INFORMATION SYSTEMS SUCCESS AND TECHNOLOGY ACCEPTANCE WITHIN A GOVERNMENT ORGANIZATION

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Numerous models of IS success and technology acceptance their extensions have been proposed and applied in empirical. This study continues this tradition and extends the body of knowledge on the topic of IS success by developing a more comprehensive model for measuring IS success and technology acceptance within a government organization. The proposed model builds upon three established IS success and technology acceptance frameworks namely the DeLone and McLean (2003), Venkatesh et al.'s (2003) unified theory of acceptance and use of technology (UTAUT), and Wixom and Todd (2005).

The findings from this study provide not only a comprehensive IS success assessment model but also insights into whether and how IS success models are influenced by application variables as applied within a government organization.

Exploratory factor analysis and confirmatory factor analysis were performed for instrument refinement and validity test of the existing and proposed models. Using data from employees of a local government municipal, the comprehensive model explained 32 percent variance. Four of the hypothesis were fully supported five were not supported, and four were partially supported. In addition, the results suggest that behavioral intention may not be the best predictor of technology acceptance in a mandatory environment.

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CHAPTER 1

INTRODUCTION

Overview

Organizations are investing heavily in information systems (IS) as they seek to remain competitive and survive in the market place. Seddon, et al. (1999) estimate that worldwide expenditure in information technology (IT) is in excess of one trillion dollars per year and continues to grow at a rate of approximately 10 percent annually. Even with such large investments, many information systems still result in failure. As organizations seek to achieve return on investments from IS, they must assess and understand what factors lead to the success of IS applications (Lassila and Brancheau, 1999).

Numerous models of IS success and their extensions have been proposed and applied in empirical studies that identify those factors that affect IS success. The two major sources of measuring IS success are the user satisfaction and the technology acceptance literature (Wixom and Todd, 2005). This study continues this tradition and extends the body of knowledge on the topic of IS success by developing a more comprehensive model for measuring IS success and technology acceptance within a government organization. The proposed model builds upon existing models such as DeLone and McLean (2003), Venkatesh, et al. (2003) Unified Theory of Acceptance and Use of Technology (UTAUT), and Wixom and Todd (2005).

This study makes a unique contribution because it proposes a new model which measures technology acceptance and IS success in a government setting. Government organizations have also been investing heavily in IT related projects but many of these

projects fail. Governments want to ensure that they are reaping the benefits of these technologies. In 2006, U. S. Federal government spent $65 billion on 1,087 IT projects (Gartner, 2006). With such large investments, government wants to ensure that the end users are effectively utilizing those technologies.

Many government projects are failing for various reasons. These include unclear business cases, misaligned accountability and incentive structure, insufficient management or technical expertise by external service providers, poor project management discipline, inadequate performance management practices and tracking systems, ineffective governance, and uncertain budget environments (Gartner, 2006).

Another notable contribution of this study is that we tested the research model for the entire set of IS applications used by employees of a municipal government. Most studies on IS success in the past did not consider differences in applications. Assessment of IS success cannot be fully and accurately accounted for without understanding the nature of the application. This is because the application is related to the functions and features it serves; who (and how many) uses it; who sponsors, owns and manages it; and whether the use is mandatory or optional. An instrument was developed to assess all the constructs of IS success along with those variables that capture differences among applications. The findings from this study provide not only a comprehensive IS success assessment model but also insights into whether and how IS success models are influenced by application variables as applied within a government organization.

Statement of the Problem

Assessing the success of information systems remains a challenging task for IS researchers as well as practitioners. Companies invest heavily in information systems and they want to ensure that they are getting a desired return on their investment. Numerous studies were conducted to assess IS success (DeLone and Mclean, 2003; Seddon and Kiew, 1994; Venkatesh, et al., 2003; Davis, et al., 1989; Taylor and Todd, 1995a; Wixom and Watson, 2001; Wixom and Todd, 2005). This study continues this stream of research by creating a more comprehensive framework to measure IS success.

The purpose of the study is to examine three established IS success assessment frameworks and propose a new framework by integrating these frameworks to provide a more holistic view of IS success. The survey instrument is created based on the measures from DeLone and McLean's (2003) Updated IS Success model; Venkatesh, et al. (2003) model and the Wixom and Todd (2005) model.

Exploratory factor analysis and confirmatory factor analysis were performed for instrument refinement and validity test of the existing and proposed models. The goal of the study is to ensure that employees are satisfied with the technology which would allow the organization to maximize the benefits from investment in IT.

The study seeks to answer these following research questions:

1. Is the UTAUT model valid and reliable?
2. Is the DeLone and McLean's Updated IS model valid and reliable?
3. Is the Wixom and Todd's model valid and reliable?
4. Is the proposed model more effective in measuring IS success?
5. Does IS acceptance contribute to organization performance?

6. What are the relationships among the constructs in the model?

Outline of the Dissertation

This dissertation is organized into six chapters. Chapter 1 provides an introduction of the research problem, the level of analysis, and the significance and the scope of the study. Chapter 2 provides a literature review. Chapter 3 provides a summary of the research methodology and the development of the instrument. Chapter 4 provides the descriptive analysis of the survey data. Chapter 5 provides the results of data analysis and the discussion of the findings. Chapter 6 summarizes the research effort and provides suggestions for future research.

CHAPTER 2

LITERATURE REVIEW

This chapter provides an overview of the pertinent literature for the study. This literature review provides support for the development of the research model proposed. The review provides information on the DeLone and McLean updated model (2003), the Wixom and Todd model (2005) and Venkatesh, et al. UTAUT model (2003).

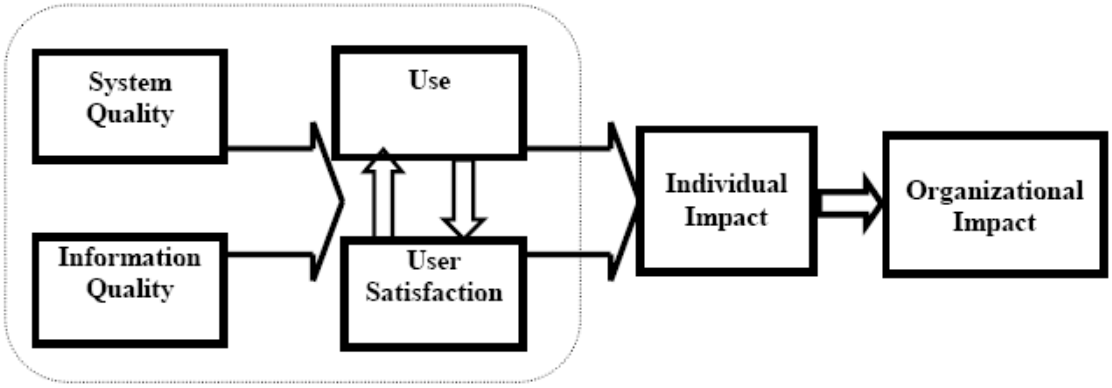
DeLone and McLean Updated IS Model

The DeLone and McLean model (1992) is one of the most cited models used to measure IS success. The main purpose of the original model was to synthesize IS success and create a comprehensive taxonomy for evaluating the factors that influence IS success. These factors were information quality, system quality, use, user satisfaction, individual impact and organizational impact. System quality refers to the quality of the performance of the system. Information quality refers to the quality of the output of the information system. Use refers to how well the outputs of the information system are used. User satisfaction refers to the users' overall approval/disapproval of the information system. Individual impact refers to the effects of the outputs of IS systems on individual users' behaviors. Organizational impact refers to the effects of the system's output on the organization. This model proposes that information quality and system quality have an effect on use and user satisfaction.

Use and user satisfaction affect each other. Use and user satisfaction have an influence on individual impact which in turn affects organizational impact. The original DeLone and McLean model of 1992 is shown in Figure 1 below.

Figure 1

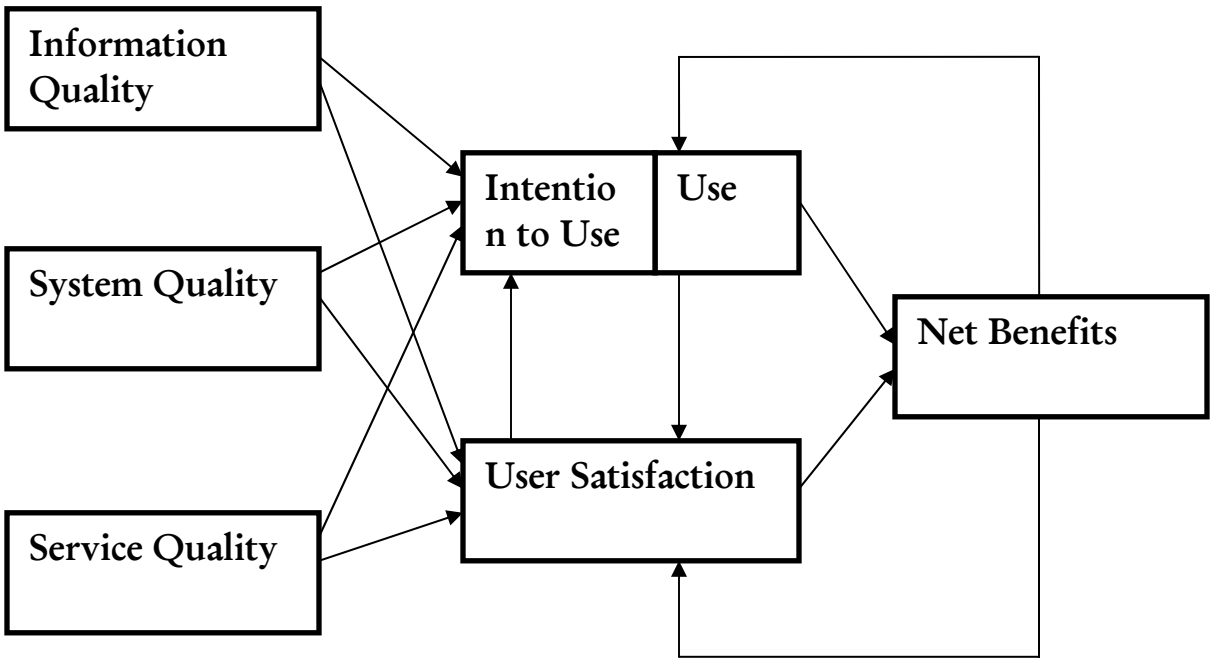
DeLone and McLean's Model of IS success (Source: DeLone and McLean 1992, p. 87)



In 2003, DeLone and McLean re-examined the original IS success model. In the updated model, DeLone and McLean addressed the strengths and weaknesses of the original model and revised it. The various impacts such as customer impact, societal impact and inter-organizational and industry impact, were grouped together as "net benefits" in order to simplify the model. The proliferation of e-commerce highlighted the importance of service as an important facet of IS success. Therefore, service quality was also included in the model. The use factor was subdivided into intention to use and use components. This alleviated some of the prior contention in the IS literature between intention to use as an attitude and actual use as a resultant behavior. The updated model is shown in Figure 2 below.

