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SOCIAL NETWORKING TECHNOLOGY AS A BUSINESS TOOL

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ABSTRACT

Americans are now spending about 25 percent of their time online on social networking sites and blogs, which is up from about 16 percent in July 2009 - an astonishing 43 percent increase in just 1 year. Social networking sites such as Facebook, Twitter, YouTube, FourSquare, LinkedIn and MySpace have only been around for a few years, but are now used by more than 500 million users globally. Businesses are taking notice of the phenomenal growth of social networking sites and are developing new strategies to take advantage of them. The purpose of this paper is to conduct a brief literature review of social networking technologies, and describe the business impacts of this relatively new technology.

INTRODUCTION

Social networking technology is rapidly gaining traction in the business world. Facebook, Twitter, YouTube, FourSquare, LinkedIn and MySpace have only operating for just a few years, but are already used by more than 500 million users. While Google still dominates the search engine market, the social networking company Facebook has become the most visited website since March 2010. A recent Nielson survey (The Nielsen Company, 2010) states that we are now spending about 25 percent of our time online on social networking sites and blogs, which is up from about 16 percent in July 2009.

Due to the relative infancy of social networking technology, there are very few formal studies published in the traditional academic media - most existing articles have been published as reports from consulting firm, trade publications, and online reports. Research in this area can be traced back to communications research which model how social influence processes affect individuals' attitudes toward communication networking and networking use behavior. With the frequent use of electronic networking, many studies began to assess the impact of electronic networking on social behavior (Fulk, 1987), (Meyrowitz, 1985).

Recently, however, organizations realized that many of their younger and future customers are growing up in an environment in which electronic social networking is the norm. The millennial generation expects an "always on" world of interactive networking, and social networking tools immensely affects their behavior and learning styles (Baird, 2005). Organizations quickly took notice that they had to address this new trend, and books such as "The New Influencers" (Gillin, 2007) began to address the need to acknowledge the importance of Social Networking. Boyd and Ellison (Boyd & Ellison, 2009) define social networking and summarize the history. As businesses started getting interested in social networking, reports such as "Web 2.0 Moves from Social Networking to Business World," (Affiliated Computer Services , 2009) suggested that businesses need a strategy for social networking technology.

There is clearly a need for scholarly research on the impact of social networking technology on the way organizations communicate with their customers, formulate new strategies for building brands, and develop new products and services that the customer needs. This research is a step in this direction.

SOCIAL NETWORKING AS BUSINESS TOOLS

Businesses and online advertisers are starting to see that social media technology can serve as an important business tool to gain strategic advantages. Internet based tools such as email, web sites, search engine optimization have already been adopted by many organizations. Social Networking technologies such as Twitter and Facebook have recently become very popular among consumers, and it now behooves organizations to find cost-effective and efficient ways to use them to stay competitive. This is reflected in the figure below, which shows that budgets for social networking technologies are projected to rise sharply over the next few years (Beal, 2009).

Social Web Media Business Spending
(Millions $)
(Beal, 2009)
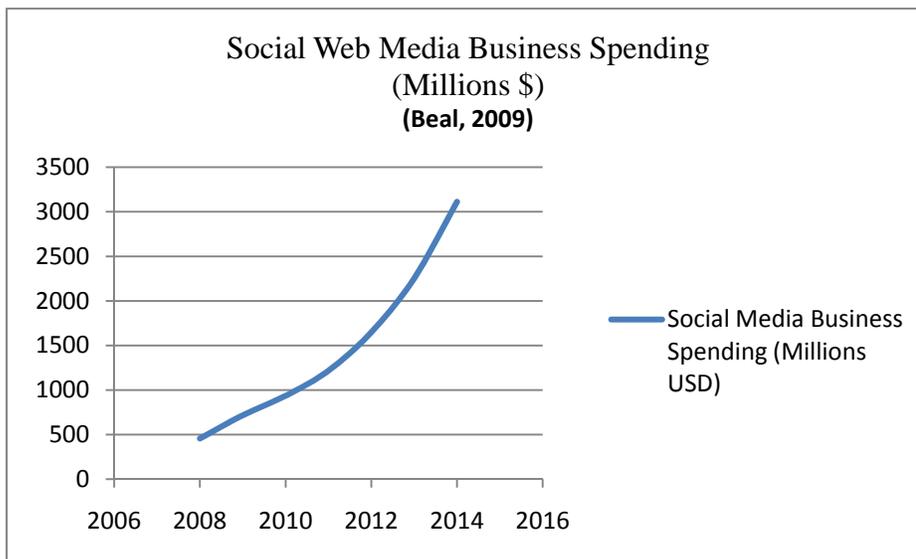
On Aug 12, 2010, Delta Airlines, for example, became the first airline to allow their Facebook fans to book and purchase airline tickets using the "Delta Ticket Window" right in the Facebook website. Foursquare, a relatively "new kid" on the social networking block, adds another interesting twist by mashing up geo-location data with social networking and smart-phones to additionally allow friends and contacts to know their locations in real-time. Restaurant chains such as Starbucks, PizzaHut, Red Robin, Chili's Grill and Bar, and Kona Grill are exploring and partnering with these so-called "location-based" social networking sites. Based on a FourSquare user's location, the business offers some kind of incentive to "check-in." Chili's, for example, offers a free item to customers just for checking in to Foursquare. The merger of social-networking and geo-location is now deemed so important that Facebook, with its 500 million users, started Facebook "Places" in August 2010 to compete with FourSquare.

SUMMARY AND FUTURE RESEARCH

The effect of social networking technology on businesses is a relatively new area, and is potentially a very fertile one for current and future research. The trend of using social networking technology is not a fad because an entire generation of consumers and individuals use it regularly and depend on it for many aspects of their lives. Businesses have little option but to find a way to leverage this new technology. The research also is interdisciplinary, and can involve IT,

marketing, organizational behavior, strategy, and economics. Research questions that will be considered by the author in future social media technology research include:

- Business perception of how important social media is currently and in the future
- Which social sites (Face book, Twitter, linked-in etc) are the most effective?
- How are these social sites used?
- Whether any social media policies are in place?
- What are the benefits of using social media for businesses?
- What are the disadvantages of using social media for businesses?
- What are the metrics used to measure effectiveness?
- What are the associated costs?
- What is the budget for social media?
- What are the Social Media strategies?

Once the data is collected, it will be analyzed to identify trends, priorities, organizational usage patterns, employee perceptions, strategies, policies, and to determine whether certain social media technologies are more suited to certain industries, and how social media issues and policies might differ by industry types.

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OPEN INNOVATION MODELING USING GAME THEORY

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ABSTRACT

Companies use open innovation approach to collaborate with external partners in research and development to reach new technologies that otherwise may not be easy or economical to achieve. This collaboration may cause them to lose control of their research, development, and operational processes which may create a higher risk for using open innovation. In this paper, we use the results of previous researches to discuss different aspect of risks in open innovations and specifically, the three risks of Arrow of Information Paradox, Contamination, and Not Invented Here Syndrome. We suggest that open innovation deals must include not only the potential rewards of the partnership for partners, but should also consider the risks involved in the collaboration. We illustrate how n-person game theory can be used as a decision making tool for a fair reward distribution, a tool to justify open innovation strategic alliances, the core value concept to identify the dominating partner, and Shapley value to generate a fair reward distribution which considers both risks and revenues of partnership deals.

