to evaluate the institution’s performance on the usual dimensions of time (time to graduation), cost (affordability), and quality (content and instructor engagement) along with, additionally in the educational context, flexibility (schedule and delivery mode) and choice (number of electives offered). From the institution’s standpoint it is strategically important that the *program* be able to deliver on such expectations. Thus an institution’s task of program management can be envisioned as one of managing multiple individual projects with the objective of optimizing average duration across the projects while meeting cost, quality, and any other criteria deemed important to the student and/or institution. Managing multiple projects simultaneously poses a significant challenge to the institution beginning, for example, with the need to define appropriate measures of project performance that capture the subtleties in the education sector.

Educational projects as defined here vary considerably from conventional projects such as infrastructure construction or IT development. The client’s (student) participation goes well beyond solely financial commitment and includes active value co-creation. Completing courses and navigating a path to degree completion requires collaboration of student and institution through the advising process. Responsibility for project performance therefore falls on both parties: the student must enroll in the right courses at the right times while the institution, for its part, must ensure that the right courses are offered at the right times. Given that institutions are increasingly coming under financial pressure, they must work within the

constraints of limited faculty and other resources. Even though a student enrolled in a program may commit to completing all the courses/credits necessary to graduate, the ultimate decision of completing courses rests primarily (if not exclusively) on the student. In this research, we propose a project management approach to managing educational programs that takes into account these various strategic concerns and operational nuances.

Risk hedging for global sourcing and domestic selling under stochastic price-sensitive demand by taking exchange rate uncertainties into considerations

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Abstract

For the purposes of this study, we assume that the retailer stocks a certain quantity of a single product from a supplier overseas during a certain time period, and then sells it to the domestic customers during the selling season. In the study, exchange rate fluctuations are involved in the oversea purchasing and the demand in the domestic selling is random and is negatively impacted by the selling price. Through simulation and numerical analysis, this paper demonstrates 1) the level of risk decreases at a rapid rate as the number of suppliers increases; 2) As the purchasing cost trend increases, the risk increases exponentially; 3) When the market demand is more sensitive to the selling price, the downside risk will become progressively larger.

Keywords: risk Management; purchasing; supplier selection

Introduction

Typically, the exchange rate for a free-floating currency varies against that of other currencies and is determined by the market forces of supply and demand. Exchange rates for such currencies fluctuate constantly, as quoted on financial markets, thus making it more difficult for buyers to know when to order.

On account of exchange rate fluctuations in international sourcing, a company will typically increase its order quantity under favorable exchange rates and decrease its order quantity when the exchange rates are unfavorable, thus impacting the seller's demand and profits accordingly.

In addition to the order quantity adjustment, the buyer will also need to adjust its domestic selling price accordingly under exchange rate floating.

We simulate the above decision environment and procedure by assuming that the retailer stocks a certain amount of a single product from a supplier overseas during a certain time period, and then sells it to the customer during the selling season. Then we analyze the corresponding risks.

Risk analysis of adding potential suppliers and decreasing exchange rate trends through simulation

We assume that the retailer will pay the supplier $a(t) > 0$ dollars per unit when the unit is purchased at time $t \in [0, T]$. We further assume that the purchase price per unit for the retailer, after exchanging the foreign currencies to U.S. dollars, satisfies the usual Black-Scholes equation (Black and Scholes 1973), *i.e.*, the price at time t is expressed by the stochastic differential equation

$$da(t) = a(t)\{\mu dt + \sigma dX(t)\} \quad t \geq 0,$$

where $\mu \in \mathbf{R}$ denotes the average rate and $\sigma \in \mathbf{R}^+$ represents the volatility rate. The process $X = \{X(t), t \geq 0\}$ is the standard Brownian motion satisfying $X(0) = 0$ a.s., $E[X(t)] = 0$ and $E[X(t)^2] = t, t > 0$.

After the retailer has completed the purchase from the supplier, the second stage involves the retailer selling the product to the customer at time T . Here we assume that the retailer charges p dollars per unit for the customer, and the demand is random and negatively influenced by the selling price p in the additive form $D(p, \varepsilon) = s(p) + \varepsilon$, where $s(p)$ is a downward sloping, concave, deterministic function of the unit selling price, and ε has a linear or log-concave density function $f(x)$ with mean μ and variance σ^2 and $x > A$. During the selling season, if the demand is less than the order quantity q , the leftovers $q - D(p, \varepsilon)$ are disposed of at the unit cost C_e and the revenue is $pD(p, \varepsilon)$. Alternatively, if demand exceeds q , then the shortage $D(p, \varepsilon) - q$ is penalized at the unit cost C_s and the revenue becomes pq .

We study two cases, in which the influence factor of selling price to the demand are .1

and .01 accordingly. In each case, we study the downside risk when the number of supplier candidates from different countries are 1,2,...and 9 and the exchange rate increases from .2 to .6 by .04.

Let $T = 100$ days and $i = .001$. We further assume that there are 9 different countries' suppliers who offer the same price after taking into account the current exchange rate. For the exchange rate trend of each supplier, $\sigma_1 = \sigma_2 = \dots = \sigma_9 = 0.1$, and $\mu_1 = \mu_2 = \dots = \mu_9 = \mu$, where μ varied according to the key in (Figure 1) to (Figure 3). At time 0 the purchase costs for supplier 1,2,3,...,9 are $\exp(1)$, $\exp(1.1)$, $\exp(.8)$, $\exp(.9)$, $\exp(1.05)$, $\exp(1.05)$, $\exp(1.05)$, $\exp(1.05)$, $\exp(1.05)$ correspondingly. The purchasing strategy was to purchase right away when the price of any supplier caused the profit to drop below the target profit. We ran the simulation 100 times and calculated the averages from the simulation results.

*Case I: demand = 3.7 - .1 * selling price + ε , where ε is a truncate normal in $(0, +\infty)$ with mean 0 and variance 1. The target profit is \$42.*

*Case II: demand = 3.7 - .01 * selling price + ε , where ε is a truncate normal in $(0, +\infty)$ with mean 0 and variance 1. The target profit is \$420.*

From Figure 1 and Figure 2, we can see that the risk increases exponentially as the purchasing cost trend increases. As the purchasing cost trend μ increases, the risk increases. It clearly shows that the downside risk increases quickly when the purchasing cost trend is more upward, and the increases are in exponential shapes from the plots. Increasing supplier bases will effectively decrease our downside risk. Also, this decreasing trend is less rigid when there are more and more suppliers. We can also easily decide the necessary number of suppliers for a certain risk level. For instance, in this example, choosing three suppliers decreased the risk to less than 20% when $\mu = .5$.

From these two cases, we notice that the downside risk is very sensitive to the impact factor of selling price to demand, *i.e.*, b in the demand function $D = y(p) + \varepsilon = g - bp + \varepsilon$. As b shrinks ten times from .1 to .01, even the target profit increase is ten times from \$42 for $b=.1$ to \$420 for $b=.01$, the corresponding downside risks decreases for any μ and number of suppliers. It seems that when the market demand is more sensitive to the selling price, the downside risk will become progressively larger.

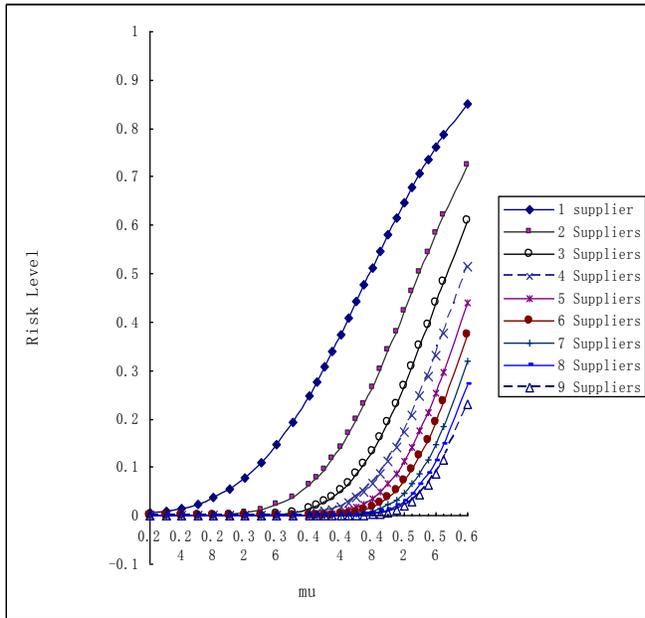


Figure 1. Risk trends when increasing the supplier bases (Case I)

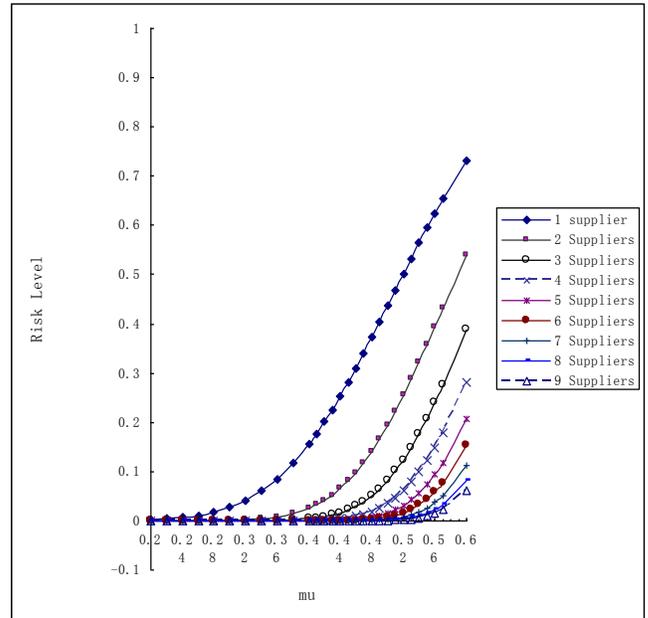


Figure 2. Risk trends when increasing the supplier bases (Case II)

Conclusion

Through simulation, this paper shows that the downside risk is very sensitive to the impact factor of selling price to demand. The level of risk decreases at a rapid rate as the number of suppliers increases. However, this decreasing rate is more obvious at the beginning and slows when there are more suppliers. As the purchasing cost trend increases, the risk increases exponentially. Furthermore, when the impact factor weights more, the risk increases more quickly. The necessary number of suppliers for a certain risk level can also be easily calculated.

Forecasting and Agility in Consumer Packaged Goods

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ABSTRACT

We present a case study assessing how the Theory of Constraints and forecasting impact shipping and retailer stocking practices for an international consumer packaged goods supplier. Our research examines a current dilemma causing out of stock issues at a large number of retailers for a well-known beverage company. Using qualitative and quantitative data and various forecasting models, we will present new insights to the CPG firm to indemnify their business and provide impactful new insights.

The Power of Indy 500 to Improve the Partner Companies

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Abstract

The Indy 500 is *The Greatest Spectacle in Racing* in the world, with about 300,000 people attending the race-day and millions of dollars in prizes for the winners. This research, which is currently under the data collection stage, proposes the use of Absorptive Capacity (AC) to understand the Indy 500 supply chain, identify how some of the Indy 500 suppliers can absorb knowledge from this partnership, and apply this experience to their own operational and financial performance.

A Makeup Purchase Decision under Uncertain Price-Sensitive Demand and Purchasing Price Uncertainty

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Abstract

If there is a potential profit increase on account of the purchase, it is quite common for a retailer to stock a specific quantity of a product a second time. However, Due to the stochastic spot market purchasing price and the selling price dependent random demand, the retailer needs to determine whether a makeup purchase is necessary and if so what are the corresponding order time, quantity, and selling price in order to maximize the expected profit. In this paper, we run simulations to analyze the inventory decisions and profits when a makeup purchase is possible. We demonstrate that when we place a makeup order, the optimal selling price drops as we order more, and when the unit cost we spend in the makeup purchase is lower, the lesser the selling price and the greater is the expected profit.

Key words: purchasing; pricing; Price Uncertainty; Price-Sensitive Demand.

Introduction

Spot market price fluctuation is very commonly practiced. The spot prices of many raw materials such as fuel, cotton, gold, metal etc. can often fluctuate more than $\pm 5\%$. Therefore, a company can potentially increase its profit by making additional purchases when the spot price drops rather than purchasing the entire quantity in advance.

Many newsvendor retailers, such as fashion retailers, enjoy a long lead time (normally 4-6 months) to place a single order since the sales season (to sell the products) is short. So during the 4-6 months lead time, even if the retailers have already made a purchase, they might still consider replenishing some more items before the selling season or they might wait for some time to possibly get an even more favorable purchasing price later on. For these companies, whether and when to place a makeup order are critical as it impacts the expected profit of the company.

Furthermore, as demand and costs impacted companies' profits, it was reasonable for the companies to combine demand and purchasing uncertainties.

In this paper, we simulate the above decision environment and procedure by assuming that the retailer has stocked certain quantities of a single product and is considering replenishing some more units from the spot market during a certain time period, and then selling this product to the customer during the selling season. As there is spot price fluctuation, the retailer needs to decide whether to place a makeup order or not, and if yes, what are the corresponding ordering time, quantity, and selling price to maximize the expected profit.

Modeling

If the firm purchases the product from the spot market before the selling season and then sells it to the market during the selling season T .

We assume that the retailer will pay the supplier $b(t) > 0$ dollars per unit when the unit is purchased at time $t \in [0, T]$. The price at time t is expressed by the stochastic differential equation

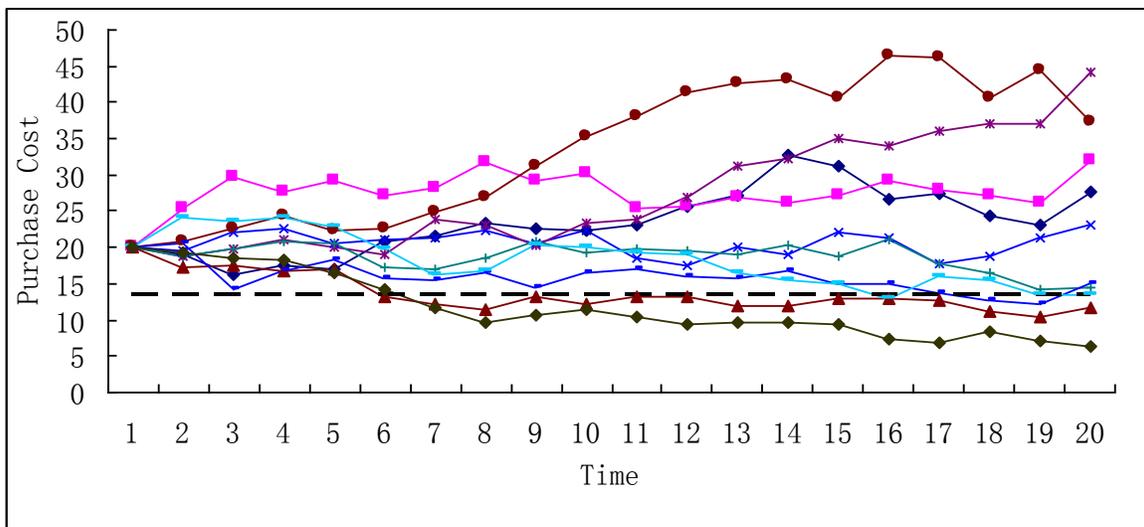
$$db(t) = b(t)\{\mu dt + \sigma dX(t)\} \quad t \geq 0, \quad (1)$$

where $\mu \in \mathbf{R}$ denotes the average rate and $\sigma \in \mathbf{R}^+$ represents the volatility rate. The process $X = \{X(t), t \geq 0\}$ is the standard Brownian motion satisfying $X(0) = 0$ a.s., $E[X(t)] = 0$ and $E[X(t)^2] = t, t > 0$. If we purchase at time $t \in [0, T]$, we assume the unit holding cost before the selling season is $b(t)[h(T - t)]$.

Simulation

In this section, we assume $Demand = 300 - 5 \text{selling price} + \varepsilon$, ε is normal with mean 0 and standard deviation 2. For the purchasing price movement, let $\mu = 0, \sigma = .1, h = .005$, and $T = 20$ weeks. We run the simulations 10 times so that we can look at multiple purchasing strategies. First, we draw the plot of these ten paths of the presale cost before selling season as depicted in Figure 2. When the trend is zero with diverse variance, we assume that we need at least 100 units for the production and purchase these 100 units at the beginning. We plan to make a makeup purchase if the unit cost drops from the present \$20 to below \$13.5 before the selling season. The dashed line shows the target purchasing cost line.

Figure 1. Numerical Examples of Unit Cost (Before Selling Season) Paths



Assuming we have already purchased 50 units at \$20 unit cost, in the makeup purchase, we purchase additional 25, 50, 75, 100, 125, 150, 175, 200, 225, 250, and 300 units when the cost goes below \$13.5 and see how the makeup purchase impacts the profit. From the plot, we notice that the target cost have been reached four times in these ten times (Theoretically the probability is 0.371) and the corresponding costs for these four times are \$13.12, \$12.64, \$12.95, and \$11.67. The corresponding average unit cost (average cost for both purchasing), optimal selling price, and the optimal profits for these four purchasing are also shown in Table1,

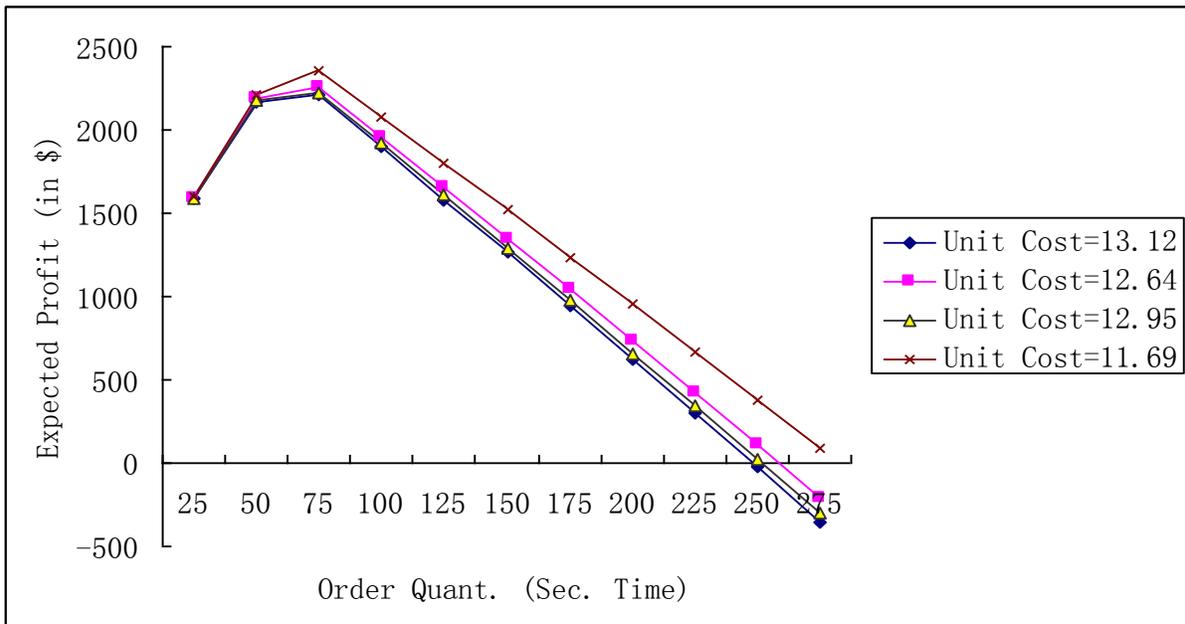
Table1. Numerical Example of the Makeup Purchasing Decision

Addit. Order Quant.	Makeup Purchasing. Unit Cost=13.12			Makeup Purchasing. Unit Cost=12.95			Makeup Purchasing. Unit Cost=12.64			Makeup Purchasing. Unit Cost=11.67		
	Avg. Unit Cost	Sell. Price	Exp. Profit	Avg. Unit Cost	Sell. Price	Exp. Profit	Avg. Unit Cost	Sell. Price	Exp. Profit	Avg. Unit Cost	Sell. Price	Exp. Profit
25	17.7	38.9	1586	17.7	38.8	1588.1	17.5	38.8	1592	17.2	38.6	1604.1
50	16.6	38.3	2172	16.5	38.2	2176.2	16.3	38.2	2184	15.8	37.9	2208.2
75	15.9	37.8	2209	15.8	37.8	2225.7	15.6	37.7	2256.2	15	37.4	2350.9
100	15.4	37.6	1898.7	15.3	37.6	1920	15.1	37.4	1958.7	14.4	37.1	2079.3
125	15.1	37.4	1583	15	37.4	1608.8	14.7	37.3	1655.6	14.1	36.9	1801.5
150	14.8	37.3	1264.1	14.7	37.3	1294.2	14.5	37.1	1349.1	13.8	36.8	1519.9
175	14.6	37.2	943.04	14.5	37.2	977.54	14.3	37	1040.3	13.5	36.7	1235.9
200	14.5	37.1	620.53	14.4	37.1	659.37	14.1	37	730.07	13.3	36.6	950.31
225	14.4	37.1	296.98	14.2	37	340.14	14	36.9	418.7	13.2	36.5	663.5
250	-	-	-	14.1	37	20.118	13.9	36.8	106.53	13.1	36.4	375.83
275	-	-	-	-	-	-	-	-	-	13	36.4	87.498

From the table, we notice that as the unit cost decreases from 13.12 to 12.95, then to 12.64, and then to 11.67, the optimal selling prices for order 150 units in the makeup purchasing are 37.3, 37.3, 37.1, and 36.8 correspondingly and the corresponding expected profit are 1264.1, 1294.2, 1349.1 and 1519.9. The same rule applies to the other order quantities as well.

Figure 2 further shows how the order quantity in the makeup purchase influences our expected profits. We notice that in these four cases, ordering additional 75 units brings the highest expected profit. The corresponding expected profits are then 2209, 2225.7, 2256.2, and 2350.9.

Figure 2. Numerical Examples of Expected Profits of Makeup Purchasing



In this case, if we only purchase 50 units at the very beginning without a makeup purchase, the optimal selling price is 40 and the expected profit is about 1000. If we purchase an additional 75 unit when the unit cost drops below 12.6, the average expected profit for these ten trials are $(2209+2225.7+2256.2+2350.9+1000*6)/10=\1504.18 .

Conclusion

In this paper, we examine the scenarios in which the retailer has the option to make a makeup purchase assuming that the retailer faces stochastic purchasing prices and selling price dependent demand. Through simulation, we demonstrate that when we place a makeup order, the optimal selling price drops as we order more, and when the unit cost we spend in the makeup purchase is lower, the lesser the selling price and the greater is the expected profit. There exist an optimal ordering time in the makeup purchase, and the further we are from optimal order time, the lower the profits we can expect.

Importance of Supplier Diversity Implementation in a Business

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Abstract

Throughout the world, societal barriers involving sexuality, race, and gender are continuing to be broken, and more people are being looked at as equals. Certifications for diverse suppliers that provide credibility to show a supplier is diverse are becoming more known across the United States. The breaking of these barriers and the increase in knowledge of diverse supplier certifications has increased the number of diverse businesses and diverse suppliers. With this increase, companies need to increase their utilization of these businesses as suppliers for parts as well as carriers for their products. Having a diverse supplier pool is very important for the company's social responsibility and return on investment, and more companies must realize the clear benefits of having a diverse supplier base.

To learn more about implementing and utilizing supplier diversity within a supplier base, a case study was conducted on the supplier diversity practices of a West Michigan company. This research allowed for the development of a framework that shows a business how to implement diverse suppliers into their supplier base using best industry practices. This framework includes a nine-step procedure to implement supplier diversity, as well as supplier diversity resources that can be used during implementation. Through the research conducted with the company and the development of the framework, conclusions were drawn that supplier diversity is an area with significant importance and complexity, as well as an area where continuous progress within a business is needed to have a successful supplier diversity program.

Interaction of National Culture and Supply Chain Disruptions- Planning and Financial Impact,

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Abstract

Supply chain disruptions have been shown to affect the financial performance of companies. Also, a company's disruptions planning and mitigation efforts may limit the financial impacts. In this research we explore the cultural factors associated with companies in different parts of the world to study their effect on disruptions planning and response. Specifically, companies from the west are contrasted with Asian companies in their disruptions planning and mitigation strategies. The stock impact from disruptions is also compared.

Mitigating Supply Chain Costs in Job-Shop Logistics Systems Using ERPs

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ABSTRACT

Research shows that poor logistics can lead to business failure. Information technology is often used in planning to improve management. Although research claims that a great number of manufacturing systems can be described as closed job shops, most recent research is more concerned with the effect of logistics on high and intermediate-volume systems such as continuous flows, assembly lines, and batch productions, than of job shops. Almost none of the studies found in the literature evaluated job-shop logistics systems with an attempt to uncover potential gains from the use of enterprise resource planning systems (ERPs). In general, logistics planning techniques with their accompanying technology such as ERPs as a package impact the execution of logistics activities. But the job-shop manufacturing component has been reluctant to adopt ERP systems for the purpose of enhancing logistics performance. Supply chain management (SCM) tools are the last mover among various industries (Kim & Kwon, 2015). Kathleen et al. (2005) found that the cost of adopting and deploying ERPs is a high entry barrier and to some extent a leading cause for not adopting logistics technology in job-shops. The average total cost of ERP ownership (TCO) is \$15 million (the lowest \$400,000 and the highest \$300 million, Meta Group, 2011; Stevenson, 2012; Koch, 2008). Hidden costs such as training, integration, testing, data conversion, data analysis, consultant fees, and post-ERP depression are among the chief reasons organizations are somewhat reluctant to embrace ERPs (Deloitte Consulting, 2010; Donovan, 2006; Weightman, 2008). This situation forces organizations sometimes to adopt simple and less costly strategies such as Slam-dunk and franchising (phased) instead of the big bang approach.

Deloitte Consulting did a study of 64 of the Fortune 500 companies. In that study, one in four companies admitted that it suffered a drop in performance when its ERP system went live. Managers explained the main reason performance drops is that everything looks and works differently from the way it did before (Stevenson, 2015) and people panic when they can do their job in a familiar way but have not mastered the new way to do it. Several studies conducted by Kumar (2008, 2009) in consideration of potential benefits of packaging American hospitals' supply chains failed to identify any significant ones, adding another reason for not adopting ERP systems in the job-shop logistics environment.

Job-shop systems are a type of production system in which a low volume of high-variety goods or services are produced. Processing is, therefore, intermittent (Stevenson, 2012). From the service perspective, a restaurant is a typical match of a service job shop to a manufacturing job shop such as a customized-carpet builder. The bill of material is a composition of a meal with ingredients such as tomatoes being components (raw materials like yarn, latex for carpet). This study was conducted in U.S. firms that design and build hand-tufted carpets for the airline industry. The firm's production systems are a job shop type, that is, a business operating on a relatively small scale. Their supply chain consists of a network of dying houses and carpet manufacturers located all over the world. Before the implementation of an ERP system, the lead-time was more than three times the average of other industries, leading to a significant decline of market shares. The situation forced the companies to lay off more than half of their workforce. New partnerships were built in an attempt to reduce the lead-time and improve the overall logistics system, but without success. Consequently, the firm was losing more and more customers. Two business audits pointed out logistics planning as the leading cause of the firm's poor performance. Many companies were facing (others are certainly experiencing) similar logistics-related issues. Prior research has claimed that performance can be enhanced by improving logistics planning using technology. The literature survey seems to indicate that manufacturing job shops could be the exception that proves the rule.

This study was conducted in its natural environment (the floor factory) to compare performance before and after the implementation of the ERP system. Although some causal aspects were explored, the study's time span was not long enough to establish a truer causation that might require a real manipulation of certain variables to study the effect of such manipulation on the dependent variable of interest. Such a study would also have required a moderate and even excessive interference that might lead to a contrived study setting. This field study certainly had minor experimental aspects. The extent of manipulation was not, still, enough for a real experiment to establish a cause-and-effect relationship beyond the possibility of the least doubt that normally requires a lab or the creation of an artificial, contrived environment in which all the extraneous factors would strictly be manipulated (Sekaran & Bougie, 2013). The results of the study indicated a statistically significant ($p < 0.001$) improvement of performance after the implementation of the ERP using a ten-dimensional variables of logistics performance framework. The variables were statistically tested using a paired-sample t-test. The results may lead to a positive social change by facilitating the acceptance of ERP systems in job shop environment, measurement of the effectiveness of logistics performance, and motivating the adoption and use of logistical components of ERP systems to improve performance in business organizations.

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APPLICATIONS OF QUALITY COMPETITIVENESS INDEX METHODOLOGY FOR STRATEGIC ADVANTAGE

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ABSTRACT

According to the operations strategy literature, quality of a firm's product or service is a significant determinant of its competitiveness and is, therefore, a key dimension of competition for all firms. It is, therefore, imperative for companies to measure and benchmark their quality with respect to their competitors' frequently in a dynamically changing market. However, measurement of quality as well as the determination of the degree to which quality influences the competitiveness of a firm remains a difficult proposition because of the subjectivity inherent in both. Kumar, Stecke, and Motwani (2004) addressed this need through construction of an index, called the Quality Competitiveness Index (QCI). The QCI represents the degree to which a firm's total quality program (TQP) is effective in contributing to its competitiveness on a unit scale. They also developed the methodology associated with the development of the QCI to identify and prioritize weak areas of a company's total quality program. In

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this paper, we use two case studies – one based on synthetically generated data and the other on real world data to show how the QCI methodology accomplishes these tasks. In addition, an exhaustive examination of the validation of the QCI methodology is undertaken in this paper. With the solitary exception of the dynamic/temporal validity (which requires long term data and therefore must wait for a future testing), the QCI methodology is found to pass all tests of validity successfully.

INTRODUCTION

Quality is one of the four dominant competitive dimensions (price, flexibility, and delivery are other three) identified in operations strategy literature. It is, therefore, important for businesses aspiring to stay ahead of their competition to continually monitor and maintain superiority of the quality of their products and services. However, due to the inherent subjectivity in defining quality and competitiveness, accurate measurement of quality is a daunting task. Kumar et al. (2004) introduced the concept of Quality Competitiveness Index to measure the effectiveness of a company's quality efforts. More precisely, the QCI represents the effectiveness of a company's total quality program (TQP) to accomplish competitive superiority. Intuitively, it could be understood as the quality-efficiency of a company; i.e., the ratio of the quality-based competitiveness (output) to the quality effort expended by a company (input), expressed in consistent and normalized units. The QCI methodology, however, has capabilities beyond yielding the value of QCI, as pointed out in Kumar et al.: (1) It provides a "macro" picture of how well is a company's quality program is serving its strategic goals, (2) It allows "macro" level comparison of the effectiveness of TQPs across companies, also known as external benchmarking, and (3) it identifies and prioritizes the components of the total quality program that need attention to deliver maximum improvements in the company's strategic position. The same information can also be used for internal benchmarking across companies. All in all, the process of developing a QCI unearths tremendous amount of intelligence that can be used to make smart decisions about redesigning, or at least realigning, the total quality program of a company to obtain the maximum possible strategic advantage.