Figure 2

DeLone and McLean's (2003) Updated Model of IS success



Although many studies have cited the DeLone and McLean IS Success Model, few have tested the original model, and even fewer studies have empirically tested the updated DeLone and McLean IS Success Model. One exceptional study is by Liu, et al. (2005). They empirically tested the updated DeLone and McLean Model in knowledge management systems and found partial support for the model. The covariance between system quality, information quality and service quality were confirmed; the relationship between perceived benefit (intention to use), use and net benefits was supported. However, the relationship between system quality and perceived benefits was not supported. There is a need to do more research to empirically test the updated DeLone and McLean Model.

Components of the DeLone and McLean Model

Use

Use is defined as the utilization of an IT application by individuals, groups or organizations (Straub, et al.,1995; Kim and Malhotra, 2005). DeLone and McLean (1992) assert that information system use is one of the most widely used measures of IS success. In fact, Straub, et al. (1995) conclude that IS use is "a core variable in IS research" (p. 1328). It is implied that if a system is used, it is useful which further means that it is successful (Seddon and Kiew, 1994). On the other hand, non-use does not infer that the system is useless; it may just suggest that there are other more pertinent things to be considered (Seddon and Kiew, 1994). However, when an IS application is not used or underutilized, it is likely that the system does not meet its objective even if works properly. Use, usage and utilization are sometimes used interchangeably. For example, Adams, et al. (1992) define usage as the actual use of the system whereas Staples and Seddon (2004) define utilization as the use of the system. Bhattacherjee and Premkumar (2004) also suggest that initial IT usage is called acceptance and long-term IT usage is called continuance. Use is measured using a subjective self-reported method or an objective computer recorded approach (Straub, et al., 1995). The level of IS use is often quantitatively assessed using such measures as the frequency of use and the number of features used (Lassila and Brancheau, 1999).

There has been a great deal of controversy over the concept of use in IS research. Some researchers contend that use should not be used as an IS success measure (Seddon and Kiew, 1994; Staples and Seddon, 2004). They argue that use is a pertinent

measure of IS success only when the use of the IS is voluntary. When usage is mandatory or the system has not been used during the duration of the study, the frequency of using the system does not provide any significance about system usefulness and success. Therefore, when use is mandatory, usefulness should be a measure of IS success and not use (Seddon and Kiew, 1994).

DeLone and McLean (2003) do not agree with the above contention and conclude that IS use should be retained as an IS success measure. They claim that even in mandatory settings, there may be "variability in the quality and intensity of the use" which would influence the benefits realized from the system (p. 16). They further claim that no system is fully mandatory. This is because although initially the use of the system may be required, the continued use of the system is voluntary since management has the option of discontinuing the system if it is not realizing its objectives. In addition, use of e-commerce systems which is becoming prevalent today is largely voluntary (DeLone and McLean, 2003).

Nevertheless, DeLone and McLean (2003) do support some of the arguments made against the use component. They also support that measuring use in terms of frequency of use, time used, and the number of access does not fully capture the utilization of the system and its impact on expected results. However, these measures are good indicators of the return on investment of the system. Declining usage for example would imply that the company is not achieving the anticipated benefit of the system.

User Satisfaction

User satisfaction is one of the key components of IS success. User Satisfaction is defined in numerous ways. Seddon and Kiew (1994) define user satisfaction as the net feeling of pleasure or displeasure that results from aggregating all the benefits that a person hopes to receive from interaction with the information system (p. 103). Doll and Torkzadeh (1988) define user satisfaction as "the affective attitude towards a specific computer application by someone who interacts with the application directly" (p. 261).

Each user has his or her own preconceived expectations of the benefits for the information system. The user's level of satisfaction is based on the extent to which the system meets or fails to meet each of these expectations (Seddon and Kiew, 1994). Various instruments have been developed to measure user satisfaction (Bailey and Pearson, 1983; Igbaria, et al., 1997; Saarinen, 1996; Shirani, et al., 1994; Thong and Yap, 1996). There is continuous discussion as to which instrument would be best to measure satisfaction (DeLone and McLean, 2003).

Service Quality

DeLone and McLean (2003) added service quality as a new component for measuring IS success. One of the most widely used instruments to measure service quality is SERVQUAL. Developed by Parasuraman, Zeithaml, and Berry in 1988, this instrument was designed to provide managers with greater insights concerning IS service quality and in some cases, provide a benchmark across IS business processes (Kettinger and Lee, 1997).

The SERVQUAL instrument is grounded in “gap theory, and measures the “gap” between customers’ expectation of the service quality and perceived performance of the services rendered (Parasuraman, et al., 1988). The original SERVQUAL consists of five dimensions:

(1) Tangibles - Appearance of physical facilities, equipment, personnel, and communication material;

(2) Reliability - Ability to perform the promised service dependably and accurately;

(3) Responsiveness - Willingness to help customers and provide prompt service;

(4) Assurance - Knowledge and courtesy of employees and their ability to inspire trust and confidence; and

(5) Empathy - Caring and individualized attention that the firm provides its customers

The SERVQUAL measurement has 22 pairs of Likert-type scales with the first 22 designed to reflect customer expectations of service for a particular industry and the second set to indicate the customer’s perceptions of the service provided by a particular organization. The measurement is operationalized by subtracting customers’ expectation scores from their perception scores on the 22 items.

Despite it is widely adopted, SERVQUAL is often criticized for several weaknesses. For example, Carman (1990) expresses a concern of the measurement of service quality over multiple service functions, and suggests that expectations may not be predominantly important in establishing consumers’ development of service quality impressions. Babakus and Boller (1992) are critical about SERVQUAL’s dimensionality, its applicability across a wide range of services, and the suitability of measuring service quality as a ‘‘gap’’ score. Other researchers contend that the expectation component is not critical or

that performance and expectations should not be measured at the same time (Oliver, 1981; Carman, 1990).

Based on these concerns, Cronin and Taylor (1992) developed SERVPERF which measures service quality in terms of the customers' perceptions of the service provider performance. Therefore, the expectation component of SERVQUAL was eliminated and only the performance component was used. They studied four industries -- banking, fast food, pest control and dry-cleaning -- and provided empirical support to the superiority of SERVPERF over SERVQUAL

IS researchers suggest that service quality be included as a measure of information system success (Dabholkar, et al., 2000; Hong and Goo, 2004). Numerous studies have been conducted to validate the use of SERVQUAL in a variety of applications. For example, Van Dyke, et al. (1997) suggest the use of an IS-context-modified version of the SERVQUAL instrument to assess the quality of the services supplied by an information service provider. Despite numerous studies using SERVQUAL and SERVPERF, few studies have performed empirical tests on service quality's relationship to information success factors. Landrum and Prybutok (2004) is one such exception which empirically test the relationship between service quality and information success factors.

There are diverse opinions about how suitable SERVQUAL is in an IS context. Firstly, there is a dimensionality problem. Nitecki (1996) found that the items of SERQUAL loaded on three dimensions rather than the five proposed by Zeithaml, Parasuraman, and Berry (1990). Jiang, Klein, and Carr (2002) found that the items loaded on four dimensions when they surveyed IT professionals. Furthermore, in Wright

and O'Neill's investigation of the conceptualization and measurement of service quality within the higher education sector using importance-performance technique (Wright and O'Neill, 2002), they found that reliability is not significant but contact, tangibles and response are significant components for online library services.

In addition to the above mentioned dimensionality problem, others are skeptical about the predictive power of using the gap theory and question the validity and reliability of the score measures of SERVQUAL (Van Dyke, et al., 1997; Van Dyke, et al., 1999). Some researchers, therefore, prefer SERVPERF, arguing that performance-only approach provides better predictive power than SERVQUAL which uses the gap-based scale (Babakus and Boller, 1992; Brady, et al., 2002; Brady and Robertson, 2001; Cronin and Taylor, 1992). Many studies have provided evidence that performance scores alone provide better reliability and validity than difference scores (Babakus and Boller, 1992; Brady, et al., 2002; Cronin and Taylor, 1992; Landrum and Prybutok, 2004; Parasuraman, et al., 1994). Methodologically, the SERVPERF scale is more efficient as it reduces the number of survey items by 50 percent. Brady, et al. (2002) also maintain that SERVPERF outperforms SERVQUAL in terms of capturing the variance in consumers' overall perceptions of service quality and validating the conceptualization of service quality as an antecedent of consumer satisfaction. This superiority of SERVPERF is further supported by Zeithaml, et al. (1990), one of the founders of the SERVQUAL scale. He states that "…Our results are incompatible with both the one-dimensional view of expectations and the gap formation for service quality. Instead, we find that perceived quality is directly influenced only by perceptions (of performance)" (Boulding, et al., 1993). Based upon

these findings, SERVPERF rather than SERVQUAL would be used to measure service quality.

