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A QUICK SOLUTION TO DISCRETE PROBABILITY DISTRIBUTION PROBLEMS

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ABSTRACT

Educators are continuously facing the challenge of enhancing their skills and teaching methodologies to accommodate students who lack the mathematical knowledge and background necessary in the courses that they teach. Although the level of this challenge may be different in different courses within a discipline, but it exists and it needs to be addressed.

This paper is focused on developing a computer program which allows students to select the type of the discrete probability distribution, i.e. binomial, Poisson, or hypergeometric, and provide the necessary input values for the selected scenario and it calculates the probability of the occurrence of the event, and other relevant statistical values.

Visual Basic programming language was used to develop this program. The user interface is very simple and intuitive and it can be installed very easily on any Windows based personal or laptop computers. This program was used in teaching statistics to business majors and it can be used in other classes that encounter these types of problems. The preliminarily results and comments from students who have used this tool have been very positive and encouraging.

INTRODUCTION

Many high school graduates who attend colleges and universities do not have the mathematical background for quantitative college courses. The most recent data (2008) from The National Assessment of Educational Progress (NAEP) shows that although there is some variation in the average mathematics scores of 17-year students since 1973, there are no significant changes in the mathematic scores of this group of students during the last thirty five years. In particular, there is no significant change in the mathematic score of 17-year old students in the last eighteen years (1990-2008). (Rampy, 2008). This is clearly seen from Figure 1 which shows the trends in NAEP mathematics average scores for 9, 13, and 17-year old students.

In mathematics, average scores for 9- and 13-year-olds increased since 2004, while the average score for 17-year-olds did not change significantly. Average scores were 24 points higher than in 1973 for 9-year-olds and 15 points higher for 13-year-olds. The average mathematics score for 17-year-olds was not significantly different from that in 1973.

Trend in NAEP mathematics average scores for 9-, 13-, and 17-year-old students

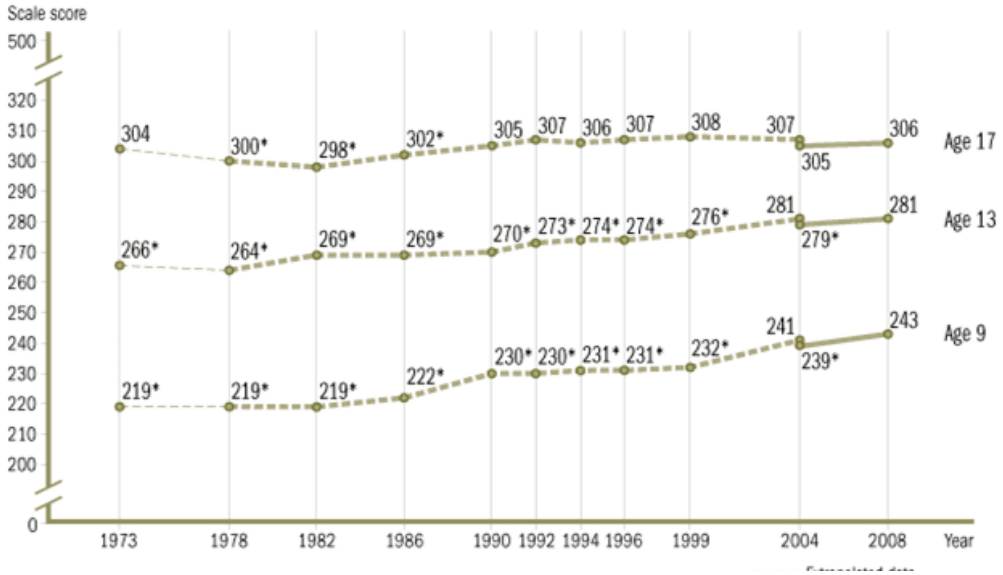

Figure 1: Trend in NAEP Mathematics average scores for 9, 13, 17-year old students

It is interesting to observe that NAEP identifies five levels of performance and the exact descriptions of its top three levels are as follows.

"Mathematics Performance-Level Descriptions

LEVEL 350: Multistep Problem Solving and Algebra

Students at this level can apply a range of reasoning skills to solve multistep problems. They can solve routine problems involving fractions and percents, recognize properties of basic geometric figures, and work with exponents and square roots.

They can solve a variety of two-step problems using variables, identify equivalent algebraic expressions, and solve linear equations and inequalities. They are developing an understanding of functions and coordinate systems.

LEVEL 300: Moderately Complex Procedures and Reasoning

Students at this level are developing an understanding of number systems. They can compute with decimals, simple fractions, and commonly encountered percents. They can identify geometric figures, measure lengths and angles, and calculate areas of rectangles. These students are also able

to interpret simple inequalities, evaluate formulas, and solve simple linear equations. They can find averages, make decisions based on information drawn from graphs, and use logical reasoning to solve problems. They are developing the skills to operate with signed numbers, exponents, and square roots.

LEVEL 250: Numerical Operations and Beginning Problem Solving

Students at this level have an initial understanding of the four basic operations. They are able to apply whole number addition and subtraction skills to one-step word problems and money situations. In multiplication, they can find the product of a two-digit and a one-digit number. They can also compare information from graphs and charts and are developing an ability to analyze simple logical relations. (Bobby D. Rampey, 2008)"

A close examination of Figure 2 reveals that only six percent of the 17-year old students were able to solve problems at the highest performance level during the 2004 and 2008 tests. This indicates the 94% of 17-year old students can only perform at the 300-level and lower levels of mathematic assessment test. This leads to conclude that 94% of the high school graduates are only comfortable with basic mathematical operations such as computing with decimal numbers, simple fractions and percentage problems.

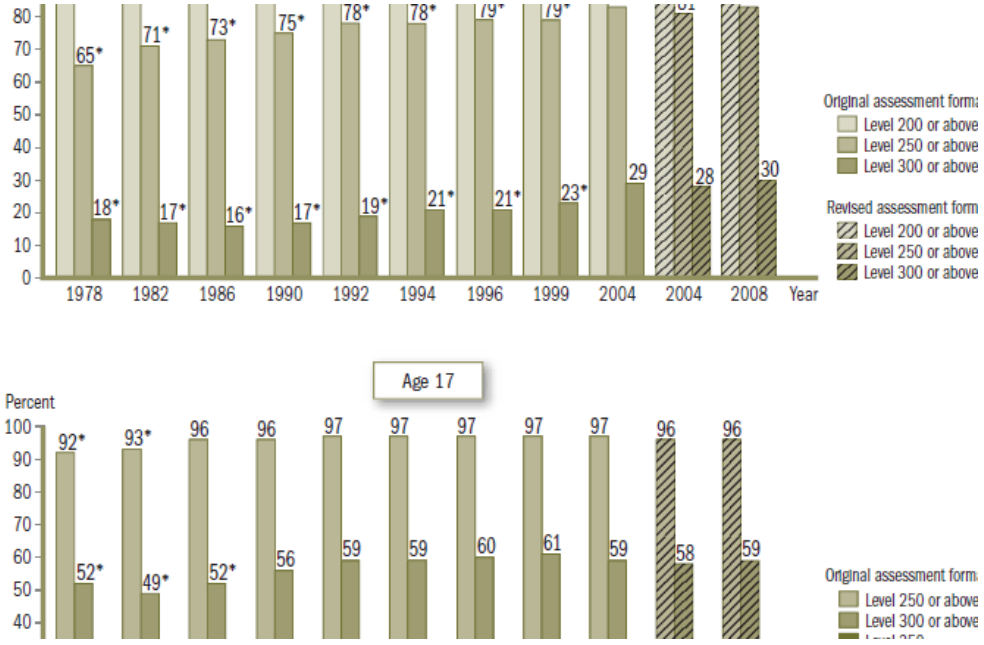

Figure 2: Percent of 17-year old students in different NAEP Mathematics assessment levels

The above observations bring a significant challenge to colleges and universities admitting these students to their programs. Because of this level of mathematical background, unless remedial courses are offered to strengthen students' math level, the big task is left to instructors to present the materials such that they will not overwhelm the students with mathematical concepts. Because of

economical issues and extra credits that students must take for remedial courses, most institutions count on instructors to develop some teaching techniques or tools to alleviate this problem.

Instructors are looking for various means, techniques and tools to use in their classrooms to accommodate students at different levels. These include animated power point presentations, virtual laboratories, and specific software tools which allow students to indentify the specific type of problems and input the required data to the program and get the final answers in few steps.

After teaching the first course in statistics for business majors, the author has observed that many of the students taking this course have difficulty evaluating expressions inside a summation term (Σ) as well as evaluating more complex equations involving power terms. Due to the nature of this course such mathematical expression are common and cannot be avoided. Therefore, the principles and methods of evaluating these mathematical expressions are reviewed in the course.

In addition, to encourage the students and build their confidence in working with such expressions in solving discrete probability distribution problems a computer program was developed. This program allows the students to solve the related problems using the appropriate equations and then input their data into the program and compare their answers with the program output. Comments from the students who have used this program have been very positive and it has helped many of them to go back and rework their problems and consequently discover the errors in their own solutions.

SCOPE OF THE PROGRAM

The program is designed to solve discrete probability distribution problems. That is, binomial probability distribution, Poisson probability distribution, and hypergeometric probability distribution (Triola, 2005).

An experiment with n independent trials such that the outcome of each trial can be identified as success or failure and the probability of success or failure being the same in each trial is classified as a binomial experiment. The probability of x successes in n trials of such an experiment can be found as follows. (Anderson, 2005)

$$p(x) = f(x) = \frac{n!}{x!(n-x)!} p^x (1-p)^{(n-x)}$$

Where p is the probability of success in any given trial.

The expected value or mean and standard deviation for the binomial distribution are calculated from the following expressions.

$$E(x) = \mu = np$$

$$\sigma = \sqrt{np(1-p)}$$

An experiment in which the probability of the occurrence of an event is the same for any two time or space intervals of equal length such that the probability of the occurrence in one interval is independent of the probability of the occurrence in other intervals satisfies the Poisson's criteria. We can use the following equations to find the probability and the standard deviation for this type of the problems. (Anderson, 2005)

$$f(x) = \frac{\mu^x e^{-\mu}}{x!}$$

$$\sigma = \sqrt{\mu}$$

Where f(x) is the probability of x occurrences in the interval and μ is the mean number of occurrences in the interval, σ is the standard deviation, and e is equal to 2.71828.

The last feature of the program deals with hypergeometric probability distribution problems. This probability distribution function is very similar to binomial probability distribution except that the trials are dependent. i.e., the probability of success changes from one trial to another.

The following equations are used to find the probability and the standard deviation for hypergeometric probability distribution type of problems. (Anderson, 2005).

$$f(x) = \frac{\frac{r!}{x!(r-x)!}\left[\frac{(N-r)!}{(n-x)![(N-r)-(n-x)]!}\right]}{\frac{N!}{n!(N-n)!}}$$

$$E(x) = \mu = n(\frac{r}{N})$$

$$\sigma = \sqrt{n(\frac{r}{N})(1-\frac{r}{N})(\frac{N-n}{N-1})}$$

Where:

$f(x)$ = probability of x successes in n trials
N = number of elements in the population
n = number of trials
r = number of elements in the population labeled success
μ= mean or expected value
σ=standard deviation

DISSCUSSION

This program was developed using Microsoft Visual Basic (Hoisington, 2009) programming and it can be installed easily to run on any computer with Microsoft operating systems. Its primary goal is to provide students with an easy to use program interface to quickly get answers to discrete probability distribution problems and allow them to compare their solutions with the program solution. In addition, the program enables the students to do parametric study by changing the numeric values for a given problem and quickly see their effect on the final result.

The students were asked to solve the assigned problems using the appropriate formulas and the program. They were asked to logically discuss any discrepancy between the two solutions. This approach would help them to redo the problems if their solution did not agree with the program answers and discover their logical or numerical errors in their computations.

Although some statistical analysis is necessary to measure the effectiveness of this tool on students learning, the students who used the program were extremely pleased and made positive comments about the impact of the program on their learning of the subject matters.

CONCLUSION

The most recent data (2008) from The National Assessment of Educational Progress (NAEP) shows that there is no significant change in the mathematic score of 17-year old students in from 1990 to 2008. (Rampy, 2008) It also indicates that 94% of the high school graduates are only comfortable with basic mathematical operations such as computing with decimal numbers, simple fractions and percentage problems. This creates a significant challenge to the university and college educators who teach quantitative courses.

A visual basic program was developed to help students who are mathematically challenged and must take statistics to complete their bachelor degree in business related disciplines. The program is very specific in solving problems dealing with discrete probability distributions. The interface was designed to be very easy to use with minimum number of steps or menus.

Comments from the students who have used this program have been very positive and it has helped many of them to go back and rework their problems and consequently discover the errors in their previous solutions. Also, some improvements on the students test scores have been observed which will be statistically analyzed once sufficient data is collected.

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THE IMPACT OF THE PSYCHOLOGICAL APPROPRIATION OF A GROUPWARE ON FUNCTIONING AND EFFICIENCY OF PROJECT TEAMS

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ABSTRACT

Faced with an ever changing and competitive environment, and with the necessity of adapting rapidly and with agility, companies rely more and more on technology and Groupware to create and mobilize project teams. The underlying objective is to make them as efficient and effective as possible, regardless of the time and place that members add their collaborations. In order to collaborate in such a context and to produce their work efficiently and according to the desired outcome, team members must first appropriate the technologies that are made available to them, whose purposes are mutual support and proper management of resources. The goal of this research is to analyze if the appropriation of a virtual work technology contributes effectively to support the group process and the efficiency of project teamwork, as well as to analyze the mediating role of mutual support and management of work between appropriation and efficiency. Appropriation refers to the measure of the team members' a) consent on specific terms of use (consensus of use) of the Groupware that they will be using and the virtual environment that it constitutes; b) on actual Groupware use; c) and on psychological appropriation towards the Groupware.

This research was carried out by handing out a survey to a sample of 304 people grouped into thirty-four teams working on real projects with fixed terms. The results of this study indicate that the two variables, psychological appropriation and consensus of use, are positively correlated to the two dimensions of the internal functioning of the group: mutual support and management of work. Moreover, the consensus on use is also linked to the three criteria for efficiency: the quality of the group work experience, the team viability and the output. However, there is no indication of a correlation between the psychological appropriation and the third factor of efficiency, output. The results do indicate that actual Groupware use is negatively connected to mutual support and to the quality of the group work experience. Indeed, the test for the mediating role of the mutual support and management of work indicate that there is, in fact, a relationship between the psychological appropriation and the consensus of use, and the three factors of efficiency.

This research contributes in many ways to the development of knowledge on this topic. Firstly, there is a clear demonstration that psychological appropriation is, in fact, possible for a virtual work environment, and that this appropriation has an impact on the inner working and efficiency of a project team. Moreover, the research also helps to demonstrate that the psychological appropriation is distinct from other variable such as consensus on use. Indeed, this unique factor allowed for the creation of a new measuring instrument with interesting psychometric

attributes. The research also contributes to the generalization of a multidimensional conception of team functioning and efficiency. Finally, the recognition of the mediating role of the mutual support and management of work between two types of appropriation and some of the efficiency criteria is both interesting and un-heard of in the context of the use of Groupware by work group with fixed terms. It would seem that the measurement framework could also be applied to project teams.

Key terms: Psychological appropriation, Groupware, teamwork, performance, project.