This paper accomplishes the following: (1) It demonstrates the capabilities of the QCI methodology summarized above using two examples, one constructed using simulated data and the other using a real world application. (2) It establishes the validity of the QCI methodology over an exhaustive set of validity-associated dimensions identified in relevant OR/MS literature.

2. THE QCI METHODOLOGY

Please see full paper available with the first author for detailed reasoning and explanation. A summary of the steps involved in determination of the QCI is provided below reproducing verbatim from Kumar et al (2004).

Notation

The notation is as follows.

i = Index of quality sub-factors, $i = 1, \dots, J_1+J_2 \dots +J_l$. For simplicity of notation, we use $J_1+J_2 \dots +J_l = l$

m = Index of departments or functional units in the company that impact quality competitiveness, $m = 1, \dots, M$

k = Index of the states of quality consciousness, $k = 1, \dots, K$

U_i = Estimated weight of sub-factor i to contribute to the quality competitiveness of the company on a scale of 1-10, $i = 1, \dots, l$. Since, we have chosen only those sub-factors that influence the competitiveness, the scale does not contain 0.

X_{mk} = Score that department m obtained in state k on a scale of 0 to 10. Note that $\sum_{k=1}^{k=K} X_{mk} = 10$, $m = 1, \dots, M$, $k = 1, \dots, K$. A department may not be in certain states at all, so that the lowest on the scale is 0.

Y_k = Weight of each state of quality consciousness based on its contribution potential to quality competitiveness on a scale of 1 to 10, $k = 1, 2, \dots, K$.

Z_m = Weight of department or functional unit m on a scale of 1-10, based on its potential to contribute to the quality competitiveness of a company, $m = 1, \dots, M$

W_m = Revised normalized weight of department or functional unit m on a scale of 1 to 10 after its quality consciousness has been factored in, $m = 1, \dots, M$

V_{im} = Actual performance of sub-factor i in department m based on its impact on the quality competitiveness on a scale of 0 to 10, $i = 1, \dots, I, m = 1, \dots, M$

V_i = Weighted current quality competitiveness strength of factor i across all departments, $i = 1, \dots, I$

V_i^{PI} = Weighted quality competitiveness strength of factor i across all departments given existing states of departmental quality consciousness and a perfect implementation of sub-factor $i, i = 1, \dots, I$.

$V_i^{PI,S}$ = Weighted quality competitiveness strength of factor i across all departments given each department's state of quality consciousness at sustenance level and a perfect implementation of sub-factor $i, i = 1, \dots, I$.

$QCSE_m$ = A composite value on a scale of 1-10 that represents the ratio of the strategic advantage available from department m 's actual state of quality consciousness as compared to that of its sustenance state.

The QCI Algorithm

The QCI development algorithm is comprised of five steps. These are now presented.

Step 1. Create a Department-Consciousness Matrix

- a. Identify all departments that play a significant role in building product or service quality or are involved in the customer-company interface.
- b. Estimate and assign weights, Z_1, Z_2, \dots, Z_m to each of the m departments on a scale of 1 to 10 that reflect the degree to which a department might influence the quality competitiveness of a company. Assign 10 to the department that is most important and assign weights to other departments based on their importance in relation to this department.
- c. Identify stages of quality consciousness.
- d. Estimate and assign weights, Y_1, Y_2, \dots, Y_K , to each stage on a scale of 1 to 10, which reflect the degree to which a stage might influence the quality competitiveness of a company.
- e. Estimate and assign weights, $X_{mk}, m = 1, \dots, M; k = 1, \dots, K$ to each cell in the department-consciousness matrix on a scale of 1-10, based on the degree of quality consciousness of that department within each stage. Weights are assigned to a

department in adjacent stages only. These weights should add up to 10 for each department to assure comparability between departments.

Step 2. Compute the Weighted Quality Consciousness Level

- a. Compute each department's normalized quality consciousness weight.
- b.

$$W_m = \frac{Z_m}{10 \text{Max}\{Z_m\}} \sum_{k=1}^{k=K} X_{mk} Y_k, \quad m = 1, 2, \dots, M.$$

Note that $\text{Max}\{Z_m\} = 10$ based on our stipulation in Step 1b. However, the formula provides flexibility in case $\text{Max}\{Z_m\} < 10$.

- c. Compute each department's quality consciousness state efficiency.
- d.

$$QCSE_m = \frac{1}{100} \sum_{k=1}^{k=K} X_{mk} Y_k, \quad m = 1, 2, \dots, M.$$

Step 3. Create a Quality Competitiveness Matrix

- a. Estimate and assign weights, U_i , $i = 1, \dots, I$, for each quality factor or sub-factor on a scale of 1 to 10 based on its contribution to the competitiveness of the company. This requires active involvement of top-level personnel from marketing, sales, production, and quality departments, customers, and higher management personnel.
- b. Estimate and assign weights V_{im} for $i = 1, \dots, I$, $m = 1, \dots, M$ on a scale of 0 to 10 such that each assigned weight accurately reflects the effectiveness and completeness with which the sub-factor in question has been applied to or implemented in department i .

Step 4. Compute the Quality Competitiveness Efficiencies of Each Sub-factor

- a. Compute the weighted quality competitiveness strength, V_i .

For each sub-factor, compute its weighted quality competitiveness strength:

$$V_i = U_i \sum_{m=1}^{m=M} V_{im} W_m, \quad i = 1, 2, \dots, I. \tag{3}$$

This expression V_i contains a composite influence of all departments in which sub-factor i was present, the state of quality consciousness of each department, and the degree to which a sub-factor contributes to the quality competitiveness of a company.

- b. *Compute the weighted maximum quality competitiveness strength given the existing state of quality consciousness and a perfect implementation of sub-factors, V_i^{PI} .*

Set each entry in the matrix (V_{im}) equal to 10 and compute the theoretical maximum quality competitiveness strength for each sub-factor for given W_m 's:

$$V_i^{PI} = 10U_i \sum_{m=1}^{m=M} W_m, \quad m=1, 2, \dots, M. \quad (4)$$

The contribution of sub-factor i towards the total competitiveness would be V_i^{PI} , if the sub-factor was implemented or applied in a manner that yields maximum possible strategic advantage.

- c. *Compute the weighted maximum quality competitiveness strength given the state of quality consciousness as sustenance in each department.*

Set each entry in the matrix (V_{im}) equal to 10 and compute the theoretical maximum quality competitiveness strength for each sub-factor for given Z_m 's:

$$V_i^{PI,S} = 10U_i \sum_{m=1}^{m=M} Z_m, \quad m=1, 2, \dots, M. \quad (5)$$

The contribution of sub-factor i towards the total competitiveness would be $V_i^{PI,S}$, if the sub-factor was implemented or applied in a manner that yields maximum possible strategic advantage (i.e., is implemented perfectly) and all departments are in a "sustenance" state of quality consciousness.

- d. *Compute the quality competitiveness efficiency of sub-factor i , given the existing state of quality consciousness.*

$$\text{For sub-factor } i, i = 1, \dots, I, \text{ QCE}_i^{PI} = \frac{V_i}{V_i^{PI}}. \quad (6)$$

- e. *Compute the quality competitiveness efficiency of sub-factor i , given the existing state of quality consciousness as perfect (sustenance).*

$$\text{For sub-factor } i, i = 1, \dots, I, \text{ QCE}_i^{PI,S} = \frac{V_i}{V_i^{PI,S}}. \quad (7)$$

Step 5. Compute the Quality Competitiveness Index for Given States of Quality Consciousness of Departments

Compute this intermediate value of the QCI, called QCI^{PI} .

$$QCI^{PI} = \frac{\sum_{i=1}^{i=I} V_i}{\sum_{i=1}^I V_i^{PI}}. \quad (8)$$

Step 6. Compute the Quality Competitiveness Index for the Organization

The quality competitiveness index, QCI, is computed using

$$QCI = \frac{\sum_{i=1}^I V_i}{\sum_{i=1}^I V_i^{PI,S}} . \quad (9)$$

3. CONCLUSION

In this paper we have shown how the QCI methodology can be used to improve the Total Quality Program in a “maximal” fashion. This means identifying areas that will result in maximum improvement in competitiveness of the company at the expense of least resources. We have also shown that the QCI model is empirically valid and delivers strategic advantage in real world when applied appropriately.

EARNINGS MANIPULATIONS A COMPLICATION BETWEEN MANAGERS AND INVESTORS

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Abstract

Relationships between investors and managers of the companies can be considered as a strategic one, because both parties involved are intelligent but pursue different goals. In order to achieve these goals both managers and investors adjust actions for the best result. For managers it is important to keep their company's stock prices up (Kadlec, 2002), which usually leads to high bonuses and compensations (Zandstra, 2002). For investors it is important to secure their money in the companies that report stable growing earnings (Teoh, Welch, & Wong, 1998). A conflict of interests takes place in this relation. Funds flow may change from companies that report low earnings to companies that report high earnings and managers know it. This variation in goals puts pressure on managers and forces some to engage in misleading strategies, like earnings management and masking operations. Some of the masking operations float around legal boundaries while others are clearly illegal. All of them misrepresent financial and accounting data and so influence the choices of investors. Being caught actively managing earnings usually not a good news for managers, and so there is a risk aspect to the phenomenon of earnings management.

In this paper we will look at ethical perceptions of earnings management, and research related to earnings management subject. Discussion of perceptions management would take place next, and reasons for desire to smooth earnings would be discussed. Set of strategies used to manipulate earnings and relevant research works would be revealed. Risk associated with earnings management and prospect theory would be looked at. Literature would be divided in accordance to relevance to particular questions. Punishments for manipulations would be concluding this work.

Risk Taking and Failure at the onset of the financial Crisis – A decade in review

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Extended Abstract

At the beginning of the 21st century, financial institutions were achieving success through risk seeking behavior. As firms found financial success, and increase in risk taking would occur. As the economy was expanding, many negative consequences of risk were not realized. It is often stated that higher risk leads to higher returns. However, as the 2008 financial crisis would indicate, greater risk also has the opportunity to have negative consequences as seen by the large number of failing banks. This study examines firm level factors of banks leading up to and continuing into the onset of the 2008 financial crisis.

Firm-Level Factors

This paper will examine two firm level factors, geographic dispersion and risk seeking behavior and their impact on bank failure during the onset of the financial crisis of 2008. The expectation is that geographic dispersion of banking activities will reduce the local market risk and subsequently insulate banks from adverse economic development in a particular region. An adverse market will not necessarily affect other customers in other markets (Emmons, Gilbert, & Yeager, 2004). Leading up to the crisis, US Banks have grown larger – spreading their operations across multiple markets. Due to the imperfection of banking markets, spreading assets across multiple markets may provide diversification benefits (Morgan & Samolyk, 2003).

Previous geographic restrictions on interstate banking were lifted by passage the Riegle-Neal Interstate Banking and Branch Efficiency Act. Geographic diversification has been shown to reduce bank risk (Liang & Rhodes, 1988), likelihood of failure (Emmons, Gilbert, Yeager, 2004) and increase bank stability (Dick, 2008). Unlike the previous large scale bank failure in the United States (1930s and 1980s) this environment didn't possess the same geographic or technological limitations. As such, banks that didn't take advantage of those opportunities were more likely to fail. Hence, we hypothesize:

H1: Increased bank geographic diversification prior to the financial crisis will be associated with lower failure rates.

Additionally, the early 2000s saw low interest rates and government incentives provide an ample situation of high risk and high returns for many banks. At the time, real estate prices were increasing regularly, giving banks a sense of security when making decisions that would be

considered high risk. At the time, the situation was seemingly universally positive. Banks could loan money to high risk candidates and high rate. If those individuals defaulted, the banks could sell the asset at a higher, newly appreciated price. To compound the situation, these mortgages were being paid back at a higher rate than expected ((Demyanyk & Hemert, 2008)) leading to many taking on additional risk. Unfortunately, this model couldn't last forever. As the economy collapse, this once high risk/high return ventures became an albatross. The advantages realized during the boom economy were now erased and left many banks in a very difficult position.

H2: Increased risk seeking behavior of banks at the onset of the financial crisis will be associated with higher failure rates.

Methodology

We plan on collecting bank data in the preceding years of the financial crisis continuing into the onset. We will evaluate a matched pair sample of firms to determine if geographic diversification was associated with survival and risk seeking behavior was associated with failure.

Triple Bottom Line (3BL) and Sustainability – a Major Change in Corporate Management

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Abstract

There has been a major change in corporate management and it has been a quiet change, considering it is almost revolutionary in practice. This paper will explore why this change took place, and where the change is taking modern business.

Introduction and Early “Business” Education

There has been a major change in corporate management and it has been a quiet change, considering it is almost revolutionary in practice. Years ago, university students were taught by their professors and textbooks, that the purpose of business was to maximize profits. Noted economist, Milton Friedman, and others argued that:

“Businesses are not organized to engage in social activities; they are structured to produce goods and services for which they receive money. Their social obligation is to return as much of this money to their direct stakeholders as possible. In a free market with significant competition, the selfish pursuits of corporations will lead to maximizing output, minimizing costs, and establishing fair prices. All other concerns distract companies and interfere with achieving these goals.¹”

Business professors taught that companies that did not strive to maximize profits would be forced out of the marketplace by more efficient competitors. Profit maximization was the key paradigm for the well-run corporation.

The concept of “selfish pursuits” discussed by Milton Friedman most likely originated from the famous economist, Adam Smith. Smith wrote the book, The Wealth of Nations, and discussed the concept of the “invisible hand.” Individuals benefit society by pursuing their own self-interest.²

“The idea of trade and market exchange automatically channeling self-interest toward socially desirable ends is a central justification for the laissez-faire economic philosophy, which lies behind neoclassical economist.³” Economist, Kenneth Arrow, noted that individuals acting in their own self-interest as buyers and sellers, help the economy grow.⁴ In the 1980’s, another

noted economist, Paul Samuelson, talked about the importance of business firms maximizing profits because this was best for the economic system.⁵ Other economist, including Simon Kuznets, noted the importance of maximizing economic welfare.⁶

In summary, until approximately 1992, the essential message from business schools and economic departments, was that acting in one's self-interest and maximizing profits was the key strategy to efficiently allocating resources and insuring the future growth of the business entity.

1992 – 2016 **The Rise of the Sustainability Movement** **and the Growth of 3BL (Profits / People / Planet) Reporting**

In June of 1992, the United Nations sponsored the first Earth Summit. This initial gathering was held in Rio de Janeiro and 172 countries participated. One of the key discussions focused on solving global warming and global climate change.⁷ This conference eventually led to the adoption of the Kyoto Protocol by several countries. The Earth Summit raised awareness of adopting sustainable practices for the protection of the earth and the people of the planet. The Earth Summit, also known as the United Nations Framework Convention on Climate Change (UNFCCC) commits governments that adopt the Kyoto agreement to “reduce greenhouse gas emissions, based on the premise that (a) global warming exists, and (b) human-made CO₂ emissions have caused it. As of December 2012, 192 countries had adopted the Kyoto agreement.⁸

Discussions at the Earth Summit went beyond focusing on the reduction of greenhouse gases and doing something about global climate change. Participants also addressed fixing problems dealing with clean, accessible water for all people, conserving the lands inhabited by indigenous people, and protecting the forests of the world.⁹ In summary, The Earth Summit was the start of the sustainability movement and the idea that maximizing profits without protecting the people and the planet, might not be an ideal situation.

In 2006, former Vice President Al Gore, initiated a campaign to educate the people of the world about the terrible consequences of global warming. Gore helped to produce a documentary film titled “An Inconvenient Truth” that was recognized with an Academy Award. The point of the film is that global warming is real, it is caused by humans, and is potentially catastrophic if the people of the world ignore this reality. Many scientists endorsed the thesis of the movie.¹⁰

Earth Summits are regularly scheduled around the world to raise awareness of global warming and its dire consequences. In 2009, President Obama attended the “Copenhagen Summit” (UN Climate Change Conference 2009) and he called on Americans to make “clean, renewable energy the profitable kind of energy.” During his term in office, Obama supported various initiatives to reduce global warming and pledged support for The Paris Agreement. The goal of the Paris Agreement is to hold the increase in average global temperatures to below two degrees C (3.6 F).¹¹

As a result of the Earth Summits between 1992 and 2016, there has been an increased awareness that the goal of business is not just to make profit but also to consider the impact of business decisions on the planet (e.g. global warming) and the people of the world.

In addition to Earth Summits, in July 2008, the main accrediting body for business schools, AACSB (Association to Advance Collegiate Schools of Business), sponsored, the first of several Sustainability Conferences.¹² Representatives from over 200 business schools attended this inaugural meeting including educators from 15 countries outside of the United States. The purpose of the conference was to share ideas on the application of sustainability and what business schools were doing to educate students on this important topic. This conference continued with the most recent gathering taking place in Atlanta, Georgia in June of 2014. Conference participants received materials making it clear that “corporate social responsibility includes sustainable business practices and that these practices themselves can encourage ethical business behavior.”¹³

As a result of AACSB emphasis on sustainability, more business schools have majors in sustainability, have classes in sustainability, and have courses covering sustainability. When teaching sustainability, it is natural to discuss the “triple bottom line: profits-planet-people” and how this gets reported.

“The phrase “triple bottom line” was first coined by John Elkington in 1994 and later explained in his 1998 book, *Cannibals with Forks: The Triple Bottom Line of 21st Century Business*.”¹⁴ “In his book, Elkington (1998) explains that 3BL (TBL) reporting expands traditional reporting framework to take into account not only financial performance (profit) but also performance in the areas of the environment (planet) and the social environment (people). According to Elkington (1998), 3BL is a way to integrate profit maximizing along with the goals of sustainability. Elkington (1998) explains that the Planet element of 3BL reporting refers to sustainable environmental practices and that a TBL endeavor reduces its ecological footprint by, among other things, carefully managing its consumption of energy and non-renewables and reducing manufacturing waste as well as rendering waste less toxic before disposing of it in a safe and legal manner.”¹⁵

As a result of the United Nations’ earth summits, the AACSB conferences on sustainability, and a greater discussion of the 3BL concept, the sustainability movement became strong. There was a feeling that when corporations were focused on maximizing profits, the world did not seem to be getting better. Man-made climate change, with the burning of fossil fuels, was leading the world toward global warming. The oceans were becoming polluted with waste. The land was harmed by the disposal of non-degradable and toxic waste. Often businesses would exploit child labor or take advantage of low-wage workers. There was a movement to get businesses to understand the impact that they have on “people” and the “planet.”

While there are many definitions of sustainability, the simple concept is that business should

operate in such a manner as to make a profit while leaving the people of the world and the planet itself a better place for future generations. Thus, because of the perceived problems to the planet and the people of the world, modern business management has shifted from profit maximization to the concept of the triple bottom line (3BL). This has been a quiet shift in thinking but an important one, and many people are not aware of this significant development.

Today, the enlightened corporation wants to operate using the triple bottom line (3BL) approach and strive to be sustainable. This change in thinking represents major corporate adjustment in the management of business, and it has been fairly quiet. Many people still believe that all corporations care about is making profits. This way of thinking is passé and usually reflects a lack of knowledge as to how the modern businesses operate.

To illustrate how society and business have changed from 1992 until 2016, it is interesting to note that in 1992 if a business or individual was seen as trying to preserve the environment, they might have been accused of being a “tree-hugger” or an “environmental wacko.” These terms were seen as derogatory and intended to put an environmentalist in a bad light. Today, most people and businesses want to be seen as being a friend to the environment.

The New Way of Thinking When Managing a Business Incorporating the 3BL

Today all businesses want to have a “green business strategy” since customers demand it. To illustrate how business is working to make a profit and yet be kind to the planet and the people of the planet, the following are case studies depicting how modern business management promotes sustainability, the 3BL, and with making profits. This helps illustrate the major change in business management during the period of 1992—2016.

Planet – Case #1 – Subaru Cars

Consumers who care about the environment are attracted to Subaru because Subaru presents itself as a company doing something to improve the environment. If you go to the Subaru web site, click on “why Subaru” and then click on “Subaru loves the earth,” the consumer discovers many earth friendly initiatives by Subaru and the many awards Subaru has won in recognition of their focus on the environment.¹⁶ For example, Subaru highlights their “Zero Landfill” policy. Thousands of Subaru cars are manufactured in Indiana and no waste goes to the landfill. Everything is either recycled or reused. “In recognition of its zero-landfill manufacturing practices as well as becoming the first U.S. car maker to achieve both ISO 1401 (environmental Management) and ISO 50001 (Energy Management) certifications, Subaru of Indiana is nominated for the prestigious Sustainia Award.”¹⁷

Planet – Case #2 – Ford Motor Company

Before 2011, the Ford Explorer SUV was losing sales primarily due to its gas guzzling reputation. In 2011, Ford changed the Ford Explorer so that it would be seen as a “green” vehicle.¹⁸ A Ford press release was titled, “2011 Ford Explorer Goes Green With More Recycled, Renewable Materials and Increased Fuel Efficiency.”¹⁹ Ford went into great detail on how the Ford Explorer was now earth friendly. For example, “The new Explorer also leverages Ford’s industry-leading use of bio foam and recycled fabric in its interior. These and other eco-improvements help make Explorer 85 percent recyclable.”²⁰ In summary, Ford “reinvented” the Ford Explorer calling it a “green machine with an eco-advantage” knowing that consumers want transportation that is earth friendly. Ford stated, “we believe customers will value these green features, as they help the environment without sacrificing the Explorer’s capability, utility and safety.”²¹

Planet – Case #3 – Herman Miller Office Furniture

Herman Miller, a major manufacturer of office furniture with distinctive design, was recognized as one of the top 20 global companies that is changing the world for the better.²² Herman Miller was recognized for reducing its “environmental footprint” by 79% over a 15-year period.²³ Herman Miller’s website devotes much attention to its focus on the environment and how this is a core value of everyone working for the company. Why do companies spend so much time discussing their contribution to the environment? Because customers want to work with companies that are improving the environment, not destroying it.

Planet – Case #4 – Tom’s of Maine

While Tom’s of Maine makes several products, it is well-known for their toothpaste. Their website is devoted to telling consumers everything that Tom’s is doing to protect and improve the environment.²⁴ For example, “Since 2006, 100% of the electricity we use at our manufacturing facility has been offset by investing in wind energy credits supplied by Green-e.”²⁵ Also, “our manufacturing facility and warehouse use sensor-controlled fluorescent energy-savings fixtures.”²⁶ “Read more about our sustainability progress and goals in our Goodness Report.”²⁷ Note how Tom’s is not just selling toothpaste—it is selling itself as a company that protects the environment (something customers want).

People – Case #5 – Walmart & Meijer & Kroger Food Company

In 2009, the t.v. network, ABC Tonight, did an undercover investigation of a blueberry grower in South Haven, Michigan. The documentary film showed news footage of children processing blueberries in violation of child-labor laws.²⁸ Since Walmart, Meijer, and Kroger bought blueberries from this company, they had a joint announcement that suspended all future purchases. Companies like Walmart, Meijer, and Kroger, who care about the people of the

world, are not going to buy products from companies that exploit child labor.²⁹

People – Case #6 – Starbucks

Starbucks knows that its customers care about the environment and the people of the world. To protect the people of the world, one Starbucks strategy is to sell “fair-trade, ethically sourced” coffee.³⁰ Starbucks promotes their C.A.F.E. (Coffee and Farmer Equity) program that, taken together, helps “farmers grow coffee in a way that’s better for both people and the planet.”³¹ Starbucks also publishes their Global Responsibilities Goals & Progress Report so consumers can track Starbucks’ progress.³²

People – Case #7 – Nike

Nike is a company that works hard to ensure that its products, produced around the world, are ethically manufactured (see Nike Corporate Responsibility Report).³³ In the past Nike had been accused of employing children in Third World countries at low wages. In Nike’s defense, it was pointed out that “fake evidence of age could be purchased for as little as \$5.” Nike claims to have made great progress toward ending this practice.³⁴ It should be obvious that in this day and age, no business wants to be seen as a company that exploits children or people in general to manufacture their product. Companies that are seen as exploiting people or the planet will lose their customer base. Today, modern management recognizes that the people and planet are just as important as profits.

People – Case #8 – General Electric

General Electric (GE) does business around the world and regularly issues a report on what GE is doing for the people and the planet.³⁵ “At GE, we solve problems for customers and find solutions that make things better for society, the environment, and the economy.”³⁶ GE’s website and reports are a clear indication of the practice of the triple bottom line and recognizing that profits, people, and the planet all matter in the operation of GE’s world-wide business.

Both People & Planet – Case #9 – Weather Tech

In, 2012, MacNeil Automotive, an American manufacturer of auto floor-liners, ran advertising in several major magazines that emphasized the planet and the people of the world, and why this was so important.³⁷ When it came to the planet, MacNeil stated, “At MacNeil Automotive, we are also very aware of sustainability and our responsibility to the environment” (and the ad went on to discuss the many things they were doing). As to the people of the world, MacNeil stated, “Life is simple: be good to your fellow man, be kind to animals and the environment, and place building a quality product, supporting your country and your fellow American worker before profit. And, one last thing-let’s all do our best to balance family time with work time as our children are the future of America.”³⁸

Conclusion

Modern businesses still exist to make a profit and they still strive to return as much of their earnings as possible to their direct stakeholders. However, modern business leaders now realize that profit maximization and stakeholder wealth mean absolutely nothing if there are no natural resources or no people to benefit from their efforts. Today's businesses increasingly operate under the 3BL paradigm and seek to leave the planet and its inhabitants better off than their predecessors. Incorporating sustainable business practices assures that we all will continue to enjoy the fruits of business endeavors for generations to come.

Footnotes / References

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- 31 id.
- 32 www.starbucks.com/globalresponsibilitygoalsandprogressreport
- 33 www.nike.com
- 34 www.commondreams.org/headlines01/1020-01.htm
- 36 www.gesustainability.com
- 36 id.
- 37 www.weathertech.com
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WELLS FARGO ...AN APPARENT FAILURE IN ETHICAL LEADERSHIP ?

Robert Frey, Grand Valley State University

Abstract

A questionable sales culture beginning at Wells Fargo as early as 2005, compensation incentives were used to pressure lower level employees to meet sales goals by quietly *“opening sham accounts in customers’ names”* for products they did not request. These products included credit cards, insurance, and special bank accounts, and resulted in more than two million such fake accounts. In most cases, the customers were unaware of such enrollments or that they were being charged for them. Following a Los Angeles Times and WSJ news accounts, California State litigation ensued in 2015, claiming that *“employees were being pressured to commit fraud”*; the articles disclosed that more than 5300 employees had been fired over the past five years for failing to meet the sales incentives. A \$185 million dollar fine was levied, but federal investigations then began.

At a Federal Senate hearing in September, 2016, Wells Fargo executive officers assumed “full responsibility,” but discounted the situation as *“nothing more than a performance management problem”*. It was admitted, however, that beyond an ongoing internal investigation, very little had been done to correct the problem, change the culture or reimburse customers. The executive officers seemed to have few serious concerns or answers to the many important questions, and one senator suggested a criminal investigation should commence. Another senator suggested to the Wells Fargo Chairman and CEO, John Stumpf, that *“this was a systemic problem ... and you are scapegoating the ‘few bad people’ at the very bottom”*. It was established that Stumpf first learned of the problem in 2013, but that he did not believe that “such sales problems did established any cultural flaw”. Senator Warren responded stating that *“this is fraud ... and a crises management 101 mistake”*; and so it turned out to be. *Mr. Stumpf was forced to resign later in September and The Wells Fargo Board “clawed back” \$41 million dollars in options and other compensation benefits.*

Many ethical business issues present themselves for discussion: (1) the importance of establishing a corporate-wide ethical culture and how to restore Stakeholder trust; (2) the fiduciary duty and accountability of senior officers, including the Chairman and CEO and the Board of Directors (who were first told of the problem when it was publicly reported); (3) “bad guy” and other company provisions involving the “claw back” of compensation and related benefits from senior officers ... the idea of “higher ethical standards (and punishments) for generals”; (4) the ethical governance issue of separating the Chairman and CEO executive roles; (5) the ethical risk of misaligned sales compensation incentives; (6) ignored Whistle Blowers and a culture of retaliation and silence; and (7) the impact of Federal Ethics related legislation. These issues will be discussed in the paper.

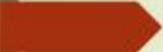
Making shared experiences meaningful: Understanding organizational knowledge

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Mambo G. Mupepi
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Abstract

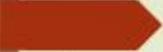
This presentation is about how to apply the skunkworks approach to advance the efficacies required in successful organization. Today's companies compete on knowledge, technology, and the ability to produce products demanded by customers. The skunkworks is a purpose-built forum where innovation in handy enterprises can be cultivated successfully. Management view the skunkworks as an enriched environment made up of individuals possessing the required experience in growing a business. The skunkworks can advance goals in at least three ways: the first is its capability to ignite the company's *raison d' et ere*. A systems-wide thinking, simplifying cognitive tasks into manageable activities leading to higher levels of work output. The second is the collective experience of its membership endowed with diversity useful in charting exceptional performance. Compete is centered on what people in the business know the most and as such, it is critical for successful entities to have exclusive expertise. The third is its ability to distribute information to cognitive centers where it is useful in producing goods demanded by customers.