USING A REAL-WORLD DATABASE AND WEB APPLICATION PROJECT TO FACILITATE LEARNING

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ABSTRACT

Many new college graduates have spent several years learning a discipline, but are only "book smart", and are unable to function effectively in Corporate America. In an effort to give students that real-world experience and an edge in the job hunt, actual "live" projects prove to be invaluable. This project follows a group of senior Information Systems students as they analyze, design, and implement a Database with Web Application solution for a local church's Awana Club. The students will follow the Systems Development Life Cycle (SDLC) methodology and will provide a variety of documents including Scope, Requirements, Entity Relationship diagram (ERD), and others. A working Web/Database Application will be provided to the customer at the end of the project.

DETERMINANTS OF SURVIVAL OF OPEN SOURCE SOFTWARE: AN EMPIRICAL STUDY

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ABSTRACT

Open Source Software (OSS) has gained notable importance and popularity among users in recent years. This paper uses data of more than 20,000 OSS projects over a 5-year period to investigate the determinants of Open Source Software survival. The results of logistic regressions show that OSS survival probability is positively correlated with general user interest, intensive user interest, and developer effort, but negatively correlated with the restrictiveness of license. Further investigation of the relationships among the determinants indicates that the interest of intensive users has a persistent positive impact on developer effort, while the interest of general users only has a short-term positive impact. It is also shown that projects on Software Development and System Administration have higher probability of survival than projects on other topics.

TESTING A MODERATOR-TYPE RESEARCH MODEL ON THE USE OF HIGH SPEED INTERNET

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ABSTRACT

Telecommunications industry is continually in a shift of change, alimented by technological innovation and consumers' demand for always better and faster communication tools. High speed Internet is now an integral part of everyday life of more than a billion people. And, as the tendency is showing up, its use will be still increasing in the future. Thus, this technology has and will continue to have major social and economic impacts. Individual adoption of technology has been studied extensively in the workplace, but far less attention has been paid to adoption of technology in household (Brown & Venkatesh, 2005). So, few studies have been conducted until now to verify satisfaction of household people using high speed Internet. The aim of this study is then to investigate the determining factors in satisfaction of using high speed Internet by people in household. 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 personal computer in household by American people, this study examines the determining factors in satisfaction of using high speed Internet in household by Canadian people. The methodology followed to conduct the study was the telephone survey research. Data were collected from 322 randomly selected Atlantic Canadian people using high speed Internet at home. Data analysis was performed using the structural equation modeling software Partial Least Squares (PLS). The results revealed that near from half of the variables examined in the study showed to be determining factors in satisfaction of using high speed Internet by people in household.

INTRODUCTION AND BACKGROUND FOR THE STUDY

The vast technological possibilities of the Internet are at the basis of the fast progress of the information society (Al-Omoush & Shaqrah, 2010). It has become one of the most important means of new forms of cooperation and competition in the various subsystems of society (Al-Omoush & Shaqrah, 2010). Anderson (2008) argues that Internet has a great influence on people's connections to friends, families, and their communities, on the social system of formal and informal support, and on the working of groups and teams. It is also the valuable instrument of scientific, social, marketing researches, and business development (Al-Omoush & Shaqrah, 2010). In addition, the Internet, as an information and entertainment technology, affects education, government, publishing, retail industry, banking, broadcast services, health care delivery, and so on (Al-Omoush & Shaqrah, 2010). So, the scope of the Internet is now worldwide and in all sectors of the society, and then forces to deliver this essential resource to people in households.

Telecommunications industry is continually in a shift of change, alimented by technological innovation and consumers' demand for always better and faster communication tools. High speed Internet is now an integral part of everyday life of more than a billion people. And, as the

tendency is showing up, its use will be still increasing in the future. Thus, this technology has and will continue to have major social and economic impacts. Individual adoption of technology has been studied extensively in the workplace, but far less attention has been paid to adoption of technology in household (Brown & Venkatesh, 2005). So, few studies have been conducted until now to verify satisfaction of household people using high speed Internet. It is therefore crucial to more deeply examine the determining factors in satisfaction of using high speed Internet by people in household. This is the aim of the present study. The related literature on the actual research area of high speed Internet is summarized in Table 1.

As we can see in the summary of literature related to high speed Internet presented in Table 1, very few studies until now examined the determining factors in satisfaction of using high speed Internet by people in household. Thus, the present study brings an important contribution to fill this gap given it allows a better understanding of the impacts of high speed Internet usage in people's everyday life. It focuses on the following research question: What are the determining factors in satisfaction of using high speed Internet by people in household?

Table 1 Related Literature Survey	
Research Area	*References*
High speed Internet social impact and economic growth.	Orazem (2005) Selouani & Hamam (2007) Anderson (2008)
High speed Internet and wages and employment.	Majumdar (2008)
High speed Internet and health.	Dumitru et al. (2007) Rains (2008)
High speed Internet and regulation.	Cambini & Jiang (2009) Howard & Mahazeri (2009)
High speed Internet migration, implementation, and support.	Ida & Sakahira (2008) Platt et al. (2010)
High speed Internet adoption and use.	Perry et al. (1998) Matthews & Schrum (2003) Middleton & Ellison (2006) Dumitru et al. (2007) Windhausen Jr. (2008) Horrigan (2009) Howard & Mahazeri (2009) Al-Omoush & Shaqrah (2010) Helsper (2010) Rosston et al. (2010)
High speed Internet (e.g., ISP) user satisfaction.	Tao et al. (2009)

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 development of the study is presented; second, the methodology followed to conduct the study is described; finally, the results of the study are reported and discussed.

THEORETICAL DEVELOPMENT

This study is based on the theoretical foundations developed by Venkatesh and Brown (2001) to investigate the factors driving personal computer (PC) adoption in American homes as well as those developed by Brown and Venkatesh (2005) in order to verify the determining factors in intention to adopt a PC 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. And Brown et al. (2006) tested the same integrated model in the context of PC use. As pointed out by Brown et al. (2006), even though the technology of interest in MATH is PC, the model is expected to generalize to other information technology (IT) products and systems in the household context. Also, with the exception of behavioral intention (we included user satisfaction instead of behavioral intention given people investigated in this study already have high speed Internet access), all the variables proposed and tested by Brown and Venkatesh (2005) are used in this study. And we added a new variable, mobility, in order to verify whether or not it is a factor of satisfaction of household people using high speed Internet. 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 *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 PC adoption (household high speed Internet 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 high speed Internet by people in household).

The definitions of MATH variables integrated in the theoretical research model proposed in Figure 1 are, in the whole, adapted from the theoretical foundations developed by Venkatesh and Brown (2001) to investigate the factors driving PC adoption in American homes. As for the definitions of the variables related to the household life cycle, they were taken from Danko and Schaninger (1990) as well as Wagner and Hanna (1983), respectively. And the definition of the new independent variable that we added to the model is from our own. In fact, we defined this variable in accordance with which we wanted to measure regarding mobility before developing and validating items that measure the variable on the basis of the definition formulated.