KNOWLEDGE MANAGEMENT CAPABILITIES CONSENSUS: EVIDENCE FROM A DELPHI STUDY

Jean-Pierre Booto Ekionea, University of Moncton
Gérard Fillion, University of Moncton

ABSTRACT

This paper aims to present the results of a Delphi study conducted from November 2006 to March 2007. The objective of the study was to find a consensus among experts developing key concepts on knowledge management (KM) capabilities. In fact, during the last two decades, KM literature has focused on getting organizational performance via the alignment of knowledge management strategies to business strategies. However, since the last 15 years, researchers started to point out that the alignment alone is no longer sufficient to explain organizational performance; we must add new elements such as the development of specific organizational capabilities. Beyond the importance accorded today to the literature related to the development of organizational KM capabilities. But what organizational capabilities must be developed? Using the Delphi method, a consensus on KM capabilities to develop for a good management of knowledge is presented in this paper.

INTRODUCTION

The Delphi method, more and more known by specialists in medium to long term strategy elaboration, aims to collect, via an open survey, the justified opinions from a panel of experts in different sectors. The procedure, based on retroaction, avoids confrontations between experts and preserves their anonymity. The results of a first questionnaire are communicated to each expert (accompanied by a summary of the general tendencies and particularities, opinions and justifications, etc.) which is then invited to react and answer to a second questionnaire developed in function of the first opinions collected, and so on until the strongest possible convergence of answers be obtained. The Delphi method distinguishes itself from usual group communication techniques on these axes: (1) it helps to get expert opinions in a sector; (2) it allows to collect information at a distance, via the Web, fax, or mail, without the respondents having to meet; (3) it eases the task of identifying and selecting experts since the number of experts participating in the study is limited to 7 to 18 (Paliwoda, 1983; quoted in Okoli & Pawlowski, 2004, p. 4); (4) it is flexible in its conception and in its survey administration: this allows rich data collection that will lead to an appropriate understanding and a consensus on knowledge management (KM) capabilities; (5) it allows with a quasi certitude to get a consensus via the issuance of consecutive questionnaires; (6) it allows a controlled retroaction consisting of a series of steps from which a summary of the previous step is provided to the participant; so if they want, they can review their previous judgements; (7) it has an advantage over other methods of group decision making given the analysis of anonymous expert opinions which are identified before the study (for example the nominal group

and the analysis by social judgement) (Rohrbaugh, 1979; quoted in Okoli & Pawlowski, 2004, p. 4); and (8) it can be used as successfully in management, economic, or technological sectors as it can in social sciences.

On the other hand, many constraints are limiting the usage of the Delphi method: it is lengthy, costly, fastidious and intuitive rather than rational, among others. In addition, the procedure constraints (multiple rounds of surveying) are questionable since only the experts that stray from this norm have to justify their position. However, we can also consider that strayed opinions, in prospective terms, are more interesting than those close to the norm. Finally, the interactions between the different hypotheses proposed are not taken into account and are even avoided, which lead the promoters of the Delphi method to develop probabilistic cross impact methods. Furthermore, it is obvious that a Delphi study does not base itself on a statistically representative sample of a population. It is rather a mechanism for group decision making that requires the participation of qualified experts having a clear understanding of the phenomenon being studied. It is for this reason that one of the most critical factors of this approach is to find qualified experts.

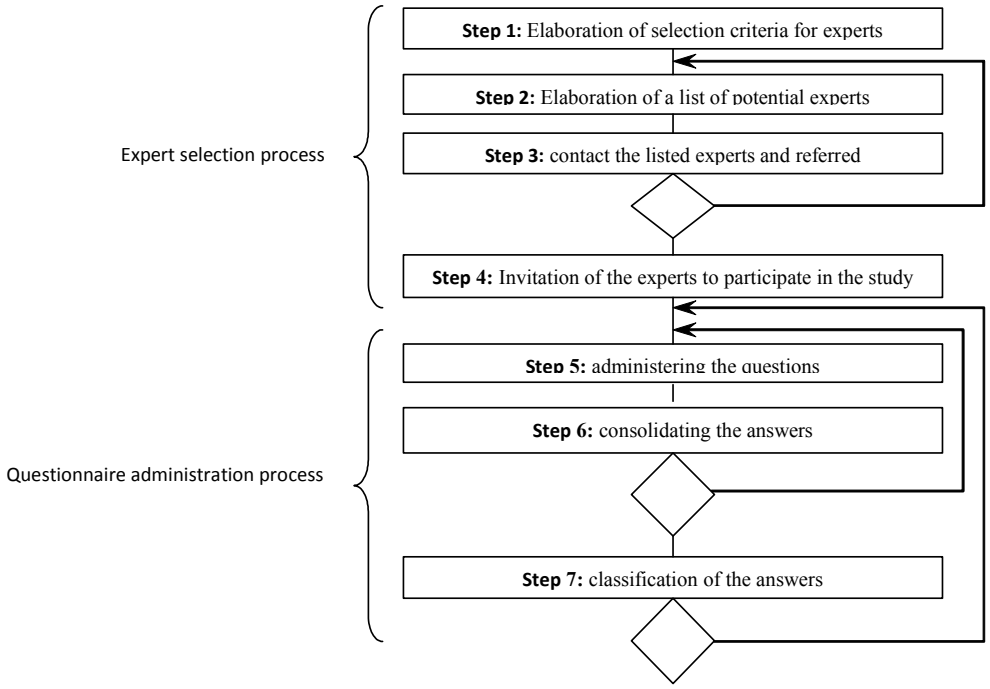
As for the present study, its objective is not to undertake a study aiming the improvement of the Delphi method or a comparative study between the Delphi method and the other methods or techniques of group communication, but rather to seek to understand the phenomenon of KM capabilities by identifying the key concepts and the characteristics of each concept in order to obtain a consensus of experts. Thus, the use of the Delphi investigation has shed the light on the ideas of KM experts and helped to find a consensus of experts on the theoretical concepts of the KM capabilities.

The paper is structured as follows: first, a brief history and some applications of the Delphi method in management, information systems (IS)/information technologies (IT), and KM are presented; second, the steps of the Delphi investigation related to this study are provided; and the paper ends with a short conclusion.

HISTORY AND APPLICATIONS OF THE DELPHI METHOD

Developed in 1950 by Olaf Helmer at Rand Corporation (Okoli & Pawlowski, 2004), the purpose of the Delphi method is to highlight the convergence of opinions and to reach a certain consensus on a precise subject, often with an important prospective, from the consultation of experts and the use of questionnaires (Dalkey & Helmer, 1963). Experts are defined here as people who are consulted during the process of the Delphi inquiry. The choice of these experts must take into account: (1) their knowledge on the subject concerned; (2) their legitimacy compared to the panel of experts whom they could represent; (3) their availability during the process of the Delphi inquiry; (4) their independence in relation to commercial, political, or different pressures. Thus, in order to summarize the Delphi inquiry, Figure 1 presents the main stages in the use of the Delphi method. We can see in Figure 1 that there are two important parts: the stages related to the procedure of experts selection and the process of administration of the questionnaire.

Figure 1
Main Stages of the Delphi Method



The expert selection procedure includes four steps: step 1: development of the selection criteria of the experts; step 2: development of a list of potential experts and attribution of an anonymous number to ensure anonymity during the questionnaire administration; step 3: contact with the selected experts; step 4: invitation of the experts by email or fax to take part in the study.

Then, the process of administrating the questionnaire to the selected experts is performed in three stages: step 5: administration of the questions: at this time each expert receives a series of questions on the subject of the study; step 6: consolidation of the answers for the development of the report for each round until a consensus is obtained: here the questionnaire is administered, then we analyze the answers and once again administers them while asking, if possible, to the experts to reexamine their original answers (opinions) or to answer some specific questions according to the feedback obtained from the other respondents taking part in the study; step 7: the classification of sub subjects (if necessary): helps to produce the final report of the Delphi investigation and to validate it with the participating experts. During the two processes, the respondents remain mutually anonymous, except for the researcher, to neutralize the mutual influences. With regard to its use, the Delphi method is used more and more today by several researchers as listed in Table 1 which presents the various applications of the Delphi method in the design of models (Okoli & Pawlowski, 2004) in the fields of IS, IT, and KM, specifically in the development of organizational capabilities in IT as well as in IT project management.

Table 1
Application of the Delphi Method in the Design of Models
(adapted from Okoli & Pawlowski, 2004, p. 3)

Authors	Studies
Bacon & Fitzgerald (2001)	Goal: To develop a conceptual framework of the main fields of the information systems. Participants: Researchers in information systems.
Holsapple & Joshi (2002)	Goal: To develop a descriptive conceptual framework of the elementary activities of handling of knowledge. Participants: Researchers and experts in the fields of knowledge management.
Mulligan (2002)	Goal: To develop a typology of the capacities of information technologies in the industry of finance departments. Participants: Members from 11 different organizations.
Nambisan et al. (1999)	Goal: To develop a conceptual taxonomy of the mechanisms of action of organizational design to increase the propensity of the users of technology in order to innovate information technologies. Participants: Senior officers of various industries.
Schmidt et al. (2001)	Goal: To develop an ordered list of common risk factors for projects of software as a base of construction of the theories in information systems projects. Participants: Three groups of experienced project managers of software of Hong Kong, Finland, and United States.
Scholl et al. (2004)	Goal: To give more structure to the field of knowledge management and to obtain the prospects on the valid developments during the ten years to come.

THE DELPHI INVESTIGATION

This Delphi investigation respected the seven stages evocated in the previous section. Thus, after having prepared the questionnaire, we selected a panel of expert respondents on the basis of suitable criteria. Then the questionnaire was administered. After, we analyzed the answers and once again administered them while asking, if possible, for experts to reexamine their original answers (opinions) or to answer some specific questions according to the feedback from the other respondents participating in the study. This process was reiterated until the respondents reached a degree of satisfactory consensus. During this process, the respondents remained anonymous to each other, except for the researcher, in order to limit the influence of the ones on the others.

Indeed, a Delphi inquiry of three rounds was necessary. On the first round, the links that presumably exist between the concept of KM capabilities and each of its three key dimensions (KM-infrastructures, KM-processes, and KM-competences) were presented to the experts. On the second round, on the basis of the answers from the first round, a report of the first round of the Delphi questionnaire was provided to the participating experts. Thus, on the basis of this report, it was requested from the experts to come to a conclusion about the questions, specifically focused

around the points of consensus and divergence of opinions. Finally, on the third round, the report of the second round is produced and proposed to the experts in order that these ones come to a conclusion about the points of consensus and persistent divergences. In fact, the steps followed by this research are: (1) definition of the selection criteria for participating experts; (2) development of a list of experts; (3) contact with the listed experts and summary of procedures; (4) invitation of the experts to take part in the study; (5) administration of the questionnaire; (6) complete examination and consolidation of the answers according to the various angles of perception and the presentation of results; and (7) development of a synthesis and classification of the key concepts characteristics. Thus, there are two important parts: steps related to the procedure of expert selection and steps related to the process of questionnaire administration. Each of these steps as well as the questionnaire administration for the three Delphi rounds are presented in the full paper.

CONCLUSION

According to the results of the Delphi investigation, we can conclude that: (1) the concept of "KM capabilities" (KMC) is the sum of the whole organizational capabilities related to the KM-Infrastructures, the KM-Processes, and the KM-Actors/people; (2) the KM-Infrastructures are the whole organizational capabilities referring to the KM technological infrastructures and the KM structures; (3) the organizational capabilities related to the KM-Processes are the whole organizational capabilities referring to the KM processes of knowledge generation, the KM processes of knowledge manipulation, and the KM processes of knowledge application; (4) the organizational capabilities related to the KM-Actors/people (Competences) is the whole organizational capabilities referring to the KM culture, with the KM motivation, the KM rewards, and the KM inciting.

In addition, some results observed from our Delphi investigation as a whole as well as the comments received from the experts taking part in the study clearly show that the choice of the Delphi method in this study was suitable in order to come to a consensus about the concepts and the key characteristics related to the KM capabilities. Finally, we also noted that, according to the opinions of the experts taking part in the study, the way at which the study was conducted was rigorous and appreciated from the participants.

References are available upon request.

TESTING A MODERATOR-TYPE RESEARCH MODEL ON THE USE OF MOBILE PHONE

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ABSTRACT

Individual adoption of technology has been studied extensively in the workplace (Brown & Venkatesh, 2005). Far less attention has been paid to adoption of technology in the household (Brown & Venkatesh, 2005). Obviously, mobile phone is now integrated into our daily life. Indeed, according to the more recent forecast of Gartner Research, 1.22 billion of mobile phones have been sold throughout the world in 2008, a 6 percent increase over 2007 sales (Gartner Newsroom, 2008). And, as the tendency is showing up, mobile phone use will be still increasing in the future. The purpose of this study is then to investigate who really are the mobile phone users and what are the determining factors who make such they are using a mobile phone? On the basis of the moderator-type research model developed by Brown and Venkatesh (2005) to verify the determining factors in intention to adopt a computer in household by American people, this study examines the determining factors in the use of mobile phone in household by Canadian people. Data were gathered from 327 Atlantic Canadian people who own a mobile phone. Data analysis was performed using the structural equation modeling software Partial Least Squares (PLS). The results revealed that half of the variables examined in the study showed to be determining factors in the use of mobile phone by people in household.

INTRODUCTION

Since numerous years, mobile phone is used for different professional purposes, particularly by senior managers in the workplace. And this technology is more and more used in the workplace since mobile applications have been integrated to actual enterprise business strategies. Individual adoption of technology has been studied extensively in the workplace (Brown & Venkatesh, 2005). Far less attention has been paid to adoption of technology in the household (Brown & Venkatesh, 2005). Obviously, mobile phone is now integrated into our daily life. According to the more recent forecast of Gartner Research, 1.22 billion of mobile phones have been sold throughout the world in 2008, a 6 percent increase over 2007 sales (Gartner Newsroom, 2008). And, as the tendency is showing up, mobile phone use will be still increasing in the future. The purpose of this study is then to investigate who really are the users of a mobile phone and what are the determining factors who make such that they are using a mobile phone?

Few studies have been conducted until now which investigate the intention to adopt a mobile phone by people in household (in the case of those who do not yet own a mobile phone) or the use of mobile phone in the everyday life of people in household (in the case of those who own a mobile phone). Yet we can easily see that mobile phone is actually completely transforming the ways of

communication of people around the world. It is therefore crucial to more deeply examine the determining factors in the use of mobile phone by people in household. This is the aim of the present study. The related literature on the actual research area of mobile phone is presented in the full version of the paper.

As we can see in the summary of literature related to mobile phone presented above, few studies until now examined the determining factors in the use of mobile phone by people in household. Thus, the present study brings an important contribution to fill this gap as it allows a better understanding of the impacts of mobile phone usage into people's daily life. It focuses on the following two research questions:

(1) Who are the buyers of mobile phone for household use?

(2) What are the determining factors in the use of mobile phone by people in household?

The paper builds on a framework suggested by Fillion (2004) in the conduct of hypothetico-deductive scientific research in organizational sciences, and it is structured as follows: first, the theoretical approach which guides the study is developed; second, the methodology followed to conduct the study is described; finally, the results of the study are reported and discussed.