Rationale for this presentation

Today's Companies:

- Compete on what they KNOW
- Apply appropriate technology ...but its PEOPLE make the difference
- Create explicit know from COLLECTIVE experience of the people
- MUST innovate to effectively compete



A statement of the literature review: **Kurt Lewin (1890-1947)**

- Lewin coined the phrase group dynamics to imply a system of behaviors and psychological processes occurring within a social group (intragroup dynamics), or between social groups.
- Lewin developed the *force field theory*, *Unfreeze/change/refreeze change management model*, *Action research approach to research*, and the *Group Dynamics approach to training*
- Lewin's work had a great influence on research and thinking leading to the field of *organizational development*
- Lewin was also behind the founding of the Center for Group Dynamics in the United States, which influenced many management thinkers

Much later after Lewin

Wageman, R. (1995). Interdependence and Group Effectiveness. *Administrative Science Quarterly*. 40 (1): 145-180

- Due to the increasingly complex business environment and the principal-agent relationship, the enterprise group should establish a control system to prevent agency risk.
- Besides traditional system control, a company should adapt an interactive control including decentralized decision making, process communication and target incentive to guide and govern activities
- Control systems include purpose-built structures to enhance effectiveness and efficiency

Situational Leadership

Daniel Alesin (2016). Dysfunctional organization: The Leadership factor. *Open Journal of Leadership* Vol. 5 no. 1

Brown, J.S. and Duguid, P. (1991). Organizational learning and communities of practice. *Organization Science* . 2: 40-57.

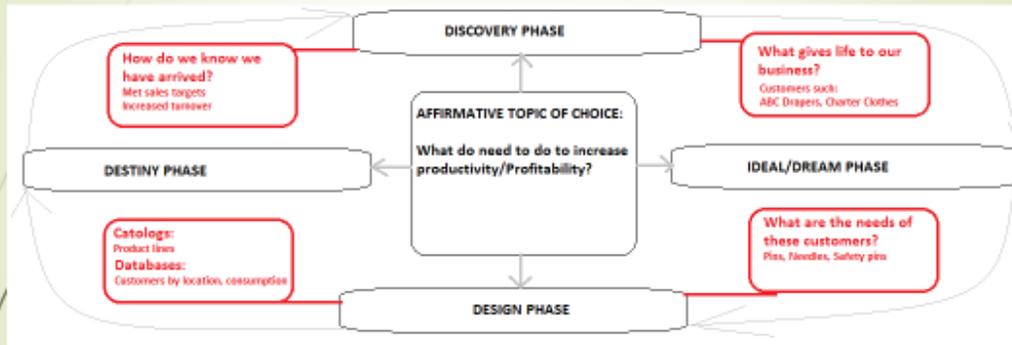
Lave, Jean; and Wenger, Etienne (1991). *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press

Positive correlations exist between organized groups and increased productivity

- Organization design is critical in enhancing effectiveness and efficiency

POSITIVE SCHOLARSHIP OF APPRECIATIVE INQUIRY

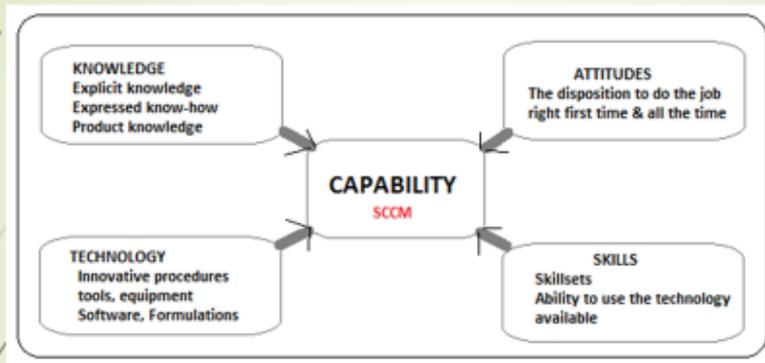
Cooperrider (1986)



Mambo G. Mupepi, Sylvia C. Mupepi, Ramkrishnan V. Tenkasi, Gayla Jewell (2008)

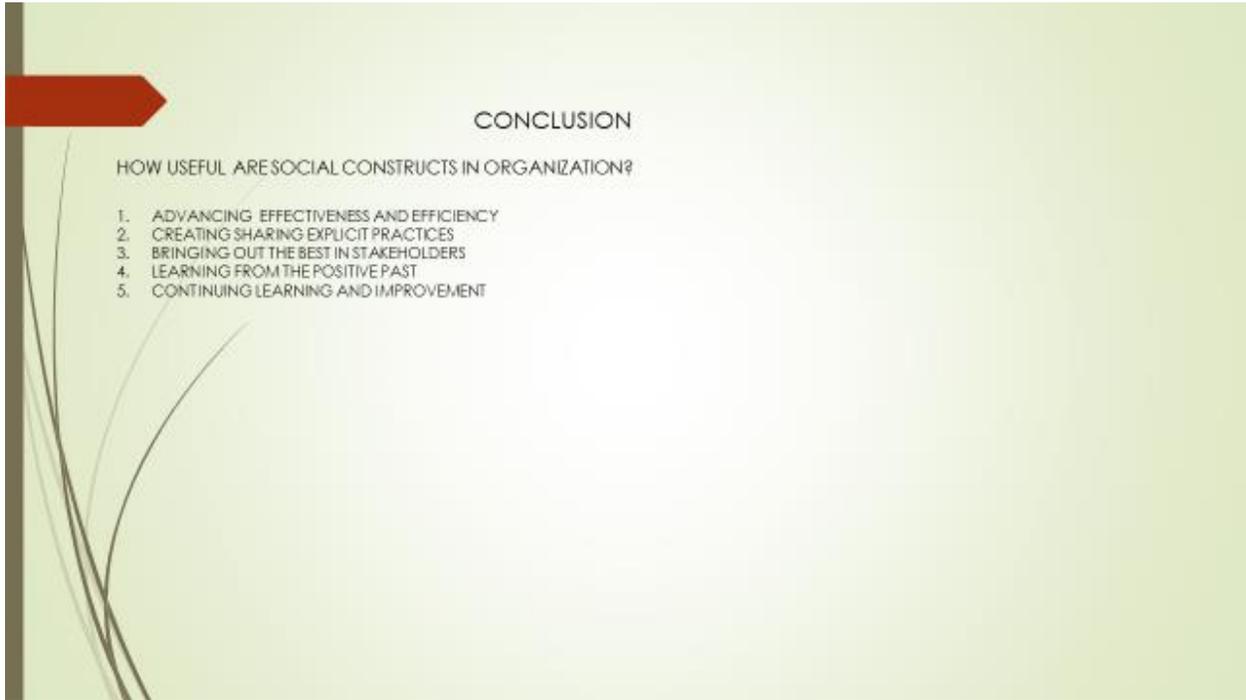
Precision in managing organizational change: identifying and analyzing needs using social constructs. *International Journal of Management Practice* Jan 2008, Vol. 3, Issue 2, pp. 150-163

A SOCIALLY CONSTRUCTED COMPETENCY MODEL



1. Can a knowledge community situated in an African village create and advance human rights practices beyond love thy neighbor principle? Mambo G. Mupepi, Jennifer Young Yim, Sylvia C. Mupepi, Kuda B. Mupepi *International Journal of Knowledge and Learning* Jan 2011, Vol. 7, Issue 3-4, pp. 233-252

2. The nature of a schematic description of a socially constructed organizational competency model (CCM) Mambo G. Mupepi, *International Journal of Collaborative Enterprise* Jan 2009, Vol. 1, Issue 2, pp. 224-240



CONCLUSION

HOW USEFUL ARE SOCIAL CONSTRUCTS IN ORGANIZATION?

1. ADVANCING EFFECTIVENESS AND EFFICIENCY
2. CREATING SHARING EXPLICIT PRACTICES
3. BRINGING OUT THE BEST IN STAKEHOLDERS
4. LEARNING FROM THE POSITIVE PAST
5. CONTINUING LEARNING AND IMPROVEMENT

Developing explicit practices in differentiating the organization

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**Hursh Motwani
Forest Hills Northern School**

**Mambo Mupepi
Seidman College**

Abstract

Tacit knowledge is the opposite of explicit knowledge and is a state of knowing difficult to transfer to another person. Words fail to verbalize what a person knows. The novice can emulate the performance of an expert by observation. This often leads to the learner acquiring the desirable skill in addition to emulation of the bad habits of the expert. Perceptive organizations can adapt the skunkworks approach to create tactics difficult for the competition to emulate. The skunkworks approach can make it possible for organizations to design complex technology and new products derived from shared experiences and continuous learning and improvement. The result leads to the charting of what gives the organization the advantages in producing the products and services demanded by customers successfully.

Rationale for this paper

- Explicit practices can be socially constructed
- Shared experience can be put into context to advance efficiency & effectiveness
- The history (data or reports) can be interpreted to advance strategy

PRODUCT DEVELOPMENT TECHNIQUES

The Disposition to:
Effectively do the job



Abilities in:

Numerous engineering fields
Maths
Physics
MIS
Etc

An overview of the literature selected

- Tom Peters (1985) *In Search of Excellency*: The primary ideas espoused solving business problems with as little business-process overhead as possible, and empowering decision-makers at multiple levels of a company.
- Ben R. Rich & Leo Janos (1996). *Skunkworks*. A personal memoir of my years at Lockheed Martin. Project Mission was to develop product/s that served lives
- Warren Bennis (2009) *On Becoming a Leader*: a combination of experience, self-knowledge, and personal ethics was critical to effective and efficient leadership
- Mupepi Mambo (2017) focuses on an interdisciplinary approach perspectives concerning talent management in successful organization

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Adam Smith One More Time: Learning from the Division of Labor to Grow Specialists

- The design and implementation of the knowledge community approach can advance specialization in the divided labor successfully
- A knowledge network is characterized by mutual engagement in a joint enterprise that gives rise to a shared repertoire of knowledge, skillsets, and practices.
- The division of labor is identified to enable the novice to develop the proficiencies required for specialization to happen.
- Bootstrapping and other techniques are applied to replicate the performance required in making effective specialists.
- A conclusion is drawn taking the position that the centrality of an epistemic community is the locus of control of the job, individual, and team; additionally, it is the only organization that can authenticate the practices necessary to boost productivity

Mupepi, Mambo Governor and Sylvia C. Mupepi. "Applying Theory to Inform Competency Development: Bootstrapping Epistemic Communities in Growing Specialists." *IJPMAT* 4.1 (2016): 28-38.

People Make the Difference

- Deconstructing the Organization
 - ...Multiple perspectives to cultivate the business
 - ...Creating exploitable databases
 - ...Sales/Customers
 - ...Marketing
 - ...Suppliers
- Creating the tools, and techniques to enhance productivity

Social Constructed Competency Models



Conclusion

Developing explicit practices is the same as designing and implementation of the core competences of the business.

1. It should provide potential access to a wide variety of markets.
2. It should make a significant contribution to the perceived customer benefits of the end product.
3. It should be difficult for similar companies in the same business to imitate.

Healthcare Supply Chain Cost Drivers in Primary Care

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ABSTRACT

Healthcare centers are becoming supply chain-sensitive organizations because their supply chain (SC) costs are increasingly on the rise, leading to limited access to quality patient healthcare. In fact, over the last decade, healthcare SC costs have increased by 40 percent in the United States (Montgomery & Schneller, 2007). A typical hospital's SC costs account for 38 percent of the total, which is high compared to less than 10 percent for most industries (Grossman, 2000). This problem is exacerbated by the fact that healthcare SC cost drivers are almost unknown, which makes the task of healthcare SC professionals more complicated than ever. As a result, healthcare centers are becoming less efficient and the population has limited access to quality healthcare. The inception of the 2009 Health Information Technology for Economy and Clinical Health Act (HITECH Act) to stimulate the use of electronic health records (HER) in the United States (HHS, 2009) has added another layer of challenge, making the task of healthcare supply chain professionals more complicated than ever. This situation often leads to unsatisfied patients, which, in the end, can force healthcare providers to close their doors.

In the healthcare sector, supply chain management (SCM) is responsible for ensuring that patients' needs are satisfied in a cost-effective manner. To do this, healthcare SCM professionals formulate strategies, allocate resources, organize activities, and assess performance. Effective and efficient SCM resource allocation is contingent upon a proper understanding and interpretation of its performance drivers and cost factors (Stock & Boyer, 2009). However, healthcare SC managers often operate on the basis of their own experience and commonly-used methodologies, which do not always result in the desired level of performance (Caputo et al., 2004). In addition, key drivers of healthcare SC costs are almost unknown. Therefore, a framework to mitigate the effect of major cost drivers on healthcare SCs performance is needed (Caputo, Cucchiella, Fratocchi, Pelagagge, & Scacchia, 2004). But before better ways to mitigate supply chain costs can be developed and utilized, healthcare SC managers first need a data-based taxonomy of the major cost drivers.

Medical SCs require a specific approach compared to their traditional counterparts. In fact, medical SCs involve organization partners that are linked in broad networks where patients, labs, drug manufacturers, and distributors are connected (Fliedner, 2003; Lightfoot, & Harris, 2003; Williams, Esper, & Ozment, 2002). Within and across the networks, SC partners collect, process, store, and disseminate information on patients, equipment, drugs, supporting facilities, funds,

and services. Medical SCs are composed of many-to-many connections, while relationships in traditional supply chains are characterized by one-to-one connections. A dramatic revision of current SCM techniques is needed (Caputo et al., 2004) to manage medical SCs chains better. Therefore, the first step is understanding healthcare SCM costs drivers. Based on the literature survey, little attention has been devoted to medical SCM cost driver evaluation, despite the high volume of ongoing research in the field (Gunasekaran et al., 2001; Sambasivan et al., 2009).

This study identifies cost drivers of medical SCs. It starts with the results of a literature review on medical SCs and the key drivers of their associated costs. In addition, it specifically assesses the current state of the literature on the logistical and cross-functional cost drivers of traditional SCs (Chopra & Meindl, 2010; Olver, Lant, Plant, Majeste, & Kursh, 2010). It compares physical product and information flows. It should be noted that SC cost drivers and their corresponding measures are effective ways for managers to ensure that the supply chain is achieving the expected benefits (Riggins & Mitra, 2001).

The author argues that the identification of key healthcare SC cost drivers is a necessity for all healthcare SCM professionals. It is even critical in the health sector because an error or any delay in the medical supply chain can, unfortunately, sometimes result in a death.

The thesis statement is that by identifying major healthcare SC cost drivers and providing ways to mitigate them, costs will decrease, resulting in additional profit gains and greater healthcare access to the population. The research question was: What are the key factors that significantly drive healthcare SC costs? The intellectual guess was that there is a set of supply chain factors that significantly drive costs more than do other factors. The study referred to those key factors as healthcare SC cost drivers in primary care.

Several procedures were used to acquire empirical evidence for answering the research question: What are the key healthcare SC cost drivers in primary care? Among the primary data was costs information from health centers and secondary data was collected from databases such as Health Care Cost Institute (HCCI), Data Resources Agency for Healthcare Research & Quality, National Health Expenditure Data, and Centers for Medicare & Medicaid.

For the purpose of validity, the research team first tested the goodness-of-fit of data to a specific distribution probability distribution to ensure that required assumptions were satisfied. In order to identify properly the healthcare SC cost key drivers based on hard data, the team ran a principal component analysis to contract the data into a lower dimensionality. The team then ran an exploratory factor analysis on collected data for empirically testing theoretical data structures, detect structure in relationships between variables, and classify variables. After deciding on the number of factors to retain, the team looked at the attributes that explain the most variation in each factor. The research team then tested the hypothesis that a set of healthcare SC cost factors significantly drive SC costs more than do other factors.

Empirical evidence showed that only four of the six traditional logistics and cross-functional SC cost drivers are significant in primary care. These are inventory, information, facility, and transportation. The results of the study might lead to a positive social change by providing a set of key healthcare SC cost drivers and a way to mitigate them. The adoption and use of such a framework can improve efficiency in healthcare organizations and increase access to quality healthcare for the population.

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Using Variance Analysis to Evaluate M&A performance

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Abstract

This paper applies strategic variance (SVA) analysis to the United Airlines acquisition of Continental Airlines. It demonstrates the value of SVA in addressing limitations hindering previous M&A research, namely the ability to examine how an acquisition affects post-acquisition profitability due to changes in sales volume, unit prices, unit costs, efficiency, and capacity utilization. It shows that post-acquisition performance changes are complex, difficult to predict, and can offset each other. By identifying post-acquisition performance changes in greater detail, SVA allows researchers to examine different perspectives on M&A: investors, regulators, and management. The findings show the predictions of United's management differed significantly from the actual post-acquisition performance changes. Also, increased market power appears to be the strongest driver of performance improvements from the United-Continental merger.

Multidisciplinary teams in Health care

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Abstract

Healthcare providers are increasingly using multidisciplinary teams (MDTs), which are comprised of professionals from various areas of expertise (e.g., physicians, nurses, dieticians, health educators, social service and mental health providers etc.), to suggest treatment recommendations for patients suffering from chronic conditions (Rowlands & Callen, 2013). The collaborative structure of the MDTs can have both positive as well as negative consequences because on the one hand while these allow for accuracy of diagnosis, they can also spawn interpersonal conflict (Copley et al., 2013; Magnani et al., 2012). Drawing on the literatures on team diversity, interpersonal conflict and organizational identity and identification I propose a framework of understanding conditions under which MDTs are likely to be successful in the health care settings.

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What is Emotional Intelligence and how can it be developed?

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Abstract

This presentation will examine how the concept of human intelligence led to the construct of emotional intelligence. The history of intelligence testing and the eventual development of a specific model of emotional intelligence will be discussed. Recent research that demonstrates a positive correlation between emotional intelligence and improved job performance will be described. Specific steps to improve emotional intelligence will be reviewed along with self-development resources.

The Concept of Emotional Intelligence

Stein and Book (2006) provided a brief history of how examining the construct of human intelligence led to the concept of emotional intelligence. Stein and Book (2006) began by tracing the roots of intelligence testing to the work of Alfred Binet during the early 1900s, searching for a method for identifying the feeble minded within the Paris, France school system. Binet's work found its way to America and was applied by the psychologist and educator, Henry Goddard, serving as an administrator in a school for children with cognitive disabilities in the state of New Jersey (Stein & Book, 2006).

In the 1920s the American psychologist, Edward Thorndike, discussed what he called *social intelligence*. David Wechsler, a pioneer in the field of intelligence testing, discussed the importance of the “non-intellective aspects of general intelligence in the 1940s” (Stein &

Book, 2006, p. 15). Wechsler saw intelligence as the ability of the individual to understand the world and deal with the demands associated with life's activities. Wechsler also felt general intelligence was a representation of the total person, including cognitive skills, personality dimensions, emotional make up, beliefs, and attitudes. Therefore, a complete measure of intelligence should include affective abilities – emotional and social intelligence (Kaufmann & Kaufman, 2001). Lastly, Kaufmann and Kaufman (2001) reflected on how the concept of emotional intelligence evolved and asserted that the roots lead back to both Alfred Binet and David Wechsler.

The concept of Emotional Intelligence (EI) was first introduced by Salovey and Mayer (1990). Since the concept was introduced, there has been an on-going debate about whether EI is truly a form of intelligence or simply a proxy for personality traits or some other constellation of competencies. The EI construct has been embraced by some theorists and questioned by others. The views expressed by proponents of EI are discussed first, followed by a discussion of some of the counter arguments made by other researchers.

According to Mayer and Salovey (1997), emotional intelligence consists of four interrelated abilities: (a) perceiving emotions; (b) using emotions to facilitate thought; (c) understanding emotions; and (d) managing emotions in a way that enhances personal growth. The focus is on abilities related to processing emotional information and managing emotions. Stein and Book (2006) add some evidence of the connection between rational thinking and emotions by asserting that neurological mapping of the human brain demonstrates thought processes pass through the brain's emotional centers.

Law, Wong and Song (2004) viewed EI as a set of abilities, which conceptually

distinguishes EI from personality traits and that EI is related to but distinct from personality dimensions. Izard (2001) posited along with the proponents of EI that emotion related abilities do exist. When discussing the EI construct, Izard (2001) stated, “Intelligence and personality do not represent all the human abilities or characteristics involved in social competence and adaptive behavior . . . humans have a domain of abilities that relate to the emotions” (Izard, 2001, p. 250). According to Izard, studies have consistently demonstrated the validity of emotion-related abilities and how those abilities relate to socio-emotional competence.

Zeidner et al. (2008) conducted a study, which focused on the science of EI, the points of consensus, and the controversies. Evidence was found that, “EI assessments measure dispositional traits rather than some form of intelligence” (Zeidner et al., 2008, p. 69). The studies examined by Zeidner et al. (2008) demonstrated positive correlations between EI and the four of the “Big Five” personality traits – agreeableness, conscientiousness, extraversion, and a negative correlation with neuroticism. According to Zeidner, emotional intelligence assessments may simply measure dispositional traits, rather than some form of intelligence. Izard (2001) appeared not quite ready to assert that emotional intelligence is indeed a form of intelligence and argued that emotion related abilities are derived more from the direct effects of emotions, rather than constituting a special kind of intelligence. In Izard’s view, “socio-emotional competence is not so much a special kind of intelligence as it is a matter of sensing or perceiving emotional cues and signals in self, others, and contexts, and responding in accordance with the emotion elicited by the perception” (Izard, 2001, p. 255).

Developing Emotional Intelligence

Some theorists believe emotional intelligence can be learned and developed. Brown et al. (2003) asserted that emotional intelligence could be taught and learned. If emotional intelligence can be taught and learned, clients can be helped to deal with work adjustment issues and career decision making difficulties. Emmerling and Cherniss (2003) put forward the idea that those lower in EI may benefit from techniques that encourage them to work with those emotions that present problems in making career choices. Di Fabio and Palazzeschi (2009) viewed emotional intelligence as malleable, able to be improved through training.

Stein and Book (2006) viewed emotional intelligence competencies as mutable skills, capable of being improved through appropriate learning interventions. Liptak (2005) also posited that emotional intelligence is a set of skills and therefore, amenable to training and learning. Zeidner et al. (2008) evaluated a number of studies and discovered that training programs to enhance emotional intelligence provided practical strategies to help people in many real life situations. According to Stein and Book (2006), the BarOn EQ-i assessment contains operationally defined skills amenable to development. Stein and Book (2006) viewed EQ as not permanently fixed, but amenable to development regardless of age, gender, or ethnic background. Lindebaum (2009) asserted, “Encouraging individuals to foster their EI by means of a personal development initiative may have great remedial effects” (Lindebaum, 2009, p. 234).

Conclusion

Stein and Book (2006) viewed emotional intelligence skills as infinitely developable. No matter what level of mastery, the skills can always be improved upon. The notions put forward

by Stein and Book (2006) are built on the concepts that define positive psychology – nurturing and improving talent and building on existing capabilities. Dulewicz and Higgs (2004) asserted that emotional intelligence (EQ) can be improved by making use of lectures, discussions, videos, exercises, dialogues, role playing, diaries, and one to one feedback. In a study reported by Dulewicz and Higgs (2004) using a pre and post research design, the learning techniques used in the intervention produced a statistically significant improvement both on the EQ total score (.001 level) and five of the seven elements assessed (.01 level).

Finally, Dulewicz and Higgs (2004) assessed a number of programs in school settings designed to develop emotional intelligence and surmised as follows:

Whether these program are actually fostering EI competencies, various skills are most likely learned during participation in these programs. This potentially useful set of skills include labeling and describing emotions and enriching linguistic experiences; appraising basic motives in oneself and others; managing emotions; managing conflict; understanding the perspective of others....cultivating a positive outlook toward life; engaging in assertiveness training...and developing self-esteem. (Dulewicz & Higgs, 2004, p. 229)

All of these skills appear to be helpful, regardless of whether one accepts the notion that the construct of emotional intelligence is indeed a form of intelligence.

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Overnight Versus Day Returns in Gold and Gold Related Assets

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Abstract

Overnight returns are significantly positive while day returns are significantly negative in the COMEX gold front futures contract, the gold spot market (London Fix), gold mining company stocks, and gold related mutual funds and Exchange Traded Funds. The findings are consistent with gold price being (too) high at the opening of the various markets. The asymmetry is shown to be present in both up and down markets for gold. The results are statistically significant and economically important even with transaction costs.

High Frequency Analysis of the Price Discovery of Gold

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Abstract

I analyze the price discovery process of gold by using high-frequency price series of three commonly traded gold investment products and find that first: modern markets disseminate new gold pricing information in less than one hundred milliseconds. My second finding is that gold future contracts lead the price discovery process of gold, closely followed by a physical gold based exchange traded fund—prices of an exchange traded fund based on gold mining stocks do not provide much informational content, but track the price of gold closely. This implies that institutional investors, who predominantly trade gold future contracts, lead the price discovery process; retail investors (trading ETFs) do not contribute much to price discovery and act as consumers.

Equity Market Response to Corporate Social Responsibility Rankings

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Abstract

This study examines the equity market response to companies ranked as the top 100 in the US based on their composite Corporate Social Responsibility (CSR) score during the nine year period 2008-2016. Although the rankings were started in 2001, after 2008 the same seven dimensions have been used for forming the composite score (environment, climate, human rights, employee relationship, corporate governance, philanthropy, and finance) and hence our sample starts in 2008 (n=900). Based on the Fama-French three-factor model with the momentum factor added, we find that the mean abnormal return on the day of the ranking announcement is significantly negative (-0.2%) and the mean cumulative abnormal return over the next three years is also significantly negative (-5.8%). Over the three years prior to ranking, however, the mean cumulative abnormal return is significantly positive (4.7%). Out of our sample of 900 companies, 80 companies have been ranked in the top 100 at least 10 times over the 2001-2006 period and only 148 companies have been ranked in the top 100 only once since 2008. The abnormal returns for these one timers is even more extreme. The mean abnormal return on the day of announcement is -4%, over the next three years is -10.6% and over the pre-ranking three years is +14%. The abnormal returns at the time of announcement are unrelated to the overall composite CSR score, but the worse the CSR ranking of a company on the finance dimension the higher the abnormal returns while the better the CSR ranking of a company on the environment dimension the worse the market reaction. Analysis of the post ranking three year abnormal returns reveals that the higher the composite CSR ranking of a company at the time of announcement the worse the long-term market reaction.

Examining CEO Compensation and Financial Performance in the U.S. Property Casualty Insurance Industry

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Abstract

Boards of directors are charged with establishing chief executive officers' (CEO) compensation packages within the U.S. property casualty insurance industry. Boards of directors have a limited understanding of the relationship between CEO compensation and the financial performance of a firm. Examining the relationship between CEO compensation and financial performance will provide boards of directors with more information to align CEO compensation packages according to the firm's financial performance. The purpose of this quantitative, correlational study was to examine the relationship between CEO compensation and financial performance in the U.S. property-casualty insurance industry (USPCI). The study was guided by agency theory and focused the research questions on examining the relationship between annual revenue and return on equity (ROE) and CEO total incentive compensation, measured by salary, stocks, bonuses, and options awards, while controlling for firm size, CEO age, and CEO tenure. Secondary, archival data was collected from Compustat and Standard and Poor's Capital IQ databases. A sample of 190 total firm years from 2010 – 2014 were examined in the study. Hierarchical multiple regression was used to analyze the data and identify variables with statistical significance to the model. CEO age and annual revenue revealed a significantly positive relationship to CEO total compensation, while ROE, CEO tenure, and firm size provided no indication of a relationship to total CEO compensation. This research can aid USPCI carriers in strategic planning and understanding how CEOs make decisions, how to compensate CEOs, and how to more efficiently understand gross annual revenue within the USPCI industry.

Introduction

The United States (U.S.) insurance sector is a \$5.5 trillion industry composed of property-casualty, life, and health insurers (Capital Markets Special Report, 2015). The insurance industry has experienced a shift from insured-owned companies to stock-owned insurance companies, through a process called demutualization (Belanger, McKenna, Murray, & Burns, 2015). Mutual insurers dominated the insurance industry in the 1930s, subsequently, 200 have demutualized and as of 2013, 78% of the insurance industry is stock owned (Capital Markets Special Report, 2015).

Property-casualty insurers, listed as Standard Industrial Classification (SIC) code (6331) account for 3% of U.S. gross domestic product (GDP) and 2.3 million jobs nationwide (Pusey, 2014). Increased demutualization, prompted the U.S. Department of Finance to draft demutualization regulations for the U.S. property-casualty insurance industry, which were enacted on February 28, 2015 (Belanger et al., 2015). Compustat reports 84 property-casualty insurers, not including subsidiaries, trade as stock owned companies on either the New York Stock or National Automated Security Dealers Automated Quotation System (NASDAQ) exchanges (McGraw-Hill Financial, 2013a).

Stock companies require boards of directors appoint Chief Executive Officers (CEOs) to manage firms. The goal of a stock owned company is to increase the value per share of existing owners' equity. Stock owned companies hire CEOs to work in the best interest of company shareholders, as expressed through goals established by the board of directors (Ross, Westerfield, & Jaffe, 2013).

Researchers, over time, have investigated the relationship between CEO compensation of stock owned companies and the financial performance of firms in many sectors and found significant relationships between CEO compensation and financial performance in each industry (Antenucci, 2013; Labovitch, 2015; Madsen & Bingham, 2014; Melinsky, 2013; Moore, 2014; Shin, Kang, Hyun & Kim, 2015; Sun, Wei, & Huang, 2013; Wesolowski, 2014). CEOs onerous obligations to the board of directors and the increase in stock owned property-casualty insurers, has made CEO compensation and financial performance research, essential to the insurance industry (Ho, Lai, & Lee, 2013).

Background of the Study

Executive compensation in the U.S. grew 92.3% between 1965 and 2012 which prompted researcher interest in evaluating if executive compensation is related to financial performance variables (Mishel & Nabadish, 2013). Research on CEO compensation has grown significantly over time. 18 studies took place from 1920-1939, 64 studies from 1940-1959, 300 studies from 1960-1980, 5,046 studies from 1981-2000, and 20,260 studies from 2001-2015 (ProQuest, 2015).

The largest contributions to research growth concerning firm performance were the availability of resources to the public under The Securities Act of 1933 and the Executive Compensation Disclosure Act of 2006. To discourage deceit and fraud, the Securities Act of 1933 requires investors have access to financial information about public securities and required public companies to disclose financial information to the United States Securities and Exchange Commission. The Executive Compensation Disclosure Act of 2006 requires compensation of the five highest-paid executives or directors be disclosed on a firm's 10-K annual report (Choudhary, Schloetzer, & Sturgess, 2013; Frantz, Instefjord, & Walker, 2013; Lee, 2014; Mitler, 2014).