Information Quality

Information quality refers to the quality of the output of the information system. Nelson, et al. (2005) suggest that in addition to the quality of the output, information quality should consider who uses the information, the application being used and the task being completed. Thus, information quality would be the degree to which the information assists a user in completing a given task. Nelson, et al. (2005) posit that information quality consists of four dimensions: accuracy, completeness, currency, and format. Accuracy refers to how exact the information stored in the system to the real world information it represents. This information must also be meaningful and believable. Completeness refers to the degree to which all facets of the information are stored. Currency refers to "the degree to which information is up to date or the degree to which the information precisely reflects the current state of the world that it represents" (p. 203). Format refers to the presentation of the information in which the user can easily understand and interpret the information as they seek to complete a given task. These four dimensions look at the user's perception of the information and is therefore, not assessed in an objective sense.

System Quality

System quality refers to the quality of the performance of the system. System quality has a direct effect on system's use and user satisfaction (DeLone and McLean,

1992). In operationalizing system quality, some researchers associate system quality with ease of use (Adams, et al., 1992; Bailey and Pearson, 1983; Davis, 1989; Doll and Torkzadeh, 1988; Rai, et al., 2002). Nelson, et al. (2005) posit that although ease of use and system quality are similar, ease of use may be an antecedent of system quality. They suggest that if a system is easy to use, it may be considered to be of high quality; therefore, ease of use may be a consequence of high quality.

System quality consists of five major dimensions which include flexibility, reliability, response time, accessibility, and integration (Nelson, et al., 2005). Flexibility refers to the ability of the system to adapt to changes and to the diverse needs of users. Accessibility refers to the "degree to which a system and the information it contains can be accessed with relatively low effort" (Nelson, et al., 2005, p. 205). Response time refers to the ability of the system to provide quick and timely responses to the user's request. Depending on the task to be performed, users may vary his or her perceptions of what is a tolerable response time. For example, while one person may be patient in waiting on an Internet application, they would be less patient if their Microsoft Word document is taking too long to open. Thus, this measure is very subjective since everyone doesn't have the same value system. Integration refers to "the degree to which a system facilitates the combination of information from various sources to support business decisions" (Nelson, et al., 2005, p. 207).

Net Benefits

Seddon (1997) defines net benefits as an idealized comprehensive measure of the sum of all past and expected future benefits, less all past and expected future costs,

attributed to the use of an information technology application. Net benefits include the various impacts such as societal impact, individual impact, and organizational impact (Venkatesh, et al. 2003). Two of the most popular impacts studied are individual and organizational impact. Individual impact can be measured using job performance and decision-making performance (DeLone and McLean, 2003). Organizational impact can be measured using various instruments such as organizational performance, return on investment and profits. However, very few studies have empirically tested organizational impact because of the complexity involved in isolating and measuring the organizational outcome of an IS (Santhanam, et al., 2000).

Although few studies measure perceived net benefits, one exception is Wixom and Watson (2001) who examined data warehousing success. They found that data quality and system quality has an impact on perceived net benefits explaining 37 percent of the variance. They therefore concluded that a system which has high data quality and system quality would improve the decision making process and increase the overall value for the organization.

UTAUT model

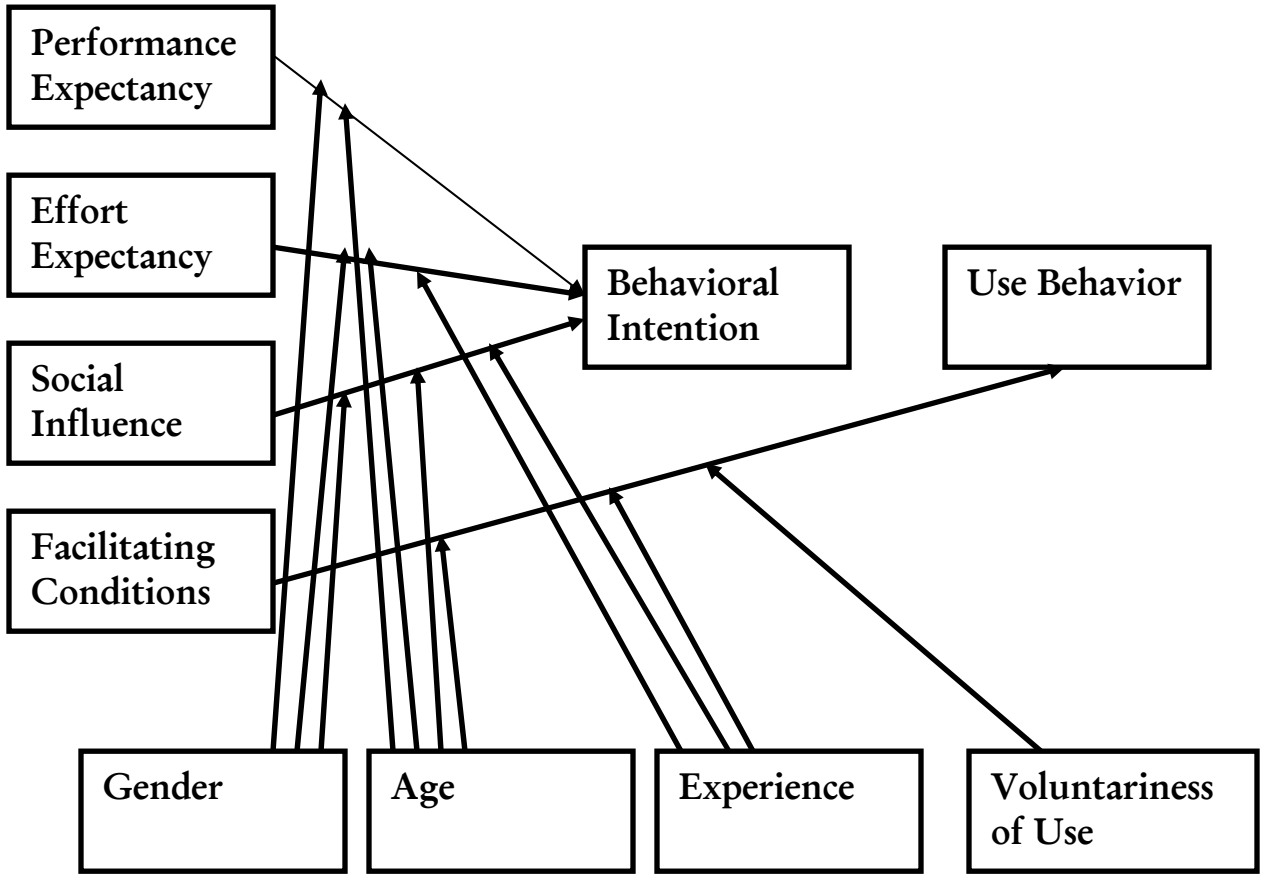
Another key indicator of IS success is technology acceptance. Numerous models have been posited to measure technology acceptance. Common among these are the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Motivational Model (MM), the Theory of Planned Behavior (TPB), a model combining the Technology Acceptance Model and the Theory of Planned Behavior(C-TAM-TPB), the

Model of PC Utilization (MPCU), the Innovation diffusion Theory (IDT), and the Social Cogniztive Thoery (SCT).

There have been very few studies which compare the major models of technology acceptance (Venkatesh, et al., 2003). As a result, Venkatesh, et al. (2003) proposed the UTAUT model to gain a better understanding of technology acceptance .They compared and synthesized eight models of technology acceptance and created the Unified Theory of Acceptance and Use of Technology (UTAUT) model. These eight models are the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Motivational Model (MM), the Theory of Planned Behavior (TPB), the Combined TAM and TPB, the Model of PC Utilization (MPCU), the Innovation Diffusion Theory (IDT), and the Social Cognitive Theory (SCT). To date, there are not many studies which empirically test this model (Schaper and Pervan, 2006; Chang, et al, 2007; Anderson, et al., 2006). The model is presented in Figure 3 below. Although the DeLone and McLean is the major theory used to assess IS success, its combined use with the UTAUT model produces a more comprehensive means of measuring Information Systems success. Venkatesh, et al. (2003) found that the performance expectancy, effort expectancy, social influence and facilitating conditions are determinants of use and use behavior. In addition, age, gender, voluntariness and experience acts as moderators of the direct determinants.

Figure 3

Venkatesh, et al. (2003) UTAUT model



Components of the UTAUT Model

Performance expectancy

Performance expectancy is defined as the degree to which an individual believes that using the system helps him or her improve job performance. Perceived usefulness (TAM/TAM2 and C-TAM-TPB), extrinsic motivation (MM), job-fit (MPCU), relative advantage (IDT), and outcome expectations (SCT) are the constructs that capture performance expectancy. Performance expectancy is the strongest predictor of intention

and remains significant at all points of measurement in both voluntary and mandatory settings (Venkatesh, et al., 2003).

Effort Expectancy

Effort expectancy is defined as the degree of ease associated with the use of the system. Effort expectancy is built on perceived ease of use (TAM/TAM2), complexity (MPCU), and ease of use (IDT). Effort expectancy is significant in both voluntary and mandatory usage contexts during post-training. However, over extended periods of time, it becomes insignificant (Venkatesh, et al., 2003).