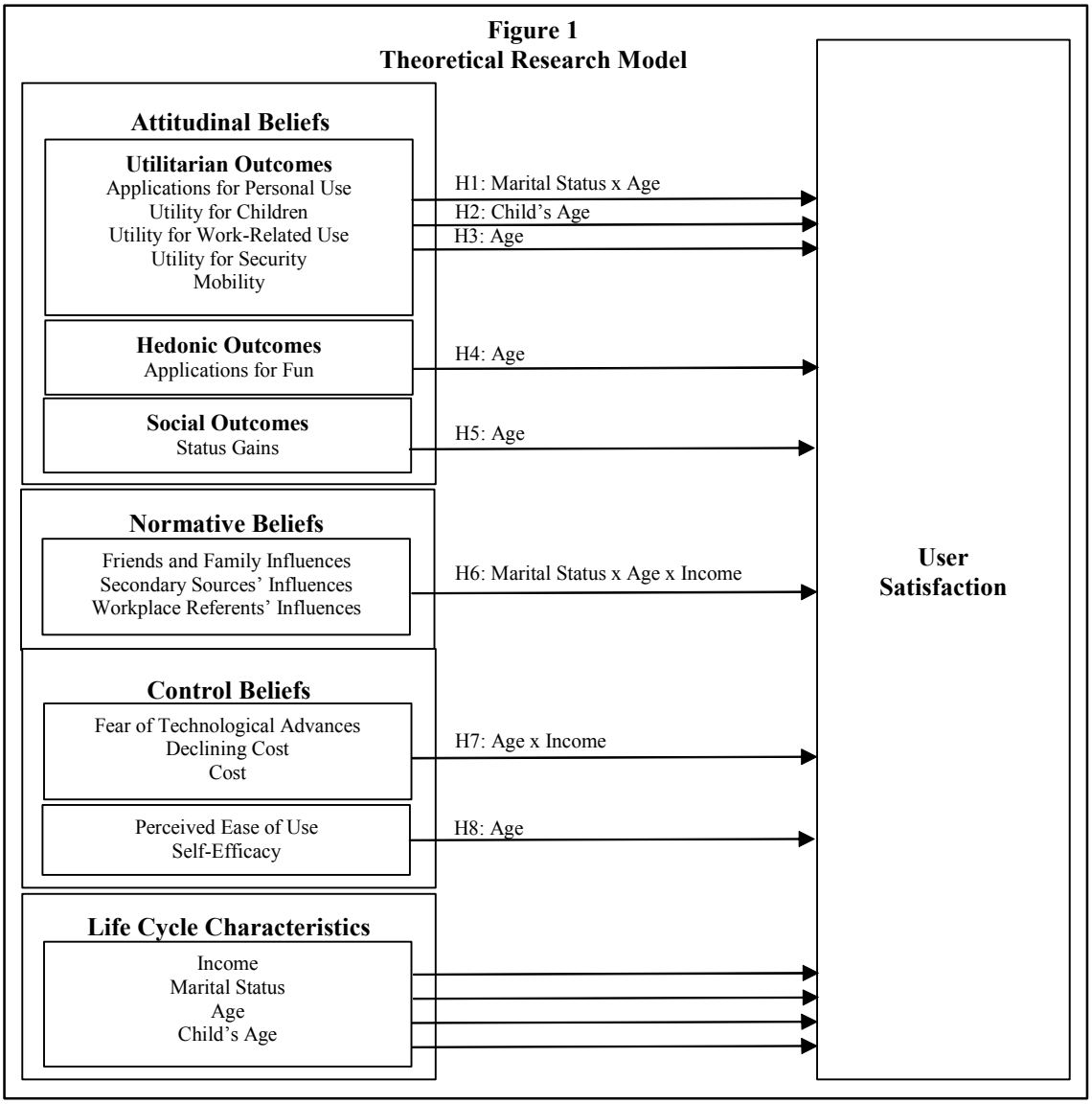
THEORETICAL APPROACH

This study is based on the theoretical foundations developed by Venkatesh and Brown (2001) to investigate the factors driving personal computer adoption in American homes as well as those developed by Brown and Venkatesh (2005) to verify the determining factors in intention to adopt a personal computer in household by American people. In fact, Brown and Venkatesh (2005) performed the first quantitative test of the recently developed model of adoption of technology in households (MATH) and they proposed and tested a theoretical extension of MATH integrating some demographic characteristics varying across different life cycle stages as moderating variables. With the exception of behavioral intention (we included user satisfaction instead given people investigated in this study own a mobile phone), all the variables proposed and tested by Brown and Venkatesh (2005) are used in this study. And we added two new variables in order to verify whether people are using mobile phone for security and mobility. The resulting theoretical research model is depicted in Figure 1.

Figure 1 shows that Brown and Venkatesh (2005) integrated MATH and Household Life Cycle in the following way. MATH presents five attitudinal beliefs grouped into three sets of outcomes: utilitarian, hedonic, and social. Utilitarian beliefs are most consistent with those found in the workplace and can be divided into beliefs related to personal use, children, and work (we added beliefs related to security and mobility). The extension of MATH suggested and tested by Brown and Venkatesh (2005) presents three normative beliefs: influence of friends and family, secondary sources, and workplace referents. As for control beliefs, they are represented in MATH by five factors: fear of technological advances, declining cost, cost, perceived ease of use, and self-efficacy. And, according to Brown and Venkatesh (2005), integrating MATH with a life cycle view, including income, age, child's age, and marital status, allows to provide a richer explanation of household personal computer adoption (household mobile phone usage in this study) than those provided by MATH alone. Finally, as shown in Figure 1, the dependant variable of the theoretical research model developed is related to user satisfaction (satisfaction in the use of mobile phone by

people in household). All of the variables integrated in the theoretical research model depicted in Figure 1 are defined and the research hypotheses are formulated in the full version of the paper.

Figure 1
Theoretical Research Model



In the next section of the paper, we describe the methodology followed to conduct the study.

METHODOLOGY

The study was designed to gather information concerning mobile phone adoption decisions in Atlantic Canadian households. Indeed, the focus of the study is on individuals who own a mobile phone. We conducted a telephone survey research among individuals of a large area in Atlantic

Canada. In this section, we describe the instrument development and validation, the sample and data collection, as well as the data analysis process.

Instrument Development and Validation

To conduct the study, we used the survey instrument developed and validated by Brown and Venkatesh (2005) to which we added three new scales, the first two measuring other dimensions in satisfaction in the use of mobile phone by people in household, that is, utility for security and mobility, and the last one measuring user satisfaction as such. The survey instrument was then translated in French (a large part of the population in Atlantic Canada is speaking French) and both the French and English versions were evaluated by peers. This review assessed face and content validity (see Straub, 1989). As a result, changes were made to reword items and, in some cases, to drop items that were possibly ambiguous, consistent with Moore and Benbasat's (1991) as well as DeVellis's (2003) recommendations for scale development. Subsequent to this, we distributed the survey instrument to a group of 25 MBA students for evaluation. Once again, minor wording changes were made. Finally, we performed some adjustments to the format and appearance of the instrument, as suggested by both peers and MBA students, though these minor changes had not a great importance here given the survey was administered using the telephone. As the instrument was already validated by Brown and Venkatesh (2005) and showed to be of a great reliability, that we used the scale developed by Hobbs and Osburn (1989) and validated in their study as well as in several other studies to measure user satisfaction, and that we added only few items to measure the new variables utility for security and mobility, then we have not performed a pilot-test with a small sample. The evaluations by both peers and MBA students were giving us some confidence that we could proceed with a large-scale data collection.

Sample and Data Collection

First, in this study, we chose to survey people in household over 18 years taken from a large area in Atlantic Canada who own a mobile phone. To do this, undergraduate and graduate students studying at our faculty were hired to collect data using the telephone. A telephone was then installed in an office of the faculty, and students, one at a time over a 3 to 4-hour period, were asking people over the telephone to answer our survey. And in order to get a diversified sample (e.g., students, retired people, people not working, people working at home, and people working in enterprises), data were collected from 9 a.m. to 9 p.m. Monday through Friday over a 5-week period. Using the telephone directory of the large area in Atlantic Canada chosen for the study, students were randomly selecting people and asking them over the telephone to answer our survey. The sample in the present study is therefore a randomized sample, which is largely valued in the scientific world given the high level of generalization of the results got from such a sample. Once an individual had the necessary characteristics to answer the survey and was accepting to answer it, the student was there to guide him/her to rate each item of the survey on a seven points Likert-type scale (1: strongly disagree … 7: strongly agree). In addition, the respondent was asked to answer some demographic questions. Finally, to further increase the response rate of the study, each respondent completing the survey had the possibility to win one of the 30 Tim Hortons $10 gift certificates which were drawn

at the end of the data collection. To this end, the phone number of each respondent was put in a box for the drawing. Following this data collection process, 327 people in household answered our survey over a 5-week period.

Data Analysis Process

The data analysis of the study was performed using a structural equation modeling software, that is, Partial Least Squares (PLS-Graph 3.0). Using PLS, data have no need to follow a normal distribution and it can easily deal with small samples. In addition, PLS is appropriate when the objective is a causal predictive test instead of the test of a whole theory (Barclay et al., 1995; Chin, 1998) as it is the case in this study. To ensure the stability of the model developed to test the research hypotheses, we used the PLS bootstrap resampling procedure (the interested reader is referred to a more detailed exposition of bootstrapping (see Chin, 1998; Efron & Tibshirani, 1993)) with an iteration of 100 sub-sample extracted from the initial sample (327 Atlantic Canadian people). Some analyses were also performed using the Statistical Package for the Social Sciences software (SPSS 13.5). The results are presented and discussed in the full version of the paper.

CONCLUSION

To conclude, much more research will be needed on the use of technology in households in order to better understand its impacts on people's daily life. The research will allow, among others, at least to minimize, if not to remove, some negative impacts of technology in people's daily life in the future and to develop new technologies still better adapted to people's needs. We will continue to inquire into this new and exciting field.

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References are available upon request.

GENDER ROLE IN JOB SATISFACTION: THE CASE OF THE U.S. INFORMATION TECHNOLOGY PROFESSIONALS

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ABSTRACT

While job satisfaction is a major concern in today's organizations, there is little empirical research concerning Information technology "IT" and its professionals. A survey of 132 IT professionals (99 men and 33 women) in various Southern California organizations were conducted using the Minnesota Satisfaction Questionnaire "MSQ" short form containing the 20 question-general satisfaction scale to indicate their satisfaction or dissatisfaction with research variables along a five-point scale. Through an empirical study and descriptive statistics, this paper examined the effects of gender on job satisfaction and accepted all its three null hypotheses that gender does not play a role in job satisfaction among IT professionals in the United States. Implications for research and practice are discussed. The research contributes to job satisfaction literature by providing empirical findings regarding the relationship between job satisfaction and the subject of gender.

INTRODUCTION

According to the U.S. Department of Labor- Bureau of Labor Statistics (2009), the U.S. employs over 3.05 million IT professionals of all skill levels annually. This number rose from 3,084,000 in 1997 to a peak of 3,631,000 in 2000, and then declined to 3,055,000 in 2006. However, the employment of computer and information systems managers is expected to grow 16 percent over the 2006-16 decade, which is faster than the average for all occupations (U.S. Department of Labor, 2008).

Little research exists on the effect of gender and job satisfaction (Clark, 1997; Ellickson & Logsdon, 2001; Jung & Moon, 2007), but such studies have yielded conflicting outcomes (Al-Ajmi, 2006; Hickson & Oshagbemi, 1999; Jung & Moon, 2007). While some studies have concluded that women are more satisfied than men (Clark, 1997; De Rijk, Nijhuis, & Alexanderson, 2009), other studies indicated the opposite outcome (i.e. that men are more satisfied) (Forgionne & Peeters, 1982; Chusmir, 1981). In a newly-released study of job satisfaction among full time faculty in 10 medical schools, the Association of American Medical Colleges (2008), in partnership with the Collaborative on Academic Careers in Higher Education (COACHE) concluded that gender differences do affect work outcomes. For example, male faculty responding to the survey "more often agreed or strongly agreed that the workplace culture at their institution cultivates collegiality than did the women" (The Association of Medical Colleges, 2008, p. 1). In addition, gender differences were also apparent

with respect to opportunities for promotion, and pay and compensation; women were significantly less satisfied compared with their male colleagues (The Association of Medical Colleges, 2008).

On the other hand, other studies concluded that there are no differences between U.S. women and men in managerial positions when it comes to sources of satisfaction at work (Bender, Donohue, and Heywood, 2005; Eskildsen, Kristensen, & Westlund, 2004; Mason, 1995; Mason, 1997).

In a study titled "why are women so happy at work," Clark (1997) concluded that women are happier than men because they have lower expectations from the workplace than do men. According to The Conference Board of Canada report, "executive women face unique challenges reconciling their work and personal lives, and many make career decisions based on how organizations help them to manage work/life issues ("Executive women in Canada", 2003, p.12).

This study investigates the factors contributing to job satisfaction and dissatisfaction among men and women working in information technology professions in the United States. This research paper attempts to determine whether gender has an impact on job satisfaction.

The research method for this study was based on an empirical study and descriptive statistics-using the Chi-Square test with 95% confidence level to determine if differences in job satisfaction are impacted by IT professionals' gender and what are the factors are that moderate such differences.

The major part of the study included a survey of 132 (33 women and 99 men) IT professionals from various U.S. Southern California organizations. Of the nearly 165 participants solicited from these organizations or their branches, 132 individuals volunteered to participate in the current study and actually completed and returned the survey (response rate of 80%).

Data were collected using the Minnesota Satisfaction Questionnaire "MSQ", the general satisfaction scale "the short form". This general satisfaction scale consists of 20 items, one item from each of the original 20 scales (Lester & Bishop, 2000; Weiss, Dawis, England, & Lofquist 1967). MSQ's short form was used with a permission of Vocational Psychology Research, University of Minnesota.

CONCLUSIONS

While the study concluded that gender does not play a role in job satisfaction among IT professionals in the United States, it suggests that a larger sample is needed to extrapolate the validity of these findings to the general population of IT professionals.

The study also suggests that qualitative studies and semi-structured interviews with focus IT professionals groups are needed to further examine and validate the causal relationship between job satisfaction and gender. Finally, a major limitation of this study was that it only focused on information technology professionals; meaning that the generalization of its findings to other professions is not valid. To offset this limitation, the study recommends meta-analysis research studies among other professions.

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ELECTRONIC COPIES VS. HARD COPIES: AN UNHAPPY MEDIUM?

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ABSTRACT

The dissemination of information has changed substantially in recent years. Powerful software is available that provides methods to distribute information that have clear advantages over the use of hard copies. This paper discusses the impact of such modern publishing methods on the cost of printing and the environment. Additionally, benefits of electronic publishing such as the capability to update information are discussed. Disadvantages of electronic information dissemination (e.g., access issues) do exist and are also presented in this paper.

INTRODUCTION

This paper discusses the advantages and disadvantages of the use of electronic copies of documents relative to hard copies. Examples from academia and outside of academia are used to illustrate the relevant issues. The paper first discusses the potential to reduce printing costs due to electronic dissemination of information. Simultaneous with cost reductions is the lessened impact on the environment if fewer hard copies are printed. An additional issue concerns access of the intended recipient of information since certain technological requirements exist for the receipt of the documents in an electronic format. The last section provides a brief outlook on future research.

How to Avoid Printing Unnecessary Copies

As an introductory example, consider the following scenario (which in part motivated this paper). It happens (too) frequently at my institution that a large number of recipients (e.g., all faculty) receive an e-mail to request information via a form that must be filled out and returned. Suppose a faculty member diligently prints out the form to submit the requested information. That in and of itself is probably wasteful since a lot of communication, even communication requiring identification via a signature, can in principle be done electronically (via secure sign-in, etc.). However, a distinct problem occurs when the following day, all faculty members receive hard copies in their mailboxes via interoffice mail. Such duplicate printing is clearly wasteful, from a cost perspective as well as an environmental perspective.