CEOs are charged with achieving goals of shareholders as established by boards of directors (Ross et al., 2013). Prior research suggests agency theory is the most relevant theory to executive compensation and financial performance (Callan & Thomas, 2014; Moore, 2014; Sun et al., 2013). Agency theory purports that principals hire agents to work in their best interest (Jensen & Meckling, 1976). Agency conflicts arise when an agent's decisions align with her or his own benefits, interests, or ambitions, rather than those of the board of directors, jeopardizing the firm's financial and overall success (Ali, 2014; Campbell, Campbell, Sirmon, Bierman, & Tuggle, 2012; Donadelli, Fasan, & Magnanelli, 2014).

The principal-agent relationship is essential to the success of a firm. The availability of financial information for publically traded firms and the need for determining base salary, incentive, and equity compensation structures has resulted in practitioner and academic research in various industries. As property-casualty insurers seek to maximize financial performance, methods of CEO have become an important component of their position in the industry.

Statement of the Problem

Board of directors are charged with establishing CEO compensation packages; a task composed of many complex variables (Wang, Venezia, & Lou, 2013). The Economic Policy Institute (EPI) conducted a study on compensation among the largest 350 Standard and Poor's firms, from 1965 to 2012, and found earnings of CEOs grew from 20 times to 273 times average workers' earnings, yet the stock market did not reflect similar growth (Mishel & Nabadish, 2013). Prior research suggests a relationship between CEO compensation and financial performance, but the strength of the relationship is dependent on the industry (Murphy, 1999). When considering the U.S. property-casualty insurance industry, present research also indicates differences between percentage change in CEO compensation and shareholder returns. Morningstar (2015) projected a 5% annual increase in CEO compensation in the insurance industry until 2020 and reports 5-year average annual returns of U.S. property-casualty insurers at 17.02%. Boards of directors in the U.S. property-casualty insurance industry lack information to understand the relationship between CEO compensation and the financial performance of a firm.

Mutual and stock owned insurers compensate their CEOs differently ("PCI Conducts Annual", 2013). The shift from mutual owned insurance companies to stock owned insurance companies has disrupted industry knowledge regarding executive compensation. Moore (2014), examined the relationship between CEO compensation and firm performance among U.S. health insurers and suggests the insurance industry still lacks this knowledge in other sectors. The relationship between CEOs' compensation and firms' performance in the U.S. property-casualty insurance industry must be examined to provide board of directors of stock owned insurance companies more information for making effective compensation decisions.

Rationale

The rationale of this study was to understand how CEO compensation could affect financial performance among U.S. property-casualty insurers. During the past 9 years, there have been four significant studies examining executives' compensation and financial performance in the insurance industry (Lo, 2006; Moore, 2014; "PCI Conducts Annual", 2013; Sun et al., 2013). Property-casualty, life, and health insurers were examined, and a significant relationship was found between CEO compensation and firm size, but findings indicated the insurance

industry was too broad and should be examined by insurance coverage categories instead of lumping together the entire insurance industry (Lo, 2006). Property-casualty insurers were examined using data envelopment analysis, and a significant relationship was found between CEO compensation and revenue, but the researchers did not use accounting measurements (Sun et al., 2013). Stock-owned health insurers in the U.S. were examined, and quantifiable constructs were found between CEO compensation and annual revenue, firm size, and tenure using accounting measurements (Moore, 2014). The U.S. property-casualty insurance industry has also been examined by the Property Casualty Insurers Association of America (PCI) to aid those responsible for hiring in the industry (“PCI Conducts Annual”, 2013). PCI results are presently limited to property-casualty insurers who elect to complete the PCI survey and subsequently, those firms that opt to pay a substantial fee for the findings (“PCI Conducts Annual”, 2013).

Given the shift in insurance company ownership growing to 78% stock ownership as of 2013, there is a growing need for evaluation of this type of business structure within the insurance industry (Mishel & Nabadish, 2013). Furthermore, research regarding CEO compensation in the insurance industry has been examined by four researchers, throughout the last 9 years, revealing measurable constructs, but there is still need for further research that is narrowed to the property-casualty insurance industry, evaluated from an accounting perspective, and available to the public at no cost.

Research Questions

The objective of this research was to examine the relationship between CEO compensation and financial performance in the stock owned, property-casualty, insurance industry. The following research questions were used to address the objective:

RQ1: What is the relationship between annual revenue (independent variable) and chief executive officer (CEO) total incentive compensation, measured by salary, stocks, bonuses, and options awards (dependent variable) while controlling for firm size, CEO age, and CEO tenure within the U.S. property-casualty insurance industry?

RQ2: What is the relationship between return on equity (ROE) (independent variable) and chief executive officer (CEO) total incentive compensation, measured by salary, stocks, bonuses, and options awards (dependent

variable) while controlling for firm size, CEO age, and CEO tenure within the U.S. property-casualty insurance industry?

Assumptions and Limitations

The study assumed information obtained from Standard and Poor's Capital IQ, ExecuComp, Compustat, and on 10-K annual reports was accurate and reliable. The study was conducted using credible resources, was free from bias, and included measures designed to ensure privacy, confidentiality, and security. This research was limited to stock owned U.S. property-casualty insurance carriers from 2010 through 2014. Results of the study were not extended to property-casualty insurers outside the U.S. or to those with different forms of ownership. Results of the study are not transferable to other time periods, other executives, or types of employees because this study did not reflect the diversity of all time periods, employee types, and industries. According to Moore (2014), financial performance in the stock owned insurance industry is measured most effectively by return on equity (ROE) and annual revenue. Prior research has evaluated several other financial measures, but they are not included in this study.

Literature Review

Smith (1776) provided the earliest academic publication that informally theorized on executive compensation and firm performance. Smith (1776) postulated that management of stock owned companies cannot be expected to watch others' money with the same vigilance as they would watch their own. Taussig and Baker (1925) tested Smith's proposition and found a limited relationship between CEO compensation and performance of their firm.

Jensen and Meckling (1976) formally defined the relationship above as agency theory, where a principal and/or principals hire an agent and/or agents to act on her, his, or their behalf. Fama (1980) used the classical economic labor market theory of supply and demand to suggest that executives, particularly CEOs, compose a limited pool of highly qualified candidates and companies must compensate them at or above peers at other organizations to retain them. Freeman (1984) discussed stakeholder theory, as the decision-maker authority benefiting the welfare to any party with a stake in the firm. Hill and Jones (1992) combined the elements of agency and stakeholder theory to stakeholder-agency theory, which generalizes agency theory to anyone with a stake in the

firm. As managerial discretion gained attention and importance, Hambrick and Abrahamson (1995) recognized the limitations of prior research, solely through qualitative constraints and extended research quantitatively to various industries. Murphy (1999) extended the study of managerial discretion and CEO compensation by examining firm profitability and CEO compensation to shareholder returns in low, medium, and high industries.

Murphy's (1999) study became an inflection point, which prompted researchers to begin examining CEO compensation and firm performance in specific industries: hospitality, banking, insurance, airline, aerospace, automotive, property-casualty insurance, health insurance, and utilities (Chambers, 2008; Choi, 2003; Crumley, 2006; Labovitch, 2015; Lo, 2006; Marin, 2010; Moore, 2014; Morlino, 2008; Sun et al., 2013).

This study's research questions evolved from industry specific examples noted above. Lo (2006) evaluated CEO compensation and financial performance in the entire insurance industry, including property-casualty, life, and health, through accounting and financial measurements. Sun et al. (2013) examined the property-casualty industry and did not use accounting and financial measurements, but instead, used efficiency scores derived from data envelopment analysis. Moore (2014) examined the health insurance industry's CEOs' compensation and financial performance under accounting and financial measures. Prior research suggests that the insurance industry is a sector worthy of investigation and that (USPCI) is a relevant topic, with increased investigations, but has not yet been investigated individually from an accounting-based, financial perspective.

Agency theory. Current literature suggests agency theory is the most relevant and commonly used for executive compensation (Flor, Frimor, & Munk, 2014; Nyberg, Fulmer, Gerhart, & Carpenter, 2010). Historically, common and pertinent literature to agency theory has found inconclusive results lacking unanimity. Dalton, Hitt, Certo, and Dalton (2007) found no relationship between CEO compensation and firm performance; whereas, Cooper, Gulen, and Rau (2009) found a negative relationship, Jensen and Murphy (1990) found a moderately positive relationship; and, Attaway (2000) and Sigler (2011) found a positive relationship. Results of Nyberg et al. (2010) indicated the correlation between CEO returns and financial performance are stronger than previously thought and warrant further research. During this same period, Wowak and Hambric (2010) indicated that agency theory needs revisiting. Prior thought was that stock options increase all risk taking in CEOs, but the researcher's

study found it only increases firm performance in specific areas, such as executives with high abilities (Wowack & Hambric, 2010). Donadelli, Fasan, and Magnanelli (2014) found that agency conflicts have adverse effects on financial performance of firms.

Stakeholder theory. The origin of stakeholder theory is traced informally to Frank Abrams Management's Responsibilities in a Complex World (Abrams, 1951). Abrams infers that businessmen, also referred to as business persons, are responsible for many groups, such as stockholders, customers, employees, and the general public, as opposed to only one particular group (Abrams, 1951). Ansoff (1965) was credited as the first researcher to term the aforementioned groups as "stakeholders" and posited that firms have a responsibility to satisfy all stakeholders, as opposed to just one group, of which he specifically mentions stockholders, because the goal of corporations heavily stresses the importance of return on investment for stockholders. Freeman (1984) had formulated stakeholder theory in *Strategic Management: A Stakeholder Approach*. Freeman (1984) argued that managers need to establish a shared sense of firm value that brings stakeholders together to achieve outstanding performance. The concept of stakeholders is expanded to have "investor and non-investor stakeholders" (Cornell & Shapiro, 1987, p. 5). Modern research evaluated stakeholder theory and found that five researchers, who have examined the concept of stakeholders, have defined stakeholders in 66 different ways. Lack of a universal definition of stakeholder groups has caused ambiguity (Emerson, Alves, & Raposo, 2011).

Stakeholder-agency theory. Major components of agency and stakeholder theory were combined to create a proposed paradigm, defined as stakeholder-agent theory. The stakeholder-agent theory uses agency theory as a foundation in that "firms can be seen as a nexus of contracts between resource holders" (Hill & Jones, 1992, p. 132). The theory of agency is generalized by using stakeholder theory, to refer to the resource holders, as management and all stakeholders, including employees, suppliers, creditors, customers, communities, and the public (Hill & Jones, 1992). Both agency and stakeholder theories individually adhere to economic markets of supply and demand. Agency theory assumes market efficiency while stakeholder theory assumes market inefficiency within stakeholder-management relationships (Salancik & Pfeffer, 1978). By combining stakeholder and agency theories with independent and opposing views of economic market efficiencies, researchers challenged

the effectiveness of the combined theory and research results indicated that stakeholder-agency theory has an efficient market regarding stakeholder-management relationships (Hill & Jones, 1992). Current research uses stakeholder-agency theory to explore the relationship between mechanisms of corporate governance and firm performance, environmentally, based on boards of directors and managerial incentives provided. Results of Kock, Santaló, and Diestre (2012) indicated a positive relationship between the level of corporate governance and the environmental performance of the firm.

Discretion theory. Discretion Theory is referred to as managerial discretion, or the level of decision-making authority an executive, specifically CEO, is given when managing an organization (Finkelstein & Hambrick, 1990). Later this term was deemed as “latitude of action” (Finkelstein & Boyd, 1998, p. 179). Finkelstein (1992) found factors pertaining to discretion theory including competition in the market, freedom from regulations, and overall stability of the firm, as well as the availability of resources, and forces within the organization (Finkelstein & Hambrick, 1988). Tosi and Werner (1995) studied and tested managerial discretion within organizations and found it significant. In 1995, Hambrick worked with a different co-researcher, Abrahamson, to define factors that influence discretion as, “product differentiability, market growth, industry structure, demand instability, quasi-legal constraints, powerful outside forces and capital intensity” (Morlino, 2008, p. 46). Hambrick and Abrahamson (1995) took these seven discretionary criteria and tested whether the degree of discretion had any significance by industry. Hambrick and Abrahamson (1995) found a mean of 4.59 for managerial discretion on a 7 point scale, to deduce that industries considered to be average have medium levels of discretion. Many studies of correlation have been conducted between industries and firm performance, based on this seminal piece.

Hambrick and Abrahamson’s ratings of managerial discretion in 71 Industries. Companies in the study were ranked according to the level of decision-making authority the CEO had and were categorized by industry on a discretion score from 0-7. A score of 0 meant CEOs in a particular industry had the least managerial discretion, and a score of 7 meant CEOs in a particular industry had the most managerial discretion. Actual scores ranged from 2.01 to 6.89. Natural gas transmission companies had the lowest decision-making authority and computer and

software wholesaling companies had the highest degree of managerial discretion. Insurance agents, brokers and service scored as medium discretion at a 4.54 overall score. All other financial service industries in the study also had results that depicted medium levels of managerial discretion (Hambrick & Abrahamson, 1995). CEO compensation evolved to be examined according to industry: hospitality, banking, insurance, airline, aerospace, automotive, property-casualty insurance, health insurance and utility industries (Chambers, 2008; Choi, 2003; Crumley, 2006; Labovitch, 2015; Lo, 2006; Marin, 2010; Moore, 2014; Morlino, 2008; Sun et al., 2013).

The Need for Insurance

Founding Father of the U.S., Benjamin Franklin, was also the father of U.S. insurance. Franklin published a letter in the Philadelphia Gazette on February 4, 1735, addressing preventing and extinguishing fires. A self-funded, 30 person, fire brigade was established to fight fires and by 1750 became the first U.S. insurer; Union Fire Insurance Company. Union Fire Insurance Company was a single peril coverage company designed to protect against fire (Dimkoff, 2012). Insurance was proposed as a risk management technique to transfer risks that are catastrophic for individuals to insurance companies that properly pool risks and collect appropriate premiums, derived by actuaries (Dimkoff, 2012). Property-casualty insurance exists to provide coverage to individuals' and businesses' assets and liabilities. Perils have expanded greatly since the inception of U.S. insurance in that almost anything can be insured as long as an insured has ownership and/or interest (Dimkoff, 2012)

Chief Executive Officers

CEO is one of the most coveted, and least understood, jobs in a company. Everyone believes that CEOs can do whatever they want, are all-powerful, and are magically competent. Of course, nothing could be further from the truth. By its very nature, the job description of a CEO means meeting the needs of employees, customers, investors, communities and the law. (Robbins, 2015, para. 1)

History of CEO Compensation

Frydman and Saks (2010) reviewed executive compensation within the United States from a Historical Perspective from 1936 to 2005. Several significant findings were made during their study. First, Frydman and Saks (2010) found that executive level compensation remained relatively flat from the end of World War II to the 1970s.

Since this time, rapid increases were observed both in firm size and in executive compensation. In addition, compensation methods have become more diversified, such as offering additional means of compensation, through items such as fringe benefits, bonuses, and stock options.

Frydman and Saks (2010) referred to an executive's salary as the real value that excludes items such as fringe benefits, bonuses or stock options. Real value of pay increased for executive management just after World War II and was 0.8%. This rate held relatively constant until the 1970s when pay increases were on the rise. It was from 1995 to 1999 when the largest pay increases were seen in the last half century; raises were commonly up to 10% for executives of the largest 300 firms sampled.

Banker, Darrough, Rong, and Plehn-Dujowich (2013) also evaluated historical CEO compensation practices as they relate to performance. The researchers examined CEO Compensation practices from 1993 – 2006. Results found a positive correlation between executive salaries, plus bonus when associated with their past performance. Conclusions of the study found salary positively correlates to future performance, however, bonuses do not.

Research found that executive bonuses are required to achieve top performance. This idea is also supported by prior research by Sobel in 1993 which refers to the 1950s as the age of giant corporations and with such growth came the rationale for the existence of such compensation practices (Spector & Spital, 2011). The U.S. government also played a significant role in executive compensation through two separate policies, wage control and taxation. The government did not set these policies as a means of them working together, but in fact, that is what happened. As a result, when the government implemented these policies in the 1950's, this was when bonuses and alternate methods of executive compensation became prevalent (Spector & Spital, 2011).

The largest contribution to the growth of research pertaining to firm performance was the availability of resources to the public under The Securities Act of 1933. The Act requires investors have access to financial information about public securities, to prohibit deceit and fraud by disclosing financial information to the United States Securities and Exchange Commission (Security Exchange Commission, 2013). Furthermore, On October 15, 1992, the SEC, Securities and Exchange Commission approved reforms that required public corporations to disclose the compensation of top executives. This reform came because shareholders and Congress were dismayed by the

lucrative compensation packages of senior executives that portrayed little or no correlation to their company's performance (Akhigbe, Madura, & Tucker, 1995). By 2006, the SEC again felt the need to intervene with more stringent compensation reporting regulations. As of December 15, 2006, the U.S. Securities and Exchange Commission (SEC) also approved the requirement to disclose each company's top five executive's compensation on 10-K annual reports (Security Exchange Commission, 2006).

Compensation of Insurance CEOs

Marx, Mayers, and Smith (2001) evaluated ownership structures of insurance companies in combination with executive compensation. The researchers evaluated the type and structure of the company with the degree of discretion needed based on the line/s of business offered and results found variation in firms. Results of the study also found that companies with lines of business that had high managerial discretion had a heavier weight in stock and higher compensation for their executives. Companies with fewer lines of business and lower managerial discretion, such as mutual companies, had lower executive compensation.

Next, Wilson and Higgins (2001) evaluated the sensitivity of CEOs pay in conjunction with the firm performance in the (USPCI) industry. The study examined 62 insurance carriers between 1992 and 1997 and used a controlled group of non-insurance companies as well. Their findings indicated CEO compensation methods were no different between insurance and non-insurance companies but found that executive salaries in insurance were sensitive to the firm's size and the markets returns, but non-insurance companies were only sensitive to market returns.

Grace (2004) studied executive compensation from 1995 – 1997 and found that the larger the size of the firm and the greater the level of risk of the firm, the more likely a company was to offer incentives in their executives' compensation. Higher executive compensation was correlated to a firm having more risk and the executive having more uncertainty about their longevity with the firm (Grace, 2004). Core, Holthausen, and Larcker (1999) also found a correlation between higher executive compensation with higher risk and uncertainty, but Smith and Watts (1992) did not find a correlation.

Min-Ming and Chen (2008) reviewed executive compensation regarding options available to executives in the insurance industry and results found that larger options contracts created higher risk-taking behaviors. The

researchers discuss whether executive compensation induces behaviors of risk acceptance or aversion as supported in prior studies (Aggarwal , 1991; Chen et al., 2006; Grace, 2004; Jensen & Murphey, 1990; Smith & Watts, 1992).

Browne, Yu-Luen, and Wang (2009) evaluated reserve errors as correlated to stock-based executive compensation in the (USPCI) industry. The researchers suggest compensating executives, specifically CEOs, through stock options, encourages CEOs to increase the value per share of company stock, but ultimately, only do this through decisions that benefit themselves. Browne et al. (2009) found that inaccurate reserve errors are often reported to skew stock performance and increase executive pay through stock options. Hoyt and McCullough (2010) also supported this research in their own study, just one year later, that also focused on reserve reporting practices as it related to managerial discretion in the (USPCI) industry to find no correlation between reported loss return levels and the regulatory scrutiny placed on the carrier.

Grace (2004) studied higher pay being related to CEO uncertainty about their longevity with the organization in the (USPCI) industry. Grace's researched was extended by He and Sommer (2011) to see if the ownership structure of the firm correlated to performance and turnover within the (USPCI) industry. Findings indicated a significant difference between turnovers in mutual versus stock based carriers, which correlated with small versus large insurance carriers respectively (He & Sommer, 2011).

Eckles, Halek, He, Sommer, and Rongrong (2011) reviewed executive compensation and corporate governance in the (USPCI) industry. The researcher's study found that managers who receive larger bonuses and/or stock awards often make decisions that decrease firm earnings. Eckles' study disproves the public bias that executives look to increase the value of stock, to increase their own earnings per share. At the same time, Milidonis and Stathopoulos (2011) were also studying executive incentives in the insurance industry and found that long-term incentives, such as equity-based compensation in company stock, encouraged managers to take risks that created equity volatility and maximized managerial pay.

Sun et al. (2013) conducted a study focusing on CEO Compensation and firm performance with evidence from the (USPCI) industry. The researchers took a different direction than previous studies and examined the relationship using Data Envelopment Analysis (DEA) to create efficiency scores. Once efficiency was established, translog modeling was performed to test correlation for the periods between 2000 and 2006. The study found firm

efficiency to have a significant and positive relationship with CEO compensation. When breaking down this study, there was significance tied between revenue efficiency and cash compensation and cost efficiency and incentive compensation. The authors are the first to use efficiency tests to evaluate CEO compensation in the (USPCI) industry. Lo (2006) and Moore (2014) instead advocate for the use of financial accounting measurements. Sun et al. (2013) posited that DEA scores are a more reliable methods of evaluating possible relationships between data of this complexity and nature, to the traditional financial ratios analyzed from accounting statements but provide no evidence. Contradictory findings between researchers in the insurance industry warrant additional study.

Performance Measures

Much of the literature review focused on the evaluation of independent research variable, CEO compensation. Evaluation of dependent variables is of equal importance. Research over time has evaluated the merit of various financial performance measurements as dependent variables. ROE and annual revenue are the dependent variables determined most applicable to this study (Moore, 2014). Age, Tenure, and Firm Size are evaluated as control variables to the independent variable. The following will assess the selected variables and their significance in this study.

Return on equity is a measurement of a corporation's profitability, found by dividing net income by shareholders equity. ROE is expressed as a percentage of how much profit is made by funds invested by shareholders (Ross et al., 2013). ROE is assessed as a useful measurement to test if a relationship exists between CEO compensation and firm performance (Moore, 2014).

Morlino (2008) evaluated CEO compensation and firm performance in the U.S. airline industry from 2006 to 2012 among three airline firms. CEO compensation (salary + bonus) served as an independent variable to ROE, ROA, and debt-to-asset ratio, which were independent variables. Findings indicated a significantly negative relationship between ROA and CEO compensation and no statistical significance between CEO compensation and ROE or debt-to-asset ratio. Limitations suggest that examination of three firms did not provide a sufficient sample size (Morlino, 2008).

Banker et al. (2013) selected ROE to examine the relationship between CEO compensation and firm performance from 1993 to 2006, with a sample of 15,512 firm years. ROE and the individual performance of stocks

served as independent variables to dependent variables, CEO salary, CEO bonus, and CEO equity compensation. Results indicated a significantly positive relationship between ROE and individual stock performance to CEO salary and CEO equity compensation and a significantly negative relationship to CEO bonus (Banker et al., 2013).

Moore (2014) examined the relationship between CEO compensation and firm performance in the U.S. health insurance industry between 2006 and 2012. 141 health insurers were examined with CEO total compensation (salary, bonuses, stock awards, and option awards) as the independent variable and annual revenue and ROE as independent variables. Findings indicated a significantly positive relationship between annual revenue and CEO total compensation and a significantly negative relationship between ROE and CEO total compensation (Moore, 2014).

Lin, Kou, and Wang (2013) examined CEO compensation and financial performance using ROE, executive tenure, executive age, and firm size. Using regression, the researchers evaluated 900 publically traded firms and each of their top five executives between 2007 and 2010. Lin et al. (2013) found no correlation between ROE and executive compensation, but did find a significantly positive relationship between age, tenure and size of the firm.

METHODOLOGY AND RESULTS

The purpose of this quantitative, correlational study is to determine if a significant relationship exists between CEO compensation and financial performance in publically traded P&C carriers in the United States. The dependent variable is CEO total compensation (salary, bonus, stock awards, and option awards). There are two independent variables in this study: return on equity (ROE) and annual revenue. Control variables are age and tenure of the CEO as well as the size of the firm.

The Population

The population consists of publically traded property-casualty insurance carriers in the United States. The Standard Industry Classification (SIC) code for such companies is 6331: fire, marine and casualty insurance, and includes direct automobile insurance carriers, malpractice insurance carriers, fidelity insurance carriers, mortgage guaranty insurance carriers, homeowner's insurance carriers, surety insurance carriers, and liability insurance

carriers.

The Research Sample

After extracting the list of USPCI carriers from SIC 6331, carriers were examined to confirm they operated on the NASDAQ or New York Stock exchanges and that they had valid financial data available from January 1, 2010 through December 31, 2014. The study had 38 USPCI carriers eligible for the sample over the course of 5 years, creating 190 firm years as the sample to be tested. Once data values were collected in Excel, it was transferred to SAS version 9.4 where descriptive statistics and the research questions were answered through hierarchical multiple regression testing of the hypotheses. Crumley (2006), Labovitch (2015), Marin (2010), Moore (2014), and Morlino (2008) conducted similar studies on CEO compensation within several industries, used similar techniques in collecting data, and found success using this collection method.

Two hypotheses were tested for statistical significance, one comparing CEO compensation against revenue, and the other testing compensation against return on equity. More specifically, the hypotheses are:

Revenue Effect

Hypothesis H_{O1} (Null):

There is no significant relationship between annual revenue and CEO incentive compensation while controlling for firm size, CEO age, and CEO tenure.

Hypothesis H_{A1} (Alternate):

There is a significant relationship between annual revenue and CEO incentive compensation.

ROE Effect

Hypothesis H_{O2} (Null):

There is no significant relationship between return on equity (ROE) and chief executive officer (CEO) incentive compensation while controlling for firm size, CEO age, and CEO tenure.

Hypothesis H_{A2} (Alternate):

There is a significant relationship between return on equity (ROE) and chief executive officer (CEO) incentive compensation.

Data Analysis

The table below shows a descriptive analysis summary of the variables examined.

Table 1. Descriptive Statistics for Study Variables

	<i>Mean</i>	<i>SD</i>	<i>Num</i>
Total Compensation	\$3,664,671	\$3,817,585	190
CEO Age	53.9 years	7.2 years	190
CEO Tenure	9.55 years	8.07 years	190
Firm Size (Assets, \$ billions)	\$24.18	\$52.08	190
ROE	6.99%	14.09%	190
Revenue (\$ billions)	\$49.29	\$78.79	190

Note that average total compensation – nearly \$3.7 million -- is a large number, dwarfed by average asset size (\$24.18 billion) and average revenue (\$49.29 billion).

Hypothesis Analysis

Hierarchical multiple regression was the instrument used to test the hypotheses. In this type of analysis, researchers perform a regression analysis, and of the variables lacking statistical significance, the one with the largest p-value is removed from further testing. A second regression test, and as before, the variable with the lowest p-value is removed. Testing continues until all remaining variables are statistically significant.

Moore (2014) found a violation of normality in testing individual components of CEO compensation and suggested CEO compensation be tested as a composite variable, called total compensation. His preliminary analysis of the relationship between dependent, independent, and control variables found residuals were not normally distributed. When a violation of normality occurs, log transformation converts values from their raw state to logarithms, reducing the degree of skewness. The transformed data does not allow negative or zero numbers, and residuals are normally distributed. (Gelman & Hill, 2007).

As a result, data for the sample's 190 firm years were transformed into logarithms, and testing began.

Regression Test 1 -- Analysis of Firm Size (Total Assets)

The first test involved a global study using hierarchical multiple regression testing to examine the relationship between the independent variable (total compensation) and the control variables (revenue, ROE, CEO age, CEO tenure and firm size). Results of the first test provided an overall *Akaike Information Criterion (AIC) value of 247.0*. *The AIC value is a measurement of the relative quality – the goodness of fit -- of the model. Smaller AIC numbers indicate a better fit and a more significant relationship among variables (Cavanaugh, 2007). A Type III test provided P-values for each independent and control variable in the model. Results are reported in Table 3 below. After creating the model, each P-value was compared with the others. A lower P-value indicates more significance within the model. If a P-value was lower than other variables, it remained in the model, while the highest non-significant P-value was removed. Based on data shown in Table 2, the asset variable was removed from further consideration, as it had the highest P-value and the least statistical significance.*

Table 2. Type 3 Test of Model 1

Effect	Num DF	Den DF	F Value	Pr > F
Revenue	1	184	46.13	<.0001
ROE	1	184	2.09	0.15
Age	1	184	15.36	0.0001
Tenure	1	184	1.86	0.1748
Assets	1	184	1.81	0.1804

Regression Test 2 -- Analysis of CEO Tenure

After removing firm size (assets) from the model in Test 1, a second regression was performed using revenue, ROE, CEO age, and CEO tenure in relation to total CEO compensation. Best fit statistics tested generated an AIC value of 222.6. The AIC value decreased from Test 1 to Test 2, supporting that the correct variable -- firm size -- was removed in Test 1. *A type three test provided P-values for each independent or control variable in the model. Table 3 below summarizes the findings. Based on these results, CEO tenure had the highest P-value, was not statistically significant, and therefore, was removed from the model.*

Table 3. Type 3 Test of Model 2

Effect	Num DF	Den DF	F Value	Pr > F
Revenue	1	185	80.83	<.0001
ROE	1	185	2.21	0.1385
Age	1	185	16.41	<.0001
Tenure	1	185	1.5	0.2216

Regression Test 3 -- Analysis of Return on Equity (ROE)

Continuing the hierarchical procedure, Test 3 evaluated a third model containing revenue, ROE, and CEO age in relation to total CEO compensation. Best fit statistics of the model provided an AIC for test three with a value of 214.7. The AIC value decreased from Test 2 to Test 3, supporting that the correct variable, CEO tenure, was removed in Test 2. *A Type III test provided P-values of for each independent or control variable in the model. Results are reported in Table 4. Based on the values reported for Test 3, ROE had the highest P-value and was removed because it had no statistical significance.*

Table 4. Type 3 Test of Model 3

Effect	Num DF	Den DF	F Value	Pr > F
Revenue	1	186	86.92	<.0001
ROE	1	186	1.89	0.1712
Age	1	186	14.95	0.0002

Regression Test 4 -- Analysis of CEO Age and Annual Revenue (Sales)

After removing ROE from the model in Test 3, a fourth and final test was run containing revenue, ROE, and CEO age in relation to total CEO compensation. Best fit statistics for the model provided an AIC with a value of 206.1. As with prior tests, the AIC value decreased from Test 3 to Test 4. Results are *reported in Table 5. Based on the values reported in the fourth test, revenue and CEO age both have P-values with significance to the model. There are no variables to discard.*

Table 5. Type 3 Test of Model 4

Effect	Num DF	Den DF	F Value	Pr > F
Revenue	1	187	88.55	<.0001
Age	1	187	20.85	<.0001

Summary of Multiple Hierarchical Regression Results

Successive hierarchical testing first removed assets as a significant predictor of CEO compensation. Then in subsequent tests, both CEO tenure and ROE were removed. The fourth and final model included only age and annual revenue as predictor variables, and both had a significantly positive relationship to CEO total compensation.