Figure 1
Theoretical Research Model
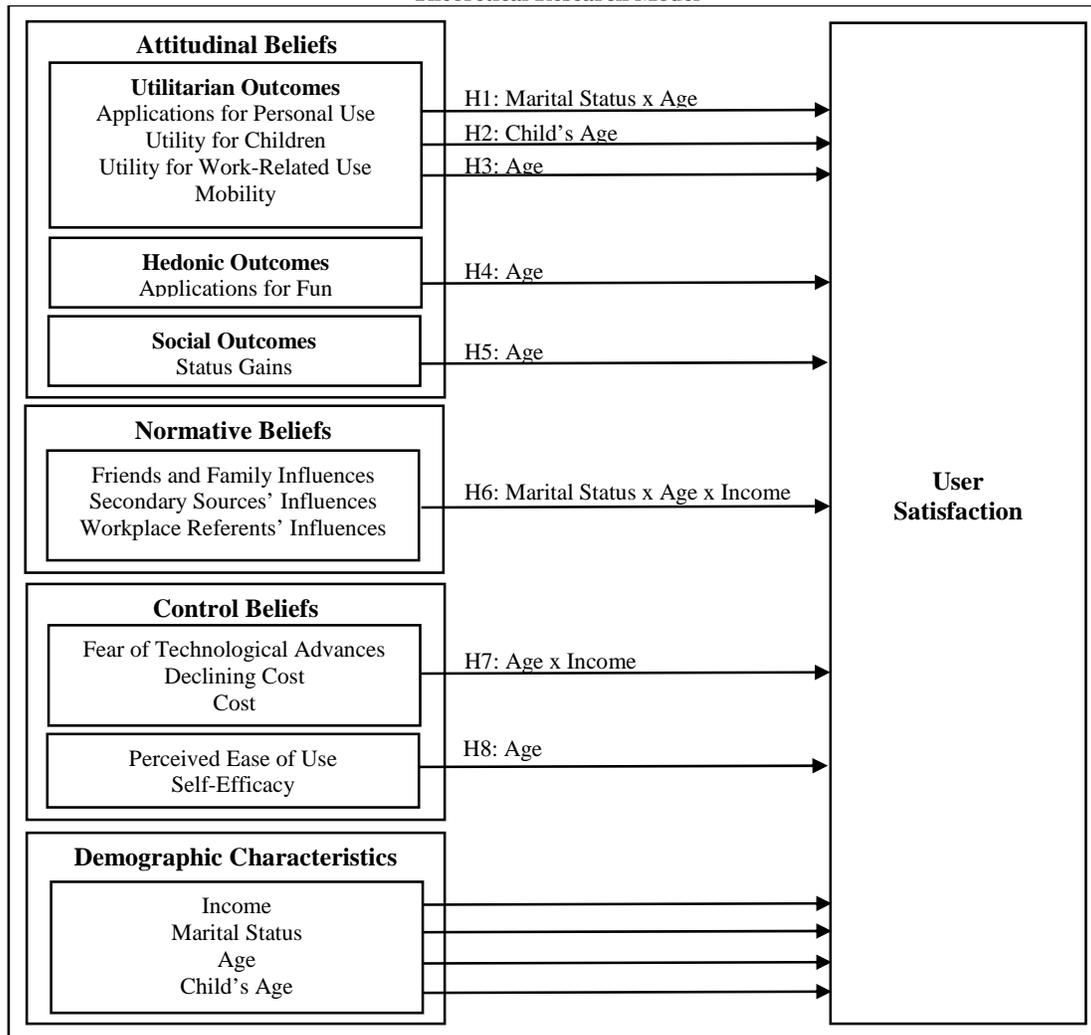
In the reminder of the section, we develop eight research hypotheses (H1-H8) related to the model suggested in Figure 1.

H1: Marital status and age will moderate the relationship between applications for personal use and satisfaction of using high speed Internet at home.

H2: Child's age will moderate the relationship between utility for children and satisfaction of using high speed Internet at home.

H3: Age will moderate the relationship between utility for work-related use and satisfaction of using high speed Internet at home.

H4: Age will moderate the relationship between applications for fun and satisfaction of using high speed Internet at home.

H5: Age will moderate the relationship between status gains and satisfaction of using high speed Internet at home.

H6: Age, marital status, and income will moderate the relationship between the normative beliefs ((a) friends and family influences; (b) secondary sources' influences; and (c) workplace referents' influences) and satisfaction of using high speed Internet at home.

H7: Age and income will moderate the relationship between the external control beliefs ((a) fear of technological advances; (b) declining cost; and (c) cost) and satisfaction of using high speed Internet at home.

H8: Age will moderate the relationship between the internal control beliefs ((a) perceived ease of use; and (b) self-efficacy) and satisfaction of using high speed Internet at home.

In the next section of the paper, the methodology followed to conduct the study is described.

METHODOLOGY

The study was designed to gather information concerning high speed Internet satisfaction in Atlantic Canadian households. Indeed, the focus of the study is on individuals who have high speed Internet access at home. 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.

**For a matter of space, we present only the sample and data collection here.
The other sub-sections of the methodology are presented in the full paper.**

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 have high speed Internet access. 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 that end, the phone number of each respondent was put in a box for the drawing. Following this data collection process, 322 people in household answered our survey over a 5-week period.

The results of the study are presented in the full paper.

References are available upon request.

TESTING UTAUT ON THE USE OF ERP SYSTEMS BY MIDDLE MANAGERS AND END-USERS OF MEDIUM- TO LARGE-SIZED CANADIAN ENTERPRISES

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Jean-Pierre Booto Ekionea, University of Moncton

ABSTRACT

Individual acceptance and use of new technologies has been studied extensively over the last two decades. And, as more and more organizations move from functional to process-based information technology (IT) infrastructure and that enterprise resource planning (ERP) systems are becoming one of today's most widespread IT solutions to this movement, the research literature on ERP systems has exponentially grown in recent years. Effectively, the importance of the ERP industry to the professional information systems (IS) community is further underscored by projections indicating that it will be a $47.7 billion industry by 2011 (Jacobson et al., 2007). To study acceptance and use of ERP systems by enterprises and their employees, several models of technology adoption are used, including the Technology Acceptance Model (TAM) (Davis, 1989), its successor the TAM2 (Venkatesh & Davis, 2000), a combination of TAM2 and the model of determinants of perceived ease of use, that is TAM3 (Venkatesh & Bala, 2008), as well as the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003). But, at our knowledge, acceptance and use of ERP systems has not been yet studied in medium- to large-sized Canadian enterprises. The aim of this study is then to fill this gap. Using UTAUT model, we gathered the feelings of middle managers and end-users in six medium- to large-sized enterprises from three Canadian regions in order to identify the influencing factors on their use of ERP systems. Data analysis was performed using the structural equation modeling software Partial Least Squares (PLS). The results highlight the key role of three independent variables (facilitating conditions, anxiety, and behavioral intention) and a moderator variable (age) of UTAUT model as influencing factors on the use of ERP systems in medium- to large-sized Canadian enterprises. The independent variable social influence can also play a less significant role (at $p < 0.10$) on the use of ERP systems.