Another example involves agendas to meetings that get sent out via e-mail ahead of time. Suppose that meeting participants wish to have a hard copy of the agenda available at the meeting. In that case, expectations play a large role. If meeting participants think that hard copies of the agenda will not be distributed at the meeting, they will print it out before the meeting. However, meeting organizers will probably assume that not everyone will do so, so they may provide a certain number of copies. Doing so may lead to a change in expectations on part of the meeting participants,

however, and they may not print out the agenda for the next meeting ahead of time. This may cause the meeting organizers to run out of hard copies at the next meeting, which may result in slightly embarrassed organizers who may resort to having a printed copy available for every expected meeting participant as well as to disgruntled participants who will now all print out the agenda themselves ahead of time. Hence, despite everyone's best efforts to reduce the copies that get printed, the described process leads to a number that is twice as high as it needs to be. Note that the typical agenda is one page long, so it may be considered not to be of too much relevance. Oftentimes, however, this process applies to a document that is being discussed at the meeting that may be 10 or 15 pages long. A good way to address this is the approach that my institution's faculty senate takes. Members of the senate receive all documents including the agenda a few days before the meeting. They can review the electronic version and print selected documents as they deem necessary. The meeting organizers do not provide hard copies at the meeting (Another option to avoid the multiple printing of a potentially large document is the use the electronic editing features of the typically used software products. In my experience, not many people make use of that option, however, and unless a critical mass of individuals in favor of such an approach is reached, it is not likely to be successful. Additionally, if the number of individuals who make changes and suggest comments is more than just a handful, the multiple edits become difficult to read and manage.). While this approach addresses the problem described above, there is still a weakness in that the advance information is only sent to faculty senate members and invited guests such as high-level administrators. If additional guests attend, they will be left without the materials that are being discussed. Even if an ideal scenario can be achieved in which no duplicate printing occurs, there is another relevant question that is discussed in the next section.

Who Pays the Piper?

If, for example, the faculty senate discusses a new academic program proposal, then the supporting documentation can be quite lengthy and providing a copy to all meeting participants (representing the university's academic departments, colleges, at-large faculty, and invited administrators) would be a substantial burden for the faculty senate office. Hence, shifting the printing burden to all invited participants (as described above) represents considerable progress for that office. To consider a non-academic example, a church in our community distributes its monthly newsletter via e-mail. It contains the following statement: "If you like having a printed copy, we ask that you print it out at home." Again, a (very explicit) shifting of the printing burden takes place (The electronic newsletter delivery via e-mail only takes place for individuals who opted in. That is, the issue that church members who lack the technology or skills to receive the newsletter electronically does not exist. Cases in which there is such an issue are discussed in a later section of this paper.).

There are cases in which the move to an electronic format saves resources. For example, online banking and credit card statements probably save paper because not every customer prints out a copy. In fact, individuals who desire to have their own record of credit card statements, etc., oftentimes have the possibility of downloading the statements to their computer, hence saving paper resources. Additionally, the move to an electronic format eliminates the need for the transportation

of hard copies of statements/bills and the customers' payment, thus further reducing the environmental impact.

In other cases it is not clear *a priori* what the effect on the environment of a shift to an electronic format is. For example, course delivery systems such as Blackboard allow instructors to post course documents (such as PowerPoint presentations) and assignments. In a scenario in which an instructor previously distributed such documents as hard copies in class, the university still bears the burden of printing if students print out the documents on campus. On the other hand, an instructor may post presentations on Blackboard, but would normally not distribute hard copies of the presentation. If the information is posted online, students may print out the PowerPoint presentation for class, hence actually *increasing* the amount that gets printed as a result of making information available in an electronic format.

Access Issues

While cost considerations and the impact on the environment are clearly important issues, they do not constitute an exhaustive list of potential problems in the electronic versus hard copy debate. Several of the examples so far discussed dealt with a university setting in which all participants have the same access to technology. For example, when students register for an online or a hybrid course at a university, they are informed about the technological requirements that are needed to properly participate in the course. Hence, it can be expected that all intended recipients of the information have access to it. Outside an academic institution, the scenario may be substantially different.

For the dissemination of electronic information to be successful, the recipient must have access to some form of technology that allows the receipt of the information. In settings such as the transmission of information from government agencies to constituents, that may not be the case. While in the arena of print media a similar problem exists, the issue typically is that individuals do not want to purchase a newspaper or do not purchase it because of limited financial means. In the context of electronic information dissemination, there is an additional dimension: There is a substantial share of the population that lack the technical skills required to access Web pages, receive e-mails, etc. In addition, the previously mentioned financial burden still exists and is likely to be higher than for print media.

In principle, publication via the Web has a number of advantages. The information can be much more current than what is feasible in print: Corrections can easily be made and updates are easy to post when there is a change in the posted information (e.g., contact information if there is a change in personnel, changing deadlines over the course of the year, new rules and regulations). Additionally, changes and updates can be made quite inexpensively (in terms of variable cost since the initial setup of the Web page and the required technology can be treated as a fixed cost). Examples of documents that are suitable for Web publication are a university's academic catalog (http://ww2.wpunj.edu/StudentServices/U_catalog1.cfm) or a municipality's site (http://www.waynetownship.com/). A further benefit of the publication of electronic documents is that the documents become easily searchable.

The considerations so far do neglect at least one important aspect, however. There presumably is a benefit in many settings to having a tangible product. For example, most universities

have some kind of program that features a series of events over the course of a semester or year. While a good amount of flexibility is lost when such schedules get printed (updates can typically not be incorporated since the cost of reprinting updated schedules is prohibitive), a printed brochure on glossy paper can make for a nice supplement to annual reports for the university administration and accrediting bodies. One might also envision the benefits from being able to provide a potential donor with a set of glossy brochures over the alternative of providing a number of Web addresses at which information about the institution can be accessed. Also, informal feedback from students at my institution indicates that they are more likely to attend the program's events when they have something tangible in the form of the brochure as opposed to an oral recommendation in class to obtain program information from a Web page.

Outside of academia, the situation is not much different. If a municipal government desires to publicize its accomplishments, the mailing of a nicely designed flier can be assumed to have a larger impact than the simple posting of the information on the municipal Web pages. The last point illustrates a drawback of the publishing via the Web: It requires initiative on the reader's part to go to the Web page, which is not the case when fliers are mailed to every resident's mailbox.

Another potential drawback has to do with the burden of proof when there are disputes regarding published information that may have recently been updated. For example, if there is a disagreement about the content of the document such as an academic policy, students may feel that the institution changed an aspect of the policy to their disadvantage, but it will be difficult for the student to prove it. It is certainly possible to print out the electronic version (and possibly to save a copy of the document), but it is difficult for students to know when a change has been made to the document and how often to print or save the information. A similar situation occurs if a municipality's rules (e.g., zoning codes) are posted online and changes are made to the posted information.

There is some anecdotal evidence that younger people are more ready to move to an all-electronic format. Also, electronic devices are improving at a rather fast pace. For example, while early versions of electronic books were relatively unsuccessful, the most recent version and the prior version of Amazon's Kindle have received very positive reviews (See http://www.amazon.com/Kindle-Amazons-Wireless-Reading-Generation/product-reviews/B00154JDAI/ref=dp_top_cm_cr_acr_txt?ie=UTF8&showViewpoints=1) from users despite a relatively high price tag (which has been recently reduced for the basic version, however).

SUMMARY AND FURTHER RESEARCH

This paper provided various examples of the advantages and disadvantages of the use of electronic documents relative to their hard copy counterparts. Examples from academia were used to illustrate the relevant issues along with example from outside academia. Further research should probably explore the impact of the perceived generational shift in how information is transmitted and accessed.

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A REVIEW OF THE DIFFERENCES BETWEEN NOVICES AND EXPERTS IN SPECIFYING INFORMATION REQUIREMENTS

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ABSTRACT

Information requirement analysis is an error prone process, especially for novice information analysts. In order to improve the accuracy of requirement specifications, various requirement analysis techniques have been proposed and used by academics and practitioners as an effective tool to help information analysts to capture, understand, and represent business information requirements. However, the cognitive abilities of information analysts are still the most important determinant for the accuracy of requirement specifications. Empirical studies have showed that the performance of novice information analysts is significantly lower than that of expert information analysts. Empirical studies have also shown that the different modeling behaviors account for the difference of cognitive abilities between novice and expert information analysts.

By literature review, this paper identified four characteristics of modeling behaviors that set expert and novice information analysts apart: model-based reasoning, mental simulation, critical testing of hypotheses, and analogical domain knowledge reuse. A future research direction is also suggested on the cognitive models that can explain the cognitive differences between novices and experts in the modeling process of information requirement analysis.

INTRODUCTION

Due to the difficulty of understanding organizational systems, incorrect requirement specifications are common in the practices of information requirement analysis. According to an estimation, incorrect requirement specifications may cost fifty to one hundred times more than what would have been required if the errors are not discovered until system implementation (Roman, 1985; Shemer, 1987). In order to improve the quality of information requirement specifications, the research in software engineering has been proposing various requirement analysis techniques to help information analysts capture, understand, and represent the information requirements (Couger, Colter, and Knapp, 1982; Davis, 1988). However, the cognitive abilities of information analysts are still the most important determinant for the correctness of requirement specifications (Schenk,Vitalari & Davis, 1998). It was found that expert information analysts who specify information requirements by model-based reasoning on the basis of requirement analysis techniques can produce more complete solutions than novice information analysts with partial or no model-based reasoning behavior (Sutcliffe and Maiden, 1992). Moreover, it was also found that novice information analysts have difficulties in identifying important concepts of problem statements with

requirement analysis techniques (Batra and Davis, 1992; Batra and Sein; 1994; Sutcliffe and Maiden, 1992).

In order to provide a more effective way to support novice information analysts to specify information requirements with fewer errors, a better understanding of the causes of the cognitive differences between novice and expert information analysts in the cognitive process of information requirement analysis is necessary. Therefore, this article tries to review the relevant literature to identify and to summarize the key differences between novice and expert information analysts in their modeling behaviors. On the basis of the finding from the literature review, a future research direction is also suggested.

COGNITIVE PROCESS OF INFORMATION REQUIREMENT ANALYSIS

Empirical research on the cognitive process of information requirement analysis has identified a strong association among the activities of gathering information, identifying relevant facts, and conceptual modeling (Batra & Davis, 1992; Sutcliffe & Maiden, 1992). This strong association reflects that information requirement analysis is basically an understanding process.

To account for the better performance of expert information analysts in understanding and specifying information requirements, the research on cognitive process has focused on the differences in the modeling behaviors between expert and novice information analysts. Empirical studies on the modeling behaviors of information analysts showed that four modeling behaviors set expert and novice information analysts apart: model-based reasoning, mental simulation, critical testing of hypotheses, and analogical domain knowledge reuse.

First, expert information analysts use model-based reasoning to model information requirements with the help of various requirement analysis techniques (Sutcliffe & Maiden, 1992; Vitalari & Dickson, 1983). Research evidence showed that model-based reasoning on the basis of requirement analysis techniques could produce more complete solutions than partial or no model-based reasoning behavior. On the other hand, research evidence also showed that novice information analysts could not perform model-based reasoning effectively because they had difficulties in identifying important concepts in the requirement statements by requirement analysis techniques (Sutcliffe & Maiden, 1992). For example, in a research study on the modeling behaviors of novice information analysts in using data flow diagrams, it was shown that the novice information analysts were more successful at recognizing system goals and inputs, while there was poorer recognition of system data stores, processes, and outputs, even though data stores, processes, and outputs were explicitly stated in the problem narrative (Sutcliffe & Maiden, 1992). Therefore, we may conclude that effective model-based reasoning is an important cognitive process that sets expert and novice information analysts apart.

The second feature of expert analysts' modeling behaviors is mental simulation. Mental simulation refers to the cognitive processes of building a mental model that establishes connections among the parts of the system under investigation and of using the mental model to reason about the interactions among the parts of the system (Adelson & Soloway, 1985; Guindon, Krasner, & Curtis, 1987; Guinder & Curtis, 1988). During information requirement analysis, expert information analysts use requirement analysis techniques for mental simulation of information requirements while novice analysts used requirement analysis techniques only for representation (Adelson &

Soloway, 1985). Mental simulation makes expert analysts focus on the semantic part of the problem statement. On the other hand, without mental simulation novice information analysts can analyze only the syntactic part of the representation (Adelson & Soloway, 1985; Allwood, 1986).

Critical testing of hypotheses is the third feature of the modeling behaviors of expert information analysts. By means of mental simulation, expert information analysts can have a clear picture about the structure of the information requirements (Guindon, Krasner, & Curtis, 1987; Guinder & Curtis, 1988). Consequently, experts may be more able to reason about a problem, to create test cases and scenarios for testing hypotheses critically (Schenk, Vitalari, & Davis, 1998; Vitalari & Dickson, 1983). On the other hand, novice information analysts can generate hypotheses only at a general level and make few attempts to test hypotheses because they focus only on the syntactic part of the representation (Schenk, Vitalari, & Davis, 1998).

Finally, analogical domain knowledge reuse makes expert information analysts able to specify information requirements more completely and accurately (Mainden & Sutcliffe, 1992). Expert information analysts tend to use higher-order abstract constructs to organize large amounts of knowledge. As a result, expert information analysts can recognize and assimilate analogies more easily (Batra & Davis, 1992; Vitalari & Dickson, 1983). In addition, expert information analysts tend to keep in memory the details of requirement specifications from their past experience. Consequently, higher quality can be expected because the reused specifications are well tested and validated. On the other hand, novice information analysts have difficulty in identifying the opportunities of analogical modeling because they tend to store concrete objects sparsely in the long-term memory (Batra & Davis, 1992; Sutcliffe & Maiden, 1992). In addition, novice information analysts tend to specify information requirements from scratch because of the lack of reusable specifications in their memory (Vitalari & Dickson, 1983).

CONCLUSION

In this article, I have discussed the four characteristics of modeling behaviors that set expert and novice information analysts apart: model-based reasoning, mental simulation, critical testing of hypotheses, and analogical domain knowledge reuse. Among the four characteristics, mental simulation is the most basic difference between expert and novice information analysts. It is well recognized that expert information analysts use requirement analysis techniques as tools for mental simulation while novice information analysts use the techniques for representation purposes only. However, it is unclear why the mental simulation does not happen as part of model behaviors of novice information analysts. In addition, the modeling behaviors should have close relationships with the knowledge of information analysts. However, the relationships are also unclear. Therefore, in order to guide the future research on improving the performance of novice information analysts in specifying information requirements, the cognitive models that are able to explain the cognitive differences between novices and experts in the modeling process of information requirement analysis are necessary.

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PREDICTION OF KNOWLEDGE ACQUISITION, KNOWLEDGE SHARING AND KNOWLEDGE UTILIZATION FROM LOCUS OF CONTROL: AN EMPIRICAL INVESTIGATION

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ABSTRACT

This study investigated the relationship between locus of control (LOC) and knowledge management (KM), i.e. knowledge acquisition, knowledge sharing and knowledge utilization. Participants were 155 individuals working in medium sized Lebanese organizations. Using hypothesis test and regression analysis, results indicated that internal LOC was positively related to knowledge acquisition, knowledge sharing and knowledge utilization. Also, a positive and significant correlation exists between external LOC and knowledge utilization whereas no relationship was found between external LOC and knowledge acquisition and sharing.

1. INTRODUCTION

Since the start of family business, owners have transferred their profit-making shrewdness to their children, artisans have conscientiously taught their skills to beginners, and employees have transferred their technical skills and ideas between each other. Therefore, there is actually nothing new about knowledge management (KM) (Hansen *et al.,* 1999). However, nowadays, fast environmental changes and rapid technological progress, KM has become significantly important. Researchers have recognized the fact that efficient KM is a key success factor and a driving force for achieving a sustainable competitive advantage (Nonaka, 1991; Quinn, 1992; Klein & Prusak, 1994; Winslow & Bramer, 1994; Bohn, 1994; Ulrich, 1998; Drucker, 2001; Bryant, 2005). In addition, other scholars contended that the traditional production factors (land, labor, and capital) have now diminishing returns whereas knowledge which has become the primary asset for both organizations and the economy (Drucker, 1994), is subject to increasing returns (Grant, 1995).