Results

Based on these results, one hypothesis is accepted and one is rejected.

Revenue Effect

H_{O1} (Null) is rejected and H_{A1} is accepted. In fact, there is a significant statistical relationship between CEO compensation and revenue.

ROE Effect

H_{O2} (Null) is accepted and H_{A2} is rejected. There is no statistically significant relationship between CEO compensation and ROE.

It is not surprising that CEO compensation is statistically related to age. Generally, the higher a professional's age, the greater the compensation. Results also show CEO compensation is related to P&C insurance company revenue. The larger the revenue, the greater the compensation. On the other hand, compensation is not statistically related to company's ROE.

DISCUSSION AND RECOMMENDATIONS

A summary of descriptive statistics for the sample is summarized below in Table 6:

Table 6. *Hierarchical Multiple Regression Results Summary*

	Test 1	Test 2	Test 3	Test 4
AIC	247	222.6	214.7	206.1
	P-Value	P-Value	P-Value	P-Value
Annual Revenue	<.0001	<.0001	<.0001	<.0001
CEO Age	0.0001	<.0001	<.0001	<.0001
Return on Equity	0.15	0.1385	0.1712	Removed
CEO Tenure	0.1748	0.2216	Removed	Removed
Total Assets	0.1804	Removed	Removed	Removed

Table 7. *Hypotheses Results Summary*

	P-Value	Results
H01	<.0001	Rejected
HA1	<.0001	Retained
H02	0.1712	Retained
HA2	0.1712	Rejected

Table 6 provides a summary of the hierarchical multiple regression and Table 7 provides a summary of the hypotheses results. Study results of hypothesis 1 rejected H_{O1} (Null) and retained H_{A1} (Alternate) suggesting a significant positive relationship between total CEO compensation and annual revenue. Annual gross revenue was considerably higher in firms that had higher levels of total CEO compensation. Demutualization of insurance companies initiated the separation of control between CEOs and shareholders and instigated the need for this study. As stock-owned companies have become prevalent within the USPCI industry, a better understanding of CEO compensation components and financial performance among insurers may be contributing factors to growth in annual revenue.

Study results of hypothesis 2 retained H_{O1} and rejected H_{A2} shows no statistically significant relationship between total CEO compensation and ROE. The data suggests return on ROE does not have significantly positive or negative relationships to total CEO compensation. Many factors can impact a firm's ROE, such as changes to net income, a company's decision to repurchase stock, or issue dividends. It is possible CEO compensation was not found to be a contributing factor because many other financial factors also influence ROE.

Recommendations for Future Research

One significant limitation in this study was that financial data cannot be downloaded automatically from Standard and Poor's Capital IQ prior to 2009. Researchers must obtain data manually, requiring a significant investment of time and increases the likelihood of errors. That is why this study focused only on years 2010 to 2014. Standard and Poor's Capital IQ is working continuously to update financials of companies for years prior to 2009. The first recommendation is to conduct the same study over a longer period of time once financial data is available for either past years or years to come.

Several other recommendations for future research can be derived from this study. This study was limited to publicly traded U.S. property-casualty insurance carriers listed on the NYSE and NASDAQ markets. Future researchers could expand the sample size to include carriers on other stock exchanges. A similar study could focus on insurers domiciled outside the US.

Another suggestion for further research is to expand the study to include not just CEO compensation, but compensation of the top five executives of each company. Companies have recently begun disclosing that data on 10-K annual reports. A future study could also examine other executive compensation components, other firm financial measurements, or individual or firm control factors. Further research is needed on the topic of executive compensation and firm performance in the U.S. insurance industry. It is the intent of the researcher that this study will spark future research on the subject matter.

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Minority Shareholder Protections and Value-Driven Payout Policy

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ABSTRACT

We posit that firms with weakly protected minority shareholders pay out more to avoid equity discounts of free cash flow retained and, with dividends, to bond future disgorgement. Analysis of relationships between three measures of protection and European bank payouts supports the discount hypothesis. An advantage of examining banks is the potentially greater wealth transfer incentives given bank leverage. Our findings, considered with past empirical findings for industrial firms yield strong support for the discount hypothesis, are robust to investment opportunities and confounding factors including regulatory pressure, and challenge past conclusions that greater legal and investor protections compel higher payouts.

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Non-linearity in corporate finance studies: bank size matters when it comes to leverage components.

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ABSTRACT

We decompose bank leverage and study short-term leverage, non-deposit leverage and excess leverage (above what a non-financial firm with similar characteristic would normally hold). Competition, diversification and liquidity are significant determinants of all three components of bank leverage. However, the relationship is non-linear and is affected by size of a financial institution. We use complete second order models to explore non-linearity and interactions between the three important determinants and bank size. The models are prone to multicollinearity as demonstrated by high VIFs, thus we cannot trust OLS estimates. Lasso, a variable selection method, robust to multicollinearity, comes to the rescue and helps demonstrating non-linearity and interaction properly. The results are enlightening, but, ultimately, we are interested in combining all effects in the same leverage model with control variables. Therefore, we study each component of leverage, short-term, non-deposit, and excess, by adding all variables from three complete second order modes based on competition, diversification, and liquidity to the base specifications, developed in previous studies. We use lasso variable selection again to choose the variables that make the most informative models. These latter estimates, however, may be subject to endogeneity – a usual concern in corporate finance studies. In the last step, we run the models, selected by lasso, with bank and time fixed effects. We evaluate both lasso and fixed effects estimates and only trust those that match, to ensure robustness against both multicollinearity and endogeneity. The study highlights important properties of the relationship between leverage components and their determinants. The above described procedure is of methodological interest to empirical corporate finance researchers, who don't explore non-linearity in their models often and, thus, miss important effects.

Exploring Reward-to-Risk for NCAA March Madness

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Abstract

There are many formal methodologies and models used by non-academic and academic professionals to predict the outcomes of the NCAA basketball tournament. Some of the existing models employ more formal and sophisticated statistical methods, while others use less technical yet complicated system for the prediction. In this paper, we investigate whether there is an optimal betting strategy for the NCAA March Madness. To this end, we perform the following: First, we attempt to theorize the optimal betting strategy analytically. Second, we empirically examine the theoretical hypothesis by using the historical results from the NCAA basketball tournaments. Third, we use simulations to further explore and check the robustness of the model. To begin with, we must define what the objective function is before we can explore the optimal strategy vis-à-vis the objective function. Furthermore, there are many variations of the scoring systems and payout structures being used in the NCAA bracket pools. For example, the scoring system can be increasing or flat. There are also variations in the increasing scoring system. The popular 1-2-4-8-16-32 system is an example of this, where correct Round of 64 picks are worth an almost negligible 1 point, while nailing the NCAA champion nets a whopping 32 points. For the payout structure, there are over 100 different versions being used, the most common prize structure is winner takes all, followed by the top three winners splitting the pot with different versions of split percentages (e.g. 60-30-10). The following shows the basic analysis for the simple cases (i.e., winner takes all cases, and single entry for top three winners payout structure case). For more complicated cases beyond these, we use formal statistical models along with simulations for the analysis.

Notations and assumptions:

(Normalized) cost per entry = \$1

Number of different entries by the investigator = M

Number of total entries in the pool = N

Total prize = \$N

(A) Payout Structure: Winner takes all

Scenario A1: M=1

Unconditional probability of finishing in the first place = $1/N$

Unconditional Expected Payoff = $\$N \cdot (1/N) = \1

Unconditional Expected Profit = $\$1 - \$1 = 0$

Variance of Profit:
$$\left(\frac{N-1}{N}\right)(-1-0)^2 + \left(\frac{1}{N}\right)(N-1-0)^2$$

$$= \left(\frac{N-1+(N-1)^2}{N}\right) = \left(\frac{-N+N^2}{N}\right) = N-1$$

Standard Deviation of Profit: $\sqrt{N-1}$

Scenario A2: M>1

Note that when M>1, the analysis treats the investigator's multiple entries as a portfolio

Unconditional probability of finishing in the first place = M/N

Unconditional Expected Payoff = \$N*(M/N) = \$M

Cost of investigator's total entries = \$M

Unconditional Expected Profit = \$M - \$M = 0

Variance of Profit:
$$\left(\frac{N-M}{N}\right)(-M-0)^2 + \left(\frac{M}{N}\right)((N-M)-0)^2$$

$$= MN - M^2$$

Standard Deviation of Profit: $\sqrt{MN - M^2}$

(B) Payout Structure #2: Top three places splitting: 60-30-10

Scenario B1: M=1

Unconditional probability of finishing in the 1st place = 1/N

Unconditional probability of finishing in the 2nd place = 1/N

Unconditional probability of finishing in the 3rd place = 1/N

Unconditional Expected Payoff = \$0.6N*(1/N) + \$0.3N*(1/N) + \$0.1N*(1/N) = \$1

Unconditional Expected Profit = (\$0.6N-1)*(1/N) + (\$0.3N-1)*(1/N) + (\$0.1N-1)*(1/N)
 =\$0

(Or simply = \$1 - \$1 = 0)

Variance of Profit:

$$\left(\frac{N-3}{N}\right)(-1-0)^2 + \left(\frac{1}{N}\right)((0.6N-1)-0)^2 + \left(\frac{1}{N}\right)((0.3N-1)-0)^2 +$$

$$\left(\frac{1}{N}\right)((0.1N-1)-0)^2 = 0.46N - 1$$

Standard Deviation of Profit: $\sqrt{0.46N - 1}$

Chandler Corp: Choosing the right costing method to evaluate new products

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ABSTRACT

This case, based on real but disguised company, has students compute and evaluate several costing methods which could be used by an outdoor shade shelter manufacturing company to make decisions regarding the production of two new products. Historically a very profitable custom job shop, Chandler Corp. is considering whether to accept two recurring orders which could potentially overwhelm their current capacity. The facts of the case can be used to a) observe the difference in product costs due to the choice of capacity measures, b) examine the cost of unused capacity, c) explore theory of constraint issues such as throughput margins and product mix, and d) consider short vs. long term product decisions.

UML and Multiplicities Under a Microscope

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Abstract

Using an eye tracker and computerized experiment, we examine the effect of several variations in descriptions of business rules on multiplicity validation performance. We find that cognitive performance during multiplicity validation is affected by a number of factors. Based on the chosen performance metric, semantic models account for an increase in effort of 107-112% compared to syntactic models. In semantic model interpretation tasks, we find that semantic variation increases task difficulty on the order of 44-45%. The interpretation of a minimum multiplicity is more difficult than the interpretation of a maximum multiplicity resulting in approximately 1 second and 4 eye fixations of task interference. We also find that it is easier for individuals to validate a syntactic model, but in the presence of semantics validating a model takes more effort. Our findings have the potential to inform theory and practice on how model design decisions impact usability.

Blockchain: An important future tool for finance

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Abstract

Blockchain will be a major part of most firm's operations in the next few years. It will help firm's control their costs while streamlining their operations. Blockchain will have a major impact on staffing requirements and job descriptions for most finance and accounting companies. This article explains several of the possible applications that financial and accounting firms will be using that involve Blockchain. It provides the benefits and pitfalls associate with applications. A secondary focus is an overview of the companies positioning themselves to provide these application and training to the finance and accounting firms. This should help executives faced with making decisions about implementing Blockchain in making better decisions.

Blockchain: An important future tool for finance

Blockchain will be a major part of most firm's operations in the next few years. It will help firm's control their costs while streamlining their operations. Blockchain will have a major impact on staffing requirements and job descriptions for most finance and accounting companies. This article explains several of the possible applications that financial and accounting firms will be using that involve Blockchain. It provides the benefits and pitfalls associate with applications. A secondary focus is an overview of the companies positioning themselves to provide these application and training to the finance and accounting firms. This should help executives faced with making decisions about implementing Blockchain in making better decisions.

Blockchain was developed as an integral part of the digital currency technology. As part of the Bitcoin process, it provided the validation of currency transactions without the need for financial intermediaries. In addition to making the Bitcoin system work, the development of Blockchain also met many of the privacy desires of individuals who were involved in the early stages of making Bitcoin transactions. These individuals involved with Bitcoin strongly wished to avoid dealing with third part intermediaries such as financial institutions. Some from legal and tax issues, others for the sake of their privacy. The result was the development of an independent source for validating transactions with Blockchain as the enabling technology.

Another way to look at Blockchain is its potential for providing a vast distributive ledger of transactions. This is known as triple-entry accounting. The fundamental storage space for information about transactions in Blockchain are called blocks. Each block stores data about the transaction. Most importantly, each block contains information about the past transactions. Once a block is completed, it gives way to the next block. These blocks are joined together in a linked

chain. This relationship leads to the name Blockchain. A Blockchain works similar to the recording of bank transactions with a block representing the transaction confirmations such as a deposit slip. However, the block not only contains information about the transaction but information about past transactions. The information on the block needs to be validated, which in the Bitcoin protocol is done through a process known as mining. Once the block is validated, it is added to the prior blocks. The block is a now part of a permanent record of transactions and now new transactions are recorded in the current block.

Thus, a block works as a real time general ledger or record book. Within each block is a permanent store of records of past transactions. Importantly, a Blockchain has the important strength that, once written, the blocks within the chain cannot be altered or removed. This is a result of the entries being cryptographically sealed once the current transaction is completed. Thus, the parties to the transaction have a permanent ledger of the transactions from their accounting entry. The debit and credits for each transaction are available for future reference. As a tool for consolidation of financial statements, data integration issues and data analytics, Blockchain offers a large potential for increased productivity and cost reduction.

The success of Blockchain has financial services firms moving quickly to utilize the benefits of Blockchain and similar systems within their firms. The financial services firms see this as appropriating Blockchain for their own settlement transactions. These could include items such as remittance settlements and mortgage settlements. The area where the finance community see Blockchain immediately changing current financial services is the back office handling of transactions. When a financial institution sells a syndicated loan or derivative, the recording of the transaction is time consuming and involves burdensome back-office processes. These processes rely on negotiated contracts with the numerous associated lawyers and contact between the parties to finish the transaction. On average, it can take 20 days to settle a syndicated loan trades. These back end activities are also costly to the financial institutions. This is in contrast to the front-end systems at financial institutions where millions are spent to achieve a nanosecond of competitive advantage. In addition, financial institutions due to regulatory requirements such as Dodd-Frank are dealing with greater requirements for reporting, transparency, and dissemination of data. They need a technological breakthrough to help solve these problems. Blockchain can be the breakthrough that can streamline these financial transactions. There are estimates that Blockchain could save financial institutions at least \$20 billion annually in settlement, regulatory and cross-border payment costs.

Given this opportunity to replace the back end systems, there are many firms and organizations using Blockchain hoping to be the one to solve these problems. For example, R3, a Blockchain startup, is offering a Blockchain as a Service (BaaS) that already involves such members as Barclays, BMO Financial Group, Credit Suisse, Commonwealth Bank of Australia, HSBC, Natixis, Royal Bank of Scotland, TD Bank, UBS, UniCredit and Wells Fargo. R3 hopes to execute financial transactions instantaneously across the global private network. The banks will simulate the financial transaction exchange values by using tokenized assets on the distributed ledger, using Blockchain protocols.

Another example is Coinbase, a major firm dealing with bitcoin transactions, has created a bitcoin debit card. Using the Blockchain protocols the debit card will be the first step in recoding the transactions straight to a Blockchain avoiding most of the back end costs. Further, Goldman Sachs is investing in the start-up Circle Internet Financial that it hopes to provide a better back end system based on Blockchain. This system should provide greater ease-of-use in online and in-person payments along with enhanced security and privacy for consumers. They are also in the process of creating a digital currency for their own needs. UBS is using its London based Level39 to develop means to use Blockchain to improve their financial service needs. Sand Hill Road, a startup dedicated to becoming the new Wall Street, is creating several Blockchain initiatives dedicated to take advantage of the benefits of Blockchain. Probably the most developed financial service using a Blockchain system is Ripple. It offers a means to make simpler and faster cross-border payments using a distributed approach to the global network. Thus, financial institutions now have real-time delivery with certainty for every settlement, resulting in the lowest total cost for any transaction. These are just a few of the many firms involved in making changes to the financial markets using Blockchain. Venture capitalists eagerly invested over 500 billion in over 100 startups in the last year, and projections are even higher in this year. Clearly, using Blockchain to change the financial system will only grow.

At the organizational level there are several ventures building on the Blockchain. NASDAQ is working with private companies such as Chain to use the Blockchain to issue and transfer the equity shares of closely held companies on the exchange's private marketplace. Their plan is for Blockchain to replace the current paper certificates system with a lowering of cost and a gain in speed of having the IPO. Clearly, there will be many beneficial outcomes from all these efforts. CFO's and financial executives need to be following these firms efforts to stay competitive.

Auditing and Accounting applications

Another area that stands to benefit from Blockchains is the accounting profession especially the auditing profession. Using a Blockchain the accounting entries between two trading partners can easily be compared while maintaining data privacy. This solution could significantly reduce the reliance on auditors for testing financial transactions. Blockchain will affect the role of the auditor because some argue that Blockchain itself provides a real-time audit, perhaps making the auditor more of a consultant.

- In May Deloitte announced a partnership with ConsenSys Enterprise, a Brooklyn-based startup that is developing digital banking technology using Balanc3, a “triple-entry accounting” system built around Ethereum's Blockchain technology (Ethereum is a competitor to Bitcoin).
- The AICPA also recently met with ConsenSys along with representatives from the Big Four accounting firms to discuss the new developments.

Additional Blockchain Developments

Within this category are the many ideas that firms are developing to utilize the benefits of Blockchain outside of financial services. IBM has introduced a protocol for smart contracts that is based on the underlying Blockchain technology.

Blockchains are being examined as a means for handling loyalty-points programs. Others are examining Blockchains as being an effective way to validate information about luxury goods. Similarly, vendors of tickets to events are looking at using Blockchains to help prevent fraud. The health care sector will be a big user of Blockchains. Storing patient data securely and accurately is a major concern of all health providers. It is strongly possible that the public sector will become a large user of Blockchains. Several municipalities are looking at Blockchains for recoding property transactions. Other municipalities are examining using Blockchains for tamper-proof voting records and vehicle registries.

Finally, one of the most advance Blockchain initiatives, Ethereum.org, has many applications already being offered for many different areas where they see an advantage for Blockchains over current processes. Thus, it would seem that there are unlimited possibilities for Blockchains.

Entrepreneurship vs Corporate Entrepreneurship: What is the difference?

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Abstract

The focus in both academia and industry is on entrepreneurship – specifically. However, there is another potential outlet for the creativity of new businesses and it is called “corporate entrepreneurship” or intrapreneurship. This presentation identifies the differences in entrepreneurship and corporate entrepreneurship from an academic and an industry perspective. A model is presented for determining the best route based on several contributing factors.

Educating Future Entrepreneurs

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Abstract

One of the biggest challenges teaching entrepreneurship in traditional academic classrooms is addressing the question of whether entrepreneurs are born or made. Entrepreneurship curriculum is often designed and delivered in the same way most business schools deliver traditional courses such as marketing, accounting, and economics through lectures, classroom discussion, and assignments. Certainly, the basics of starting and running a small business can be taught traditionally; however, many entrepreneurial traits, habits, and skills can only be obtained through experience or trial and error. New business startups enjoy the benefits of immersive learning within business incubators and accelerators. But, rarely are the same opportunities open to students while attending a college or university. Therefore, traditional teaching methods may not provide the best outcomes for entrepreneurs within a higher education setting. We believe that an immersive learning process is key to entrepreneurial success. In this paper, we will discuss the history, experiences, insights, and recommendations on moving from classroom entrepreneurial learning to predominantly applied or experiential learning.

Introduction

Entrepreneurial education is currently in a state of transition as many colleges and universities are beginning to place more emphasis on entrepreneurial teaching and experiential programs. The researchers were interested in new pedagogies to enhance the success of young entrepreneurs as traditional entrepreneurship programs have been helping business schools achieve increased numbers of students enrolling in entrepreneurship majors or minors.

Introductory entrepreneurship courses introduce students to basic concepts including entrepreneurial traits and characteristics of successful entrepreneurs. Without having the ability to understand these traits and characteristics as they apply to the individual learner and future entrepreneur, these courses might be seen as a waste of time without some form of pedagogical change.

Almost all higher education entrepreneurial programs offer classes that range from mere knowledge transfer to actual entrepreneurial practice or applied learning. This is causing existing pedagogies to be questioned and new ones developed. Krueger (2007) suggests that modern pedagogical approaches are beginning to change from professor-focused classrooms to problem-based learning environments. Kakouris (2015, p. 88) identified how “Gibb (2002) distinguishes three forms of entrepreneurship education: the ‘for’, ‘about’ and ‘practice in’ entrepreneurship. Only the first one is based on lectures and knowledge transfer while the rest [sic] are experiential. Specifically, cultivation of entrepreneurial skills concerns the ‘about’ form of entrepreneurship education.” Therefore, this paper will suggest an alternative to professor-focused approaches presenting an alternative pedagogy such as experiential teaching environments.

A typical higher education entrepreneurial curriculum focuses on knowledge transfer and the entrepreneur in isolation: one product/service, one business, and one entrepreneurial orientation. Section 2 will describe the different approaches the researchers used with entrepreneurial students to move beyond utilizing a typical higher education entrepreneurial pedagogy. In Section 3, key takeaways will be shared from the anecdotal research performed and Section 4 will outline suggested next steps in research.

Background and Experimental Study

The researchers have non-academic work experience in new product development, industrial design, and business. These experiences often included work environments where industrial designers, business people, product engineers, and model makers collaborated to develop new products or services. Therefore, it was hypothesized that richer, collaborative entrepreneurial experiences were needed within the classroom to mimic what students might expect outside of the classroom.

Initial approach

In addition to the student’s traditional entrepreneurship classroom training, each student was encouraged to enter entrepreneurial pitch and business plan competitions outside their respective institutions to provide broader exposure to other local entrepreneurs and aid in networking with business professionals.

The outcome of this approach was exposure to like-minded or similar stage entrepreneurs and

experiences that lacked diversity in thought to expand new business ideas and concepts beyond a rudimentary stage. These students rarely pursued their idea beyond the competition or engaged others to help further develop their ideas or concepts.

Unhappy with these results, the researchers began searching for opportunities outside the classroom that would allow students to collaborate with other student designers, engineers, model makers, and business people. A national collaborative experience, Startup Weekend, was sponsored, organized, and offered to students.

Startup Weekend

Startup weekend is a professionally organized, three-day event where participants pitch ideas on Friday, the audience votes on the top ideas, and then teams form around the ideas. Friday night through Sunday morning, teams develop the ideas, develop prototypes, conduct research with potential customers, and develop a final plan and pitch. What is unique about each team is the composition of the participants. Teams are cross-functional including industrial designers, engineers, and business people. The compressed schedule causes teams to problem solve and rely on various skills from team members. Diversity of thought and approach were outcomes for student participants.

The three-day event provided students with unique and collaborative experiences. But, a longer collaborative experience was developed to allow students more time to develop their ideas, research with customers, develop prototypes, and then present their final pitches. To accomplish a longer experience, the researchers developed a collaborative project with a company in the UK, Swifty Scooters.

Swifty Scooters

Swifty Scooters is a company located in Manchester England. The company designs and manufactures adult scooters. Again, a combination of design, engineering, and business students were challenged with growing a new segment of the company's business through a new product or series of product extensions. The project was assigned on Monday and students had to present to the company on Friday. Teams researched the market and identified customer needs. Next, they began to develop product sketches and potential use cases. Each team researched their ideas through field questionnaires. Customer data was analyzed and final product concepts were prototyped. Teams developed business plans and pitches for their respective ideas and then pitched to the Swifty Scooter owner.

Although this project was longer, the researchers felt that a project within a semester would be a more meaningful student experience. A collaborative team with Grand Valley State University, Kendall College of Design, and Spectrum Health was then formed.

Spectrum Health Innovations

A local hospital innovation group, Spectrum Health Innovations approached Grand Valley State University to request a team of students to work on a Spectrum Health physician's idea for a knee rehabilitation device.

The students were shown the current method for patient rehabilitation after knee surgery. Issues with device costs, weight concerns with the device, patient complaints, caregiver complaints, and Spectrum Health Innovations objectives for the project. Two Grand Valley State University students (an engineering and a business student) along with a Kendall College of Art and Design industrial design student worked on the project for fifteen weeks. The team worked with physicians, nurses, and hospital staff to completely understand the problem(s) and gain necessary knowledge around this particular use case. At the end of the project, the cross-functional team presented their findings and prototype.

These experiential, cross-functional, and collaborative student projects provided useful insights that can be used to design a new entrepreneurial pedagogical approach.

Key Findings

From the research that was conducted, ten guidelines for creating experiential, cross-functional, and collaborative entrepreneurial experiences were identified.

1. Build a “pivot” culture. Teams should be forced to make assumptions about the project, customers, and potential outcomes. The teams should then be provided with frequent opportunities to change and defend their value propositions as they learn. Teams should avoid getting stuck on a “single idea.”
2. Require objective validation. Validating problems, ideas, and strategies with all stakeholders throughout the process makes decision-making more objective and keeps the team aligned.
3. Focus on the pitch. The skill of storytelling is very important to successful entrepreneurs. Workflow activities for the team should be designed around information and assets needed to tell a story that will sell the solution and strategy. The team's pitch should be that story.
4. Structure teams intentionally. Successful teams rarely happen organically in academic settings. Recruit the right disciplines and balance personalities if possible according to the needs identified for each project. Often working with people students do not know will lead to a genuine learning experience.
5. Build in time for discussion. Learning how to find value in and balance different perspectives is one of the most important experiences. All team members should be expected to contribute to every discussion and decision.

6. Learn to lead and follow. Situational leadership means that teams should learn to leverage individual strengths and know how to pass the leadership baton. Learning how to contribute without leading (“followership”) is just as important.
7. Manage a parallel workflow. Learning how to divide and conquer helps a team get more done and leverage all the team’s disciplines. When possible, use the “SCRUM” method to help teams focus on short sprints.
8. Challenge ideas often. Help teams learn how to gather information and balance their own collective point of view. Teams should be challenged to rationalize decisions and stand behind them.
9. Give teams their own space. Team projects depend on continuity and require a space where people can co-create and leave work up and out while in progress. Then, be able to pick up right where they left off.
10. Make it real. A genuine opportunity to make an impact on a “real” business and learn in real context will drive passion, work ethic, and output. Feeling like the project could continue beyond the class is highly motivational.

Since this research project is highly anecdotal, we recommend a quantitative study be designed to validate or dispel our assumptions. However business plan competitions, the number of undergraduate startup businesses, post graduate startup businesses, and placement within corporate innovation teams leads the researchers to believe that further study would significantly change the future pedagogy around entrepreneurship teaching.

Next Steps

A combination of case study and quantitative research is recommended as the next step. Similar case studies as described in this paper will need to be identified along with detailed participant information. As students proceed to other opportunities outside of their college or university, data will need to be collected to see if experiential, cross-functional, and collaborative entrepreneurial experiences contribute to more students pursuing entrepreneurship or intrapreneurship beyond their respective academic experiences.

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An Exploratory Study of Change Management and System Outages in a Hospital Setting

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Abstract

System outages in healthcare are not only costly, but can be life threatening. Even with internal control procedures, outages occur. Research shows that configuration changes are strongly related to system outages. The purpose of this research is to examine in greater detail the relationship between types of outages and attributes of configuration changes, specifically risk and urgency of implementation. Data was collect from a large Midwest hospital system Network from May 1, 2014 through February 24, 2017. Regression analysis was used to understand the factors that influence outages. Preliminary results show that planned changes are associated with fewer outages than emergent changes. Conditions of risk for a given change as measured by impact and probability of adverse effect, did not show a systematic relationship to outages. The conclusions suggest that compliance with internal controls in not sufficient to prevent outages especially in unplanned urgent changes where more rigor is need to better evaluate the impact of the change on the overall system.

Exploring Shareholder Value Reactions to Product Recall

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Abstract

In this paper we examine the effect of product recall on firms' value recognized by the investors in the financial market. We use the typical methodology of event study in our investigation. We collect data on product recall events in China and evaluate the abnormal returns in a unified way.

Expanding Training Possibilities: Flipping the Zone of Proximal Development For Talent Management

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ABSTRACT

Currently, new approaches for training can effectively adopt the “Flipped” model of instruction as an important means of organizing and developing workforce competencies. One of the goals in the university setting at Grand Valley State University is to improve skills and training opportunities which can most efficiently utilize training time. In order to improve cognitive practice and increase skillfulness in a value creation socio-technical system, the Zone of Proximal Development (ZPD) is deployed to progress the talent needed to advance productivity. Seeing much success is noticed in this newest pedagogy “flipped instruction” design, it has changed various disciplines in business education which can best be applied to the training component of the workforce today. The success of this model continues to create higher learner motivation resulting in desired outcomes. The technology of the ZPD juxtaposed with the flipped classroom technique can lead to the improvement of a highly talented workforce.

INTRODUCTION

Many organizations continue to investigate ways in which talent management can be accelerated in their companies. While many approaches are presently applied, one alternative suggested is to implement the flipped classroom instructional strategy to improve a company’s talent pool. While minimal pedagogical approaches are currently used to manage talent, the flipped instructional model provides a satisfactory alternative to training and skills development in the workforce. As we consider the options to increase our choices for talent management, we can apply the flipped classroom strategy and define the complexity of the “zone of proximal development” (ZPD) and experiential learning theory (figure 1). To guide the discourse, we must:

- 1) conceptually frame how talent management is presently approached;
- 2) present the ZPD theoretical approach create value to the learner/talent and the organization;

- 3) the shared experience to enable learning; and,
- 4) draw a conclusion, mentioning the limitations of the arguments provided in the debate, and a final suggestion can be supported for future research in “flipped” instructional pedagogy as it relates to talent management.