INTRODUCTION

It is now evident that information systems (IS) are used at all organizational levels to manage all activities of the enterprises, as much small- to medium-sized enterprises (SME) as medium- to large-sized enterprises. Further, since more than a decade, enterprise-wide IS has gradually been adopted by these two types of enterprises. Indeed, it stands that one of the most pervasive organizational change activities in the last decade or so has been the implementation of enterprise-wide information technologies (IT), such as enterprise resource planning (ERP) systems,

that account for 30 percent of all major change activities in organizations today (Davenport, 2000; Herold et al., 2007; Jarvenpaa & Stoddard, 1998; quoted in Morris & Venkatesh, 2010). Some estimates suggest that ERP adoption is as high as 75 percent among medium- to large-sized manufacturing enterprises (Meta Group, 2004; quoted in Morris & Venkatesh, 2010) and about 8 percent among SMEs (Raymond & Uwizeyemungu, 2007). In their comparative analysis of the factors affecting ERP system adoption between SMEs and large companies, Buonanno et al. (2005) showed that business complexity, as a composed factor, is a weak predictor of ERP adoption, whereas just company size turns out to be a very good one. In other words, according to these authors, enterprises seem not to be disregarding ERP systems as an answer to their business complexity. Unexpectedly, SMEs disregard financial constraints as the main cause for ERP system non-adoption, suggesting structural and organizational reasons as major ones. This pattern is partially different from what was observed in large organizations, argue Buonanno et al. (2005), while the first reason for not adopting an ERP system is organizational. On the other hand, Ranganathan and Brown (2006) found a positive relation between ERP system adoption and a favorable reaction on the part of investors. They also found support that ERP projects with greater functional scope (two or more modules) or greater physical scope (multiple sites) result in positive, higher shareholder returns when implementing an ERP system. And, the highest increases in returns (3.29%) are noted for ERP implementation with greater functional scope and greater physical scope.

But what is an ERP system? "An ERP system combines methodologies with software and hardware components to integrate numerous critical back-office functions across a company. Made up of a series of 'modules', or applications that are seamlessly linked together through a common database, an ERP system enables various departments or operating units such as Accounting and Finance, Human Resources, Production, and Fulfillment and Distribution to coordinate activities, share information, and collaborate." (Business Software, 2010, p. 2) The fact that all the modules are interconnected on a common database allows to avoid to a large extent, if not totally eliminate, dysfunctions and data redundancy and inconsistency which represent a major and extremely costly problem for the enterprises still using individual systems connected on a series of separate databases to coordinate the activities of their different functions or units.

And what are the key benefits of an ERP system? ERP systems are designed to enhance all aspects of key operations across a company's entire back-office – from planning through execution, management, and control. They accomplish this by taking processes and functions that were previously disparate and disjointed, and seamlessly integrating and coordinating them. As a result, an ERP system can: facilitate more efficient completion of day-to-day tasks; reduce the redundant and overlapping activities that waste time and money by standardizing core procedures; eliminate data silos by creating a single, centralized repository of timely, accurate business data; enable more effective resource allocation and management; reduce overhead costs; and enhance strategic planning by allowing for more accurate assessment of needs, and enabling measurement of goals versus outcomes. (Business Software, 2010)

Individual acceptance and use of new technologies has been studied extensively over the last two decades. And, as more and more organizations move from functional to process-based IT infrastructure and that ERP systems are becoming one of today's most widespread IT solutions to this movement, the research literature on ERP systems has exponentially grown in recent years. Indeed, the importance of the ERP industry to the professional IS community is further underscored by projections indicating that it will be a $47.7 billion industry by 2011 (Jacobson et al., 2007). To study acceptance and use of ERP systems by enterprises and their employees, several

models of technology adoption are used, including the Technology Acceptance Model (TAM) (Davis, 1989), its successor the TAM2 (Venkatesh & Davis, 2000), a combination of TAM2 and the model of determinants of perceived ease of use, that is TAM3 (Venkatesh & Bala, 2008), as well as the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003). But, at our knowledge, acceptance and use of ERP systems has not been yet studied in medium- to large-sized Canadian enterprises. The aim of this study is then to fill this gap in investigating the following research question: What are the influencing factors on the use of ERP systems in medium- to large-sized Canadian enterprises?

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, a literature review on the subject is presented; second, the theoretical approach which guides the study is developed; third, the methodology followed to conduct the study is described; fourth, the results of the study are reported; and the paper ends with a discussion about the findings, the theoretical and practical implications, the limitations of the study, and the future directions.

**The literature review is presented in the full paper.**

THEORETICAL APPROACH

First, this study is theoretically-based on the unified view of user acceptance of IT developed and empirically validated by Venkatesh et al. (2003), that is, UTAUT model. UTAUT model integrates eight theories of user acceptance of IT derived from the existing IS literature: the theory of reasoned action (TRA), the technology acceptance model (TAM), the motivational model, the theory of planned behavior (TPB), a model combining TAM and TPB, the model of PC (personal computer) utilization, the innovation diffusion theory (IDT), as well as the social cognitive theory (SCT). Since the development of UTAUT by Venkatesh et al. (2003), several researchers tested the model in diverse situations involving different technologies (see Table 1). In the present study, we are testing UTAUT in the context of acceptance and use of ERP systems in medium- to large-sized Canadian enterprises. The model is depicted in Figure 1.

Figure 1 shows that UTAUT model is formed of six independent variables having an influence on two dependent variables. In addition, four moderator variables might affect the direction and/or the strength of the relations between independent variables and dependent variables (Baron & Kenny, 1986). Performance expectancy, effort expectancy, social influence, facilitating conditions, self-efficacy, and anxiety are the independent variables, while behavioral intention and use behavior are the dependent variables. As for the moderator variables, they are gender, age, experience, and voluntariness of use.

On the basis of the theoretical research model depicted in Figure 1, we have formulated nine research hypotheses.

Figure 1
Theoretical Research Model
(UTAUT, adapted from Venkatesh et al., 2003, p. 447)
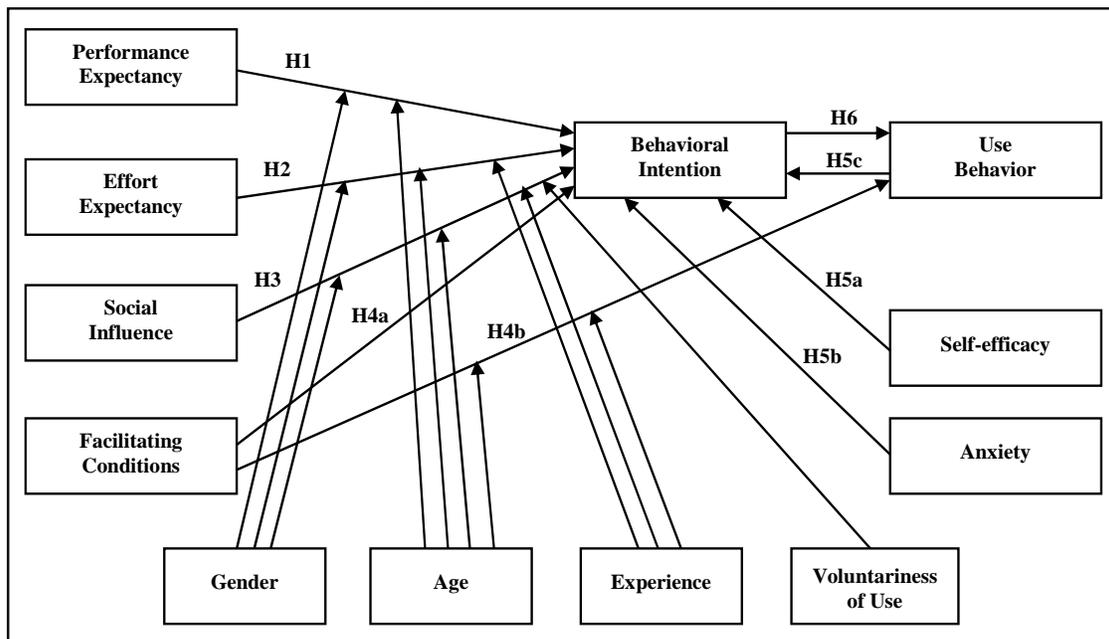
H1: The influence of performance expectancy on behavioral intention will be moderated by gender and age.