The number of studies on KM has more than doubled in the past decade as reported by Despres and Chauvel (1999). These studies have focused on different aspects of KM. Such as KM and organizational commitment (Putti *et al.,* 1990), knowledge transfer and individual characteristics (Vera-Muñoz, Ho & Chow, 2006), KM and experience (Fargher et al., 2005), KM and ability and motivation (Solomon & Shields, 1995) and KM and culture (Taylor *et al.,* 2001). According to Gupta and Govindarajan, (2000, p. 478), "there are many possible determinants of motivational dispositions to engage in inflows or outflows e.g., personal characteristics of subsidiary managers such as age or locus of control and their organizational commitment". Despite this

considerable abundance in KM literature, no existing studies have investigated thoroughly the relation between KM and locus of control (LOC).

This research studies the influence of internal and external LOC as a personality trait on knowledge acquisition, sharing and utilization. This paper will assist human resource managers when selecting employees for certain positions which require KM. Moreover, it observes the effect of LOC on KM in organizations.

2. LITERATURE REVIEW

2.1 Knowledge Management

Knowledge is information, ideas and expertise with a purpose that have been put to productive use (Bartol & Srivastava, 2002). It is described as the consciousness to understand ideas, events, information acquired through experience and learning, and the collection of interrelated information which has less significant value when separated. However, it is the individual's justified true belief which may improve the potential, efficiency and capacity of individuals, groups, communities and organizations (Nonaka, 1994).

There are two forms of organizational knowledge: explicit or tacit (Nonaka, 1991; Nonaka & Takeuchi, 1995). Explicit knowledge is knowledge that may be codified, documented or stored in accessible information technology systems such as corporate intranet web site, databases, shared directories on file servers or any other forms of the organization's intellectual property portfolio. While tacit/implicit knowledge resides in the individual's mind which makes it harder to express in writing. It includes operational know-how, technical expertise, insights about an industry, and business decision (Hansen *et al.,* 1999). The main challenge today is how to manage knowledge in a way to transform tacit into explicit.

During the past decade, organizational knowledge activities have increased drastically (Davenport & Klahr, 1998) and knowledge became the primary asset which generates organizational wealth (Cole, 1998) and whose protection has turned to be critical for the generation and preservation of competitive advantage (Porter-Liebeskind, 1996). According to Scarborough & Swan (1999), KM is a procedure of creating, acquiring, capturing, sharing and utilizing knowledge in order to develop organizational performance and learning. It encompasses the creation and acquisition, modification, utilization, storing and protection, transfer and sharing, translation and repurposing, and access and disposal of knowledge. However, it is not only about the knowledge flow between people and information technology systems and vice versa, but it is also about how knowledge is conveyed from one individual to another.

It is essential to conserve and share knowledge in the organization so that when an employee leaves, the existing employees will have sufficient information about how to perform their job (Probst *et al.,* 1999 and Shaw *et al.,* 2003). However, a common problem of KM is knowledge retention. When there is a lack of knowledge sharing, difficulties exists in obtaining adequate knowledge after the employee leaves the organization.

According to Tan (2000), KM is the practice of actively and analytically controlling knowledge and information within an organization. KM possess strategies which intensively promote knowledge sharing by linking people together and making information easily accessible

so that they learn from documented experiences (i.e. explicit knowledge). When knowledge is retrieved from those who hold it and shared with those who need it, organizational effectiveness is significantly improved, as Mecklenberg *et al.,* (1999 p.162) affirmed that "knowledge management allows companies to capture, apply and generate value from their employees' creativity and expertise".

Two attitudes toward KM have been identified (Hansen, 1999): codification and personalization. The first is a document driven strategy where the knowledge which is thoroughly encoded easily accessible information technology systems, becomes independent of its original owner, and easily accessible and used by others. Conversely, the latter is a collaboration strategy between at least two individuals to share tacit knowledge, closely tied in this case to its owner.

From the above, KM within the organization leads to a sustainable competitive advantage (Riege, 2005; Nonaka & Takeuchi, 1995). On the other hand, personality traits explain how individuals behave in different situations (Costa & McCrae, 1992). According to Lin (2007), knowledge sharing depends on the person's values, beliefs, motivation, experience and personal traits. Then, the researchers expect personality traits (e.g. LOC) to correlate with knowledge acquisition, knowledge sharing and knowledge utilization.

2.2 Locus of Control

The psychological concept of LOC was first introduced in 1954 by Julian Rotter (Rotter, 1954). It is defined as the people's perception of the source of control over their destiny or actions (Gershaw, 1989). It is the extent to which individuals judge themselves or believe that an external force, such as luck, is related to the influence on particular events in their life (Moorhead and Griffin, 2004; Firth *et al.,* 2004). Individuals, who consider that their own capacities and behaviors can determine their rewards, are referred to as internals, while externals assume that they obtain rewards outside of their control (Rotter, 1966).

Thus, internals consider that they have the capability to influence the environment around them and that they can alter the outcome of events that influence them through their behavior, attitudes, ability, personality and effort. On the other hand, externals consider that the outcome of the events is a function of uncontrollable or incomprehensible forces such as fate, luck, chance and stronger people or powerful institutions (Phares, 1962).

This concept has been first applied to the field of organizational behavior by Spector (1982). Further research has related it to individual's job satisfaction, job performance and job stress (Chen & Silverthorne, 2008; Martin *et. al.,* 2005), motivation (Chen & Silverthorne, 2008) and commitment (Judge *et al.,* 2000). In addition, it has been presented as a moderating factor between incentives and motivation, satisfaction and turnover. Also, many scholars proved that high internal LOC scores are good predictors of occupational success (McShane & Von Glinow, 2008).

Previous researches show that individuals with high internal LOC are more likely to experience higher levels of job satisfaction and performance and lower levels of job stress (Chen and Silverthorne, 2008). According to Phares (1962), people with internal LOC prefer to have power over their own environment, learn faster and perform better in tasks that require expertise and skills. They do not value outside support or help, and prefer to count on themselves. Their capability will lead to high self-confidence. However, individuals who think that the rewards they receive are due

to external factors rather than internal factors are more likely to be less productive and act more passively. Externals tend to adapt to the group's influences and believe that success is achieved with the help of others.

Rahim (1996) concluded that internals can cope with stress more easily and effectively than externals. According to Kalbers and Fogarty (2005), individuals with an internal LOC are less likely to experience a high level of stress but those with an external LOC are more likely to be vulnerable to stress and perceive certain events as stressful. Moreover, external LOC has a significant negative influence on job stress and tends to reduce personal accomplishments and job performance.

Internals are more likely to have higher levels of job performance and satisfaction (Martin *et al.,* 2005). It has long been assumed that higher employee satisfaction leads to an increase in employee performance and productivity (Lucas, 1999). However, while some researchers found that higher job satisfaction may lead to higher job performance others have not (Nerkar *et al.,* 1996). Jamal (1984) found that as job stress increased, the level of job performance decreased. He also found that job stress was significantly related to job satisfaction (Jamal and Baba, 2000).

Internals, tend to ask for more information about the tasks they have to perform in order to increase performance (Lefcourt, 1982). According to Gershaw (1989), internals can better evaluate, learn and obtain larger benefits from social support. They search and apply new knowledge that is helpful for dealing with difficulties and for control. Since internals are concerned with information and knowledge, the researchers predict that:

H1: Internal LOC will be positively related to Knowledge Acquisition.
H2: Internal LOC will be positively related to Knowledge Sharing.
H3: Internal LOC will be positively related to Knowledge Utilization.

Externals approach the task with less enthusiasm (Lefcourt, 1982) and are concerned with social demands. They merge easily with a group for support (Phares, 1962). Thus we predict that:

H4: External LOC will be negatively related Knowledge Acquisition.
H5: External LOC will be negatively related Knowledge Sharing.
H6: External LOC will be negatively related Knowledge Utilization.

3. METHODOLOGY:

The research aim was to determine the effect of internal and external LOC (the independent variables) on knowledge acquisition, knowledge sharing, and knowledge utilization (the dependent variables). For that purpose, the researchers surveyed employees working in medium size organization operating in Lebanon. Medium size enterprises are defined in this study according to the number of employees (100>employees<500) relative to the country size, where the majority of businesses are either small or medium.

The questionnaire used for this research was of three main parts: the first part collected demographic data and asked about age, gender, level of education, promotion and position. The second part included the Work Locus of Control Scale (WLCS) developed by Spector (1998). It is designed to measure LOC orientation in the work place, i.e. internal or external. This scale showed high reliability and validity (Furnham and Steele, 1993). This scale consisted of 16 questions, half

related to internal LOC, and the other half to external LOC. This scale has a minimum score of 16 and a maximum score of 96. The lower score represents internal LOC and the higher score represents external LOC. In the third part KM components was measured using OECD (2003) scale. The researchers used 15 items with 5 questions related to knowledge acquisition, 5 related to knowledge sharing and 5 to knowledge utilization. The questionnaire were measured on a five point Likert scale that ranged from 1=strongly disagree to 5=strongly agree.

To test our hypotheses, a survey was carried out between October and December 2008. 200 questionnaires were distributed across six reputable companies in Lebanon with a letter indicating the purpose of the survey. The overall response rate was 77.5 per cent or 155 employees. The researchers stimulated participants to answer all the questions in the survey, assuring them absolute anonymity.

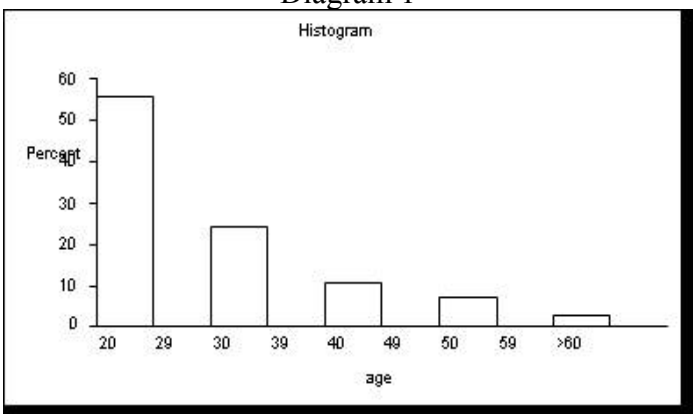
4. RESULTS:

4.1 Demographic Analysis

The purpose of this research was to investigate the relationship between LOC and KM (KA, KS and KU) and whether it enhances or impedes KM. The major demographic results were as follows: 83.87% of the respondents were internals with a mean of 55.84 and standard deviation of 4.87. The remaining 16.13% were externals with a mean of 44.44 and a standard deviation of 2.66.

55.5 % of the respondents were between 20-29 years old (see Diagram 1), with 51% females and 49% males. 58% held BA/BS degrees, 40% held Masters Degree, and the remaining 2% Doctorate. 62.6% (97 out of 155) were promoted, 42 out of 97 were between 20-29 years old, while the remaining was not promoted.

Diagram 1



The demographic variables did not show any significant relationship to neither KM facets (knowledge acquisition, knowledge sharing and knowledge utilization), nor personality traits (internal LOC/external LOC).

4.2 Discriminate Analysis for the variables: internal/external LOC

Using SPSS, a discriminate function analysis was performed to predict group membership based on a linear combination of the interval variables.

Table 1
Classification Results

		LOC	Predicted Group Membership		
			external	Internal	Total
Original	Count	external	15	10	25
		internal	34	96	130
	%	external	60	40	100
		internal	26.2	73.8	100

a.71.6% of original grouped cases correctly classified.

The above table (Table 1) shows that 15 individuals out of 25 were external LOC and 96 individuals out of 130 were internals. Therefore, the model correctly predicts our results, i.e. 71.6% of original grouped cases are correctly classified.

4.3 Hypothesis test

The hypothesis test (Means vs. Hypothesized value) was used to examine the association between LOC and KM variables (i.e. knowledge acquisition, knowledge sharing and knowledge utilization). The null hypotheses for each dependent variable (KA, KS and KU) are stated below:

H1-0: Internal LOC and knowledge acquisition are not related.
H2-0: Internal LOC and knowledge sharing are not related.
H3-0: Internal LOC and knowledge utilization are not related.
H4-0: external LOC and knowledge acquisition are not related.
H5-0: external LOC and knowledge sharing are not related.
H6-0: external LOC and knowledge utilization are not related.

Where Mean KA is the mean of knowledge acquisition, KS is the mean of knowledge sharing and KU is the mean of knowledge utilization.

The results from null hypotheses are stated in Table 2, 3, 4 and 5.

Table 2: Hypothesis Test results for H1-0 Hypothesis Test: Mean vs. Hypothesized Value Internal LOC with knowledge acquisition	
3	hypothesized value
3.6508	mean KA
0.5531	std. dev.
0.0485	std. error
130	N
13.41	Z
0	p-value (one-tailed, upper)

The result of the hypothesis test H1-0 is presented in Table 2. The computer output produced a Z-value of 13.41 and a corresponding P-value of 0.0000. Therefore, the test is highly significant. Thus, H1-0 is rejected.

Table 3: Hypothesis Test results for H2-0 Hypothesis Test: Mean vs. Hypothesized Value Internal LOC with knowledge sharing	
3	hypothesized value
3.3092	mean KS
0.5405	std. dev.
0.0474	std. error
130	N
6.52	Z

The result of the hypothesis H2-0 test is presented in Table 3. The computer output produced a Z-value of 6.52 and a corresponding P-value of 0.000. Therefore, the test is highly significant. Thus, H2-0 is rejected.

Table 4: Hypothesis Test results for H3-0 Hypothesis Test: Mean vs. Hypothesized Value Internal LOC with knowledge utilization	
3	hypothesized value
3.8262	mean KU
0.6534	std. dev.
0.0573	std. error
130	N
14.42	Z
0	p-value (one-tailed, upper)

The result of the hypothesis H3-0 is presented in Table 4. The computer output produced a Z-value of 14.42 and a corresponding P-value of 0.0000. Therefore, the test is highly significant. Thus, H3-0 is rejected.

No relationship has been found between External LOC and Knowledge Acquisition and Knowledge Sharing, thus H4-0 and H5-0 are accepted.

Table 5: Hypothesis Test results for H6-0 Hypothesis Test: Mean vs. Hypothesized Value: external LOC with knowledge utilization:	
3	hypothesized value
3.528	mean KU
0.7346	std. dev.
0.1469	std. error
25	N
3.59	Z
0.0002	p-value (one-tailed, upper)

The result of the hypothesis test H6-0 is presented in Table 5. The computer output produced a Z-value of 3.59 and a corresponding P-value of 0.0002. Therefore, the test is highly significant. Thus, H6-0 is rejected.

From the above hypothesis tables (Table 2, 3, 4 and 5), results indicate that the null hypothesis H4-0 and H5-0 are accepted, while the null hypothesis H1-0, H2-0, H3-0 and H6-0 are rejected. Then more analysis of H1, H2, H3 and H6 among LOC is required.

For further analysis the researchers conducted a regression analysis with knowledge acquisition, knowledge sharing and knowledge utilization being the dependent variables and LOC being the independent variable. Hypothesis 1, 2, 3 and 6 were further tested for statistical significance.

4.4 Regression analysis

Regression results for internal LOC with Knowledge Acquisition
The analysis of these findings generated the following linear regression equation:
KA= -2.793+0.123 internal LOC
0.000 sig

The results of the ANOVA showed an F-value of 33.286 and a significance of 0.000 at 0.05 significance level. Thus, the results support Hypothesis 1, i.e. knowledge acquisition is affected positively by internal LOC.