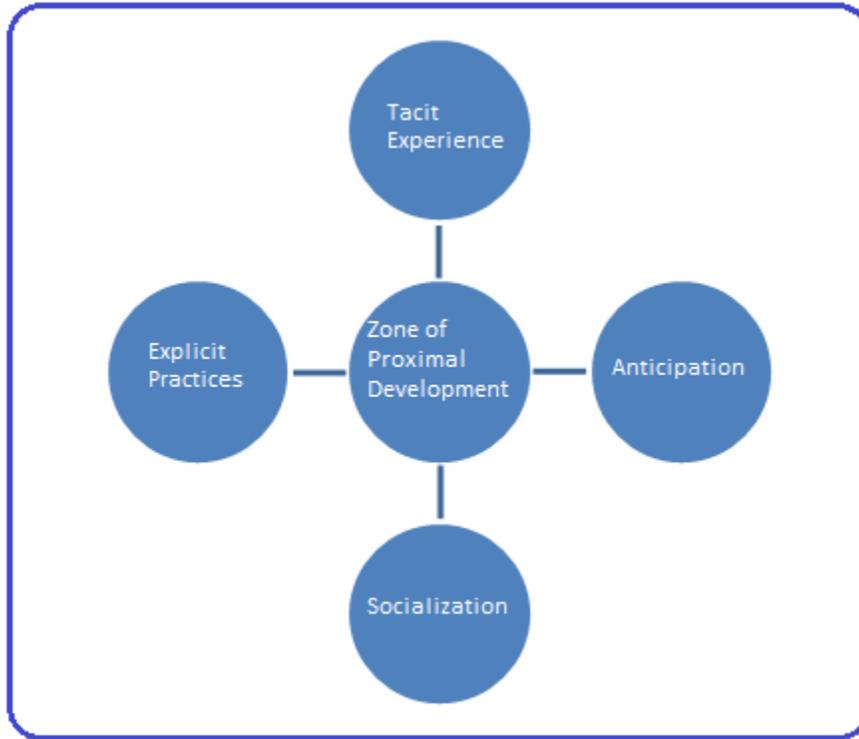


Figure 10: The Zone of Proximal Development (Barrons, 2015)

BACKGROUND

Defining Key Dimensions:

Flipped Instruction - A model that allows for the traditional format of a classroom to be transformed into more of a hybrid design for learning. The focus of the model is to provide reading and the preview of content which needs to be completed before the class meeting. Individuals are then allowed time in class to work on projects individually and in teams as part of the learning process which promotes more of a problem-solving atmosphere.

A “*flipped classroom*” educational model exchanges the traditional format of a classroom lecture and homework problem set. We piloted two flipped classroom sessions in our emergency medicine (EM) residency didactic schedule. We aimed to learn about resident and faculty

impressions of the sessions, in order to develop them as a regular component of our residency curriculum (Young, Bailey, Guptill, Thorp & Thomas, 2014).

In Barrons (2015), the flipped classroom is viewed as a zone of proximal development where the novice can increase their skillfulness in job performance. The flipped classroom provides an opportunity to nurture talent (see figure 1). The relationships of the key elements illustrated are tacit knowledge, anticipation, socialization and explicit practices.

Tacit knowledge is fundamentally difficult to transfer from one person to another by means of writing or speaking. Tacit knowledge can be defined as skills, ideas, and experiences that people have in their minds and are, therefore, difficult to access because it is often not codified and may not necessarily be easily expressed (Chugh, 2015).

Anticipation is associated with predictions, desires or intentions which can strongly influence behavior, adaptation, and learning. Since Pavlov, there has been an appreciation of the link between anticipation and learning. Briefly, in typical Pavlovian conditioning, an *unconditioned stimulus* (US) has some natural or a prior *unconditioned response* (UR). Classic examples of US-UR pairs include food-related salivation and vasoconstriction due to exposure to cold. Any stimulus that is regularly contingent, either preceding or concurrent, with the US is a potential *conditioned stimulus* (CS), for example, the ringing of a bell. The result of Pavlovian conditioning is a *conditioned response* (CR), which either mimics or compensates for the UR. In either case, the CR is anticipatory with respect to the US. Anticipation is most clear when the CR and UR are of the same kind, for example, salivation, but compensatory responses, such as those that play a role in drug tolerance, have an anticipatory coping function discussed at length by the functional school of Pavlovian conditioning (Domjan, 2005).

Socialization in the learning process is known to improve the environment to increase knowledge. For decades, educational institutions have promoted and practiced the socialization components supported by John Dewey. By interacting with others, individuals receive feedback on their activities; they learn socially appropriate behaviors, and they understand what is involved in cooperating and working together (Dewey 1940, 1966).

Explicit practices in this context applies to the knowledge relevance of sharing information regarding intrinsic motivation. In public sector work, the idea of public sector motivation (PSM) assists individuals in their skill levels. With the introduction of PSM, the present study connects knowledge sharing with public administration. Public service as a calling leads civil servants to share knowledge to create more advanced organizational knowledge and accordingly improve public service performance. Compared to situational factors (e.g. the use of information technology and rewards), PSM plays an even more pivotal role in promoting knowledge sharing, according to the results of our empirical research. Thus, altruistic motivation should be addressed and emphasized if knowledge sharing in the public sector is to be encouraged (Chen & Hsieh, 2015).

Maintaining the competitive advantage

The current strategies in the job market require a level talent management that is lacking attention in the job market today. Currently, there is no consistent framework for employers to adhere to to manage a successful talent pool. Presently, standards vary from one company to another on how talent can be managed according to the most current literature review. In light of the extreme competitiveness in the global business environment, maintaining a competitive advantage is critical to a company's success. However, many businesses are failing to properly utilize their arguably most important asset- human capital (Axelrod, Handfield-Jones, & Michaels, 2001). The inability to develop employees, assist poor performers and identify leaders is dampening the performance of businesses worldwide. It is time for companies to realize that talent management is not a job that should be contained to the human resources department, but rather a role which should be taken on by senior leaders company-wide (Donahue, 2001).

There are many actions organizations can take to utilize their workforce more effectively. Overall, corporations should market the brand that they seek to promote, to attract people that mesh with their culture. Once employees are retained, training programs should also stress and embed the corporate culture. In this way, talent management will be better aligned with a company's strategy (Bjorkman, et al., 2012). Within the organization, senior leaders should be extensively trained in talent management and take an active role in developing their teams (Axelrod, Handfield-Jones, & Michaels, 2001). This includes identifying high and low performers and developing them accordingly. Special attention should be paid to ensure that each employee is facing proper challenges and is given the appropriate resources and freedom to execute their tasks (Donahue, 2001). If all senior leaders worked diligently to manage the skills of their teams, talent would permeate throughout the workforce, and the organization would reap tremendous success (Axelrod, Handfield-Jones, & Michaels, 2001).

Talent management can be categorized into two approaches: 1) differentiated; and, 2) inclusive. Under the differentiated approach, energy is focused most heavily on the high performers while weeding out those who do not meet expectations. The inclusive approach, on the other hand, focuses on leveraging value from all different employee levels under the belief that each person has something unique to contribute. In reality, most companies utilize a hybrid system of talent management that looks to combine both mindsets (Bjorkman, et al., 2012). Whether using the differentiated or inclusive approach, global companies must ensure that their method allows for both global and local talent standards to be implemented. It is helpful for these businesses to maintain a consistent approach to the overall strategy while simultaneously leaving smaller matters up to local discretion to appease local customs and preferences (Bjorkman, et al., 2012).

In addition to focusing on the development of individual employees, businesses need to focus on investing in social capital through increasing group loyalty and developing trust. The implementation of this social capital will allow for increased employee motivation, productivity,

and longevity. Some employees, of course, will maintain a “free agent” mentality and be willing to leave the company anytime they believe they will reap higher rewards elsewhere. It is important for managers to identify the both the free agents and the loyalists, as important decisions, such as layoffs, may be well-suited to take this information into consideration (Donahue, 2001).

An Overview of Talent Management Strategies and Flipped Approaches to Learning:

The “Flipped Classroom” approach is applied during the instructional delivery of the Management 351- Management Information Systems course at GVSU located Pew Campus in Grand Rapids, Michigan. Likewise, this approach can be applied as one of the possible talent management strategies by companies. Much success in training talent and teaching a course in the past has applied a traditional instructional method of class lecture (and or computer lab time). Presently, the “flipped classroom” model allows more time for learners (employees) to problem solve in teams, review class lectures outside of class with pre-recorded slides, sound, and videos, and use valuable class time completing class exercises. Seeing more than 50% of the focus of the class requires weekly hands-on exercises applying the integrated business processes with enterprise resource planning (ERP/SAP) software, students are allowed more in-class time for problem-based learning (PBL) activities related to each weekly activity. Students have required reading assignments, quizzes, and instructor prepared recordings that are reviewed before class and applied to each weekly exercise. This “flipped classroom” model allows students to work both independently to complete outside class assignments to allow the students to achieve mastery at their learning pace. Further, when students come to class, they spend more time working with the instructor (subject matter expert) applying their outside class activities with higher level learning activities. Therefore, the “flipped classroom” model can be effectively applied to the theoretical approach to “The Zone of Proximal Development” in this discourse. The Zone of Proximal Development (ZPD) inside the classroom setting or cyberspace continuous learning environments has borrowed practices and techniques from Vygotsky (1978), Bandura (1977), Senge (1990), Lave & Wenger (1991), Brown & Duguid (1991), Jenkins (2009), Mupepi (2014) & SAP.Com(2015), among many others. Table 1 displays the responses of students enrolled in the Flipped Classroom Management 351 – Management Information Course which shows level of favorability and unfavorability of the Flipped Classroom strategy.

Table 1 displays the responses by the students enrolled in the Management Information Course. Students indicated an 80 percent favorable response they were spending 2-4 hours per week watching course materials while 20 percent indicated unfavorable responses. The videos used in the course in addition to the recording for the power point presentations lectures were favorable at 61 percent while 39 percent indicated unfavorable. The student responses for the class format was favorable at 66.67 percent while the unfavorable responses were 33.33 percent. A strong indication of working in teams and problem solving exercises was favorable at 77.78 percent while 22.22 percent was unfavorable. Students indicated a 77.78 percent favorable and 22.22 unpercent unfavorable response they were able to make contributions to others and provide assistance as needed with problem solving in class.

N=32 Table: Student Responses to the Flipped Classroom Survey

Description	Percent Favorable	Percent Unfavorable
Students who spent 2-4 hours per week watching course materials outside of class	80.0	20.0
Students said videos were helpful in addition to the recordings for the power point lectures	61.0	39.0
Students indicated the class format was helpful for their learning	66.67	33.33
Working in teams and problem solving exercises were helpful	77.78	22.22
Students indicated they were able to make contributions to others and provide assistance as needed with problem solving in the class	77.78	22.22

Source: Barrons(2017) Management 351 Class Survey, Grand Rapids, MI. , Seidman College.

At the beginning of this survey, 20 percent of the participants in the class possessed the dexterity was lower compared to 80 percent whose proficiency was superior to the others in the class. Thirty nine percent lacked the necessary technology skills while 66 percent demonstrated acceptable skillfulness in applying the review of videos for instructional purposes. Twenty two percent did not participate in team activities immediately. There was a need to explain what they were expected to do as part of the course requirements. The summer population in this survey are those who also hold full time employment. Which are necessarily in education or work force development. Further, in the last group 77.78 percent demonstrated that they could work in teams and were knowledgeable about experiential learning and its usefulness in advancing organizational goals.

The Zone of Proximal Learning:

Adapting the learning technologies progressed by Bandura (1977), Vygotsky (1978) and Senge (1990) I have contrasted their proposition to a zone of proximal learning. Vygotsky (1978) suggests that the Zone of Proximal Development (ZPD) can be adopted to develop the skillfulness of learners in different learning environments such as MIS. In the ZPD, Vygotsky propounds that competencies can be enhanced by the expert(s) demonstrating the “how to” in developing competencies. In the ZPD, Vygotsky demonstrates three stages of skills development by the novice. The lower limit of ZPD is the level of skill reached by the learner working

independently. The upper limit is the level of potential skill that the learner can reach with the assistance of a subject matter expert. Bandura (1977) propounded that learning begins at home. If learning begins at home, we begin learning at an early stage. It a truism that charity begins at home. Senge appreciates learning in a different but similar way. He suggests in organizations, the need to create is a shared vision, personal mastery, systems thinking, team learning and mental models in this learning strategy.

In Figure 1, the centrality of the ZPD is illustrated to be surrounded by three equal circles. If the circles are misaligned, the ZPD will not be real and the potential will of learning not be achieved. Vygotsky also makes reference to a community of practice. The ZPD develops concepts that can be applied to understand job specifications and the competencies required to do certain jobs. Mupepi (2014) suggests that the division of labor enables the managers to understand the skills dexterity in the job and the explicit knowledge to be successful. The division of labor is expanded and analyzed to understand the knowledge, skills, technology and disposition required by a worker to be become proficient.

Bandura (1977) posits that the socialization process must be understood for learning to take place. The socialization process constitutes the environment of the learner at work, at home and in social contexts. This environment is argued by Bandura to be critical for successful skills and language acquisition. According to Bandura, he discusses the importance social learning theory in skills acquisition where people learn through observing others. As MIS students imitate the teacher, this can be applied to the concept of socialization and learning. In the MIS area of study, the students develop the MIS confidence and increase self-efficacy in their ability to apply their skills to execute a set of courses of action.

Roehl, A., Reddy, S.L. & Shannon, G.J. (2013) suggest various ways in which we can use technology to free class time from the lecture. Certainly increasing learning activities during class time provides improved teacher-to-student mentoring, peer-to-peer collaboration and cross-disciplinary engagement. Most recently, the Flipped Classroom has been approached in various formats. This may include self-learning packages, problem-based learning, project-based learning, pre-recorded video lectures and or, demonstrations for personal review. It is important to focus on the level of knowledge transfer when one identifies the ZPD in this discourse. The Flipped Classroom is a step ahead of the ZPD model because of the emphasis on experiential learning, problem-based learning and the relationship to solving problems in social contexts.

An Overview of Pedagogical Perspectives:

An overview of current pedagogical perspectives has been drawn from a careful selection of literature to answer the questions: 1) How did the SAP software development start? And, 2) How does the shared experience enable learning?

In 1972, the idea of creating a corporate software company was unheard of. SAP's five founders refused to let that stop them. They set out on a path that would transform the world of

information technology and forever alter the way companies do business. Since then, SAP has moved on to what it is today to deliver, cloud solutions, enterprise resource planning, banking, customer relationship management, human resources, retail and mobile solutions. According to SAP (2015 a), the company is the world leader in enterprise applications regarding software and software-related service revenue. Based on market capitalization, the company asserts that it is the world's third largest independent software manufacturer preceded by Oracle and Microsoft at the helm. SAP has more than 291,000 customers in 190 countries, greater than 74,500 employees located globally, a 43-year history of improvement and evolution as a true industry leader and yearly income exceeding 18 billion eurodollars (SAP 2015 b).

The concern of researchers, Bandura (1977) Vygotsky (1978) & Senge (1991) has been focused on organizational learning & competence development. The research on skills transfer and knowledge acquisition in socially constructed learning environments have been expanded very well in Bandura, Vygotsky & Senge. In the case of the MIS approach, the skills transfer occurs in defined places such as; using the workstations, exploring the software, the application usage, computer labs and real business problems. Vygotsky (1978) argues that the ZPD is the space where the learner acquires desirable skills after consultation with the subject matter experts. Long after the experts have left, the novice continues to practice to make perfect his/her skillfulness. Bandura (1977) suggests that the learner is influenced by the environmental factors to acquire knowledge and skills necessary to function in the ways the community desires. Bandura introduces a community of practice concepts positioned in the environment. This community can be the family, the school, and workplace. Thus the socialization of the learner is critical to the acquisition of explicit practices.

Both Bandura and Vygotsky used children in their research. We are now applying the business model approach as the focal point of an older age group. Bandura and Vygotsky used their research with children and did not have a business organization in mind. The ZPD context can now be focused in the context of student's learning in a business simulation in a computer lab in this situation. It was Bandura who defined the socialization process as a continuum of learning from home to school and work. Thus, a student appreciates skills, knowledge, and attitudes from this experience. The same can be said where the child can develop attitudes at home which can be shared at school or many social contexts.

Senge, Kleiner, Roberts, Ross & Smith. (1994) provide a point of view about learning techniques. They identify five learning modules that can be applied to progress organization. The first learning model is "personal mastery" which constitutes the skills sets an individual must possess in doing a given job. Personal mastery allows the learner to build the capacity to use his/her skills to produce the goods and services demanded by the customers. In the MIS area of study, students build their confidence to use software such as SAP by constantly conversing and consulting with experts and sharing knowledge with other students. The second is "the mental model" which is applied. This model includes reflection, clarification, and the ability to improve a shared window of the world. This model allows a community of practice in which to create, diffuse and distribute co-constructed practice. Senge suggests that a "shared vision is co-

constructed as well. A shared problem is a problem solved.

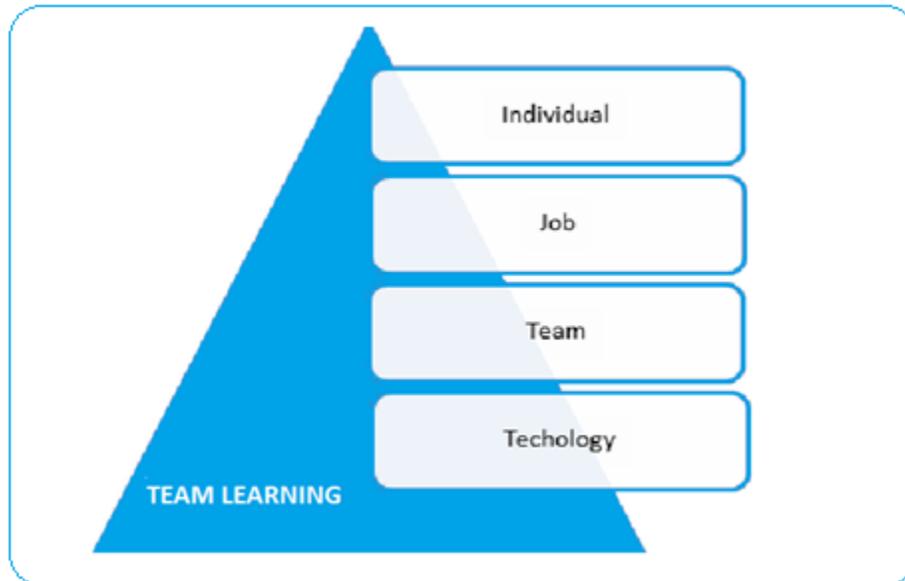


Figure 11: Team learning (Barrons 2015)

The fourth model is the “team learning” approach. The shared learning concept leads us to Lave & Wenger (1991) about knowledge creation in distributed cognitive environments. They suggest that an organization can build a community of practice based on the notion of highly cohesive teams. They propound that a community of practice can be composed of a group of people preferably from the same organization that meets in defined places at agreed times or in cyberspace at any time. A community of practice becomes a tool which can be deployed to enhance learning in the value creation process. The Flipped Classroom embraces the social interaction in the community of practice. In the MIS course, students learning the SAP software use the interaction of business problems to increase knowledge and skillfulness at solving problems. This process continues to build as the course progresses until the job is complete. In all, this problem-solving experience amongst the team members builds confidence in the learning process.

Senge, et al. (1994) alludes to the fact that the fifth learning discipline “systems thinking” which enables the entire organization to operate on the same page. Because a community of practice shares the same language, it implies they are aware of the organizational mission which each individual deduces his job description which resonates with the mission statement.

According to Roehl, Reddy & Shannon (2013), it is suggested that the advantages of the Flipped Classroom are easy and use readily accessible technology. This allows for an expanded range of learning opportunities in a given time frame. The instructor gets to know each student “on a one-to-one basis” as they demonstrate how to use software or assists students as needed. These

relationships continue by email, shared Google docs and with learning management systems online collaboration tools.

The centrality of the flipped classroom:

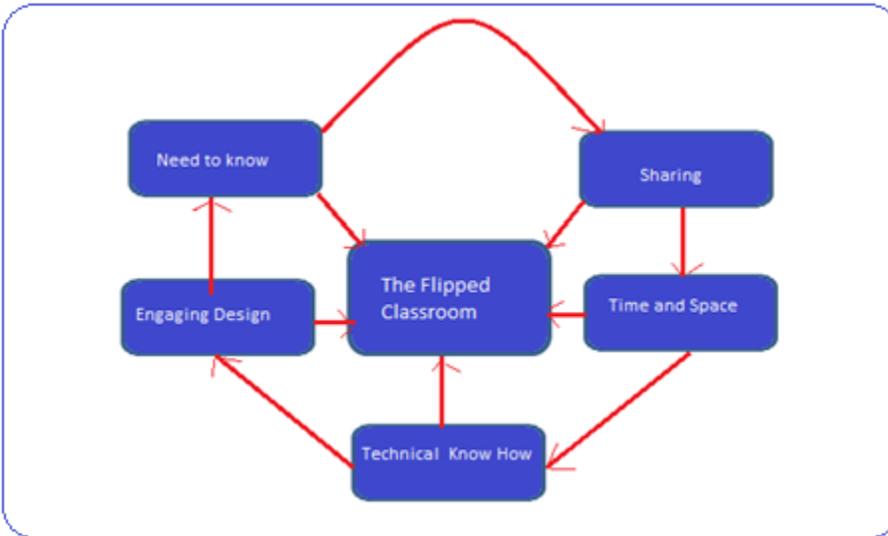


Figure 12: The flipped classroom (Barrons, 2015)

The need to know:

Barrons (2015) suggested that there are five observations for the flipped classroom strategy. In the first part, the emphasis is placed on the “need to know” by the learner. The instructor will document this in the syllabus, which all those attending the class should have in hand. Prior knowledge is important for students as well as employees. They need to understand the syllabus. For example, the University of Michigan was engaged in a lawsuit for canceling classes because of snow and in the syllabus, this was not pointed out. The plaintiffs argued that the grades they received, in the end, could have been better if the class was not canceled. If they had prior knowledge of the canceled class, they could have received a higher grade. The court awarded damages to the plaintiffs leading to a refund of the tuition (Fraser, 2006). Further, we can continue the debate on the need to know about this issue; prior knowledge is an essential skill.

Appreciating models:

The classroom instructor must identify a pedagogical model that stresses the learning. This may include concepts such as project-based learning (PBL), problem-based learning (PBL), game-based learning (GML), understanding by design (UbD), and genuine literacy. Then the Flipped Classroom model can be assimilated to any of these concepts. Lave & Wenger (1991), allude to the fact that the above models could be implemented in the Flipped Classroom effectively by a community of practice. The ZPD, on the other hand, has been described distinctly by Vygotsky

(1978) to be the area where the novice acquires competence.

Simple Tools:

The community of practice needs to know how to use the simple tools available in the classrooms, or within the learning community. Twenty-first-century students are highly engaged with the educational technology tools in the ZPD. The tools allow for higher motivation, stimulation, and comprehension. The technology enables students to interact among themselves, the virtual libraries, software, and instructors, which promotes higher level thinking skills.

Replication of Competencies:

The use of technology and visual aids such as YouTube, pre-recorded videos, text, and PowerPoint presentations allow for reflection and enable students to benchmark competence in areas in which proficiency is sought. In the flipped model, students can review information materials before attending an in-classroom class which composes their prior knowledge before coming to class. Also, some activities can be assigned and completed as they pertain to the instructional objectives. Flavell (1979) suggests shared experiences are any conscious cognitive or affective familiarities that accompany and relate to intellectual exchange which happens in flipped classrooms.

Time, Stage and Location:

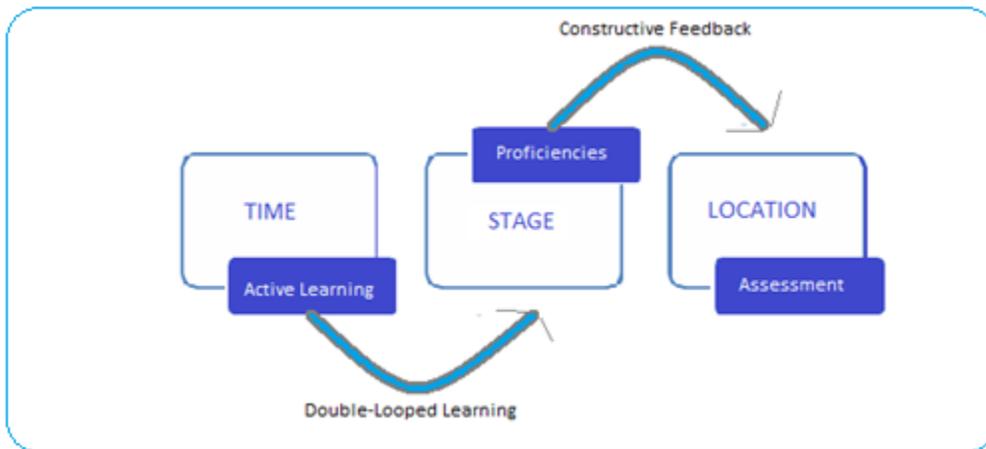


Figure 13: Double loop learning (Argyris, 1991).

In Argyris (1991) double-looped learning is introduced into the organization as imperative to successful business. We can apply this concept to the Flipped Classroom strategy. Both instructor and the learner receive constructive feedback (see Figure 4). Given the Flipped Classroom requires structure, the learning environment is important. The instructor will need to incorporate proficiencies to keep the students engaged. Most learners who are reviewing

information before coming to class will need accountability. Allowing active learning to take place outside of class similar to hybrid or online learning techniques will require a means of formative assessment to evaluate student performance. These assessments will assist the educational leader in addressing the needs of the learners. Meyers & Jones (1993) discuss the active learning process and instructional tools which keep the learning environment “active” those include problem-solving exercises, cooperative student projects, informal group work, simulations, case studies, and role-playing as examples. Argyris (1991) propounds that feedback is critical in business environments which would apply to classrooms. He refers to this as double-looped learning.

Epistemic Communities:

The epistemic communities or knowledge communities have been described in Foucault (2002) as a group of people who meet regularly to create priorities in organizations. Foucault leads to the thought that an epistemic community co-constructs those priorities. Mupepi (2010) develops organizational strategy hinged on an epistemic community. For example, organizational efficiency and effectiveness can be advanced by a knowledge community. Mupepi gives the analogy of the Adam Smith pin production factory showing the division of labor. Adam Smith proposes that the division of labor into specialization units which can yield increased productivity. By determining the desired capacity and the set of skills that capture what the organization does best by utilizing appreciative inquiry (AI), the entire organization can advance to the next level. Adam Smith envisioned increased ratio of output as each man perfected his act. AI, a change management method can be deployed to determine the skillfulness required in avoiding wasted time and efforts. The AI methodology makes it possible for the entire organization to participate in the determination of what needs to be changed making it possible to distinguish between efficiency and effectiveness. It is essential to make this differentiation because successful corporations are both efficient and effective. By drawing from the Adam Smith pin-making enterprise, learning the best methods used to perfect the acts of different specialists, can be documented and communicated to all members of the epistemic community. Feedback on all the practices is imperative to developing specialist. The Flipped Classroom offers the opportunity to co-construct curricular by sharing experiences and drawing lessons from the instructors’ syllabus.

The Impact of Communications:

In Barrons (1993) organizational communications are viewed as critical to effective learning. In later research, Mupepi, Mupepi & Motwani (2015), posit that the centrality of organizational learning is clear and concise communications. In the Flipped Classroom, there should be an all-around communication among students and the instructor as they share information and experiences. Barrons suggests that the environment nowadays includes information from the media, social networks, and prevailing cultural trends. For example, if students attended a concert they would discuss the performance in class. This reflects that learning continued outside the classroom. Learning was influenced by the motivation from this experience. Mupepi et al.,

argue that the relationship between skills acquisition and motivation is highly correlated.

Instructors Role:

Barrons (1993) considers the instructor is central to all the activities in the (flipped) classroom. The role of the instructor is still central in the reductions of dropouts and to increase the skillfulness of higher order learning. Barrons argues that the most critical problems of all times are to address the problem-solving skills of each student. Chall (1983) the scripts of Sesame Street which serves as an informal television classroom for pre-school children up to age 5 (Vygotsky & Bandura) were change to incorporate problem-solving skill development. In much later research Jacobs & Chall (2003) argue that the developmental stages of reading development, reading is conceptualized not as a process that is the same from beginning stages through mature, skilled reading, but as one that changes as the reader becomes more able and proficient. Therefore, problem solving is a developmental skill. In the flipped classroom, group exercises constitute problem solving and the conceptualization of explicit practices in relation to co-constructive epistemology.

One of the responsibilities of the instructor in the flipped classroom is dictate notes to students. This exercise enables the student to continue to develop their language arts skills. Lave (1988) suggests that there is a correlation between writing and memory. In the flipped classroom, it is important as students share information they write down what they want to remember. Lave argues that apprentices in the field of electrical engineering took notes as they saw the instructor provide demonstrations. In their final assessment, they were required to repeat those demonstrations. From the notes, they remembered the demonstration were learned in the classroom during the final exams.

MAIN FOCUS OF THE PAPER

This paper focused on how the flipped classroom technology can be applied to develop a highly talented workforce. The Zone of Proximal Development is deployed to allow the instructor to demonstrate what needs to be done and how it will be done and setting performance standards. Instructional pedagogy techniques are applied to build the capability to enhance effectiveness and efficiency in the workforce.

Issues

It takes considerable resources to develop talent in an individual. Without making binding agreements, people soon find greener pastures elsewhere. When this happens turnover increases and so does operational costs. Employers situated in the same locality doing similar business can porch those who qualify by offering them competitive conditions of service. While making trainees sign a contract, some will offer to pay the agreement violation (usually with the help of their new employers) and leave.

SOLUTIONS AND RECOMMENDATIONS

Looking ahead, the concept of the Flipped Classroom strategy as applied to pedagogical models will continue to open alternatives to the learning community. Effective instructors (like employers) are looking for ways to provide the highest levels of achievement to their students (and employees). In business alike, the process of learning continues in a similar manner when it comes to new tasks.



Figure 14: The Making of Explicit Practices (Barrons, 2016)

Learning that has high-level relevance to the participants provides a high-level of engagement. Using the flipped strategy allows one to apply real-world problem-solving experiences by adding a high level of relevance to the process of developing explicit practices from tacit knowledge. In Figure 5 a practical model shows how flipped learning will move forward the pedagogical process which can be applied to talent management. However, this can only be done if one consider all the variables in this discourse and believing that the overall goal is to improve instruction and training.

The last but not least recommendation is to improve the conditions of service in the company as students' progress their skills development. This will reduce turnover and help to retain talented workers. Training of any kind is not cheap; it draws upon the resources of the company, and it is only fair to get the commitment of students by signing a binding agreement.