H2: The influence of effort expectancy on behavioral intention will be moderated by gender, age, and experience.

H3: The influence of social influence on behavioral intention will be moderated by gender, age, experience, and voluntariness of use.

H4a: Facilitating conditions will not have a significant influence on behavioral intention.

H4b: The influence of facilitating conditions on usage will be moderated by age and experience.

H5a: ERP system self-efficacy will not have a significant influence on behavioral intention.

H5b: ERP system anxiety will not have a significant influence on behavioral intention.

H5c: Attitude toward using technology will not have a significant influence on behavioral intention.

H6: Behavioral intention will have a significant positive influence on usage.

In the next section of the paper, the methodology followed to conduct the study is described

METHODOLOGY

The study was designed to gather information concerning adoption and use of ERP systems by middle managers and end-users in medium- to large-sized Canadian enterprises. Indeed, the focus of this study is on middle managers and end-users. We conducted this study using the questionnaire mailed with prepaid return envelope in medium- to large-sized Canadian

enterprises. In this section, we describe the sample and data collection of the study. The instrument development and validation, and the data analysis process are described in the full paper.

Sample and Data Collection

First, in this study, we chose to survey middle managers and end-users using an ERP system in medium- to large-sized Canadian enterprises. To do this, the directors of about ten medium- to large-sized enterprises from all the Canadian territory were contacted to participate in the study involving their usage of an ERP system. In fact, the first step was to select medium- to large-sized enterprises in Canada. And the second step was to contact the directors of these enterprises by e-mail and/or by telephone in order to get their agreement to participate in our study. During this second step, the objective of the study was presented to each director and we were verifying whether his/her enterprise was managed using an ERP system. In the case where the enterprise had not an ERP system, the director was thanked and the enterprise was retired from our list (a list of medium- to large-sized Canadian enterprises taken on the Web). Some enterprises having an ERP system have not participated in the study either because the director was lacking time or because the enterprise had a strict politic about the confidentiality of its activities. Once the director was giving us his/her agreement to participate in the study, we were sincerely thanking him/her and we were asking him/her to find someone (sometimes himself/herself) who could personally take the study in hand in the enterprise. This responsible-person had to receive the questionnaires from us and to distribute them to middle managers and end-users using the ERP system in the enterprise. The number of questionnaires sent was depending on both the size of the enterprise and the number fixed by the director contacted. Prepaid return envelopes were also provided to the responsible-person who was distributing the questionnaires to middle managers and end-users of the ERP system. Overall, six medium- to large-sized enterprise's directors from three Canadian regions (e.g., New Brunswick, Nova Scotia, and Manitoba) agreed to participate in the study.

In the whole, over one hundred questionnaires were mailed to the six enterprises having agreed to participate in the study, and that, in two versions, that is, French and English. More specifically, we posted 126 questionnaires to the responsible-persons in the medium- to large-sized Canadian enterprises having agreed to participate in our study. Only two enterprises returned few completed questionnaires. We think that middle managers and end-users in these two enterprises had too much work to complete the questionnaire and then neglected answering it. But, the response rate, in general, was excellent. In brief, we got a response rate of 57.1%. Of the 72 middle managers and end-users that have answered our questionnaire, only one questionnaire has been withdrawn given too much information was lacking. Thus, the final response rate is 56.3%. Considering that, in general, the response rates of such studies involving mailed questionnaires including prepaid return envelopes are varying between 10% and 25%, the response rate of 56.3% that we got in this study is really exceptional.

The results of the study are reported and discussed in the full paper.

References are available upon request.

PREDICTING INFORMATION TECHNOLOGY ADOPTION IN SMALL BUSINESSES: AN EXTENSION OF THE TECHNOLOGY ACCEPTANCE MODEL

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ABSTRACT

Studies that examine information technology (IT) adoption in small businesses are relatively scarce. Of those studies, a few have used the Technology Acceptance Model (TAM) to predict IT adoption in a small businesses environment. Even so, the TAM still fails to explain much of the variance in computer usage. The mental model literature suggests that providing users with a diagram of how a particular technology works may be an enhancement over the current version of the TAM. In the current paper, a revised model that incorporates mental models is empirically tested. Future research aspirations are also discussed.

SMALL AND MEDIUM SIZED ENTERPRISES' E-COMMERCE ADOPTION MODEL IN VIETNAM

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ABSTRACT

There has thus far been little research exploring the adoption and utilization of e-commerce in SMEs (Grandon & Pearson, 2004). This study has, based on an extensive review of literature on relevant theories on adoption of an innovation, proposed a success model for e-commerce adoption in Vietnamese SMEs. Finally, future research is discussed.

INTRODUCTION

Vietnam is still a developing economy; however, it has utilized the Internet since mid-1990s. Nowadays with the development of IT (information technology) infrastructure, Vietnam has been becoming a country with its high percentage of the Internet usage in South East Asia. The rapid development of communication and information technologies throughout the world generates motivations for the Vietnamese government to make more informed decisions about IT investments. Since 2000, the government has constructed many programs of information and communication development to facilitate more IT investments in Vietnamese organizations. Such programs are aimed at aiding Vietnamese small and medium sized enterprises (SMEs) to be more aware of IT improvements in general and e-commerce in particular. It is strongly believed that doing business internationally, entering into new markets and customers domestically and internationally, and realizing numerous advantages of utilizing the Internet for all business processes have been making significant contributions to the advent of e-commerce in Vietnam. Furthermore, because of regional strategic importance of Vietnam in South East Asia, utilizing e-commerce is expected to bring about opportunities for Vietnamese SMEs to reap more benefits via the world's business globalization process. Hence, it is very urgent to build a success model for e-commerce adoption consisting of important factors that are very likely to have impacts on Vietnamese SMEs' e-commerce adoption. Thus, the objective of this study is to construct such a success model through a comprehensive relevant literature review regarding adoption of an innovation.

MODEL CONSTRUCTION

Using the combination of two theories DIT (Diffusion of Innovation Theory) and TAM (Technology Acceptance Model), through reviewing a substantial amount of research on other IT adoption models, Grandon & Pearson (2004) identified organizational readiness, compatibility, external pressure, perceived ease of use and perceived usefulness as the most important factors affecting e-commerce adoption in SMEs. Due to the fact that this research is using Grandon & Pearson's model, thus the variables of their model are discussed in the following.

Organizational readiness: Organizational readiness was assessed by including two items about the financial and technological resources that the company may have available as well as factors dealing with the compatibility and consistency of e-commerce with firm's culture, values, and preferred work practices (existing technology infrastructure; and top management's enthusiasm to adopt e-commerce) (Grandon & Pearson, 2004). Financial readiness refers to financial resources available for IT to pay for installation costs, implementation of any subsequent enhancements, and ongoing expenses during usage (such as communication charges, usage fees, etc.). Technological readiness is concerned with the level of sophistication of IT usage and IT management in an organization (Iacovou et al., 1995). IT sophistication (Pare & Raymond, 1991) captures not only the level of technological expertise within the organization, but also assesses the level of management understanding of and support for using IT to achieve organizational objectives.