Regression results for internal LOC with Knowledge Sharing
The analysis of these findings generated the following linear regression equation:
KS= -2.793+0.136 internal LOC
0.000

The results of ANOVA showed an F-value of 68.632 and a significance of 0.000 at 0.05 significance level. The results support Hypothesis 2, i.e. knowledge sharing is affected positively by internal LOC.

Regression results for internal LOC with Knowledge Utilization
The analysis of these findings generated the following linear regression equation:
KU= -1.785+0.120 internal LOC
0.000

The results of ANOVA showed an F-value of 29.5 and a significance of 0.000 at 0.05 significance level. The results support Hypothesis 3, i.e. knowledge utilization is affected positively by internal LOC.

Regression results for external LOC with knowledge Utilization
The analysis of these findings generated the following linear regression equation
KU= -16.08+0.393 external LOC
0.037

The results of ANOVA showed an F-value of 4.904 and a significance of 0.037 at 0.05 significance level. The results did not support Hypothesis 6 since knowledge utilization is affected positively by external LOC.

5. DISCUSSION:

The researchers investigated the relationship between the internal/external LOC with the three variables of KM (knowledge acquisition, knowledge sharing and knowledge utilization). To the researchers' knowledge, this is the first study that examines the above mentioned relationship. The results from current study demonstrated overall strong empirical evidence that: (a) a relationship exists between LOC and KM; (b) different relationships existed between internal and external LOC and the different aspects of KM.

The results showed that internal LOC is positively related to knowledge acquisition because internals like to acquire knowledge in order to develop their skills and enrich their knowledge. These individuals have a strong desire to learn, adopt new ideas and receive empowerment from managers (Lefcourt, 1982; Gershaw, 1989).

Internal LOC is highly linked to knowledge sharing. The higher the internal LOC the higher the individual contribution to knowledge sharing is. Individuals with high internal LOC have intrinsic interest and desire and are self-motivated people who like to share their knowledge with other employees in order to broaden their knowledge.

Although the results of the study demonstrated that both internals and externals were positively associated with knowledge utilization, their level of knowledge utilization varies from one another. In fact, externals are likely to rely more on automatic decision aids than internals because they prefer applying what others have come up with rather than making the effort themselves (Kaplan et al, 2001). They also tend to behave passively since they prefer delegating decision-making and problem-solving processes (Merton, 1946). However, individuals with high internal LOC prefer to take decisions themselves since they have more control of their work environment (Phares, 1962). This is in agreement with Hyatt and Prawitt (2001) that externals outperform internals in structured firm (Bamber and Snowball, 1988). Since structured firms have a stronger codification strategy and therefore stored knowledge is accessed and used more easily when making decisions. An interesting finding in this study is that having internal LOC positively correlated with the three variables of KM (knowledge acquisition, knowledge sharing and knowledge utilization) i.e., the higher the level of internal LOC the more the knowledge acquisition, sharing and utilization in the organizations.

6. CONCLUSION

This research extends the Organizational Behavior and KM literature and empirically tests the relationship between two personality traits, internal LOC and external LOC, with knowledge acquisition, knowledge sharing and knowledge utilization. The analysis showed how the personality traits had significant impact on knowledge acquisition, knowledge sharing and knowledge utilization. Our results cannot be generalized due to the small sample size, we recommend that further research should be carried on different size organizations, (small/large), different countries and sectors, where organizations value and support KM, to ensure its survival and success.

7. MANAGERIAL IMPLICATION

The researchers recommend that human resource managers should focus on personality traits of the candidate as a predictor to knowledge acquisition, knowledge sharing and knowledge utilization. Human resource managers would also focus on personality traits that are unlikely, in order not to select these candidates.

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ADOPTION OF PERSONAL INFORMATION SYSTEM: INNOVATION DIFFUSION THEORY AND TASK-TECHNOLOGY FIT

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ABSTRACT

This study contributes to the understanding of adoption of multifunctional wireless handheld devices and will help to envision new strategies for developing and marketing the devices. Previous research has focused on wireless handheld devices as single-function devices and has applied adoption and acceptance theories to explain adoption processes without the recognition of the levels of adoption processes. This paper will examine the following research questions: (1) how do the factors revealed by previous research impact four functions (tasks) of wireless handheld devices and (2) how do innovation diffusion theory and task-technology fit explain adoption processes? This paper outlines multifunctional adoption processes of wireless handheld devices and helps practitioners set new strategies. We believe that this paper will be of great interest to both academics and practitioners who study wireless handheld devices.

INTRODUCTION

The current study is motivated by three limitations of previous research. First, previous studies have overlooked customers' responses to Personal Information System (PIS), focusing the impact of mobile technology on customers' adoption. (Chen and Nath, 2004; Gebauer and Shaw, 2004; Bauer, 2005; Harris et al., 2005; Hosoe, 2005; Fang et al., 2006; Hong and Tam, 2006; Akesson, 2007). Little research has paid attention to the *process* of mobile device adoption. Second, prior research has mostly considered mobile devices as a single functional systems (Clarke and Madison, 2001; Zhang and Yuan, 2002; Camponovo and Pigneur, 2003; Lee et al., 2004; Gebauer and Shaw, 2004; Karjaluoto et al., 2005; Lee and Shim, 2006; Hong and Tam, 2006). But, given the multifunctional nature of PIS, consumers could perceive distinctive values from different functions, such as fun from entertainment tools. In order to explore overall PIS values, we suggest aggregating the values of PIS attributes. Third, previous research has applied innovation diffusion theory (IDT) and task-technology fit (TTF), which were developed for organizational information systems (Bransheau and Wetherbe, 1990; Tzokas and Saren, 1992; Drury et al., 1999; Rajagopal, 2002; Melville and Ramirez, 2008), to explore the processes of individual level information system adoption without the recognition of the levels of adoption processes. Thus, the purpose of our study is to investigate how IDT and TTF explain PIS adoption and implementation. To do so, we combine IDT and TTF and find variables to explain PIS adoption and implementation: quality, compatibility, relative advantages, cost and complexity. That is, the intended contribution of this paper is to present

a more complete framework for analyzing user pre-experience responses and their impact on future usage, including exploring task usage.

MOBILE TECHNOLOGY

Mobility is unlimited by users' physical movements (Akesson, 2007). Lyytinen and Yoo (2002) explain that mobility provides identical and similar services at different sites and while the devices are on the move. Mobility consists of two dimensions; spatiality and temporality (Kakihara & Sorensen, 2002). Spatiality refers to unlimited geographical movements of users, resources and devices and temporality includes more than clock-time perspective. Accessibility has been used in the study of wireless device characteristics with different names; *connectivity* and *reachability* (Wen and Gyires, 2002; Ng-Kruelle et al.., 2002). *Accessibility* refers to all-time connection (Clarke, 2001; Hong and Tom, 2006). With accessibility, consumers go beyond the constraints of time and place limitation in accessing e- and m-commerce. Clarke (2001) argues that accessibility is a determinant of m-commerce from e-commerce. With PIS, only one-to-one or many-to-one relationship devices and users are allowed. Thus, a device is personalized to a user. *Personalization* refers to a device, applications and services that are customized to the owner's preference and interests. Gregory et al. (2000) suggest that current PIS focus interaction on a sole individual, rarely incorporating other users' information. Localizability refers to the identifiability of geographical position, which is a distinctive characteristic PIS provides. This gives service providers and content providers a chance to deliver localized information and services to users.

PERSONAL INFORMATION SYSTEMS

In this study, our first mission is to define personal information system. In our effort to define PIS, we found characteristics of personal information systems from mobile device research: mobility, accessibility, personalization and localizability. Therefore, we can define PIS as a device having four characteristics and providing four tasks that will be discussed below. Thus, *personal information system* is defined as an information system equipped with mobility, accessibility, personalization and localizability to support communication, information, transaction and entertainment task.

INNOVATION DIFFUSION THEORY and TASK-TECHNOLOGY FIT

Roger (1983) proposes innovation diffusion theory to explain how innovation spreads. Innovation diffusion is defined as the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers 1983). Moore and Benbasat (1991) define five characteristics in the information system adoption context and empirically assess the effect of characteristics of innovation on the information system adoption: 1) relative advantage, 2) compatibility, 3) complexity, 4) observability, and 5) trialability. Swanson (1994) also defines innovation from the perspective of an information system as "innovation in the application of digital and communications technologies" (p. 1072). Premkumar et al. (1994) study the implementation of electronic data interchanges (EDI) with innovation diffusion theory.

Vessey (1991) argues that a cognitive fit encourages the use of problem-solving processes in the solution of a specific task. The study of fit has been focused on the relationship between task and technology on task performance or information system performance (Goodhue and Thompson, 1995; Dishaw and Strong, 1998; Goodhue, 1998; Zigurs and Buckland, 1998; Zigurs et al., 1999; Dennis et al., 2001; Maruping and Agarwal, 2004; Vatanasakdakul and D'Ambra, 2007). Goodhue and Thompson (1995) argue that task-technology fit (TTF) results in performance impact. They define TTF as "the degree to which technology assists an individual in performing his or her portfolio of task" (p. 216).

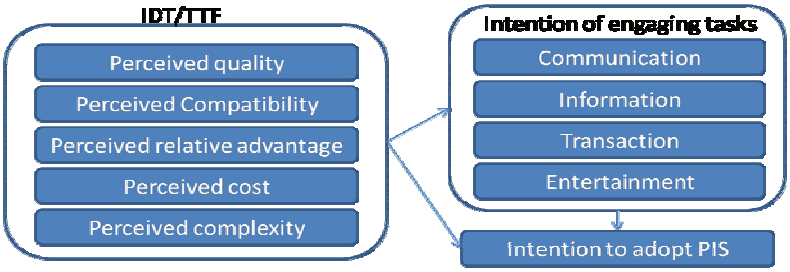
TASK

In MIS, task is used mostly for measuring system performance. Goodhue and Thompson (1995) define task as "the actions carried out by individuals in turning inputs in to outputs" (p. 216). Fang et al. (2006) measure the moderating effect of task on the adoption of wireless technology, categorizing the task in the perspective of users' objectives into three types: 1) general tasks that do not involve transactions and gaming, 2) transactional tasks, and 3) gaming tasks. Harris et al. (2005) study the adoption of m-commerce based on the four types of services: 1) communication tasks, 2) informational tasks, 3) transactional tasks, and 4) entertainment tasks. According to previous studies (Harris et al., 2005; Mahatanankoon et al., 2007; Jih, 2007), task is categorized into four groups: 1) communication tasks, 2) informational tasks, 3) transactional tasks, and 4) entertainment tasks.

CONCEPTUAL MODEL

We present our conceptual model in Figure 1. The following sections present our propositions and detail our arguments in support of this model.

Figure 1: Conceptual model



A justification for elaborating the innovation diffusion model is provided when innovation is less complex and thus compatible with old technology. The adoption processes are accelerated in a situation where the legacy system and the innovative system fit in such a way as to improve performance (Zigurs et al., 1999) because users are able to capture the knowledge of innovation that is transferred through the analogy (Gentner, 1983; Ross, 1984; Holyoak and Koh, 1987; Gregan-Paxton and John, 1997) of the two system. In addition, the transferred knowledge reduces cognitive efforts for doing the task with innovative technology (Punj and Staelin, 1983; Alba and Hutchison,

1987) and affects the performance of innovation (Rao and Monroe, 1988; King and Balasubramanian, 1994; Ratchford, 2001). In turn, people realize the relative advantage. These effects are strengthened in the individual level of adoption because knowledge is an important trigger of the individual adoption process (Brancheau and Wetherbe, 1990). Thus, we believe fit between the legacy system and the innovative system enables users to adopt innovation. This leads us to put task-technology fit and innovation diffusion into one research model in order to explain PIS adoption.

Our research model points out the difference between the adoption order of PIS adoption and organizational information system adoption. While organizational information systems have acquisition-and-evaluation models, PIS has evaluation-and-acquisition. That is, the acquisition of an information system in an organization occurs through the passive channel to the end users. The adoption decision is made by upper-level managers or c-level executives. An implicit assumption of TTF and IDT is that an information system is already in the hands of end users. After the system is delivered to users, diffusion theory assesses the success and speed or success of adoption, and the TTF model assesses the performance impact along with how (much) technology supports the task. Unlike organization level acquisition, PIS acquisition occurs by users' spontaneous willingness and self-evaluation. Thus, individual users are not able to experience PIS before they acquire it, whereas the users meet systems before they evaluate them. Therefore, it is difficult to assess actual adoption rates or speed and performance impact on systems due to perceived-and-adopted behavior. Therefore, we recommend perceived values instead of actual behavior. Even though it is possible to measure actual behavior, the results are limited to the nature and behavior of the early adopter because the study might be conducted in the early stage of adoption where only early adopters are involved in innovation (Rodger, 1983; Brancheau and Wetherbe, 1990; Drury, 1999). Therefore, perceived performance may affect perceived adoption based on the perceived-and-adopted model. This is also the assumption of the technology acceptance model (Ajzen, 1985; Davis, 1989).

The research model explains the relationship between innovation characteristics in IDT and technology characteristics in TTF. Originally, the two theories were built to explain different objects: innovative technology and existing technology. But the concept of fit is also an important factor to explain the process of innovation adoption. Therefore, TTF will provide benefits to explain the adoption of innovative individual information systems. The processes of parsimony are required in order to merge two theories because they share high multicollinearity. Finally, this study posits six factors: perceived quality, perceive reliability, perceived compatibility, perceived relative advantage, perceived cost and perceived complexity. Since the current study deals with the phase before adoption, where it is too early to assess actual usage or behavior (Davis, 2004), this study examines potential users' perceived values.

Perceived quality. This study defines *perceived quality* as the extent to how perceived information and services are provided to meet users' needs. Consistent with previous research, we believe that perceived quality is positively related to the intention of using PIS and engaging tasks.

> *H1. Perceived quality is positively related to (a) intention to adopt and execute PIS, (b) communication, (c) information, (d) transaction, and (e) entertainment task.*

Perceived compatibility. According to IDT, compatibility includes two dimensions: values, or norms, of the adopter and practices of the adopter (Tornatzky and Klein, 1982; Moore and Benbasat, 1991). The first dimension implies cognitive compatibility (compatibility with what people feel or think about a technology), while the second argues practical or operational compatibility (Tornatzky and Klein, 1982). This study includes both dimensions because from the perspective of PIS, an individual's norm or value plays a critical role in adoption decision. We define *perceived compatibility* as the degree to which PISs are perceived as being consistent with the existing values, needs and past experience of adopters.

H2. Perceived compatibility of PIS is positively related to (a) intention to adopt and execute PIS, (b) communication, (c) information, (d) transaction, and (e) entertainment task.

Perceived relative advantage. Tornatzky and Klein (1982) define relative advantage as "the degree to which an innovation is perceived as being better than the idea it supersedes" (p. 34). However, "being better" may be interpreted in several ways (i.e. economic profitability, social benefits, cognitive effort saved, or time saved). To eliminate confusion with the definition, we exclude economic profitability and include productivity, efficiency and effectiveness (Martino, Chen, and Lenz, 1978). Thus, *Perceived relative advantage* refers to the degree to which PIS is perceived as being better than its precursor. Also, we suggest that perceived relative advantage plays an important role in the decision to acquire PIS and use it for tasks.

H3. Perceived relative advantage is positively related to (a) intention to adopt and execute PIS, (b) communication, (c) information, (d) transaction, and (e) entertainment task.