Social Influence

Social influence is defined as the degree to which an individual perceives that important others believe he or she should use the new application. Social influence consists of three dimensions which include internalization, identification and compliance (Kelman, 1961). Internalization refers to the acceptance of social influence because it is congruent with the individual's value system and perception of the reality. Identification refers to the adoption of an individual behavior because it satisfies the relationship with another person. Compliance refers to the acceptance of an influence explicitly to receive rewards and avoid certain punishment under the control of another person. Social influence is developed from the subjective norm construct in TRA, TAM2, TPB/DTPB and C-TAM-TPB; social factors in MPCU; and image in IDT.

Social influence is only significant in a mandatory setting. Mandatory contexts cause social influence to have a direct effect on intention to use. On the other hand,

social influence in voluntary contexts operates by influencing perceptions about the technology. Individuals would internalize the opinion of others if they are consistent with their own experience (Venkatesh and Morris, 2000). In mandatory settings, social influence appears to be important only in the early stages of user experience with the technology where interaction with the system is somewhat limited. The individual may comply with others' view and use the system to gain a favorable response. However, the role of these referents wears off and becomes insignificant with sustained usage (Venkatesh, et al., 2003; Venkatesh and Morris, 2000).

Facilitating Conditions

Facilitating conditions are defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system. This definition captures concepts embodied by three different constructs: perceived behavioral control (TPB/ DTPB, C-TAM-TPB), facilitating conditions (MPCU), and compatibility (IDT) (Venkatesh, et al., 2003).

Facilitating conditions refers to the type of support provided to individuals which has an impact on their use of the technology. They are those factors which make an act easy to do such as training; provision of support in the workplace; resources such as time and money; and technology compatibility (Lu, et al., 2005; Taylor and Todd, 1995b; Thompson, et al., 1994; Triandis, 1979). Facilitating conditions are important because the lack of these conditions may present a barrier to the use of the technology as the task is perceived to be more difficult to complete (Taylor and Todd, 1995a; Thompson, et al., 1994). As a result, facilitating conditions have an indirect effect on ease of use (Taylor

and Todd, 1995a). In addition, facilitating conditions have a direct effect on actual use and not intention because even if an individual intends to use a technology, that technology would not be used if the environment does not support that behavior (Limayem, et al, 2004).

There has been increased interest in the study of facilitating conditions. In e-commerce literature, facilitating conditions are usually studied as an antecedent of trust. For example, Lu, et al. (2005), in their study of the impact of facilitating conditions on trust, examined the facilitations conditions -- attributes of training and provision of support in the workplace. On the other hand, Ratnasingam, et al. (2005) identified and examined facilitating conditions of institutional trust based on the lessons learned from traditional EDI, namely IT connectivity, standards, security, and uniform product descriptions. In IT usage literature, facilitating conditions have been studied in various contexts including software piracy (Limayem, et al, 2004); mobile technology (Lu, et al., 2005); electronic marketplace (Ratnasingam, et al, 2005); and personal computer (Thompson, et al., 1994).

Experience

User experience is defined as the time elapsed since the initial use of the IT application (Venkatesh, et al. 2003). Prior research suggests that an increase in experience would decrease the influence of effort expectancy and social influence on behavioral intention to use the information system. This occurs because experienced users are more concerned how using the system helps him or her perform the job better (performance expectancy). Kim and Malhotra (2005) confirm Venkatesh, et al. (2003) by

showing that when user experience increases, effort expectancy and social influence decreases.

Voluntary vs. Mandatory Use

In a voluntary use environment, users believe that they have a choice in the technology adoption or use decision (Brown, et al., 2002). On the other hand, in a mandatory use environment, users believe that it is compulsory to use the technology (Brown, et al., 2002; Venkatesh, et al., 2003; Agarwal and Prasad, 1997; Venkatesh and Davis, 2000). The study of voluntary versus mandatory use has created some interest in the IS literature. Some researchers suggest that voluntariness is a continuum scale (Seddon and Kiew, 1994; Moore and Benbasat, 1991; Karahanna, et al., 1999). Some researchers further suggest that when use is mandated, user satisfaction is more important than use (DeLone and McLean, 2003; Seddon and Kiew, 1994). Others suggest that although there is some variation in mandated environments, this variability occurs because of variability in job functions (Brown, et al., 2002, Melone, 1990). DeLone and McLean (2003) further posit that no use is completely mandatory. At some level of the organization, an executive or management committee makes the decision to implement a system and require employees to use it. However even if this system is mandatory at one level, the continued adoption and use of the system itself may be wholly voluntary, based upon management judgment, at a higher level. This is because management always has the option of discontinuing a system that is not providing the desired results and benefits.

There has been very few studies that empirically test the differences in IS success in both voluntary and mandatory settings. Staples and Seddon (2004) is one of the few studies which examine IS in both mandatory and voluntary contexts. In their study, two different systems were utilized by two separate sets of individuals. In the first study, surveys were sent to librarians who gave their opinions on their use of the library's mandatory central cataloging system. In the second study, students were surveyed on their use of word processors and spreadsheets. Although this study provides an initial step in examining IS in both mandatory and voluntary settings, it is not without limitations. With the two studies using two separate sets of individuals— adults and individuals— it is difficult to compare these two groups. Furthermore, the use of students may not be generalizable to the workplace.

Brown, et al. (2002) also investigate the use of IT in a mandatory environment. They propose that in a mandatory environment, the TAM model may act differently than it would in a voluntary setting. They did not, however, empirically test the TAM model in a voluntary setting; instead, they made comparisons based on prior studies. In their field study of a banking industry which switched to a new system, the researchers studied three versions of the TAM model, one with and the other without the attitude construct, and a third in which perceived behavioral control and subjective norm were included in the model. They concluded that in this mandatory setting where the attitude construct is removed, ease of use has a stronger effect on behavioral intention to use than perceived ease of use. This is different from prior studies in a voluntary setting which concluded that perceived ease of use was the more important factor. When attitude was included in the model, they found that usefulness was more important than ease of use in measuring

attitude. However, they found that the relationship between usefulness and behavior is insignificant. In the third model in which perceived behavioral control and subjective norm were included, they found that the relationship between perceived usefulness and behavioral intention as well as attitude and behavioral intention were insignificant. On the other hand, perceived behavioral control and subjective norm had a significant effect on behavioral control. Thus, they believe that in a mandatory environment the antecedents of behavioral intention to use and attitude toward use differ; and attitude is more important than behavioral intention to use.

Gender

Gender is defined as biological sex. There is a growing body of research on the study of gender in IT research (for example, Gefen and Straub, 1997; Gefen and Straub, 2000; Stowers, 1995; Igbaria and Chakrabarti, 1990; Venkatesh and Morris, 2000). The differences in men and women have been studied in various contexts including email (Gefen and Straub, 1997), information retrieval (Venkatesh and Morris, 2000) and electronic commerce (Van Slyke, et al., 2002), computer-mediated communication (Gefen and Straub, 2000), and instant messaging (Ilie, et al., 2005).

Gender differences have been demonstrated in various ways. Studies found that women experience higher levels of computer anxiety (Igbaria and Chakrabarti, 1990), lower computer aptitude (Fetler, 1985) and lower levels of computer self-efficacy (Venkatesh and Morris, 2000) than men. Anandarajan, et al. (2000) found that men are more likely to access the company's web pages than women. However, gender is not associated with such individual factors as ease of use, time usage, frequency of use, and

business activities. Morris, et al. (2005) examined the effect of both gender and age simultaneously in technology adoption and use decisions. They found that as age increases, men are more influenced by attitude toward using the technology than women. On the other hand, as age increases, women are more influenced by perceived behavioral control than men. In addition, as age increases, subjective norm has a significant impact on women but not on men. Gefen and Straub (1997) found that men and women differ in their perceptions of email. Women perceive the social presence of email and usefulness more strongly than men. On the other hand, men perceive ease of use more important than women. However, the actual use of email did not differ across gender.

Konrad and Hartmann (2000) also found that men and women differ in terms of job attributes. In a meta-analysis they conclude that men place a higher value on earnings, promotions, leadership, and power. On the other hand, women place greater emphasis on interpersonal relationships, good hours, easy commute, and other intrinsic job aspects. Ahuja and Thatcher (2005) found that with men, there is a direct effect of qualitative overload and trying to innovate whereas this relationship is indirect in women.

Gender influences the usage of an information system. Venkatesh, et al. (2000) suggest that gender would moderate the relationship between perceived usefulness, perceived ease of use, and subjective norm on intention to utilize the technology. They found that these factors are more important for men. This claim is further supported by O'Neill (1982) who suggests men stress the importance of outcomes, work and accomplishment more than women do.

Age

Age is an increasingly important issue in IT as there are more older persons in the workforce. Morris and Venkatesh (2000) found that in the short term, subjective norm, attitude toward using technology and perceived behavioral control have a significant impact on older workers while only attitude toward using the technology has an impact on younger workers. Attitude towards using the technology is more important to younger workers than older workers. In the long run (2-5 months after post implementation), older workers are influenced by attitude toward using the technology and perceived behavioral control while younger workers are influenced by attitude towards using the technology. Overall, Morris and Venkatesh (2000) found that younger workers, when compared to older workers, were more inclined to use the technology. This is further supported by the claim that older workers generally have a more difficult time in adapting to a new work environment (Myers and Conner, 1992).

Kleijnen, et al. (2004), in a study of consumer acceptance of wireless technology, found that the relationships between perceived usefulness and attitude, and perceived cost and attitude were strengthened with age. However, they did not find such strengthening relationship between perceived system quality and attitude.