This factor was considered because small firms tend to lack the resources that are necessary for IT investments (Bouchard, 1993). Such items were found relevant in other researches as well (Thong, 2001).

External pressure: External pressure to adopt refers to influences from the organizational environment (Iacovou et al., 1995). External pressure was assessed by incorporating five items: competition, dependency on other firms already using e-commerce, the industry, social factors, and the government (Grandon & Pearson, 2004) as it said that another pressing and practical reason for small businesses to adopt IT comes from government policies (Kuan & Chau, 2001). Also the two main sources of external pressure that includes the concept of competition and the industry are competitive pressure, and more importantly, imposition by trading partners (Iacovou et al., 1995). Competitive pressure refers to the level of IT capability of the firm's industry and, most importantly, to that of its competitors. As more competitors and trading partners become IT-capable, small firms are more inclined to adopt IT in order to maintain their own competitive position. Small businesses are extremely susceptible to impositions by their large partners (Saunders & Hart, 1993). Such impositions are especially prevalent in case of EDI, Internet or e-commerce because of its network nature (Iacovou etal., 1995).

Perceived ease of use & perceived usefulness: They considered a subset of Davis's instrument to measure perceived ease of use and utilized the six items for perceived usefulness as modified to make them relevant to e-commerce (Davis, 1989). According to Davis, perceived ease of use could be measured by identifying how IT is: easy to learn, controllable, clear & understandable, flexible, easy to become skillful in and easy to use. Perceived usefulness can be measured by investigating the impact of IT on job performance, speed of work, increased productivity, effectiveness, make job easier and useful.

Besides these above constructs, Grandon & Pearson (2004) discussed one more factor that is compatibility. In their study, Grandon & Pearson (2004) found that the enthusiasm of top management, compatibility with the company's work environment, perceived advantage from e-commerce, and knowledge of the company's employees about computers were significant factors that differentiated between adopters and non-adopters of e-commerce.

In addition, it should be noted that understanding IT's business value is a vitally important issue in today's technology-intensive world, and there is a need to establish a method that appropriately represent IT's value in a business context (Lee, 2001). Few studies have focused on the perceptions of organization members regarding the strategic value of e-commerce. Diffusion of Innovation theory suggests that individuals or decision makers within an organization will evaluate an innovation's characteristics (relative advantage, compatibility,

complexity, trialability, and observability) and their perceptions of these characteristics will determine whether that individual or organization will adopt this innovation (Fichman, 2000). On the other words, the purpose of perception is economy of thinking. It picks out and establishes what is important to the organization for its survival and welfare. Perceptions also influence attitudes, behavioral intentions, and the actual behavior of individuals (Davis et al., 1989). In the case of an organization, strategic value can be determined by a summation of perceived benefits minus a summation of perceived costs over a period of time. The benefits frequently attributed to an e-commerce implementation include increased number of transactions, new customers, better service to key customers, and increased profit and market share. Costs associated with an e-commerce implementation include cost of hardware, software, development and possible loss of customer goodwill. (Sutanonpaiboon & Pearson, 2006).

Based on an extensive literature review, Grandon & Pearson's model will be adapted by adding trust that is strongly believed to have positive impacts on both perceived of strategic value and adoption of e-commerce. Rotter's (1967) definition of trust has been cited by Zineldin & Jonsson (2001) - "Trust refers to an individual or an organization's generalized expectancy that another individual or organization's words can be reliable". It should be noted that such a definition shares many common aspects with the definition developed by Morgan & Hunt (1994). Specifically, Morgan & Hunt (1994) define trust as a measure of an individual's confidence in another individual's reliability and integrity.

Under the view of Blois (1998), trust is also defined as an acceptance of vulnerability to another individual's words or possible actions. In addition, a number of other explanations and definitions of trust have been thoroughly analyzed by Morgan & Hunt (1994). For instance, according to Berry, trust is viewed as an important antecedent to loyalty; trust is emphasized by Schurr & Ozanne as an important factor to deal with mutual problems and develop conversations in a constructive manner; and in Spekman's opinion, trust is regarded as the foundation for the development of strategic partnership.

It should be noted that in e-settings, people from almost everywhere in the world are easily to get access to documents stored on computers and in the same vein, information is easily to be transferred through e-technologies with computer networks. That is why under the security perspective, e-commerce is considered as being risky. In addition, e-commerce is characterized by highly uncertain transactions due to the fact that people who make e-transactions very often come from different places in the world (Clarke, 1997). Thus, trust plays an important role in e-commerce and is strongly believed to have strong impacts on the development of e-commerce.

Besides trust, perceived risk is strongly believed to have significant impacts on e-commerce adoption (Wilson, Daniel & Davies, 2008). Thus, the proposed model is given as follows:

Figure 1. A Model for E-commerce Adoption in Vietnamese SOEs
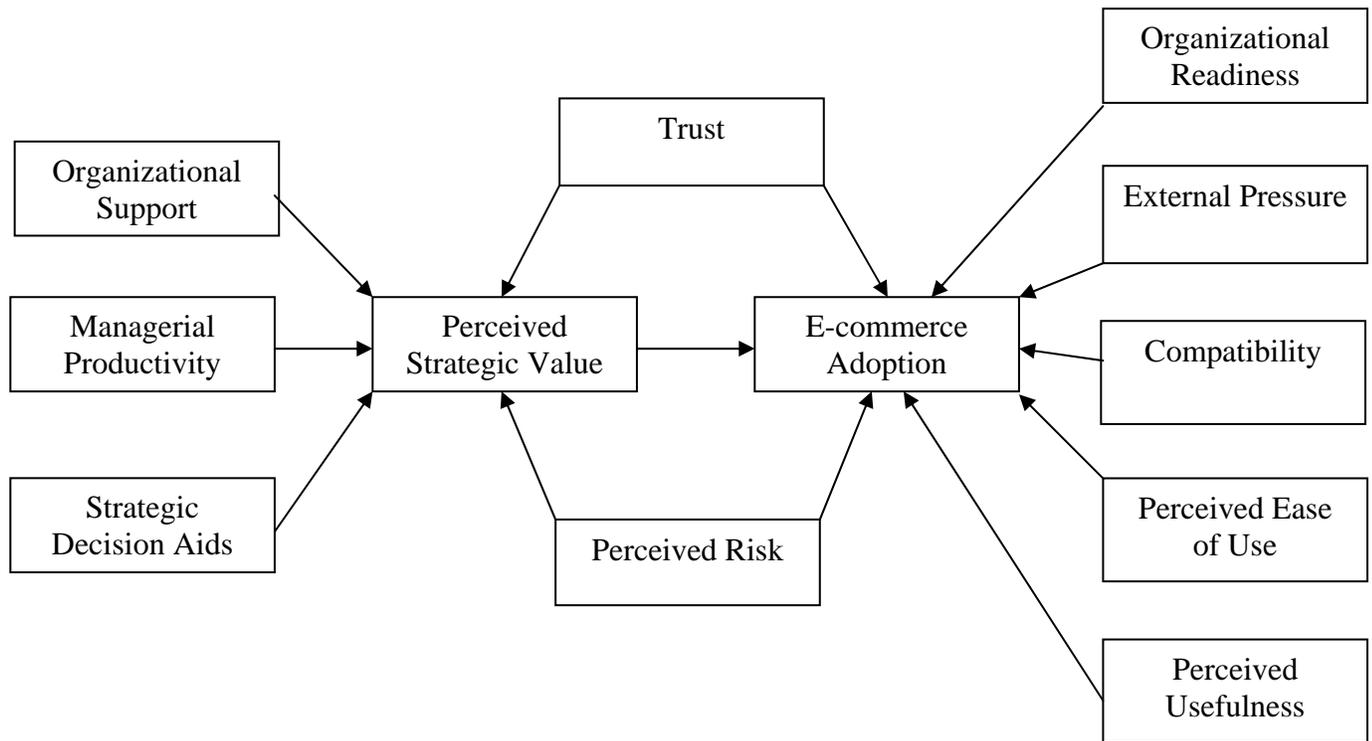
CONCLUSION