Perceived Cost. In early IDT, cost factor is considered only an absolute value (price) (Tornatzky and Klein, 1982). Afterward, cost includes perceived relative value (i.e. relative benefit against economic effort) (Moore and Benbasat, 1991), evaluating innovation with economic profitability and cognitive effort. Thus, the current study implies both of the dimensions so that *perceived cost* refers to the extent to which users perceive monetary and cognitive effort to adopt PIS and engage its tasks.

H4. Perceived cost is negatively related to (a) intention to adopt and execute PIS, (b) communication, (c) information, (d) transaction, and (e) entertainment task.

Perceived complexity. Perceived complexity is defined as the degree to which PIS is perceived as being difficult to use. Given its multifunctional nature, PIS may be perceived as being difficult to use. In addition, limited interface such as a small screen and a small number of keys (one key plays various roles in different tasks or context) may present difficulty for the user. Consistent with previous studies (Tornatzky and Klein, 1982; Moore and Benbasat, 1991), we propose that perceived complexity is negatively associated with intention to adopt PIS.

H5. Perceived complexity of PIS is negatively related to (a) intention to adopt and execute PIS, (b) communication, (c) information, (d) transaction, and (e) entertainment task.

Intention of executing tasks and intention to adopt PIS. Overall perceived performance and satisfaction of a product is a collection of attributes of a product. Oliver (1993) defines *attribute experience* as "the consumer's perception of a product or services feature" (p. 421). *Attribute satisfaction* is referred to as "the consumer's subjective satisfaction judgment resulting from observations of attribute performance" (p. 421). That is, a customer consumes various functions of a product on the basis of experience and evokes both positive and negative affects toward each function. Then, satisfaction about each function is aggregated to overall satisfaction. In turn, the overall satisfaction affects intention to use (Anderson and Sullivan, 1993; Fornell, Johnson, Anderson, Bolton & Lemon, 1999; Olsen, 2002; Gustafsson, Johnson & Roos, 20052003). Thus, we believe that the intention to execute tasks influences intention to adopt PIS. We define *intention to execute tasks* as the extent to which users engage in executing task behavior with PIS. *Intention to adopt PIS* is defined as the extent to which customers engage in PIS adoption behavior.

H6. Intention of executing (a) communication, (b) information, (c) transaction, and (d) entertainment task is positively related to intention to adopt PIS.

CONCLUSION

The goal of this paper was to explore the antecedents of success in adoption and implementation of PIS, by integrating innovation diffusion theory and the task-technology fit model. We hypothesized that innovation diffusion theory and the task-technology fit model explain the process of adoption and implementation of PIS from the individual level of information system. In addition, the research model explores the technology adoption process with two important perspectives: acquisition and implementation. A large body of debates about the success of an information system has been formed on its measurement. But DeLone and McLean (2003) argue that system use is an appropriate measure of success. In other words, the success of an information system depends on a company's ability to sell the product or to make its customers use the information system. We believe that the two issues are unable to be separated so we test both in our research model. From that, our study contributes to academics and practitioners to understanding adoption and implementation.

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SUCCESSFUL LEADERSHIP STYLES IN SOFTWARE PROJECTS IN OFFSHORE CENTERS IN INDIA

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ABSTRACT

U.S. organizations have successfully used offshore resources in software projects. There is a lack of academic research, however, regarding business leadership styles in technology sectors that contribute to software project success. This quantitative research study examined the leadership styles contributing to software project success as perceived by project managers and project stakeholders. Based on the leadership models for understanding styles by Bass, a referral sample (N = 110) of offshore software development center stakeholders completed an electronic survey, indicating leadership factors that contributed to success. The current study contributes to the understanding of the role that leadership styles of project managers have in determining the success or failures of IT projects in offshore datacenters.

INTRODUCTION

The practice of project management has evolved since the mid-1970s and so have the roles and responsibilities of the project manager (Kerzner, 2000). During the period of traditional project management, project managers were selected from the technical ranks and expected to have significant technical expertise (Kerzner, 2000). Project success was measured by the technical merit of the project with little or no concern for the knowledge of business or its customers (Kerzner, 2000). As project management evolved, however, there was an increased focus on the behavioral aspects of project management and the management skills, such as leadership skills, of project managers (Kerzner, 2000; Kloppenborg & Opfer, 2002; Shenhar & Wideman, 2000). Modern project managers were expected to have basic technical skills and significant business expertise along with leadership skills. Rather than performing the work, they built teams of subject matter experts (SMEs) that brought the skills needed to fulfill the project requirements (Kerzner, 2000). As a result, modern project managers were required to be skilled in interpersonal communications, as well, in order to delegate tasks to SMEs.

Information technology (IT) software project success has been a common topic in peer-reviewed literature and the subject of study by research analysts and practioners over the past 15 years. In 1994, the Standish Group issued its Chaos Report and surveyed 365 IT executive managers from companies in different industries and of different sizes to derive an analysis of project resolution by type (The Standish Group International, 1995). The Standish Group also conducted a qualitative study using four focus groups to understand the impact and magnitude of software project failures, the factors causing software failures, and the factors that could increase the potential for software project success (The Standish Group International, 1995).

IT project managers' leadership style is crucial to the success of a software project (LeBlanc, D., 2008; Schwalbe, 2004). IT projects require a project manager to have the effective leadership style to understand what motivates, inspires, and stimulates the thinking of IT team members (Turner & Müller, 2005). Through the examination of the available literature on leadership styles, IT software project success, survey instruments, and statistical analysis, this research attempted to determine the factors that contribute software success in offshore development centers in India using referral sampling methodology. The examination of leadership styles attempted to ascertain the impact on software project success.

BARRIERS AND ISSUES

One of the major barriers to assess leadership styles and impact on software success in offshore development centers is lack of available public data. Most offshore datacenter organizations do not publish their failures due to fear of losing future business or employees. They may be afraid that the competition can use published data to win-over their clients.

There may be other barriers to conducting a successful research on investigating software project failures, including:

- Imperfect understanding of the offshore domain and how it works,
- Incomplete knowledge of offshore culture and management structure,
- Lack of availability of participants and data,
- Lack of knowledge of participants' understanding of successful IT projects (such as completed projects vs. live projects),
- Retention issues, including high attrition, such employees' not seeing the project through to completion and, thus, being unable to articulate whether the project succeeded or not,
- Lack of openness of speaking of problems in front of management, and
- A combination of any and all of the above factors.

RESEARCH QUESTIONS

The intent of the research questions for this study was to focus on the leadership styles of project managers who played a central role in the execution of offshore IT related projects. The established research questions were necessary to gain a better understanding of the IT leadership styles of the offshore development centers. By answering the research questions seeking to address leadership style deficiencies that are believed to be contributing factors to software project failure, offshore development center (or datacenter) management can design and implement training and mentoring programs that can reduce the likelihood of software project failure due to ineffective leadership styles.

CONCLUSIONS

The findings of the current study confirmed the theory of previous studies on the impact the leadership style of IT project managers on project success. This present study attempted to ascertain

the affect of the leadership styles of offshore development managers on software project success to inform organizational leadership of the impact that different styles have on software project outcomes. The current study adds to the body of knowledge in the areas of applied management, project management, leadership styles, information technology, offshore management, and organizational behavior.

FURTHER RESEARCH OPPORTUNITIES

Recommendations for future researchers to replicate this study include:

1. Conduct a study in India's Best Place to Work (BPW) and other organizations within technology sector,
2. Design a qualitative study of interviews with managers of offshore data centers and their employees to measure the criteria of the project manager's success,
3. Conduct a study using various demographic variables, such as the IT manager's gender, age, educational level, project type, and IT segment,
4. Conduct a quantitative study of relationships between the IT project manager's leadership style and various project Software Development Life Cycle (SDLC) stages (requirements, specifications, technical design, code and unit testing, development system test, release test, performance test, installation verification test, model office test, customer acceptance test, and, finally, system live into production environment),
5. Conduct a study using project success to measure using an additional variable of "Customer Referenciability" to IT project success factors. Referenciability refers to existing customers agreeing to be a reference and giving more business, and finally,
6. Conduct a study in an organization that adopts Malcolm Baldrige National Quality Award (MBNQA) criteria and validate whether leadership styles of IT manager impact on IT project success. The primary research question that may be investigated is - What is the influence of Organization following models that satisfy MBNQA criteria on the day to day project management?

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A STUDY OF THE RELATIONSHIP OF FINANCIAL INCENTIVES AND CONSUMERS' WILLINGNESS TO DISCLOSE INFORMATION TO E-COMMERCE MARKETERS

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ABSTRACT

The purpose of this study was to determine if monetary incentives would be a beneficial means to increase consumers' involvement in eCommerce and thereby boost the growth of eCommerce and the economy. A sample (N =110) of Internet users completed an eSurvey, on whether they would provide sensitive private information for varied incentive offers. Based on an established conceptual model for understanding consumers' privacy concerns, cross-tabulation of the financial incentives against consumers' willingness to disclose private data were performed. Chi-square tests (p=.05) of the data revealed consumers were very hesitant to disclose private information; however, men and the age group of 40-59-year-olds were more willing to do so than women and other age groups. This research indicates to legislators to protect consumers' privacy as a way of boosting the growth of eCommerce and the economy, for a positive social change.

PROBLEM STATEMENT

Electronic commerce holds enormous potential for revolutionizing and globalizing businesses and the economy. Therefore, the use of eCommerce and the means to realize its full potential are of paramount importance for the growth of the domestic and the global economy (Javalgi, Wickramasinghe, Scherer, & Sharma, 2005). However, eCommerce currently holds a small, if increasing, share of the total economy. Examples of the major players in eCommerce are Amazon.com, eBay, and Yahoo Shopping. These players are considerable drivers of their state's economy (Brown & Riley-Katz, 2008).

One of the reasons for the lack of faster growth of eCommerce is the consumers' concerns about online privacy. At first, the use of eCommerce without a face-to-face contact seemed to enhance privacy. However, in practice, eCommerce marketers have asked their consumers for much private information (Feigenbaum, Parkes, & Pennock, 2009). These requests for disclosure of private information, which include not only the consumers' demographic data, but at times also their addresses, product preferences, account numbers, and even their Social Security numbers, have led to the consumers' increased concern for information privacy. Initially, these concerns lead to lack of trust on the part of consumer and, subsequently, to rightful disloyalty and abstention from eCommerce transactions (Miyazaki, 2008).

At times, businesses have tried to settle consumers' concern by offering them financial incentives and benefits in exchange for the voluntary disclosure of their personal information. The

results of these financial incentives, however, have been contradictory. Some studies showed that financial incentives were successful in enticing consumers to disclose their private information, whereas others showed no success in this respect. One reason for this contradiction might be the type of information sought from the consumer. For example, consumers might be willing to release their e-mail addresses for a financial incentive, but not their credit card numbers. The problem for marketers is a lack of research-based information about (a) how financial incentives relate to consumer responses for the voluntary disclosure of private information, and (b) which types of information are considered most sensitive by consumers. This study sought to address the problem as specified in the section on the research purpose.

RESULTS

The results from this study indicate that consumers are, by and large, not willing to disclose their private information to eCommerce marketers even when presented with financial incentives. Some exceptions were found with respect to gender. Also, consumers are not willing to disclose different types of potentially sensitive private information (personal, financial, or medical) to eCommerce marketers in exchange for financial gains, with two exceptions: Men and Internet users in 40-59-year age group showed willingness to disclose some personal information in exchange for financial gain.

RECOMMENDATIONS FOR FURTHER STUDY

The current study focused specifically on consumers' willingness to disclose their private information to eCommerce marketers in exchange for financial incentives. This could be considered a beginning point for many other studies to provide a more comprehensive understanding of consumers' concerns relative to Internet information privacy. One avenue for future research could be the study of consumers' actual behavior for disclosure of their private information in exchange for financial incentives. This study researched the participants' intended behavior rather than their actual behavior.

Also absent in this study was the consumers' control over their information, once disclosed to eCommerce marketers. They were not given any level of control after the disclosure of their information. A future study might focus on consumers' willingness to disclose their information if they are given the opportunity to retain certain levels of control after disclosure. Examples of such controls would be time limits of, perhaps, 1 year on the use of the disclosed data, after which the eCommerce marketers would no longer be able to use the information, or limitations on other entities to whom the information can be handed over, that is, to whom the original marketers may sell or release the information obtained.

Future research might also focus on the trust factor among consumers. This study showed that men were more willing to disclose some personal information in exchange for money than women. One might examine whether men are more trusting of eCommerce than women or whether other factor might account for these findings.

Future studies on this topic might also focus on the cultural background of consumers and its effects on willingness to disclose private information. Because eCommerce and the Internet are

not confined by geographical boundaries, the participants in this study could have come from varied cultural backgrounds. A future study might focus on consumers of one culture versus those of another, and compare their willingness to disclose private information. Cultural values might play an important role on consumers' willingness to disclose private information to eCommerce marketers.

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THE SIGNIFICANCE OF CAREER COMMITMENT IN GENERATING COMMITMENT TO ORGANIZATIONAL CHANGE AMONG INFORMATION TECHNOLOGY PERSONNEL

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ABSTRACT

The commitment of individuals is critical for the success of an organizational change initiative. In this quantitative survey-based study conducted at a large global bank, we analyze the perceptions of 575 information technology (IT) software professionals in India and Malaysia regarding an enterprise-wide change in order to understand the impact of career commitment vs. organizational commitment and how they impact change messages (beliefs) to generate commitments towards the change. Our finding is that the role of career commitment among IT personnel is more important than organizational commitment in generating commitment to change. Also, we show that it is career commitment, rather than organizational commitment, that is critical for change messages to be effective.

Keywords: Career commitment, organizational commitment, organizational change

ANALYSIS OF THROUGHPUT AND DELAY PERFORMANCE FOR MULTIPATH VIDEO MULTICASTING IN WIRELESS AD HOC NETWORKS

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ABSTRACT

An ad-hoc network is a collection of wireless mobile hosts dynamically forming a temporary network. Quality of Service (QoS) is a set of service requirements that needs to be met by the network while transporting an information stream from a source to its destination. QoS support for Mobile Ad-hoc Networks (MANETs) is a challenging task due to the dynamic topology and limited resource. The main objective of this work is to split the video into multiple parts and send each part over a different path so as to increase robustness to loss and other transmission degradations. MANETs should provide multiple QoS metrics for real time applications.Two of the QoS aware parameters such as delay and throughput are taken and a framework is designed for sending each part of the video in different paths to the receiver and the video can be multicast from the destination to all the nodes in the mobile ad-hoc networks. The throughput of the proposed system is significantly higher than the conventional multicast wireless networks. It demonstrates the increase in tolerance to packet loss due to network congestion and achieves less delay compared to the non-adaptive methods.

STUDY ON INFORMATION ASSURANCE PRACTICE AND STANDARDS FOR COMMERCIAL BUSINESS

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ABSTRACT

The purpose of this exploratory descriptive research is to examine the paucity of Information Assurance (IA) policy and practices in commercial industry and the resulting serious threat to commercial IT databases and networked infrastructures. The conceptual framework for this study is grounded in the work of Kurt Lewin and his organizational change process. IA processes and standards are compared between commercial and government infrastructures to identify gaps in the field of IA knowledge and application. A prior IA survey tool developed by Suchan has been modified to identify commercial IA policies and applications currently employed. Frequency analyses of this data will describe identified gaps within the commercial IA industry. This study supports positive social change improving IA awareness across commercial industry thus promoting additional national security.