Behavioral Intention

Behavioral intention refers to the willingness of individuals to work hard and exert effort in order to achieve the given behavior (Ajzen and Fishbein, 1980). Behavioral intention to use the system has been widely studied in the IS literature. Most of these studies on behavioral intention are based on the Theory of Reasoned Action (TRA)

proposed by Fishbein and Ajzen (1975). TRA states that one's behavior is best predicted by intention, and "intentions are jointly determined by the person's attitude and subjective norm concerning the behavior" (p.216). Thus, behavioral intention is an antecedent of action (e.g., actual usage of the information system). Behavioral intention is also an important construct in the Technology Acceptance Model. Davis (1989) posits that behavioral intention to use the system has an impact on the actual usage of the system.

Numerous studies have empirically tested and found support for the impact of behavioral intention to use the system on system use (Davis, et al., 1989; Jackson, et al., 1997; Taylor and Todd, 1995a; Venkatesh, et al., 2003). The UTAUT model also postulates that performance expectancy, effort expectancy and social influence have an effect on systems (Venkatesh, et al., 2003).

Attitude toward Use

Attitude toward use is defined as "an individual's overall affective reaction to using a system" (Venkatesh, et al., 2003, p. 455). Melone (1990) also defines user attitude in IS as "a predisposition to respond favorably or unfavorably to a computer system, application, system staff member, or a process related to the use of that system of application" (p. 81). Many studies have shown that attitude towards use has an impact on behavioral intention in voluntary settings. However, when the setting is mandatory, there are contradictory results. For example, Brown, et al. (2002) posits that in a mandatory setting attitude would not have an impact on behavioral intention to use. On the other hand, Bagchi, et al., (2003) contends that even in mandatory settings attitude is important. Venkatesh (2003) concedes that attitude should not be included in the model since effort expectancy and performance expectancy capture part of that variable.

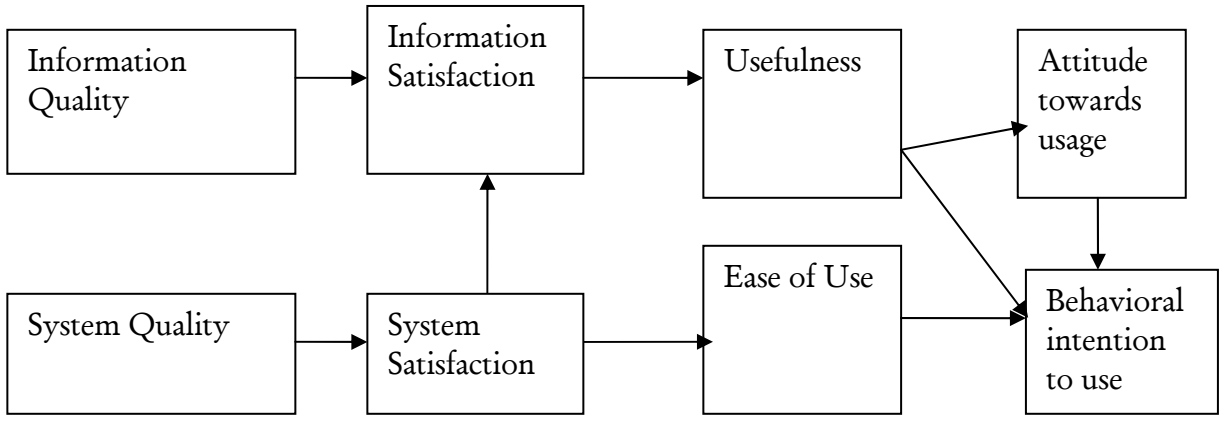
However, their study is based upon respondents' self-reports of expected use. In this study, however, the applications have already been implemented. Therefore, attitude is included in the study to determine if there is a difference when the self report is on actual use instead of expected use.

Wixom and Todd Model

Wixom and Todd (2003) proposed a third model to measure IS success. They posit that there are two complementary streams of research which seeks to measure IS success: user satisfaction literature and technology acceptance literature. Although, they recognize that user satisfaction is a weaker predictor of systems usage than technology acceptance, they suggest that the integration of these two streams of research would provide a more predictive means of measuring systems usage. Using Ajzen and Fishbein's (1980) conceptualization of attitudes, object-based versus behavioral beliefs, they integrated these two steams of research and created a new model for measuring information systems success. Their model is shown in Figure 4.

Figure 4

Wixom and Todd's (2005) Model



This model was then empirically tested in a database application environment where 465 users from seven different companies completed a survey. Results suggested that information quality was a significant determinant of information satisfaction and system quality was a significant determinant of system satisfaction. There were also significant relationships between information satisfaction and usefulness, and between system satisfaction and ease of use. Ease of use and Usefulness had a significant influence on attitude; and attitude and usefulness had a significant influence on intention.

Components of the Wixom and Todd Model

In integrating user satisfaction and technology acceptance, Wixom and Todd included the following components in their model: information quality, system quality, information satisfaction, system satisfaction, usefulness, ease of use, attitude, and

intention. Most of the above components have been addressed above. However information satisfaction and system satisfaction which are the two components of user satisfaction are discussed below.

Information Satisfaction

Information satisfaction refers to “a behavior response to a variety of factors related to the delivery of information products and services” (Sethi and King, 1999, p. 88). This satisfaction is different form overall satisfaction which refers to how satisfied the user is with all the experiences and encounters of the organization (Park and Kim, 2006). IS literature suggests that information quality has an impact on information satisfaction (Wixom and Todd, 2005; DeLone and McLean, 2004; Park and Kim, 2006).

System satisfaction

System satisfaction is “the degree of favorableness with respect to the system and the mechanics of interaction” (Wixom and Todd, 2005, p. 91). They posit that a user would find the system easier to use as their satisfaction for the system increases. They further found evidence that system satisfaction would have an impact on information satisfaction. Thus, the more a person is satisfied with the system, the more likely he or she would be satisfied with the information the system produces.

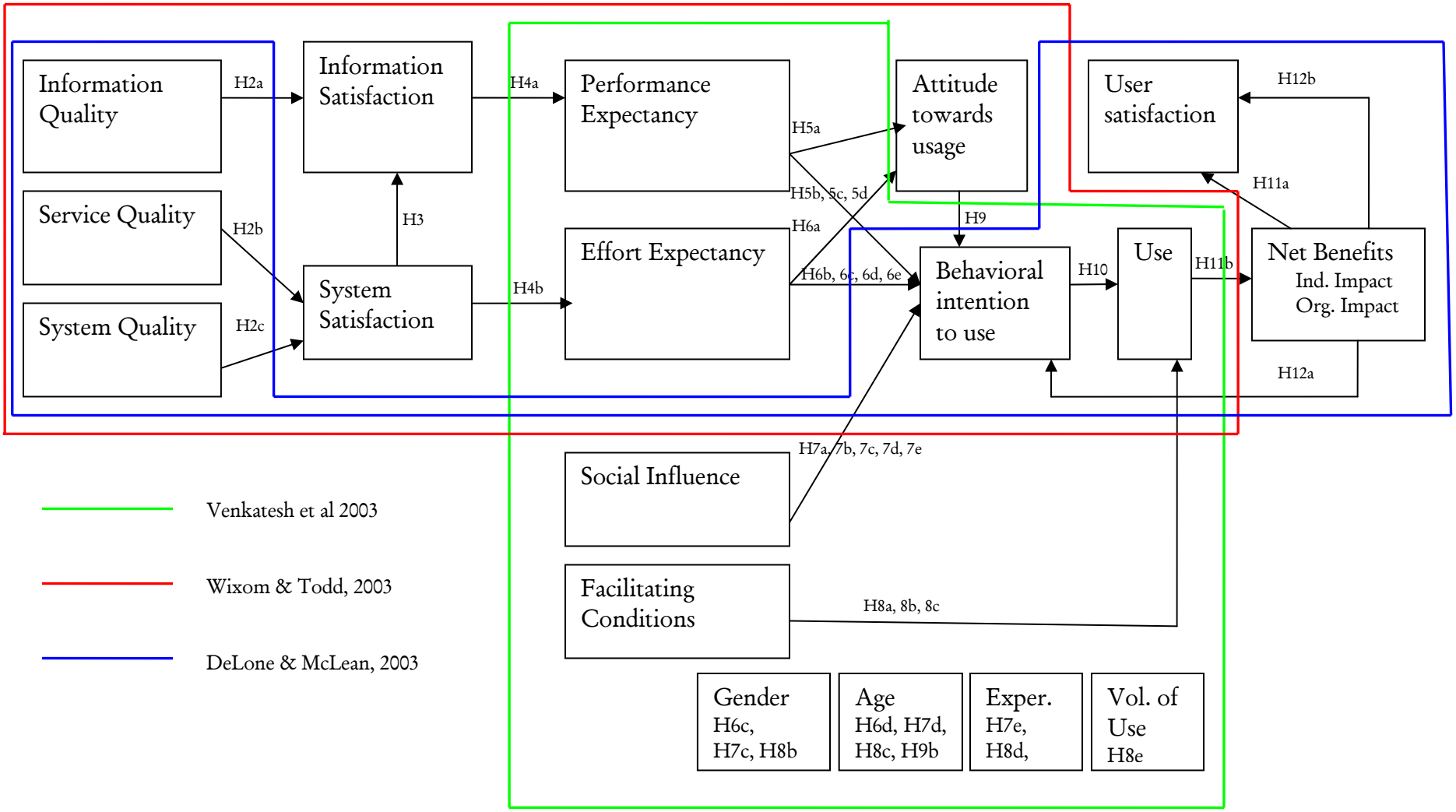
Conceptual Framework

While all three models provide fairly comprehensive means of assessing information systems success individually, it is reasoned that none of them would be as

complete and effective as all three models combined. Thus a comprehensive new model is developed in this study by combining the three major models: the DeLone and McLean (2003) updated IS Success Model, the Venkatesh, et al. (2003) UTAUT Model and the Wixom and Todd (2005) Model. As presented Figure 5 below, this proposed model incorporates the missing constructs within these models and provides a more holistic view of measuring IS success.