There has thus far been little research exploring the adoption and utilization of e-commerce in small and medium sized enterprises (SMEs) (Grandon & Pearson, 2004). Nobody can deny the fact that SMEs play an important role in both developed and developing economies. It should be noted that various potential advantages can be created by e-commerce, but surprisingly SMEs' adoption of e-commerce has still been limited perhaps due to the fact that SMEs have different characteristics from large enterprises. Under the opinion of Seyal & Rahman (2003), distinct characteristics imbedded in SMEs consist of small management teams, strong owner influence, lack of staff in specialized areas such as information technology, multi-functional management, limited control over their business environment, limited market share, low employee turnover, a reluctance to take risks, and avoidance of sophisticated software or applications. Such characteristics lead SMEs to be very slow with respect to technology adoption and have more difficulties in taking advantage of benefits from the technologies than large enterprises (Poon & Swatman, 1999).

Vietnam is still a developing economy; however, it has utilized the Internet since mid-1990s. Nowadays with the development of IT infrastructure, Vietnam has been becoming a country with its high percentage of the Internet usage in South East Asia. The rapid development of communication and information technologies throughout the world generates motivations for the Vietnamese government to make more informed decisions about IT investments. Since 2000, the government has constructed many programs on information and communication development to facilitate more IT investments in Vietnamese organizations. Such programs are aimed at aiding Vietnamese SMEs to be more aware of IT improvements in general and e-commerce in

particular. It is strongly believed that doing business internationally, entering into new markets and customers domestically and internationally and realizing numerous advantages of utilizing the Internet for all business processes have been making significant contributions to the advent of e-commerce in Vietnam. Furthermore, because of regional strategic importance of Vietnam in South East Asia, utilizing e-commerce is expected to bring about opportunities for Vietnamese SMEs to reap more benefits via the world's business globalization process. Hence, it is very urgent to build a success model for e-commerce adoption consisting of important factors that are very likely to have impacts on Vietnamese SMEs' e-commerce adoption.

This study has, based on an extensive review of literature on relevant theories on adoption of an innovation, proposed a success model for e-commerce adoption in Vietnamese SMEs. The next step in the development of this model is to specify the model hypotheses and statistically test such hypotheses in the context of Vietnamese SMEs. Each of the factors identified in the previous discussion will form the basis for analysis in the empirical study of e-commerce adoption in such a new context. The model presented in this paper is unique as at present, there is no comprehensive theoretical and practical model for analyzing e-commerce adoption in the context of Vietnamese SMEs. None of the prior models have taken into account the interactions between innovation theories, trust, perceived risk, and the TOE framework to investigate e-commerce adoption. This model can provide an impetus for future research, structuring it along the lines of interactions between such above theories and factors that will expand the frontiers of knowledge in e-commerce adoption.

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GENETIC ALGORITHM FOR MULTI-FACTOR USER INTERFACE COMPONENT LAYOUT PROBLEM

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ABSTRACT

In this paper, genetic search technique is used to obtain the near optimal layout from the population of initial layouts of the multi-factor user interface components layout problem for the example task under consideration. The resulting layouts are compared with that of the improvement procedure for the reported case under consideration.

INTRODUCTION

Within the computer science, there is a growing awareness of the need for great attention to human factors issues. The business cases for human factors in computer and information systems are strong as demonstrated by many successful products whose advantage lay in their superior user interface. There is one-to-one relationship between the facilities layout problem in a manufacturing plant and the user interface components layout problem in human-computer interface design (Peer et al., 2004). The quadratic assignment problem (QAP) formulation for assigning 'n' facilities to 'n' mutually exclusive locations is the most typical model used in manufacturing or interactive service systems.

A classical QAP is formulated handling qualitative (subjective) factors and quantitative (objective) factors to obtain the layouts, using construction procedure. Then the search techniques such as simulated annealing, ant colony optimization technique, genetic algorithm etc. are used to obtain the best layouts. In this paper, genetic search technique is used to obtain the best layout from the population of the initial layouts of the multi-factor user interface components layout problem for the example task under consideration as given in Peer et al. (2003). Then the final layouts are compared with that of the improvement procedure for the reported case under consideration.

GENETIC SEARCH TECHNIQUE

Genetic search technique starts with a set of solutions called population. The solutions of this population are used to form a new population with better solution based on their fitness. This procedure is repeated until the conditions for improvement of best solution are satisfied. The members in population may be represented by string bits, arrays, trees, lists or any other valid data structure form. In order to make use of the fundamental theorem of genetic algorithms, the data structure of string bits representing the member of population is used (Conway & Venkataramanan, 1994).

Reproduction operator is used to select chromosomes or parent from population. The various methods are used to select parent chromosomes, such as roulette wheel selection, Boltzmann selection, Tournament selection, Rank selection, and steady-state selection Reproduction makes clones of good strings, but does not create new ones.

Then, crossover operator is applied to the mating pool to create better string by preserving the information of parent strings. Crossover proceeds in three steps. First, the reproduction operator selects a random pair of two individual strings for mating, then a cross-site is selected at random along the string length and the position values are swapped between two strings. The crossover rate is the probability of cross over (p_c), which varies from 0 to 1. If good strings are not created by crossover, they will not survive too long, because reproduction will select against those strings in subsequence generations. When the crossover probability is p_c, their $100p_c$ percent strings in the population are used in the crossover operation.

Finally, mutation is used to modify errors in strings caused in the previous operations. The mutation operator introduces new genetic structure in the population randomly modifying some of its building blocks. The bit-wise mutation is performed bit-by-bit by flipping a coin with a probability of p_m. A number between 0 and 1 is chosen at random. If the random number is smaller than p_m, then the outcome of coin slipping is true, otherwise the outcome is false. If at any bit, the outcome in truce then the bit is altered, otherwise the bit is kept unchanged. The bits of the strings are independently muted. That is, the mutation of bit does not affect the probability of mutation of other bits. Mutation rate is the probability of mutation (p_m), which is used to calculate number of bits to be muted.

LAYOUTS OF USER INTERFACE COMPONENTS

In this section, genetic search technique is used to improve the solution of layouts obtained with the construction procedure for the multi-factor user interface components layout problem using the peer and Sharma (2005) model. The combined qualitative factor (R_{ik}), combined quantitative factor (F_{ik}), composite factor ($A_{ik}=W_1 R_{ik}+W_2 F_{ik}$) obtained for $W_1 = 0.2$ and $W_2=0.8$ and the distances (d_{jl}) between locating j and l are given as shown in the Figure 1, for the example task presented in Sharma, Peer and Alade (2003).