Lastly successful classrooms have teachers who have utilized a strategy that promotes successful learning. Most successful businesses today have a developed plan that encourages the cultivation of talent at every level of management. Figure 6 is a model representation of an approach to establish and retain talent. It starts with an introduction of personnel. Then a continuous loop of engagement, development, leadership and planning all occurs, all the while there are continuous measurements taken during this development and actions take to realign with the plan in

necessary. This loop is never ending. However, the results of this process lead to better businesses. In education, the same rules apply for student achievement. The results are measurable by the objectives achieved and the level of information learned. Typically, you tend to see more productivity out of employees that have been trained and developed as well as a better atmosphere in the working environment. This is likely to come from the people feeling more positive about themselves and the work that they do when they see effort placed in their development and future. Figure 6 presents a positive outcome for both employers and employees when proper leadership and training is provided.



Figure 15: Talent management for superior business results (Barrons, 2016).

FUTURE RESEARCH DIRECTIONS

There is no substitute for on-job training for a number of reasons. OJT is easy to implement, and it is cost-effective. As technology is constantly evolving, the training of employees or stakeholders who are distributed in the world can be a challenge. Research on how to training employees virtually dispersed could be much needed.

CONCLUSION

One can continue to observe achievements as organizational learning such as the flipped classroom techniques, a process of creating, retaining, and transferring knowledge within an organization. Thus, an organization improves as it gains the capability to produce what the market demands. The flipped classroom offers learners the opportunity to continue to practice

until desirable job proficiency are reached. A flipped classroom does not have a standard framework. However, there are many ways in which a classroom can be “flipped. This writing has offered only just one of the many approaches to talent management strategies.

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KEY TERMS AND DEFINITIONS

Pedagogy:

The theory and practice of education. It focuses on how actually to develop and implement curricula.

Socio-technical systems:

Sociotechnical systems in organizational development is an approach to complex organizational work design that recognizes the interaction between people and technology in workplaces.

Flipped classroom technology:

The flipped classroom is an instructional strategy and a type of blended learning that reverses the traditional learning environment by delivering instructional content, often online, outside of the classroom.

Zone of proximal development (ZPD)

THE ZPD is the difference between what a learner can do without help and what he or she can do with help.

LEAN APPLICATION IN HEALTH CARE

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ABSTRACT

Lean is a method designed to maximize customer value while eliminating waste from an organization. Waste is any activity that doesn't add value to the process but consumes resources. Lean can be used in healthcare to improve these processes by improving the quality of healthcare and decreasing healthcare costs. The number one complaint in healthcare is the long wait times. Improving patient flow by reducing wait times means more satisfied patients. This also leads to increased efficiency and extra capacity that accommodates more patients without increasing resources leading to more profitability. Analyzing the movement of patients through the facility is very important in identifying the non-value added activities vs. value added activities that are key to identifying wastes. We strongly believe that all students studying business and healthcare management should be exposed to lean thinking. This paper is divided into 2 major parts. In part 1, we demonstrate the importance of lean application in Urgent Care facilities. In part 2, we present a three-prong approach that helps student learn about integrating lean in a business and/or healthcare program.

INTRODUCTION

Over the past few decades, continuous improvement methods such as Quality, Lean, Six-Sigma, etc. have helped manufacturing organizations to improve their productivity and quality levels significantly. Today many service organizations are successfully applying these powerful process improvement methods and tools. Health care organizations have also joined the bandwagon, and are looking at lean applications at all levels.

Lean is a method designed to maximize customer value while eliminating waste from an organization. Waste is any activity that doesn't add value to the process but consumes resources.

Fundamentals of Lean (McManus, 2012)

- a. Specify value: Value is defined by customer in terms of specific products & services
- b. Identify the value stream: Map out all end-to-end linked processes that transform inputs to outputs to identify and eliminate waste
- c. Make value flow continuously: Having eliminated waste, make remaining value-creating steps flow
- d. Let customers pull value: Customer pulls system all the way back to the lowest level supplier, enabling just-in-time production
- e. Pursue perfection: Pursue continuous process of improvement striving for perfection

Benefits of Lean

Customer satisfaction, reduced cycles, better delivery, more capacity, better quality and increased productivity are benefits of lean.

Pull vs. Push system

A push system keeps moving people forward in the system until the next resource needed is unavailable. They then wait until that resource becomes available. This creates multiple wait steps and multiple patient queues. This is the most common queuing being done in primary care and urgent care practices

A pull system waits until the resource is ready to pull a patient through the system. Since there will be only one patient queue to manage it is more efficient than a push system. All waiting is done on the front end of the visit. Much more difficult to do without an automated patient queuing system

Lean in healthcare

Lean or just-in-time production was initially developed at Toyota for improving their manufacturing process. But later, lot of diverse fields started applying lean principles for improving their processes. Healthcare is a badly behaving complex system of processes. 20-30% of healthcare spending is a waste (McManus, 2012). Lean can be used in healthcare to improve these processes by improving the quality of healthcare and decreasing healthcare costs. The number one complaint in healthcare is the long wait times. Improving patient flow by reducing

wait times means more satisfied patients. This also leads to increased efficiency and extra capacity that accommodates more patients without increasing resources leading to more profitability.

Value added vs. Non-Value added activities (Ayers)

The following are the three different types of activities as defined by Lean.

- a. Value added activities – these activities are directly related to treating a patient and providing patient satisfaction and cannot be avoided. Example: physical exam, treating patients, documenting findings etc.
- b. Non-Value added but Essential activities – these are not directly related to treating a patient but still are essential. Ex: Insurance verification, collecting co-pay, lab tests etc.
- c. Non-Value added activities (Waste) – these activities don't add any value to the patient. Ex: Wait-times, transit time etc.

Wastes identified by Lean

Lean identifies seven different types of wastes. They are over-production, inventory, transportation, motion, waiting, defects and over-processing. Analyzing the movement of patients through the facility is very important in identifying the non-value added activities vs. value added activities that are key to identifying wastes. Reducing non-value added activities (waste) and increasing value added work increases throughput.

INTEGRATING LEAN IN A HEALTHCARE PROGRAM

The basic philosophies, concepts and tools of waste identification and elimination, if applied appropriately, are applicable in health care organizations. All students studying business and healthcare management should be exposed to lean thinking. This paper demonstrates how some of the lean philosophies and tools can be applied in urgent care setting. A three-prong approach to integrating lean in a business and/or healthcare program is presented.

Urgent Care:

Urgent cares provide services that fall in between primary care and emergency department. They are generally focused on episodic, acute care rather than on long-term management of chronic illness or preventive care. There is future prediction that shows a shortage of primary care physicians so, there is a great growth potential for urgent cares. Also, a lot of visits to emergencies are for non-emergent care, which can be provided by urgent cares.

Characteristics of Urgent Care

Urgent Cares offer Walk-in or unscheduled care. Services are provided during weekends and extended hours are offered during weekdays. They provide services that are beyond primary care like on-site lab testing, onsite radiology etc. Often occupational health services are also provided.

Wastes in Urgent Care (James P. Womack, 1996)

Table 1 provides examples of some wastes that can be identified using lean in urgent care facilities.

Table 1:

Wastes (NVA)	Urgent Care
Over-production	1. Tests ordered unnecessarily 2. Printed reports that are unused
Inventory	1. Patient waiting in exam room 2. Supplies purchased in excess
Transportation	1. Multiple trips by patient to front desk to complete paperwork 2. Patient moving between different steps 3. Storage of supplies in temporary locations
Motion	1. Doctor/nurse moving in and out of exam room multiple times a. For data entry b. For missing supplies
Waiting	1. Patient waiting for registration 2. Waiting for results
Defects	1. Incomplete or inaccurate prescriptions 2. Errors in registration causing rejected insurance claims
Over-processing	1. Same information written on multiple forms by patient 2. Staff entering patient information in different systems

Time spent at each step in an urgent care

The typical time spent by a patient at each step in an urgent care is in Table 2 (Backer, 2002). From these steps, Value added and Non-Value added activities are identified first and then the total patient time spent in each of these activities is calculated. From Table 2 55% of time spent by a patient in an urgent care is Non-Value added time, which is a very big portion of the total time. Non-value added time is what the patient is not willing to pay for and hence should be reduced or eliminated by applying Lean principles. This leads to shorter wait times and less administrative hassle, improved accuracy and quality of care, improved financial performance and overall leads to more satisfied patients with improved experience.

Table 2:

Step	Time (Min)	Value added (VA) vs. Non-value added (NVA)
Wait at Check-in	2	NVA
Complete Check-in	6	VA
Wait in Waiting Room	14	NVA
Move to Exam Room	4	NVA
Wait for Physician	10	NVA

Interaction with Physician	19	VA
Move to Check out	3	NVA
Wait at Check-out	3	NVA
Check out	4	VA
Total Cycle time	65	

THE THREE-STEP APPROACH

A three-step approach that helps student learn about lean by integrating lean in a business and/or healthcare program was designed. Students should first understand lean concepts then perform simulations in classroom and finally do a real-time project at healthcare facilities in order to fully learn Lean applications to healthcare.

Step 1 - Understand Lean Concepts

The objective of step-1 is to understand the concepts of Lean and how they can be applied to healthcare to eliminate waste and deliver value to customers. In this step students should learn fundamentals of Lean, benefits of Lean, understand Pull vs. Push system, Value-Added and Non-Value Activities, types of wastes and how Lean can be applied to Healthcare. After understanding all lean concepts, students should be able to identify healthcare process issues, define what is of value to the customer, analyze the product flow and identify the value stream, flow the product through the process by eliminating wastes and bottlenecks, pull the product through the process and strive for perfection through continuous improvement.

Step 2 - Perform Simulations in Classroom

The objective of step-2 is to perform series of hands on operations reflecting a real life healthcare issue/process, and apply concepts of lean to improve the process. Healthcare professionals like nurses and doctors are trained on mannequins that simulate a real patient before performing any procedures on real patients. Similarly, simulations can be performed in different ways using Computers, Legos, timers and paper to reflect real like issues and apply lean concepts.

There are several benefits of using simulations to learn Lean concepts. Lectures and case studies provide abstract learning where as simulations provide concrete learning. Simulations are small and flexible compared to real issues and issues can be tested with simulations first to reduce the risk, compared to making changes directly to real issue. Simulations promote experiential learning and helps students to learn without the fear of personal failure. They provide more control over the environment and promote independence and skill development. (Robert James Campbell, Laura Gantt, & and Tamara Congdon, 2009).

Simulations demonstrate lean principles in action and should be designed to mimic the environment students will encounter in real-life and allow students to perform real-life roles

through role-playing. They should provide the opportunity to develop a hypothesis to eliminate waste and experimentally test the hypothesis to check if it improved the process. (Robert James Campbell, Laura Gantt, & and Tamara Congdon, 2009)

Simulations will allow students to visualize the process/issue and have an increased understanding of lean concepts. After performing simulations students should be able to manipulate the process, figure out best solutions to eliminate wastes, develop solutions to improve the process and find solution that can be confidently applied in real life to resolve the issue.

Step 3 - Real-time Project at Healthcare Facilities

The objective of step-3 is to analyze healthcare issues and propose improvements using lean principles, by working on a project. An actual project should provide an opportunity for students to work at a healthcare facility that allows them to apply classroom and simulation knowledge on Lean concepts to real issue. During the project it is advisable for students to simulate real issues first and find solutions for improvement before implementing changes. (Anabela C. Alves, 2014)

After working on an actual project, students should have an in-depth understanding of Lean tools and techniques. They should be able to confidently implement changes to real issues that were identified by successful simulations. Also, students should be able to improve their ability to estimate healthcare facility cost savings through lean implementation and finally be able improve communication and leadership skills in business environment.

CONCLUSION

Even though lean has been proved to improve manufacturing process its applications to healthcare industry are not fully tested. We recommend universities and colleges to integrate the three-step approach provided in this paper in their healthcare programs in order to provide students with an opportunity to fully and confidently learn lean application in healthcare. Once these students enter the work force they would have all necessary tools in hand to apply lean concepts to real healthcare process issues and help healthcare facilities to improve their processes by eliminating/reducing wastes that will ultimately result in cost-savings to the facility.

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PREDICTING BLOOD DONATIONS USING MACHINE LEARNING TECHNIQUES

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ABSTRACT

We study the performance of machine learning algorithms that have not been previously investigated to support this problem of blood donation prediction. We build models on clustered data sets using k-means clustering and not using clustering to see if performance is significantly improved using clustering or not. The motivation for this research is that blood demand is gradually increasing by the day due to needed transfusions due to accidents, surgeries, diseases etc. Accurate prediction of the number of blood donors can help medical professionals know the future supply of blood and plan accordingly to entice voluntary blood donors to meet demand. We found that in a SVM clustered model with $k = 4$ led to the best test set sensitivity (98.4%), which beat other studies. Our current solution is within the top 8% of all current participants in the DataDriven.org blood prediction competition.

INTRODUCTION

The donation of blood is important because most often people requiring blood do not receive it on time causing loss of life. Examples include severe accidents, patients suffering from dengue or malaria, or organ transplants. Extreme health conditions such as Leukemia and bone marrow cancer, where affected individuals experience sudden high blood loss and need an urgent supply of blood and do not have it can also lead to loss of life. Sound data-driven systems for tracking and predicting donations and supply needs can improve the entire supply chain, making sure that more patients get the blood transfusions they need, which can reduce mortality risk.

One of the interesting aspects about blood is that it is not a typical commodity. First, there is the perishable nature of blood. Grocery stores face the dilemma of perishable products such as milk, which can be challenging to predict accurately so as to not lose sales due to an expired product. Blood has a shelf life of approximately 42 days according to the American Red Cross (Darwiche, Feuilloy et al. 2010). However, what makes this problem more challenging than milk is the stochastic behavior of blood supply to the system as compared to the more deterministic nature

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of milk supply. Whole blood is often split into platelets, red blood cells, and plasma, each having their own storage requirements and shelf life. For example, platelets must be stored around 22 degrees Celsius, while red blood cells 4 degree Celsius, and plasma at -25 degrees Celsius. Moreover, platelets can often be stored for at most 5 days, red blood cells up to 42 days, and plasma up to a one calendar year.

Amazingly, only around 5% of the eligible donor population actually donate (Linden, Gregorio et al. 1988, Katsaliaki 2008). This low percentage highlights the risk humans are faced today as blood and blood products are forecasted to increase year-on-year. This is likely why so many researchers continue to try to understand the social and behavioral drivers for why people donate to begin with. The primary way to satisfy demand is to have regularly occurring donations from healthy volunteers.

In our study, we focus on building a data-driven system for tracking and predicting potential blood donors. We investigate the use of various binary classification techniques to estimate the probability that a person will donate blood in March 2007 or not based on his past donation behavior. There is a time lag between the demand of blood required by patients suffering extreme blood loss and the supply of blood from blood banks. We try to improve this supply-demand lag by building a predictive model that helps identify the potential donors.

Based on our understanding of the problem, we follow a structured analytical process widely known in the data mining community, called the Cross-Industry Standard Process for Data Mining (CRISP-DM) (Chapman, Clinton et al. 2000). The idea behind this analysis framework is to develop and validate a model (or solution) that satisfies the requirements of problem and needs of stakeholders. We used guidance in the academic literature to get ideas of how others have modeled this problem and followed a similar process. Some authors clustered data before building their predictive models and some did not. We tried both and used some algorithms that others have not yet investigated to see if our solution was as good or better than what others have found.

We structured this paper as follows. We performed a review on the literature to see what methodologies have found to be successful at understanding this problem. We discuss the data set used in our study. Next, we discuss the methodology/design we implemented and discuss the models we investigated. Lastly, we present our results, discuss our conclusions, and how we plan to extend this research.

LITERATURE REVIEW

We examined the academic literature and grouped what we found into a couple different categories. First, blood banks often will survey donor volunteers to try and understand the factors that led them to donate. For example Godin, Conner et al. (2007) found that the important factors that lead to repeated blood donation among experienced donors were intention, perceived

control, anticipated regret, moral norm, age, and past donation frequency. Moreover, the factors leading to repeated blood donation among new donors were only intention and age.

Others have designed studies to understand one’s motives for donating blood. Sojka and Sojka (2008) surveyed over five hundred donators and found that the most commonly reported motivator among their participants was friend influence (47.2%), followed by media requests (23.5%). Lastly, they found that altruism (40.3%), social responsibility (19.7%), and friend influence (17.9%) were the primary drivers for blood donors to continue to be blood donors in the future.

As stated previously, only around 5% of eligible donor population actually donate (Katsaliaki 2008). The reasons for this are regularly reviewed by social and behavior scientists to help improve population participation (Ferguson, France et al. 2007).

The studies just discussed are outlined below in Table 10 are just a fraction of the many studies being performed to better understand the social and behavioral aspects of why people donate blood. We have found that many studies are trying to extend what is known as a theory of planned behavior (TPB), which continues to be developed in this area. This theory predicts the occurrence of certain behavior given that it is intentional and under volitional control (Veldhuizen, Ferguson et al. 2011). A systematic review and meta-analysis was performed in this area by Bednall, Bove et al. (2013).

Authors	Methods	Data	Drivers
(Godin, Conner et al. 2007)	Logistic Regression	Survey (2070 experience donors, 161 new donors)	<i>Experienced donors:</i> intention, perceived control, anticipated regret, moral norm, age, and past donation frequency. <i>New donors:</i> intention and age
(Sojka and Sojka 2008)	Descriptive statistics	Survey (531 participants)	<i>General motivators:</i> friend influence (47.2%), media requests (23.5%). <i>Continued donations:</i> altruism (40.3%), social responsibility (19.7%), friend influence (17.9%)
(Masser, White et al. 2009)	Structural equation modeling	Survey 1 (263 participants); Follow-up survey (182 donors)	Moral norm, donation anxiety, and donor identity indirectly predicted intention through attitude.
(Masser, Bednall et al. 2012)	Path analysis	Survey1 (256 participants)	Their extended TPB model showed intention was predicted by attitudes, perceived control, and self-identify

Table 10: Social and psychological studies investigating drivers of blood donations

The focus of our study is to understand the performance that using traditional machine learning techniques can have at predicting future blood donation. Table 11 outlines what we believe is an exhaustive list of all published studies in this domain, the data set used, methods employed, and results achieved. The “-” symbol indicates that nothing is reported in their paper in this table field.

Authors	Methods	Data	Results
(Mostafa 2009)	ANN (MLP), ANN (PNN), LDA	Survey (430 records, 8 features)	ANN (MLP): Test accuracy (98%) ANN (PNN): Test accuracy (100%) LDA: Test accuracy (83.3%)
(Santhanam and Sundaram 2010)	CART	UCI ML blood transfusion data ⁵ (748 donors, 5 features)	Precision/PPV (99%), Recall/Sensitivity (94%)
(Sundaram 2011)	CART vs. DB2K7		
(Darwiche, Feuillooy et al. 2010)	PCA for feature reduction ANN (MLP) vs SVM (RBF)	UCI ML blood transfusion data (748 donors, 5 features)	SVM (RBF) using PCA: Test Sensitivity (65.8%); Test Specificity (78.2%); AUC (77.5%) MLP with features recency & monetary: Test Sensitivity (68.4%); Test Specificity (70.0%); AUC (72.5%)
(Ramachandran, Girija et al. 2011)	J48 algorithm in Weka (aka C4.5)	Indian Red Cross Society (IRCS) Blood Bank Hospital (2387 records, 5 features)	Recall/Sensitivity (95.2%), Precision/PPV (58.9%), Specificity (4.3%)
(Lee and Cheng 2011)	k-Means clustering, J48, Naïve Bayes, Naïve Bayes Tree, Bagged ensembles of (CART, NB, NBT)	Blood transfusion service center data set (748 records/donors, 5 features)	Bagged (50 times) Naïve Bayes: Accuracy (77.1%), Sensitivity (59.5%), Specificity (78.1%), AUC (72.2%) * model had best AUC among competing models
(Zabihi, Ramezan et al. 2011)	Fuzzy sequential pattern mining	Blood transfusion service center data set (748 records/donors, 5 features)	Precision/PPV (Frequency feature 88%, Recency feature 72%, Time feature 94%)
(Sharma and Gupta 2012)	J48 algorithm in Weka (aka C4.5)	Blood bank of Kota, Rajasthan, India (3010 records, 7 features)	Accuracy (89.9%)
(Boonyanusith and Jittamai 2012)	Artificial Neural Network (ANN), J48 algorithm (aka C4.5)	Survey (400 records, 5 features)	<u>ANN:</u> Accuracy (76.3%); Recall/Sensitivity (81.7%); Precision/PPV (87.9%); Specificity (53.8%) <u>J48:</u> Recall/Sensitivity (81.2%); Precision/PPV (87.3%); Specificity (52.5%)
(Testik, Ozkaya et al. 2012)	Two-Step Clustering with CART This is fed into a serial queuing network model	Blood donation center (1095 donors, 3 clusters)	-
(Bhardwaj, Sharma et al. 2012)	-	-	-
(Khalid, Syuhada et al. 2013)	-	-	-
(Ashoori, Alizade et al. 2015)	C5.0, CART, CHAID, QUEST	Blood transfusion center in Birjand City in North East Iran (9231 donors, 6 features)	<u>Model accuracy (train/test):</u> C5.0 (57.49/56.4%), CART (55.9/56.4%), CHAID (55.56/55.61%), QUEST (55.34/56.11%)
(Ashoori, Mohammadi et al. 2017)	Two-step clustering, C5.0, CART, CHAID, QUEST	Census survey from a blood transfusion centers from Birjand, Khordad, & Shahrivar (1392 participants)	<u>Important features:</u> Blood pressure level, blood donation status, temperature <u>Model accuracy:</u> C5.0 (99.98%), CART (99.60%), CHAID (99.30%), QUEST (89.13%)

⁵ <https://archive.ics.uci.edu/ml/datasets/Blood+Transfusion+Service+Center>

Table 11: Predicting blood donation with a focus on data mining/machine learning techniques

The first published study we found investigating machine learning classification techniques to identify donors versus non-donors was by Mostafa (2009). They show that it is possible to identify factors of blood donation behavior using machine learning techniques. They train and test two artificial neural network (ANN) variants; one using a multi-layer perceptron (MLP); the other a probabilistic neural network (PNN). They then compare these non-linear models to a linear discriminant analysis (LDA) model. They conclude that the ANN models both perform very well compared to LDA due the nonlinearities that exist in their data.

Santhanam and Sundaram (2010) used the Classification and Regression Tree (CART) from the University of California – Irvine Machine Learning repository. They showed on this data set that this algorithm has the ability to classify future blood donors accurately that had donated previously (i.e. recall/sensitivity of 94%). We found a very similar study published by one of the original authors the following year with a comparison of what they call a Regular Voluntary Donor (RVD) versus a DB2K7 (Donated Blood in 2007), which led to slightly better recall and precision (Sundaram 2011). Their key contribution was that the RVD model realized better accuracy than DB2K7. Darwiche, Feuilloley et al. (2010) extend this investigation of this data set by testing ANN with a radial basis function (RBF) as well as investigate performance using Support Vector Machines (SVMs). Even though the feature space is limited they also build and evaluate these models using principal components analysis (PCA) as feature inputs instead of the raw feature inputs. The SVM (RBF) model performed best using PCA as inputs because this model achieved the highest area under the curve (AUC) on the test set (i.e. 77.5%). The ANN model achieved the best AUC of 72.5% using only the features recency and monetary value. Lastly, we found the study design of (Darwiche, Feuilloley et al. 2010) better than (Santhanam and Sundaram 2010) and (Sundaram 2011) because their models are assessed on a test (i.e. holdout) set, which provides more realistic performance on future observations. Furthermore, this design allows one to identify if a model has overfit to the data by comparing the testing set statistics to the training set statistics.

Zabihi, Ramezan et al. (2011) investigate the use of fuzzy sequential pattern mining to try and predict future blood donating behavior. The features investigated in this study were (1) months since last donation, (2) total number of donations, (3) time (in months) since first donation, and (4) a binary feature indicating whether blood was donated in March 2007 or not. These features are similar in nature to those we investigated in our study.

Ramachandran, Giriya et al. (2011) investigated the performance of the J48 algorithm provided in Weka⁶. The J48 algorithm is an implementation of the C4.5 decision tree written in Java (Wikipedia , Quinlan 1993). They found this methodology to also perform well at predicting blood donors whom had donated before having a sensitivity of 95.2%, but performed poorly at

⁶ Weka is a data mining software for Java users. <http://www.cs.waikato.ac.nz/ml/weka/>

future non-donors. Sharma and Gupta (2012) also used the J48 algorithm in Weka on a different blood donation data set obtained from a blood bank in Kota, Rajasthan, India. While they were attempting to predict the “number” of donors through their age and blood group, they actually performed a classification of donors versus non-donors which raised concerns over the validity of this study.

Boonyanusith and Jittamai (2012) performed a blood donation survey in Thailand. Like previous studies they used the J48 decision tree, but also tried an artificial neural network. Both models yielded similar performance with sensitivity (81.7% vs 81.2%) and specificity (53.8% vs. 52.5%).

Bhardwaj, Sharma et al. (2012) provided a very limited review of data mining in blood donation and do not actually train and test any models. They propose to do this in the future research. Likewise Khalid, Syuhada et al. (2013) provide a slightly more extensive review of the literature, but also do not perform any modeling or analysis.

Testik, Ozkaya et al. (2012) use the idea of trying to group similar donors based on arrival patterns using Two-Step clustering (SPSS 2001). Then once clusters are formed, CART was implemented on the individual clusters to try to improve predictive accuracy. This approach has been tested in other domains and is an approach we investigate in our study. However, instead of Two-Step clustering we implement models based on more widely known k-Means clustering algorithm. The authors do not report the predictive accuracy of their approach, nor provide a comparison of using Two-Step clustering-CART versus using CART alone. Their primary contribution is the formulation of a serial queuing network model that could be used in the case of blood center operations where arrival patterns could be estimated and used to support workforce size utilization.

Ashoori, Alizade et al. (2015) collected census data collected from a blood transfusion center located in Birjand City, North East Iran. This data set consisted of 9,231 donors and measured six features. They tried to predict future blood donors using four types of decision trees (C5.0, CART, CHAID, and QUEST). Their cross-validated models all yielded poor performance ranging from 55 to 57 percent accuracy. One interesting aspect of their results was that the best performing model, the C5.0 tree, had 41 rules compared to only 13 (CHAID), 8 (CART), and 5 (QUEST). With trees the more rules (or splits) used often will lead to overfitting to the data, but can also lead to more distinct probability values in the prediction. Ashoori, Mohammadi et al. (2017) extend research into the performance of these techniques by first using two-step clustering before employing the same decision tree algorithms used in their previous study. They conclude that this approach helped them predict faster and more precisely compared to their previous study.

DATA

The dataset used in our study is one used by others researchers studying the problem posted on

the UCI Machine Learning Repository ⁷. The source data has been taken from blood donor database of the Blood Transfusion Service Center in Hsin-Chu City in Taiwan. 748 donors were randomly selected from the donor database for the study. The features measured include R (Recency - months since last donation), F (Frequency - total number of donation), M (Monetary - total blood donated in c.c.), T (Time - months since first donation), and a binary variable representing whether the donor donated blood in March 2007 (1 stands for donating blood; 0 stands for not donating blood) as shown in Table 12.

Variable	Type	Description
X	Integer	Donor ID
Months since Last	Integer	This is the number of months since this donor's most
Number of	Integer	This is the total number of donations that the donor has
Total Volume	Integer	This is the total amount of blood that the donor has
Months since First	Integer	This is the number of months since the donor's first
Donated blood in	Binary	This gives whether person donated blood in March 2007

Table 12: Data dictionary

METHODOLOGY

Figure 16 outlines the flow of our study. First, we used k-Means clustering to cluster the data into similar groups. The idea is to group like items with like items before building predictive models, as this can lead to better predictive model performance per cluster, and thus lead to improved performance over all clusters.

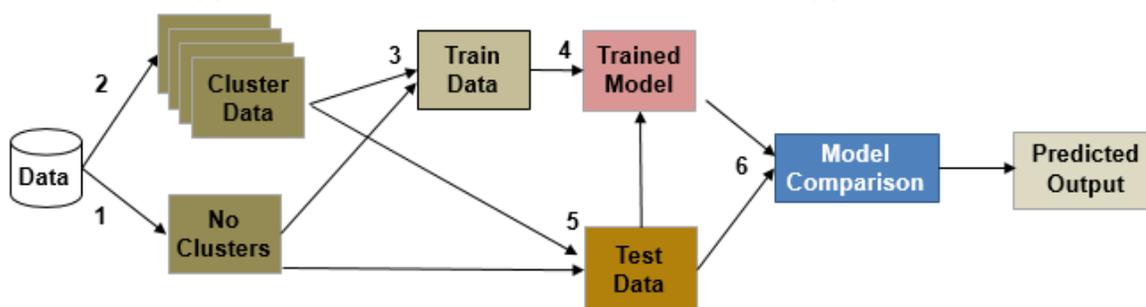


Figure 16: Methodology flow diagram

The dataset was randomly partitioned into training set and testing set using a 70/30 train/test partition. Models are trained using various algorithms using the entire training set, as well as trained on each cluster generated within the training set. Each model was trained once using what

⁷ <https://archive.ics.uci.edu/ml/datasets/Blood+Transfusion+Service+Center>

is sometimes referred to as a validation-set approach. We did try 5-fold 10-fold cross-validation on two of the models we researched. The idea here is to estimate a model over multiple folds (i.e. random partitions) instead of just one random training set. Cross-validation averages model fit performance measures such as prediction error to correct for the optimistic nature observed from the training error and thus provide an estimate of prediction risk that is more transparent (Seni and Elder 2010). The problem with k-fold and is the reason we only tried this on a couple models is we have a very small data sets when the data sets are clustered. Folds will make these training sets even smaller which might not provide any algorithm enough examples to learn.

Once models are trained, the test (i.e. holdout) data is fed into each trained model to measure model performance. These measures allow us to gauge the generalizability of the remaining subset of data not used in the study, and provides us a feel to the degree of how overfit any models are to the training data.