Figure 5

IS Conceptual Model



Research Hypothesis

A major purpose of this study is to measure technology acceptance and IS success in a government setting using the proposed conceptual model. Thus, the relationships among variables in the conceptual model and the individual models will be assessed. The research model put forward in this study would be tested through the following hypotheses. The first hypothesis validates the research model itself .

H1: The proposed model is statistically significant.

Then each of the relationships would be individually tested. As technology acceptance and user satisfaction constitute major components of information systems success, the DeLone McLean, Wixom and Todd and UTAUT model are synthesized and their relationship tested.

Quality

The dimensions of the conceptual IS model include information quality, system quality, information satisfaction, system satisfaction, performance expectancy, effort expectancy, social influence, facilitating conditions, attitude towards use, behavioral intention to use and user satisfaction, use and net benefits. Quality refers to “the totality of features and characteristics of a product or service that bears on its ability to satisfy given needs" (American National Standards Institute, ANSI/ASQC 1978). Quality can be examined from many different perspectives (Guimaraes, et al., 2007). DeLone and McLean (2003) posit that there are three

dimensions of quality: information quality, system, quality and service quality. These three dimensions of quality have an impact on the dimensions of satisfaction.

Information quality refers to the quality of the information that the system generates. Information quality is associated with information satisfaction (Wixom and Todd, 2005). Thus, the higher one perceives the quality of the information received, the more likely one would be satisfied with the information.

Service quality refers to the users' perception of the quality of the IS department's service (Pitt and Watson, 1995). Service quality is a key indicator of IS success (Pitt and Watson., 1995). If one perceives that the quality of the service of the IS department is high, then one is more likely to be satisfied with the system.

System quality refers to the quality of the performance of the system (DeLone and McLean, 2003). System quality is also linked to system satisfaction (Wixom and Todd, 2005). Thus, the higher the quality of the system, the more likely the person would be satisfied with the system. The three dimensions of quality have an impact on the dimensions of satisfaction. Therefore, the following hypotheses are proposed:

H2a: Information quality is significantly related to information satisfaction.

H2b: Service quality is significantly related to system satisfaction.

H2c: System quality is significantly related to system satisfaction.

Satisfaction

Satisfaction is the degree of pleasure that arises when one interacts with the application (Doll and Torkzadeh, 1988; Seddon and Kiew, 1994). System satisfaction measures “the degree of favorableness with respect to the system and the mechanics of interaction” (Wixom and Todd, 2005, p. 91). The more satisfied a person is with the system, the more likely he or she would be satisfied with the information the system generates. (Wixom and Todd, 2005). Thus the following hypothesis is proposed:

H3: System satisfaction is significantly related to information satisfaction.

When individuals are satisfied with the information generated by the system, this is likely to influence their perceptions of usefulness (Wixom and Todd, 2005). Hence, the higher the level of information satisfaction with the information, the more likely one would find the system to be useful. System satisfaction refers to the individual’s appreciation of the system (Wixom and Todd, 2005). The more satisfied the individual is with the system, the more likely he or she would find the system to be easy to use. The following is therefore hypothesized:

H4a: Information satisfaction is significantly related to on performance expectancy.

H4b: System satisfaction is significantly related to effort expectancy.

Performance Expectancy

Performance expectancy refers to the degree to which an individual believes that using the application will help him or her attain gains in job performance (Venkatesh et al., 2003). When one perceives that using the system would aid in achieving gains in the workplace, one would be more likely to have a positive attitude towards using the technology. In addition, the more one believes that using the system help him or her achieve gains in job performance, the more likely the individual intends to use the system.

The effect of performance expectancy on behavioral intention is moderated by gender and age (Venkatesh et al., 2003). Men tend to be highly task-oriented (Minton and Schneider, 1980; Venkatesh et al., 2003). Therefore, performance expectancies which focus on task accomplishment would be more prevalent in men. In addition, younger workers focus more on the importance on extrinsic rewards (Venkatesh et al., 2003). Therefore, performance expectancy would be more salient in younger workers. Thus, the following hypotheses are proposed:

H5a: Performance expectancy is significantly related to attitude towards use.

H5b: Performance expectancy is significantly related to behavioral intention to use.

H5c: Performance expectancy will have a higher positive effect on behavioral intention for men.

H5d: The effect of performance expectancy on behavioral intention to use will be stronger for younger persons.

Effort Expectancy

Effort expectancy refers to level of ease associated with the use of the system (Venkatesh et al., 2003). When an individual perceives that a system is easy to use, he or she is more likely to have a positive attitude towards using the system and are more likely to want to use the system in the future.

The effect of effort expectancy on behavioral intention is also moderated by gender, age and experience. Gender roles have a strong psychological basis and are quite permanent (Venkatesh et al., 2003). Prior research on gender assert that effort expectancy will be stronger determinants of individuals' intention for women (Venkatesh and Morris 2000; Venkatesh et al. 2000; Venkatesh et al. 2003). In addition, as individuals get older, studies have shown that they experience difficulty in dealing with complex situations and being conscientious to information on the job (Venkatesh et al, 2003), which are both necessary components of using software systems. Research has shown that effort expectancy will be stronger determinants of individuals' intention for older workers (Morris and Venkatesh 2000; Venkatesh et al., 2003). When a user is new to a technology, ease of use is expected to be more relevant to their intention to use the technology in the future. However as the user becomes more

skilled in using the technology other issues such as instrumentality concerns become more important (Venkatesh et al., 2003). Thus the following hypotheses are proposed:

H6a: Effort expectancy is significantly related to attitude towards use.

H6b: Effort expectancy is significantly related to behavioral intention to use.

H6c: The effect of effort expectancy on behavioral intention will be stronger for women.

H6d: The effect of effort expectancy on behavioral intention will be stronger for older persons.

H6e: The effect of effort expectancy on behavioral intention to use will be stronger for individuals with limited experience.

Social Influence

Many studies have shown the positive effect of social influence on behavioral intention (e.g., Karahanna et al., 1999; Venkatesh and Davis 2000; Venkatesh et al., 2003). When individuals believe that their peers, supervisors and others around them support their use of the technology, they would be more willing to use the system in the future.

The effect of social influence on behavioral intention is also moderated by gender, age, experience (Venkatesh et al., 2003). Theory suggests that women tend to be more sensitive to others' opinions and therefore find social influence to be more prevalent when deciding whether or not they should use new technology (Venkatesh et al., 2000;

Venkatesh et al., 2003). Also, as individuals get older, their affiliation needs increase (Venkatesh et al., 2003). Therefore, older workers are more likely to place increased significance on social influences. In addition, as individuals become more experience with the technology, the influence of others would be diminished.

Voluntariness also moderates the relationship between social influence and behavioral intention. When use is mandatory, compliance is a major issue and the influence of others has a direct effect on intention (Brown et al., 2002); Venkatesh and Davis, 2000) However, when use in voluntary, social influence simply influence the perceptions about the technology in earlier phase. The following hypotheses are therefore proposed:

H7a: Social influence is significantly related to behavioral intention to use.

H7b: The effect of social influence on behavioral intention to use will be stronger for women.

H7c: The effect of social influence on behavioral intention will be stronger for older persons.

H7d: The effect of social influence on behavioral intention will be stronger for limited experience.

H7e: The effect of social influence on behavioral intention will be stronger in mandatory settings.

Facilitating Conditions

Facilitating conditions are defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system (Venkatesh et al., 2003). When employees recognize that the environmental conditions around them support their use of the technology, they would be more inclined to use the technology.

Facilitating conditions are also moderated by age, experience and voluntariness. Older workers place greater emphasis on receiving help and assistance on the job (Venkatesh et al., 2003). Thus, if the technical and organizational support is available, this would have a greater impact on older people using the technology (Morris and Venkatesh, 2000; Venkatesh et al., 2003). In fact, the effect is expected to increase with experience as users of technology find multiple avenues for help and support throughout the organization, thereby removing impediments to sustained usage (Bergeron et al. 1990). Thus, the following hypotheses are proposed:

H8a: Facilitating condition is significantly related to use.

H8b: The effect of facilitating conditions on usage will be stronger for younger persons.

H8c: The effect of facilitating conditions on usage will be stronger for increased experience.

Attitude

When employees respond favorable to the system, they would be more incline to use the system. The positive effect of attitude towards use on behavioral intention to use has been presented in many studies (e.g. Bagchi, et al., 2003; Brown et al., 2002; Melone, 1990; Wixom and Todd, 2005)

H9: Attitude is significantly related to behavioral intention to use.

Behavioral Intention

The eight models of technology acceptance mentioned and most intention models posit that behavioral intention will have a significant positive influence on technology usage.

H10: Behavioral intention to use is significantly related to use.

Use and User Satisfaction

Use and user satisfaction are closely connected (DeLone and McLean, 1992; DeLone and McLean, 2003). When users have a positive experience with their use of the application, they would be more satisfied. In addition, when systems are being used, owners or sponsors of the system hope that the users would obtain positive benefits from using the system. Thus, the following hypothesis is developed:

H11a: Use is significantly related to user satisfaction.

H11b: Use is significantly related to net benefit (individual impact).