PROBLEM STATEMENT

Commercial businesses process, store, access, and transmit data via their intra/inter networked infrastructure while conducting normal business. Protection of these networked infrastructures and the ability to maintain their proprietary information is imperative to the survival of commercial business communities and our nation's information technology (IT) infrastructures as a whole. This study addresses the paucity of IA policy and practices in commercial businesses and the serious threat this presents to our commercial business IT databases and infrastructures. The potential security deficiency associated with inadequate IA practices and procedures leads to numerous issues, but paramount is the development of a false sense that a company's data are trustworthy and protected. Several organizations (NITRD, 2006 & 2007; PITAC, 2005) have conducted studies, and the federal government has recommended strategies to follow, but no known agency has established a recognized IA process for commercial industry to date. Industry, academia, and the DoD have established working groups to study and recommend the needed strategies to eliminate the lack of IA deficiencies (PITAC, 2005).

SIGNIFICANCE AND METHODOLOGY

The significance of this study is to address the limited IA applications and processes being applied towards the commercial enterprises. The focus will be on the commercial companies' basic IA knowledge employ within their business enterprise and data network infrastructures Prior research has only identified IA as a threat to our commercial networked infrastructures (PITAC, 2005 & NITRA, 2006). Across the business industry, there is a need for all organization to have IA

standards in keeping with best practices for information assurance (NITRA, 2006). Commercial businesses are addressed in three different categories: pure commercial businesses, DoD commercial businesses, and federal and state businesses.

Exploratory research is selected for several reasons. One of the main reasons is the need for additional knowledge in our commercial industry. This researcher wants to know more information about the commercial IA practices and processes currently in use. Exploratory type questions tend to lead towards additional research. Exploratory research collects data; " that will help define problems and suggest hypotheses" (Kotler et al.2006, p. 122).The results of this proposed study will provide stronger documented facts on what the commercial enterprises are using in regards to IA and a strong indication of what they understand in terms of information assurance protection overall. This exploratory study will only scratch the surface of commercial IA processes used and identify lack of corporate knowledge toward IA. The proposed study will open the door for more in depth studies towards improved IA security for commercial enterprises.

Exploratory studies consist of reviewing available data on a given topic. Exploratory studies involve reviewing prior research and documentation on a selected issue then you collate existing research with data collected. This research examines the sources of the data collected and compares to existing processes in a non-commercial industry (DoD) for incorporation to the commercial industry. This exploratory case study investigates what commercial enterprises are using for IA practices and application. The study reviews processes and policies that are currently used in the commercial environment. The study reviews the DoD IA process and academic applications in identifying a recommended commercial solution. The ability to make the necessary changes to implement an IA process is addressed and tied into the Lewin change theory. The study will be an exploration of IA processes within the commercial information assurance population, which, despite its small unique size, impacts the whole organization significantly.

The researcher examines basic organizational changes required to improve the current IA process of doing business and potential impacts to commercial information architectures and infrastructure. The world is ever changing and the business environment is constantly changing to stay viable in today's market. This researcher believes change management impact the lack of IA in commercial industry. This researcher examines the mixture of changes required within an organization's current structure, business processes, and decision methodologies, applying Kurt Lewin's change theory and Force Field Analysis Model. The Force Field Analysis Model is being utilized as a decision change management tool towards IA application within an organization.

The study is divided into two main areas of investigation. The first is the DoD community with an effective and established process clearly defined and the second is a commercial industry with no apparent identifiable established process clearly defined. The DoD IA community has established standards and documentation along with a leadership/management hierarchy. Those standards and established processes are compared against the commercial enterprises (Department of Defense Instruction, 2003).

SUMMARY

A is one segment in our national security that has continued to go unstructured in our commercial industry, thus making data protection of company sensitive information a weak link in

our nation's information systems. This research will identify deficiencies in IA processes for commercial industry. It will also take a side by side comparison of DoD IA standards and IA application in the commercial industry evaluating to see if any can be leveraged for use. This data will increase the limited knowledge base on commercial IA applications used and assist in future research for commercial IA applications. This study is a work in process towards doctoral dissertation.

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ASSESSING THE LEVEL OF INFORMATION TECHNOLGY (IT) PROCESSES PERFORMANCE AND CAPABILITY MATURITY IN THE PHILIPPINE FOOD, BEVERAGE, AND TOBACCO (FBT) INDUSTRY USING THE COBIT FRAMEWORK

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ABSTRACT

A grounded literature on how information technology (IT) processes are being managed is imperative in an industry with an increasing reliance on IT for its strategic and operational undertakings. This study seeks to provide a comprehensive assessment of the level of IT processes performance and capability maturity in the Philippine food, beverage, and tobacco (FBT) industry by applying the theory of benchmarking and the CobiT framework on IT governance. After administering the 167-item survey instrument to 22 publicly-listed companies in the FBT industry, represented by respondents composed largely of IT managers and administrators and subjecting the results to statistical tests and IT experts' validation, it was found out that the FBT industry currently has a maturity score of 2.05. At this maturity level, IT processes have developed to the stage where similar procedures are followed by different people undertaking the same task but there is no formal training of communication of standard procedures. To be able to evolve to the next immediate level where IT processes are standardized, documented, and communicated through training, companies in the FBT industry should bank on their key strength in the Acquire and Implement (AI) domain and improve on their weakness in the Monitor and Evaluate (ME) domain.

INTRODUCTION

The advent of information technology has significantly influenced and changed how businesses are being managed and monitored today (Hunton, Bryant & Bagranoff, 2004). To ensure smooth management of the new business set-up, the concept of corporate governance was redesigned to include information technology as a major part of it. New governance and internal control frameworks came up just for this concern to be addressed. This resulted to an increased awareness that IT governance is a major ingredient in achieving every organization's goal of value creation. In spite of the availability of new governance and internal control frameworks, many organizations still compromised their going concern because of poor enterprise-wide governance. The collapse of Enron in 2002 and the recent 2009 Satyam scandal in India are among the proofs of this predicament. Because of this, the awareness for both corporate and IT governance must be heightened and taken more seriously.

THE STATE OF THE FBT INDUSTRY

Over the last few years, the global food, beverage and tobacco (FBT) industry group has exhibited modest growth, with growth particularly low in the tobacco and beverage markets. The industry group generated total revenues of $4,140.3 billion in 2005, this representing a compound annual growth rate (CAGR) of 2.9% for the five-year period spanning 2001-2005 (Datamonitor, 2006).

But looking forward, the global FBT industry group is expected to accelerate from its current value growth position. With an anticipated CAGR of 3% over the 2005-2010 period, the industry is expected to reach a value of $4,805.5 billion by the end of 2010. The drivers operating during the last five years are set to persist for the next five (Datamonitor, 2006).

In the Philippines, the FBT industry belongs to the industrial sector. There are 23 publicly-listed companies under the FBT industry. It is a highly regulated industry particularly the tobacco companies. A study by RNCOS in New Delhi on September 13, 2008 on the Philippine FBT Market Forecast until 2011 showed the patterns in consumption behavior in the different food segments. The study indicated five key results about the sub-industry: (1) because of the strong increase in consumer expenditure during 2001 to 2006, a rise of 7.5% is also expected from 2007 to 2011; (2) the increase in the working hours of employees, increase in number of employees and diverse eating habits has lead to a high consumption of ready-to-eat meals; (3) the demand for organic food will increase at a growth rate of 10% to 20% because of the growing middle class population; (4) an increase in disposable incomes and demand fro imported alcoholic beverages; and (5) there is an inadequate water supply and healthy drinking concerns that have resulted in the growth in the bottled water industry (Dy, Ha, Gan & Alba, 2009).

IT GOVERNANCE: A FOCUS ON COBIT

According to Simonsson & Johnson (2006), the existing literature on IT governance has inherited much from the discipline of corporate or enterprise governance but it has been able to develop itself into a discipline of its own (Dy, Ha, Gan & Alba, 2009). Though at present, there is still lack of consensus on how IT governance is viewed; CobiT is the most renowned framework for support of IT governance concerns. It is based on best practice, focusing on the processes of the IT organization and how its performance can be assessed and monitored. This framework has been developed and is maintained by an independent, not-for-profit research institute, drawing on the expertise of its affiliated association's members, industry experts, and control and security professionals (IT Governance Institute (ITGI), 2007).

CobiT defines IT activities in a generic process model with four domains and 34 generic control processes. These domains are Plan and Organize (PO), Acquire and Implement (AI), Deliver and Support (DS), and Monitor and Evaluate (ME). The domains map to IT's traditional responsibility areas of plan, build, run, and monitor (ITGI, 2007). PO domain covers strategy and tactics, and concerns the identification of the way IT can best contribute to the achievement of the business objectives. AI domain addresses the aptness and likelihood of providing solutions that will meet business needs. DS domain is concerned with the actual or physical delivery of required services, which includes service delivery, management of security, and continuity, service support

for users, management of data and operational facilities. ME domain addresses performance management, monitoring of internal control, regulatory compliance and governance. Across these four domains, CobiT has identified 34 IT processes where links are made to the business and IT goals that supported (ITGI, 2007). The four domains and 34 IT processes largely represent a comprehensive dimension of an organization's IT processes performance and capability that needs to be managed.

BENCHMARKING

Robert Camp (1989) developed a 10-step model moving sequentially through for phases. Kearns, along side, defined benchmarking as the continuous process of measuring products, services, and practices against toughest competitors or those companies recognized as industry leaders (Moriarty, 2008). Watson (1993) views benchmarking as a continuous process that searches for and applies significantly better practices for the purpose of achieving superior competitive performance (Moriarty, 2008). Yu, Rogacion, Perez & Lichengyao (2006) defined benchmarking as a comprehensive technique that can be used to identify operational and strategic gaps, and to look for best practices that eliminate such gap. Benchmarking has an "internal dimension" whereby the organization critically examines itself searching for best practices and an "external dimension" whereby the organization explores its industry and other relevant areas outside of its own industry in order to identify those best practices that may be applicable in its own operating environment (Yu, Rogacion, Perez & Lichengyao, 2006).

PREVIOUS STUDIES

Separate studies on IT practices conducted by Yu, Rogacion, Perez & Lichengyao (2006) and Acosta, Samson, Tan & Tecson (2009) yielded maturity scores of 2.97 and 2.70 for listed expanded and non-expanded commercial banks and selected life insurance companies in the Philippines, respectively.

RESEARCH PROBLEM AND RESEARCH DESIGN

A shortcoming recognized in the previous studies conducted by Yu, Rogacion, Perez & Lichengyao (2006) and Acosta, Samson, Tan & Tecson (2009) was the non-conclusiveness of their findings with respect to the industries chosen. By making use of 22 (of which 21 responded) out of 23 (one was excluded) publicly-listed companies in the FBT industry, this study provides a comprehensive assessment of the level of IT processes performance and capability maturity.

Applying the first six steps of Camp's benchmarking model, a validated 167-item survey instrument was administered to determine the maturity scores. They were tabulated and were subjected to statistical tests and IT experts' validation. Lastly, conclusions and recommendations were drawn.

RESULTS, DISCUSSION AND CONCLUSION

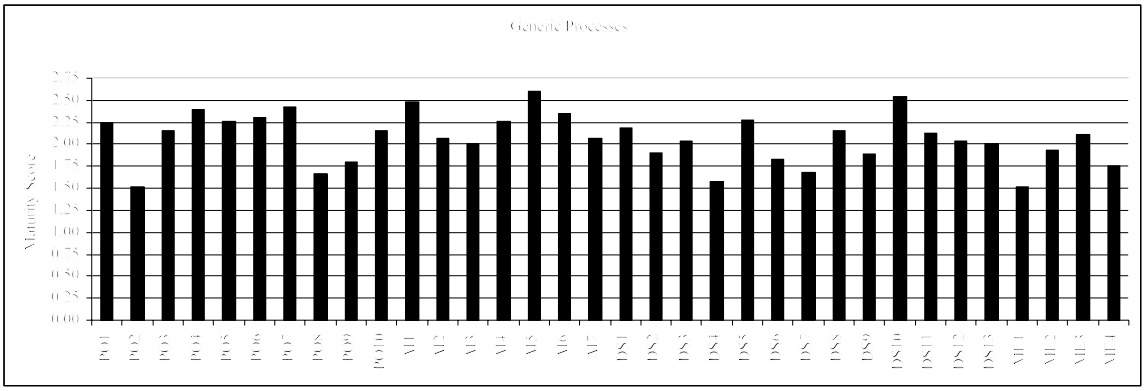
The respondents were composed of senior technical managers, wide area network (WAN) and data administrators, management information systems managers, and corporate IT managers. The total assets of publicly-listed companies in the FBT industry range from P237 million to P339 billion. Of the industry's total assets of P579 billion, 98.34% was from the respondent-companies. Of the 21 respondent-companies, 18 were audited by a Big 4 firm.

Table 1 Overall and per domain mean and standard deviation (obtained and adjusted)

	Obtained mean	Standard deviation	Adjusted mean	Standard deviation
Plan and organize (PO)	2.51	1.28	2.09	1.03
Acquire and implement (AI)	2.71	1.46	2.26	1.23
Deliver and support (DS)	2.46	1.41	2.02	1.15
Monitor and evaluate (ME)	2.41	1.6	1.83	1.16
Overall level	2.52	1.39	2.05	1.08

The FBT industry registered a 2.52 maturity score but taking into consideration the concept of outlier as used in the study of Yu, Rogacion, Perez & Lichengyao (2006), the FBT industry would have an adjusted maturity score of 2.05. The adjusted figures, with lower standard deviation, would be used in the analysis and discussion of the results.

Figure 1. Maturity score per generic process



In the PO domain, the industry scored the highest (2.42) in managing IT human resources (PO7) and the lowest (1.52) in defining the information architecture (PO2). The PO7 score, though not that high, can be attributed to the local laws enforced that govern recruitment, training, promotion, and termination practices. The PO2 score can be attributed to the communication problems between business and IT. In the AI domain, the industry scored the highest (2.60) in

procuring IT resources (AI5) and the lowest (2.01) in maintaining technology infrastructure (AI3). The AI5 score can be attributed to procurements that management is fully aware of but the AI3 score is an indication that once these resources are procured, less emphasis is given to their maintenance thereby reducing efficiency of use over time. In the DS domain, the industry scored the highest (2.55) in managing problems (DS10) and the lowest (1.58) in ensuring continuous service (DS4). The DS10 score tends to compensate the low AI3 score; poor maintenance means more problems to manage. Because of this, continuous service (DS4) is compromised since most of the resources are used up in troubleshooting. In the ME domain, the industry scored the highest (2.12) in ensuring regulatory compliance (ME3) and the lowest (1.51) in monitoring and evaluating IT performance (ME1). The ME3 score, though not that high, can be attributed to the awareness of potential financial liability once regulations are not complied with. But this still indicates a lack of full understanding of all issues related to these requirements. Moreover, the low score in ME1 can be attributed to the costs related to monitoring controls and the absence of a culture geared toward continuous improvement.

The overall maturity score of 2.05 is an indication that IT processes performance and capability maturity level in the Philippine FBT industry is repeatable but intuitive. Though companies in this industry have been existing, in an average, for more than 15 years, they still are in the transitional stage to a completely standardized IT processes. As they aim to a higher maturity level, they usually just stick to a repeatable but intuitive IT processes. This maturity level is only temporary as these companies may choose to improve on their internal setup. One reason that companies undergo this stage is the absence of a concrete set of formal procedures on how processes are performed. Procedures are usually established by middle- or low-level management. However, if new processes are set, then it would only follow that the proper procedures are yet to be established for these new processes. Having the proper procedures is a matter of discovery for most companies. Then they will realize that these are the best practices. It takes numerous revisions to the manuals before the most effective and efficient means of executing the process is discovered. With this, it takes a while for a company to reach the level where a defined IT processes are already documented and in place and are practiced.

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