The statistical performance measures we obtained were overall accuracy, sensitivity, specificity, and area under the curve (AUC). The first three measures are easily calculated using a confusion matrix as shown in Figure 17. The overall accuracy measures how well you classify donors versus non-donors ($TP+TN/Total$). Sensitivity measures how well we are able to correctly predict donors whom have actually donated ($TP/(TP+FN)$). Specificity allows us to gauge how well we are able to predict non-donors among those whom did not donate ($FP/(FP+TN)$).

		Actual Donor		
		Yes	No	
Predicted Donor	Yes	TP	FP	TP + FP
	No	FN	TN	FN + TN
		TP + FN	FP + TN	Total

Figure 17: Confusion matrix used to generate statistical performance measures of donating

AUC is generated from a receiver operating characteristic (ROC) curve. This curve plots sensitivity versus 1-specificity for varying probability cutoff values. The typically used cutoff in binary classification model performance evaluation is 0.50, but it need not be. It is often standard practice to use the AUC statistic as the preferred statistic to use to compare which model performs better than another. Using varying cutoff thresholds (e.g. 0.01, 0.02, ... , 0.99), one can construct a confusion matrix for each threshold and plot the sensitivity vs. 1-specificity performance. The estimated area under this curve provides the modeler a better feel of performance across a plethora of cutoffs, where the AUC closer to 1 indicates a perfect classifier, while a value close to 0.50 indicates a model that is not able to learn.

MODELS

Some of the models tested in our study have been used by other authors in their studies, but we

also try other techniques to see how they perform. We used k-means to cluster our data as did (Lee and Cheng 2011). The predictive models similar to other studies include **CART** (Santhanam and Sundaram 2010, Lee and Cheng 2011, Sundaram 2011, Testik, Ozkaya et al. 2012, Ashoori, Alizade et al. 2015, Ashoori, Mohammadi et al. 2017), **J48/C4.5/C5.0** (Ramachandran, Girija et al. 2011, Boonyanusith and Jittamai 2012, Sharma and Gupta 2012, Ashoori, Alizade et al. 2015, Ashoori, Mohammadi et al. 2017), **artificial neural network (ANN)** (Mostafa 2009, Darwiche, Feuilloy et al. 2010, Boonyanusith and Jittamai 2012), **support vector machines (SVM)** (Darwiche, Feuilloy et al. 2010). The additional models we investigate that are not investigated in the literature is logistic regression (often referred to as just a logit model), boosted and bagged versions of the logit, and random forests.

K-means clustering is an unsupervised learning method which is used when labelled data is not available. In this method, the number of clusters or groups that the data needs to be divided is determined beforehand and it is assigned to the variable K. Randomly k points are chosen as the centroids of the cluster. Each data point is assigned to one of the K clusters based on the vicinity of the point to the centroid of the Kth cluster. The assignment is determined by calculating the least Euclidean distance of the data point to all the K centroids. After formation of the clusters, the process is repeated several times until the centroids converge, that is they stop moving. This is determined by calculating the Euclidean distance between the new centroid and the old centroid of the same cluster.

CART

Classification and Regression Techniques (CART) coined by Leo Breiman is used to refer to decision trees used for classification and regression techniques in predicting modelling. Trees have nodes and leaves. Every node is a question. In a binary tree, it is a yes or no question. The parent node is split into two child nodes. The splitting continues until a decision is reached for the target variable. The last node where the data cannot be split further are called leaves or terminal nodes. Every node is split on certain variable which gives the maximum information gain. Various methods like minimum entropy and Gini index is used for this. Sometimes probability is also used. Due to the nature of trees, it is quite easy for the model to overfit. Hence methods such as pruning are used where the nodes are not split after reaching a predetermined maximum depth. The nodes are then replaced by a leaf.

C5.0 Decision Tree

J48/C4.5 and C5.0 are the successive versions of CART which accept both continuous and discrete features along with missing data points. Pruning is also implemented along with normal tree construction. C5.0 incorporates variable misclassification cost. It considers the fact that certain kind of misclassification penalize the model more. Hence, C5.0 is designed to minimize expected misclassification costs rather than error rates. It also gives different weightage to different cases minimizing case weight attribute. It is also found to be faster than C4.5.

Artificial Neural Network

Artificial neural networks (ANNs) are learning algorithms inspired by human brains. The main architecture of ANN is the input layer, the hidden layer and the output layer. Except for the input layer, all other layers are connected to their previous layer by weights in the form of a directed graph. The nodes represent a neuron which has a linear or non-linear activation function. The learning happens in two parts, feed-forward and back-propagation. In feed forward, weights are assigned and in back-propagation, actual learning happens. The error is calculated at each node and the weights are updated. This process is repeated until the algorithm converges. We investigated the multi-layered perceptron (MLP) neural network where the activation layer is a linear function which maps the weighted inputs to the output of each node.

Support Vector Machines

Support vector machines (SVMs) are supervised classification or regression techniques widely used for non-linear datasets. The kernel trick allows the user to deal with non-linear data without having to worry about its linear separability. In SVM-RBF, a radial basis function is used as the kernel. The algorithm transforms the data into higher dimension into a linearly separable space and implements quadratic programming to increase the speed. The crux of the algorithm is that the data is transformed into a linear space. The data is then separated using a hyperplane which is supported by data points. The best separating hyperplane is one with maximum support vectors and the maximum margin. However, the drawback is that a very complex or wiggly hyperplane is likely to overfit the data.

Logistic regression

One of the benefits of the traditional logit is it is a parametric model that allows one to interpret the effect each variable has on the response. Often public health researchers use this model to estimate odds ratios which provide a meaningful statistic for interpretation. Logistic regression is a binary class classification algorithm which is used to predict a binary outcome. Given a set of independent variables, it gives the probability of a data point by fitting it to a logit function. In generalized linear model (GLM) terms, the logit is the link function that transforms the response into a logistic s-curve.

The initial exploratory analysis revealed that there was a high correlation between total volume donated and number of donations made. The first logit model estimated included all variables, and we found that the effect of total volume donated was not able to be estimated in the software we used. We then created two: one models removed total volume, the other model removed total number of donations and kept the other variables in model. We found both the variables are statistically significant when not estimated together, but are when estimated together, indicating

an issue of multicollinearity. We concluded to use total number of donations, months since first donation, and months since last donation as predictors.

Model: Made Donation in March 2007 ~ f (Total Number of Donations, Months Since First Donation + Months Since Last Donation)

LDA

Sir Ronald Fisher published developed Linear Discriminant Analysis (LDA) in 1936, which makes it one of the first classification techniques ever developed. LDA takes a different approach to estimating probabilities by modeling the distribution of the features separately in each of the response classes (blood donor vs non-blood donor). Then uses Bayes' theorem to flip these around into conditional probabilities. It turns out that the model is very similar in form to logistic regression when the distributions of the features are assumed to be normal. According to James, Witten et al. (2013), when the response classes are well-separated, the logit will tend to be unstable, while LDA tends to not have this issue. Also, if the number of observations is small and the distribution of features are normally distributed in each of the classes, the LDA model tends to be more stable than a logit.

Ensemble approaches

Ensembling approaches are a family of machine learning algorithms which tend to convert weak learners to stronger ones. Random Forest is the most popular ensembling technique used today. This algorithm ensembles decision trees which can be used for both classification and regression problems. In this method, multiple decision tree models are built on smaller samples. The final output of a classifier is determined by the mode of output of all trees and mean of the outputs if it is a regression problem. Many have found random forests to be one of the more competitive approaches in machine learning.

Bootstrap aggregation or bagging is an ensembling technique primarily used to reduce bias and variance in supervised learning. Bootstrapping is random selection with replacement. From the entire dataset, a fixed number of data points are randomly selected with replacement. A full blown logistic regression model is constructed on the bootstrapped sample, which involves applying validation and regularization techniques. This process of generating bootstrapped samples and training a model is done several times. The final output is either the mode or the mean of the combination of all model outputs depending upon classification or regression problem respectively.

RESULTS

In the initial exploratory analysis phase of our study, we tried to find a visible line of distinction between donors and non-donors. Figure 18 shows a 3D graph of months since first donation,

number of donations and months since last donation. We found that the groups of donors and non-donors were not visibly distinct.

Since the number of features available for modeling was so few, exploratory data analysis (EDA) was very limited. We investigated interactions among features as well as tried two-way and three-way interactions as model inputs but either led to the same performance or poorer performance. In such cases, we decided to use the main effects and no interactions in any of the methods we investigated. We followed the commonly accepted philosophy in predictive modeling that a simpler, less complex model is preferred when the statistical performance measures are no different.

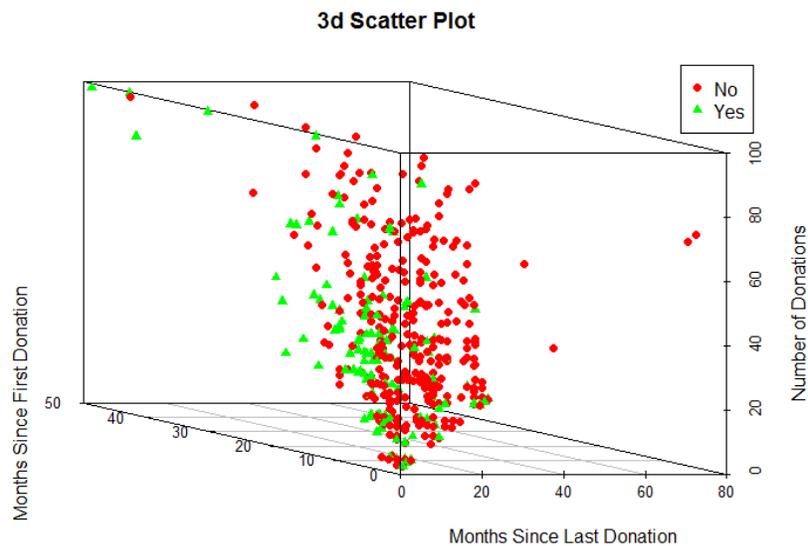


Figure 18: A 3D scatter plot depicting the distribution of patients donating blood or not

We evaluated the clusters generated from the k-Means algorithm using an elbow plot of mean squared error (MSE) versus the number of clusters as shown in Figure 19. We ran models by varying cluster size from 2 to 5. We found that five clusters was the ideal number of clusters for this data set as the MSE had marginal improvement with more groups. We also needed to consider the number of observations available in each cluster to train intelligent predictive models on each cluster, so having more than five would be questionable.

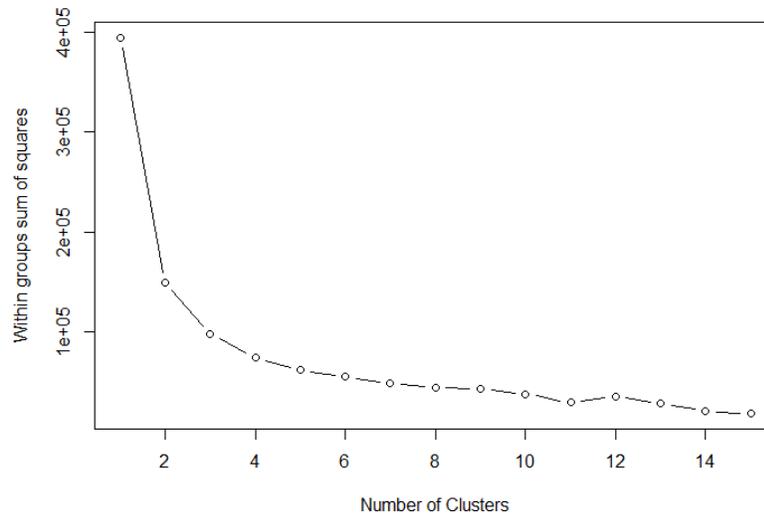


Figure 19: k-Means elbow plot

Figure 20 shows how the clusters are formed with regard to the features available. There is a clear grouping by the number of months since first donation.

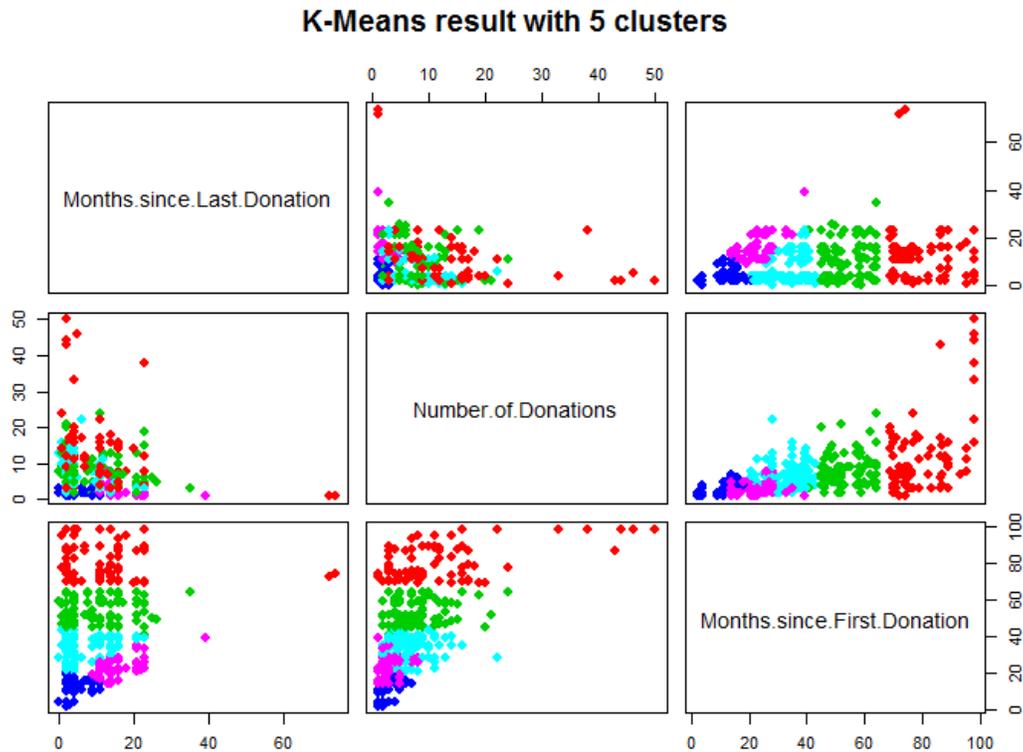


Figure 20: Colored clusters by features

Figure 6, Figure 7, Figure 8 summarizes the statistical performance for every model we investigated. The results are rather conclusive that using k-Means clustering with $k=4$ does improve performance of our models. High sensitivity on the testing set consistently is higher compared to not clustering. Compared to (Lee and Cheng 2011), our 5-fold cross-validated logit model performed the best among all models generated and slightly beat their best AUC of 72.2% using a boosted Naïve Bayes model.

They also tend to get a better balance of sensitivity versus specificity (59.5% vs 78.1%) compared to our model (85.5% vs. 36.59%). From the blood bank perspective, this means our best model predicts true blood donors better, but does not predict non-donors as well. Depending on how the blood bank markets to donors each of these models could lead to significantly different business performance and marketing costs. The argument made in some studies is that knowing whom will be a repeat donor is more important than knowing whom will not donate. Blood banks have invested significant effort to get recurring customers because those individuals help make the supply of blood more consistent over time, which helps supply chain management less risky.

Focusing on sensitivity in such cases we could achieve the best results using a clustered SVM model (sensitivity = 98.4%).

		Training				Testing			
		Accuracy	Sensitivity	Specificity	AUC	Accuracy	Sensitivity	Specificity	AUC
No Clustering	ANN	0.8610	0.9348	0.6220	0.7635	0.8372	0.8931	0.6585	0.7190
	C5.0	0.8836	0.9576	0.6494	0.7688	0.8837	0.9236	0.7560	0.6809
	CART	0.8143	0.9218	0.5054	0.7629	0.7965	0.8625	0.5853	0.6937
	Logistic Regression	0.7822	0.9674	0.1959	0.7616	0.7616	0.9542	0.1463	0.7260
	Logit (5-fold CV)	0.7871	0.8860	0.4742	0.7766	0.7384	0.8550	0.3659	0.6806
	Logit (Bagged)	0.9530	0.9935	0.8247	0.9273	0.7326	0.8473	0.3659	0.6373
	Logit (Boosted)	0.8317	0.9414	0.4845	0.8227	0.7558	0.8702	0.3902	0.6970
	LogitBoost	0.8045	0.9772	0.2577	0.7407	0.7674	0.9542	0.1707	0.6543
	LDA	0.7673	0.9674	0.9674	0.7637	0.7558	0.9542	0.1220	0.7244
	RandomForest	0.9431	0.9902	0.7938	0.9178	0.7500	0.8779	0.3415	0.6530
	SVM	0.8193	0.9642	0.3608	0.7693	0.7674	0.9160	0.2927	0.6536
	SVM (5-fold CV)	0.8094	0.9544	0.3505	0.7687	0.7733	0.9160	0.3171	0.6655

Table 13: Table comparing the statistical performance metrics of non clustered model investigated

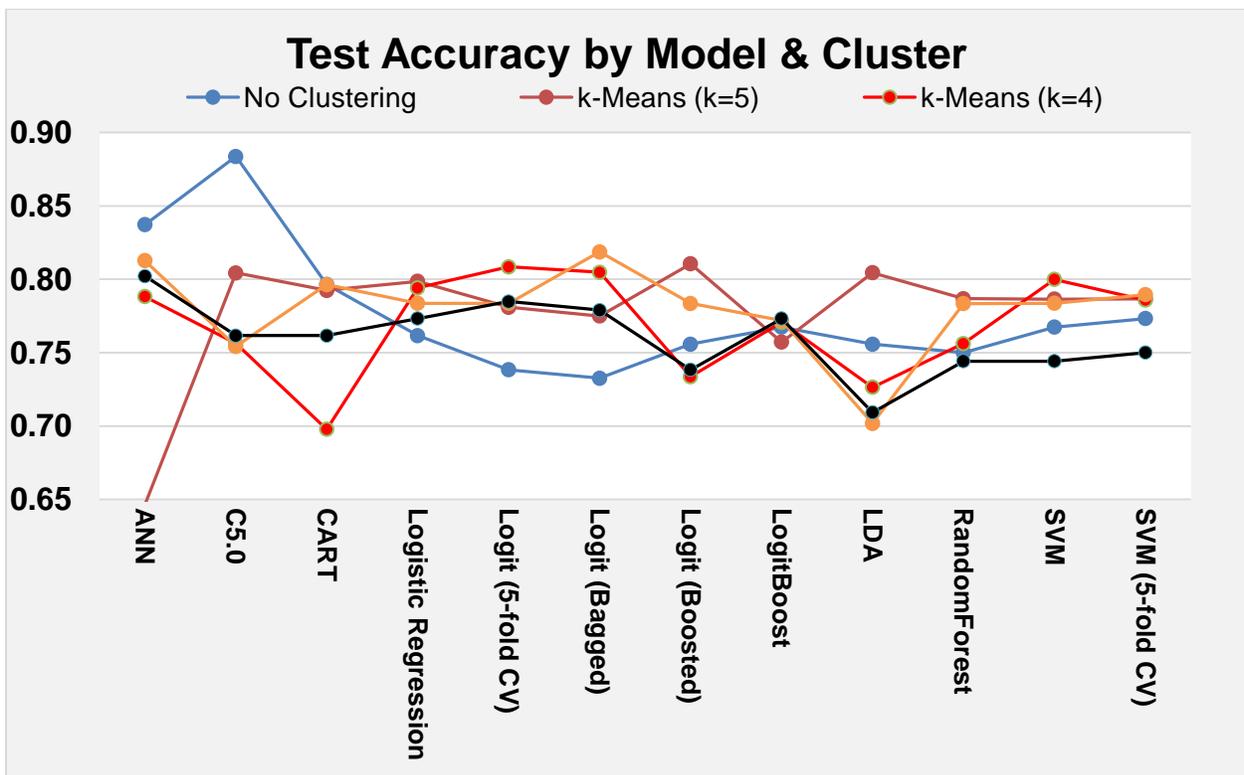


Figure 6 Graph comparing accuracy of different model on clustered and non clustered dataset

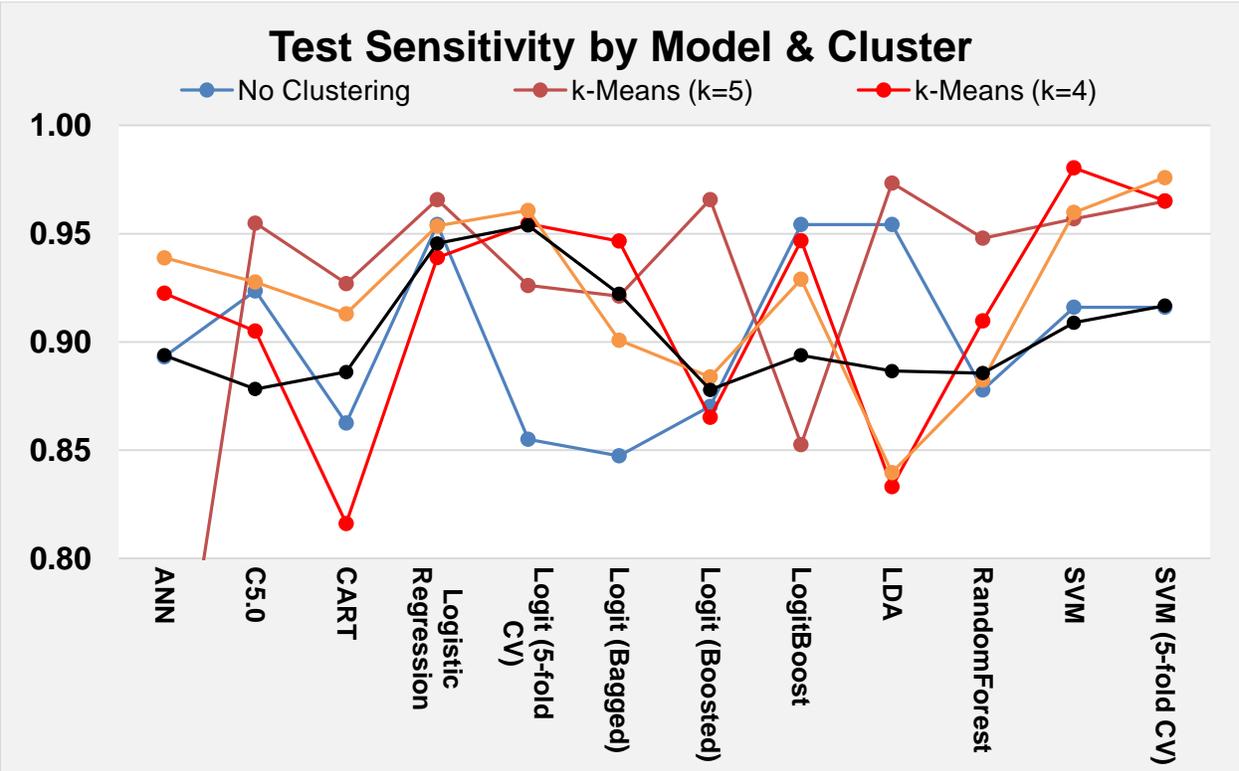


Figure 7 Graph comparing sensitivity of different model on clustered and non clustered dataset

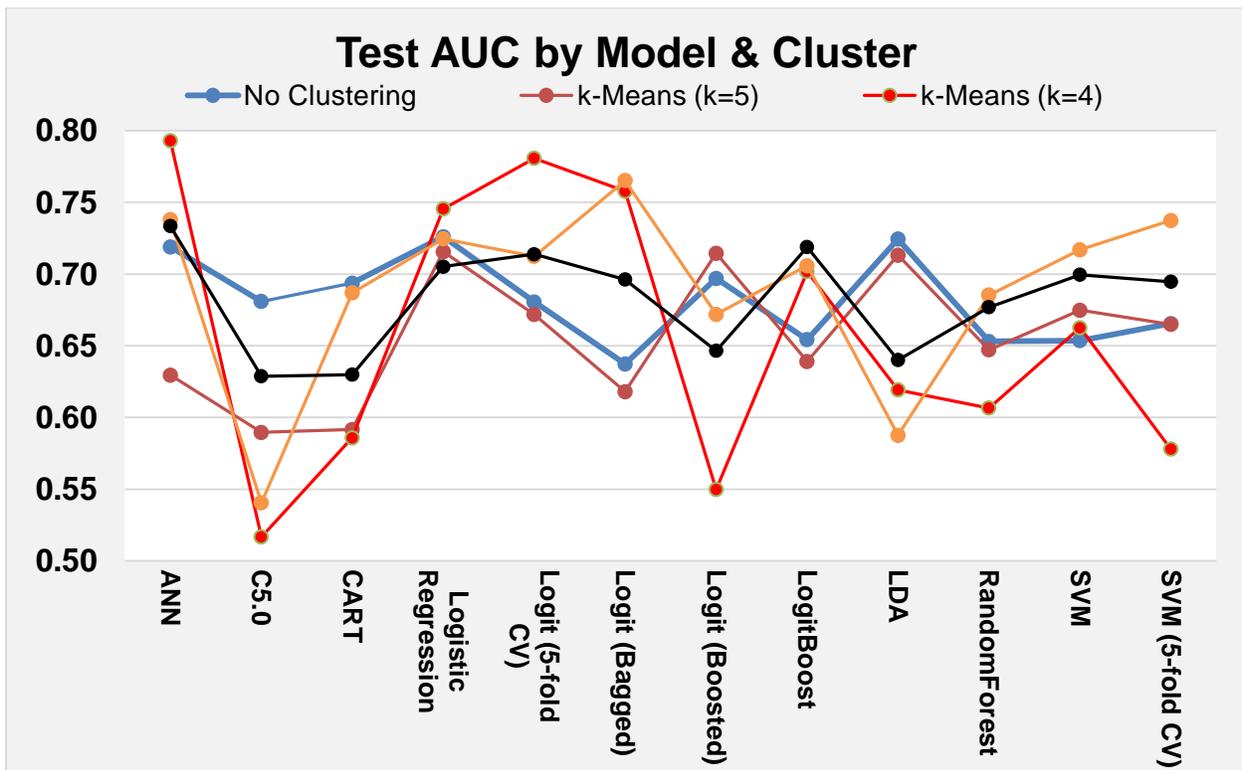


Figure 8 Graph comparing AUC of different model on clustered and non clustered dataset

Figure 921 shows that various models perform significantly better than others on the test/holdout set. AUC is the statistic used frequently by practitioners to compare model performance among competing models. The bagged logit (blue line) performed very poorly as its closest to the 45-degree line (i.e. 50% AUC). The basic logit (red line) appears to be one of the strongest performers, while the random forest (neon green line) is surprisingly not.

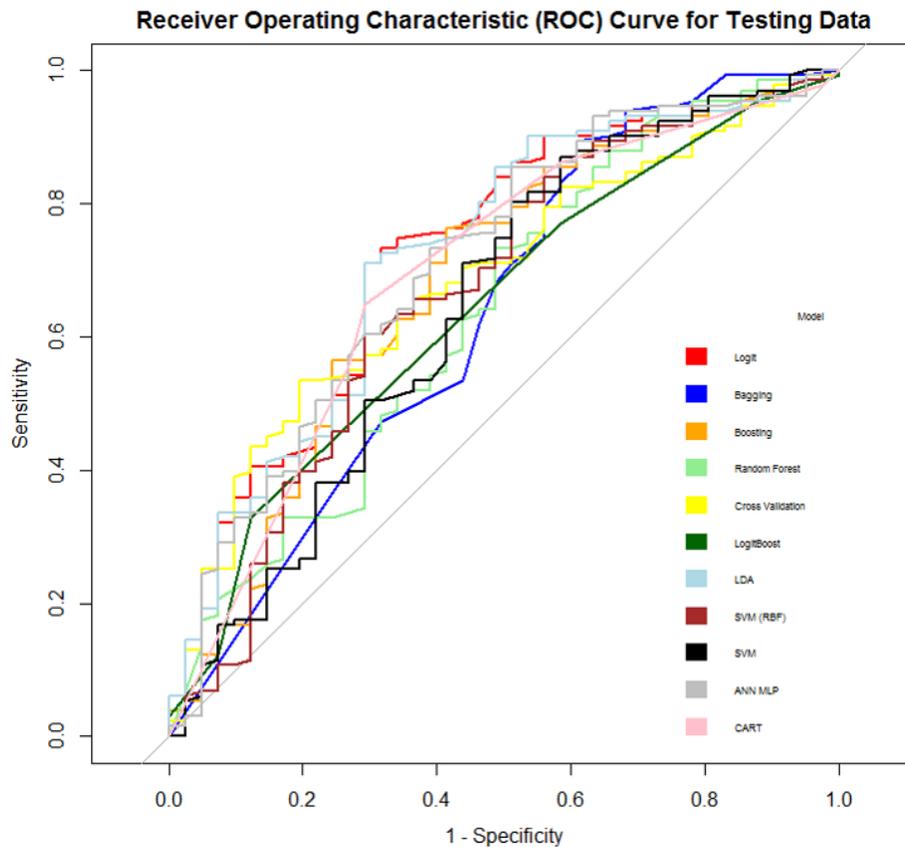


Figure 921: ROC curves for each model

CONCLUSIONS

In this study, we have compared the performance of various binary classification algorithms not investigated previously on clustered data and non-clustered data to see if we can better predict if a person is going to donate blood or not.

Among the algorithms examined, the un-clustered 5-fold cross-validated logistic regression model performed the best based on the test set AUC. However, AUC alone may not be best performance measure with respect to likelihood to predict blood. That is because AUC considers the area determined by True Positive Rate (TPR)/sensitivity and False Positive Rate (FPR)/(1-Specificity). Our model could be used for targeted advertisement. In such a case, we are more interested in the TPR which would be to target the actual donors who would be interested in donating blood regularly. Hence, our performance would focus more on sensitivity leading us to recommend a clustered SVM model.

We believe this study could be a valuable extension to the academic literature in blood donation modeling if we add the following. First, some authors used algorithms that are specific to a

certain software package. For example, CHAID and QUEST are decision tree algorithms specific to SPSS Modeler. Two-Step clustering is also specific to SPSS. We believe we should test and compare these algorithms to have a more complete comparison to what other authors have done. Secondly, there are many other machine learning algorithms that could be tested where one (or a combination of several) might yield to significantly better results. Lastly, we believe the statistical performance found to date would likely be deemed as “good” among blood banks practitioners in the field. We believe assessing the models from a cost-benefit perspective where the financial cost of misclassification and reward of correct classification is incorporated into the confusion matrix and assessment statistics likely provide additional insights to the blood bank than just statistical performance measures alone.

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