Net Benefits

Net benefits refers to the sum of all past and expected future benefits, less all past and expected future costs, attributed to the use of an information technology application. If the technology is to be continued, it is assumed that the net benefits from the perspective of the owner or sponsor of the system are positive (DeLone and McLean, 2003). This would influence and reinforce subsequent use. Two dimensions of net benefits are included in this study: organizational impact and individual impact. The following is hypothesized:

H12a: Net benefits (organizational impact) are significantly related to behavioral intention to use.

H12b: Net benefits (organizational impact) are significantly related to user satisfaction.

CHAPTER 3

METHODS

Introduction

This chapter provides an overview of the research methods and design. The unit of analysis and the construction of the survey instrument are discussed. This is followed by a description of the statistical techniques used to test the model and hypotheses. Finally, assessment of validity and reliability of the research methods is discussed.

Unit of Analysis

The purpose of the research is to determine the factors that influence user satisfaction and use of the information system and their relationships. Therefore, the unit of analysis is the individual since the study is concerned with the perceptions of individuals and what influences their decision to use a particular application.

Development of the Instrument

This study combines three models of IS success -- the DeLone and McLean's Updated model; the Wixom and Todd's model and the Venkatesh, et al. UTAUT model -- to produce a comprehensive model. The initial instrument was created by first compiling items from each of the three

models. Duplicate items were removed and when necessary the wording was modified to fit the study setting. Items that were irrelevant or ambiguous were revised or removed. The new instrument was then presented to a panel of experts and potential participants, including city officials for their feedback with which further modifications were made. The development of the instrument starting with the three validated studies is discussed below.

Instrument of DeLone and McLean's Updated IS Success Model

DeLone and McLean's model is regarded as one of the most comprehensive models to assess IS success. Between 1993 and 2002, approximately 285 studies cited this model (DeLone and McLean, 2002; DeLone and McLean, 2003). Numerous studies empirically tested the associations of various dimensions included in the model (Seddon and Kiew, 1994; Taylor and Todd, 1995b; Etezadi-Amoli and Farhoomand, 1996; Doll and Torkzadeh,1988; Igbaria and Tan, 1997; Baroudi and Orlikowski 1988). Ten years later, the model was updated to extend, validate, or strengthen the original one. The new model incorporates the following dimensions: systems quality, information quality, service quality, intention to use, user satisfaction, and net benefits. However, few studies have empirically tested the updated model. This study adopts DeLone and McLean's measures as shown in Table 1.

Table 1.
Instrument of Updated IS Success Model Adapted from DeLone and McLean's Model (2003)

Dimension	Items
System quality	1. In terms of system quality, I would rate the system highly 2. Overall, the application is of high quality 3. Overall, I would give the quality of the application a high rating
Information quality	1. Overall, I would give the information from the application high marks 2. Overall, I would give the information provided by the application high ratings in terms of quality 3. In general, the application provides me with high-quality information 4. In general, the application provides me with high-quality information
Use	1. How much time do you spend with the system during the ordinary day when you use computers? (1) Scarcely at all (2) Less than ½ hour (3) ½- 1 hour (4) 1-2 hours (5) 2-3 hours (6) More than 3 hours 2. How often on average do you use the system? (1) Less than once a month (2) Once a month (3) A few times a month (4) A few times a week (5) Once a day (6) Several times a day
Intention to use	1. I intend to use the system in the next 12 months 2. I predict I would use the system in the next 12 months 3. I plan to use the system in the next 12 months
User satisfaction	1. I am pleased with my use of the application 2. I am content with my use of the application 3. I am satisfied with my use of the application 4. I am delighted with my use of the application
Net benefits - Individual impact	1. Overall, there has been a positive impact as to how much my performance was improved by the aid of CoD's Information Technologies

Net benefits - Organizational impact	1. The application provides competitive business advantage 2. The application provides improved client/seller relationships 3. Overall the application is cost effective 4. The application provides improved corporate image 5. The application provides improved customer service 6. The application keeps up with the organization's business requirements 7. Overall, there has been a positive impact as to how much the CoD's performance was improved by the aid of Information Technologies
Service quality	1. The TSD staff does what it promises to do 2. The TSD staff performs services right the first time 3. When I have a problem, the TSD staff does its best to respond as soon as possible 4. The people on the TSD staff gives me prompt service 5. Members of the TSD staff are always willing to help 6. The TSD department responds quickly to my requests for help with software applications 7. The behavior of the TSD staff instills confidence in me 8. The TSD staff is continuously courteous with me 9. The TSD staff is continuously courteous with me 10. The TSD staff gives me individual attention 11. The TSD staff gives me personal attention 12. The TSD staff has my best interest at heart 13. The TSD staff understands my specific needs

System quality is an important dimension of IS success. System quality includes ease of use, response time, data accuracy, reliability, data accuracy, completeness, and flexibility. Information quality deals with the accuracy, timeliness, reliability, relevance and currency of the information.

Use is another common measure of IS success. Examples of use include frequency of use, number of functions used, number of records processed, number of hours IT is used and number of computer queries.

Use in this study is measured using the number of hours per week for which the application is utilized.

User satisfaction refers to the overall satisfaction one gains from the use of an application. There are numerous measures of user satisfaction (Bailey and Pearson, 1983; Gefen, and Straub, 2000; Doll and Torkzadeh, 1988; Bhattacherjee and Premkumar, 2004). This study adopts Bhattacherjee and Premkumar's (2004) measure to assess user satisfaction. This measure was chosen because it incorporates how users' satisfaction changes over time; it measures the two dimensions of satisfaction – intensity and valence; and evaluates how users' beliefs changed over time in both end-user and system development contexts.

Net benefits refers to the impact caused by the use of an IS application. Individual and organizational impact would be included in this study. Individual impact refers to the effect that the IT has on the individual's performance. Examples of individual impact include the number of options generated, user confidence, change in behavior, and time to reach decision.

Organizational impact refers to the impact that the use of the IS application has on the overall organizational performance. Examples of organizational performance include profit increases, cost reductions, and productivity gains. Organizational performance is measured using Skok, et al.'s (2001) measure. Skok et al. (2001) used improvement performance

analysis to examine the success of IS investments in the health care industry. Thus, this was modified in this study for a governmental setting.

Instrument of Wixom and Todd (2005) Model

Wixom and Todd (2005) recognize the need to merge the technology acceptance and user satisfaction literature because these two streams are complementary. They utilized Ajzen and Fishbein's object-based and behavioral beliefs and attitude to develop the model. The model includes the following constructs: information quality, system quality, information satisfaction, system satisfaction, usefulness, ease of use, attitude and intention.

Wixom and Todd (2005) utilized Bailey and Pearson (1983), Ives, et al. (1983), Baroudi and Orlikowski (1989) and Doll and Torkzadeh (1988) to develop an integrative instrument. They suggest that system quality is characterized by accessibility, timeliness, language, flexibility, efficient and integration. Information quality is characterized by precision, accuracy, reliability, currency, completeness, format and volume. Service quality includes the relationship, communication, technical competence, attitude, response time of the IT staff. They posit that this model would provide a more comprehensive measure of information systems success. The dimensions and items used in the instrument by Wixom and Todd model are summarized in Table 2.

The Wixom and Todd model was adopted for this study as the base model to integrate the major factors that measures technology acceptance and IS success in a government setting. Thus, the conceptual model for this study provides a comprehensive approach which utilizes DeLone and McLean (2003) model which measures IS Success; Venkatesh et al.'s (2003) UTAUT model which measures technology acceptance; and Wixom and Todd;s (2005) model which integrates technology acceptance and user satisfaction.

Table 2.

Instrument for Wixom and Todd's Model

Dimension	Items
System quality	(Same as DeLone and McLean) 1. In terms of system quality, I would rate the system highly 2. Overall, the application is of high quality 3. Overall, I would give the quality of the application a high rating
Information quality	(Same as DeLone and McLean) 1. Overall, I would give the information from the application high marks 2. Overall, I would give the information provided by the application high ratings in terms of quality 3. In general, the application provides me with high-quality information
Information satisfaction	1. Overall, the information I get from the application is very satisfying 2. I am very satisfied with the information I receive from the application
System satisfaction	1. All things considered, I am very satisfied with the application 2. Overall, my interaction with the application is very satisfying

Perceived usefulness	1. Using the application enhance my effectiveness on the job 2. Using the application makes it easier to do my job
Attitude	1. Using the application is a good idea 2. The application makes work more interesting 3. Working with the application is fun 4. I like working with the application
Intention	1. I intend to use the system in the next 12 months 2. I predict I would use the system in the next 12 months 3. I plan to use the system in the next 12 months

Instrument of UTAUT Model

The UTAUT model attempts to synthesize eight popular models that measure technology acceptance: (1) the theory of reasoned action, (2) the technology acceptance model, (3) the motivational model, (4) the theory of planned behavior, (5) a model combining the technology acceptance model and the theory of planned behavior, (6) the model of PC utilization, (7) the innovation diffusion theory, and (8) the social cognitive theory. This model includes the following constructs: performance expectancy, effort expectancy, social influence, facilitating conditions, behavioral intention and usage behavior. These constructs are moderated by age, gender, experience and voluntariness of use.

Performance expectancy refers to the degree to which an individual believes that using the system will help him or her improve job performance. Effort expectancy is defined as the degree of ease associated with the use of the system. Social influence is defined as the degree to which an

individual perceives that important others believe he or she should use the system. Facilitating conditions are defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system. Behavioral intention refers to the intention of the user to utilize the system in the future.

The original instrument has been modified to fit the context of the study as summarized in Table 3.