Figure 1: Combined qualitative factor (R_{ik}), combined quantitative factor (F_{ik}), composite factor (A_{ik}) for $W_1 = 0.2$ and $W_2 =0.8$ and distances (d_{jk})

$R_{ik}=$

	1	2	3	4	5	6
1	-	0.033	0.024	0.035	0.028	0.038
2	0.033	-	0.038	0.025	0.019	0.045
3	0.024	0.038	-	0.035	0.019	0.046
4	0.035	0.025	0.035	-	0.042	0.046
5	0.028	0.019	0.019	0.042	-	0.035
6	0.038	0.045	0.041	0.046	0.035	-

$F_{ik}=$

	1	2	3	4	5	6
1	-	0.038	0.016	0.037	0.033	0.035
2	0.038	-	0.029	0.027	0.048	0.032
3	0.016	0.029	-	0.031	0.033	0.028
4	0.037	0.027	0.031	-	0.029	0.40
5	0.033	0.048	0.33	0.029	-	0.38
6	0.035	0.032	0.028	0.040	0.38	-

$A_{ik}=$

	1	2	3	4	5	6
1	-	0.037	0.018	0.037	0.032	0.036
2	0.037	-	0.031	0.027	0.042	0.035
3	0.018	0.031	-	0.032	0.030	0.032
4	0.037	0.027	0.032	-	0.032	0.041
5	0.032	0.042	0.030	0.032	-	0.037
6	0.036	0.035	0.032	0.041	0.037	-

$d_{jl}=$

	1	2	3	4	5	6
1	--	3	6	3	5	7
2	3	--	3	5	3	5
3	6	3	--	8	6	3
4	3	5	8	--	3	6
5	5	3	6	3	--	3
6	7	5	3	6	3	--

A sample of 10 layouts and their scores obtained using construction procedure are given as shown in Figure 2.

Figure 2: Layouts and Scores obtained with construction procedure for the user interface components layout problem.

Layouts			**Scores**		**Layouts**			**Scores**
2	3	6	2.319		4	3	5	2.353
1	4	5			2	6	1	
5	3	2	2.326		1	3	2	2.352
4	1	6			5	4	6	
5	6	4	2.342		2	4	1	2.329
1	3	2			6	3	5	
6	1	5	2.365		5	4	3	2.354
2	3	4			1	6	2	
6	3	2	2.441		2	6	5	2.321
5	1	4			4	3	1	

In order to apply the fundamental theorem of genetic algorithm, the data structure (string) representing the member of the population is defined because of the following reasons (Conway & Venkataramanan, 1994). (1) The objective value of the feasible objective function can easily be calculated for the string chosen to crossbreed. (2) The first period layout is related to the second period layout by way of changeover cost and within by layout quality. That is, any element of the string is related only to its immediate layout and the two surrounding layouts. (3) Schema, or sub-strings, which are short, low order, and have an average fitness will be expected to survive.

Let the string representing the member of the population P is m, n is the number of components. Then $P = a_{11} \ a_{21} \ a_{31} \ \ldots. \ a_{n1} \ b_{12.} \ b_{22} \ldots. \ b_{n2} \ \ldots.. \ P_{1n.} \ P_{2n} \ldots..P_{nn}$ where a_{j1} is the component number in the location j of population number 1, b_{j2} is the component number in location j of population number 2 and P_{jm} is the component number in location j of population number m. The strings are separated by one place leaving the schema (sub-string) together. For n=4, m=3, P=2413 4132 3214 is interpreted as component 2 is in location 1 in the population number 1 and so on.

The population size of 10 layouts of user interface components layouts with 6 components as shown in Figure 2 is considered for the application of GA search technique to obtain the final layout. Each layout of 6 components is represented as a string of 6 decimal digits as follows.

236145	532416	432516	346125	156324
526134	256143	641235	132645	351462

Reproduction operator is used on population to select the chromosomes for parents to crossover. It is performed with Roulette wheel selection method (Rajasekaran & Pai, 2005) to

choose the strings of feasible solution as chromosomes. Thus, the pair of strings is selected from the population according to the distribution of the relative strength of the strings to the entire strength of the population. Then, a cross-site is selected at random along string length and the strings are split as follows.

| 236145 | 532416 | 432\|516 | 346125 | 156324 |
| 526134 | 256143 | 641\|235 | 132645 | 351462 |

Next, the sub-strings to the visit of cross-site are swapped as follows.

| 236145 | 532416 | 432 ab5 | 132645 | 351462 |
| 526134 | 256143 | c4d 516 | 346125 | 156324 |

Since the cross-site selected for split of the string is the middle of a single period layout, the stronger of the two strings regains the partial layout and the weaker fills in the unassigned component positions, which correspond and are feasible (Conway & Venkataramanan, 1994). Remaining positions are filled by unassigned components which correspond to their neighboring feasible layouts and then by randomly. Hence, the 'a' becomes a 6 because the period has a 6 in the fourth position, which forces the 'b' to become a 1. The 4 is carried from weaker string to get feasible solution. Similarly, the 'c' becomes 3 because the period has a 3 in the first position, which forces the 'd' to become 2 and resulting strings of the population are obtained as follows.

| 236145 | 532416 | 432615 | 132645 | 351462 |
| 526134 | 256143 | 342516 | 346125 | 156324 |

Decimal digits are used to represent the strings in population and hence, the use of mutation operation does not guarantee the feasible solution. Finally, the scores of the layouts in the population are computed and compared with the least initial score of the layout, in order to determine the improved layout after the first generation. The genetic search technique is repeated for 50 generations and the score of the final layout is obtained as follows.

| 6 | 4 | 3 |
| 1 | 5 | 2 |

=2.252

The percentage of improvement over the least initial layout score of construction procedure is computed as shown in Figure 3.

Figure 3: Percentage of improvement with genetic search technique over construction procedure for $W_1 = 0.2$ and $W_2 = 0.8$

Construct procedure		Genetic Search technique		% improvement
Layout	Score	Layout	Score	
5 3 2 / 4 1 6	2.316	6 4 3 / 1 5 2	2.252	2.8

The genetic search technique is used to obtain the best layout for the populations of construction procedure for different combinations of weights and compared as given in Table.

From the results, it is observed that the solution obtained with genetic search technique is improved by an average 3.92 percent whereas the same is improved by an average 2.30 percent with improvement procedure.

RESULTS

In this paper, genetic search technique is used to obtain the best final layouts from the initial population of construction procedure for the user interface components layout problem of 2 by 3 as given in Sharma, Peer and Alade (2003). For each combination of weights W_1 and W_2, the population size of 10 layouts is obtained with construction procedure. The generic search technique is used for 50 generations to obtain the best layout. The layout obtained with each generation is compared with that of the least score layout obtained with the construction procedure. The score of the final layout obtained with genetic search technique is compared with the least score layout of construct procedure for all the combinations of weights W_1 and W_2 assigned to combined qualitative factor and combined quantitative factor. It is observed form the results that the solution obtained with genetic search technique is improved by an average 3.92 percent, whereas the same is improved by an average 2.30 percent with improvement procedure.

CONCLUSION

Genetic Algorithm is used efficiently to evolve the population of initial solutions into near optimal solution, once the data structure of solution is chosen so that the fundamental theorem of genetic algorithm can be applied. The structure of genetic algorithm is exploited to use it in parallel processing. This technique is found to be best suited to evaluate the obtained solution from the initial population of solutions, and hence the best solution is guaranteed compared to the heuristic procedure such as improvement procedure of the layout problems that uses one solution to improve it further.

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