Table 3. Instrument for Venkatesh et al. UTAUT model

Dimension	Items
Performance expectancy	1. I find the application useful to accomplish tasks 2. Using the application enables me to accomplish tasks more quickly 3. Using the application increases my productivity 4. Using the application improve my job performance
Effort expectancy	1. My interaction with the application is clear and understandable 2. It is easy for me to become skillful at using the application 3. I find the application easy to use 4. Learning to operate the application is easy for me
Social influence	1. People who influence my behavior think that I should use the application 2. People who are important to me think that I should use the application 3. The senior management of this business has been helpful in the use of the application 4. In general, the organization has supported the use of the application
Facilitating conditions	1. I have the resources necessary to use the application 2. I have the knowledge necessary to use the application 3. The application is not compatible with other applications 4. A specific person (or group) is available for assistance

	with the application
Behavioral intention	(Same and Wixom and Todd) 1. I intend to use the system in the next 12 months 2. I predict I would use the system in the next 12 months I plan to use the system in the next 12 months

Use	(Same as DeLone and McLean) 1. How much time do you spend with the system during the ordinary day when you use computers? (1) Scarcely at all (2) Less than ½ hour (3) ½- 1 hour (4) 1-2 hours (5) 2-3 hours (6) More than 3 hours 2. How often on average do you use the system? (1) Less than once a month (2) Once a month (3) A few times a month (4) A few times a week (5) Once a day (6) Several times a day

Survey Method and Subjects

Subjects

The subjects in this study are employees of the City of Denton. Denton, Texas, is a city located approximately 30 miles north of Dallas. With a population of approximately 103,000, this city employs over 1,200 employees.

Survey Methodology

The study used an online survey methodology to collect data. Online survey is gaining popularity. Almost $500 million was spent on online surveys in the U.S. in 2002 (Hogg, 2003; Evans and Mathur, 2005). Evans and Mathur (2005) provided a thorough analysis of the strengths and weaknesses of online surveys. They assert that this type of survey is

beneficial because it has a global reach which would allow respondents from various regions and countries around the world to partake in the study. Thus, a large sample is easy to obtain. Online surveys are also flexible. These surveys can be in different formats and easily customized to fit the target population. An online survey also has the added benefit of speed and timeliness. Respondents can get the survey faster and the time for data collection is also decreased. Online surveys are also convenient. Respondents can choose when, where and how they participate. In some cases, participants can answer part of the survey and then return later to questions that they missed. There is also the ease of data entry and analysis. Survey data are automatically recorded without manual input and they are easily tabulated. Questions can be presented in a wide variety of formats such as dichotomous, multiple-choice, scale, multimedia, single-response, multiple-response or open-ended. Administration cost is generally low for online surveys. An online survey can require users to answer only specific questions. In addition, it is easy to follow with an online survey. It is also easier to tabulate the differences between respondent and non-respondent characteristics especially when they already know the potential of a given respondent from their own database.

Online surveys are not without weaknesses. Evans and Mathur (2005) suggest that they can be perceived as being junk mail which may lead to a low response rate. The results may be skewed based on the Internet population. The respondent may lack online experience and

expertise. The instructions for answering may be unclear for some participants. Some surveys are also impersonal and participants may become wary of privacy issues.

A web-based survey was prepared for employees of the City of Denton to participate online. A letter was sent to all employees by a senior manager of the City to encourage their participation in the study. The employees were informed that their identity would remain anonymous and the survey would be conducted on the University's computer and only summary data would be shared with the city to help improve its performance. They were also informed that their participation in the study is voluntary and their refusal to participate in the survey does not adversely affect them in any way.

Procedure for Data Analysis

The reliability and validity of the study was assessed by exploratory factor analysis and confirmatory factor analysis. Reliability refers to the stability, precision, or consistency of the measures (Kerlinger and Lee, 2000). One commonly used measure of reliability is Cronbach's (1951) coefficient alpha. This alpha provides the first assessment of the quality of the instrument (Churchill, 1979). A high coefficient alpha indicates that the items efficiently capture the construct, whereas a low coefficient alpha indicates that they do not adequately capture the construct. Crano and Brewer (1973) suggest that the coefficient alpha is one of the best estimates of internal consistency. Chau (1999) further posits that the Cronbach alpha is better than other estimation methods because it is less restrictive, sets an upper limit on reliability and is easy to compute. Therefore, Cronbach's alpha was used to assess internal consistency. In calculating the alpha, listwise deletion was used to deal with missing values.

Construct validity refers to the degree to which an instrument measures the construct it claims to measure. To measure construct validity in this study, correlation and factor analysis was used. If the construct is valid, high correlation for each item within the construct and low correlation for items of other construct are expected. Two types of construct validity are convergent and discriminant validity (Kerlinger and Lee, 2000). Convergent validity means that evidence gathered from different sources in different ways all indicate the same or similar meaning of the construct. Discriminant

validity on the other hand means that one can empirically differentiate the construct from other constructs that may be similar. For convergent validity, the items measuring the same construct should have a high correlation. For discriminant validity, we expect that other items not measuring the construct should have low correlations.

Factor analysis is used to describe the relationships between observed variables (items) by a few underlying but unobservable variables called constructs. Exploratory factor analysis assumes total variability and finds the factors that maximize the common variance that is explained. Eigenvalue is one means of demonstrating the total variance explained by a factor. The most common method of factor analysis is the principal axis factor (PAF). PAF with a varimax rotation in SPSS was used to analyze the items. PAF selects the smallest number of factors which account for the common variance (correlation) of a set of variables. Confirmatory factor analysis would then be used to validate the model.

Confirmatory factor analysis estimates the parameters and empirically validates the hypothesized model. Confirmatory factor analysis would be analyzed using structural equation model (SEM) technique of Partial Least Squares. The most popular SEM technique is the covariance technique which include using software such as LISEL, AMOS, EQS, EZPath, SEPATH, CALIS, MX, and RAMONA (Chin,1995). This technique generally follows five stages: model specification, identification, estimation, testing fit and respecification.

Identification involves the estimation of unknown parameters based on observed covariances or correlations (Kelloway, 1995). Models are under-identified when the number of unknowns exceeds the number of equations, just- identified when the number of unknowns and the number of equations were equal, or over-identified when the number of equations exceeds the number of unknowns. There are no solutions for an under-identified model; there is one set of values that completely fit the observed correlation matrix; and there are many possible solutions for over-identified model which is the preferred solution. Three types of estimation are usually used. These include ordinary least squares, generalized least squares, and maximum likelihood. Maximum likelihood estimation is the most popular estimation technique used (Kelloway, 1995).

To test fit, the incremental, absolute and parsimonious fit would be used to assess the model. Absolute fit measures the "degree to which the overall model predicts the observed covariance or correlation matrix" (Hair, et al., 1995, p. 654). Absolute fit includes the standardized residual, chi-square test statistic, root mean square residual, root mean square error of approximation, noncentrality parameter, and goodness of fit. The incremental fit compares the proposed model to the baseline model. The incremental fit includes adjusted goodness of fit and comparative fit index would be utilized. Parsimonious fit is concerned with the goodness of fit of the model and the number of estimated coefficients. The parsimonious fit includes parsimonious goodness of fit index, and normed chi square.

The alternative SEM technique is the variance technique known as Partial Least Squares (PLS). PLS estimates the variance of dependent construct and their associated latent variables (Chin and Newsted, 1999; Chin et al., 2003). PLS basically relies on principal component analysis whereas the covariance method relies on common factor analysis. Falk and Miller (1992) posit that there are four conditions in which PLS is better than covariance-based SEM. These include theoretical conditions, measurement conditions, distributional conditions, and practical conditions.

Theoretical conditions consider the purpose of the study and whether or not strong theory exists. PLS is the better SEM technique when "hypotheses are derived from macro-level theory in which all salient and/or relevant variables are not known"; "relationships between theoretical constructs and their manifestations are vague"; and "relationships between constructs are conjectural" (Falk and Miller, 1992: 5).

Measurement conditions consider the characteristics of the latent and manifest variables. PLS is best suited when "some or all of the manifest variables are categorical or they represent different levels of measurement"; "manifest variables have some degree of unreliability" and "residuals on manifest and latent variables are correlated" (Falk and Miller, 1992: 6).

Falk and Miller (1992:6) posit one distribution condition in which PLS is better suited: "data come from non-normal or unknown distributions". PLS is also more appropriate when these practical

conditions are present: “cross-sectional, survey, secondary data, or quasi-experimental research designs are used”; “a large number of manifest and latent variables are modeled”; and “too many or too few cases are available” (Falk and Miller, 1992: 6). Based on the distribution, measurement, and practical conditions, PLS was the statistical technique chosen for this study.

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CHAPTER 4

RESULTS

This chapter presents the analysis of the survey data gathered in this study. Descriptive statistics of the user's profile and the model instrument is also presented.

Survey Respondents

Email was sent out to all employees of the City of Denton inviting them to participate in an online web-based survey in April and May 2006. The survey was conducted in two phases over a four week period. During the first phase, April 17-29, the project champions of the IS applications participated in the survey to determine if their perceptions differ from the rank and file employees. Project champions are people who embrace the project as their own and are personally committed to it; vigorously generate support from other people in the firm; and advocate the project beyond job requirement in a distinctive manner (Markham, 1998).

Twenty-three of the recognized project champions participated in the survey for a response rate of 59.0 percent. In the second phase, 1,061 rank and file employees with email addresses were invited to participate in the survey. Three hundred and ten responded for a response rate of 29.2 percent. A total of 333 responses (23 champions and 310 rank and file employees) were received over the three week period resulting in an overall response rate of 30.3 percent. A t-test for independent samples was

performed on early and late response groups to assess the differences of means among these groups in three variables, job type, years at current job and number of IT hours worked. The early respondent group was made up of the first fifteen respondents of the rank and file employees to complete the survey; whereas the late respondents included the last fifteen respondents to complete the survey. The results of t-test as shown in Table 4 indicate no significant differences between the two groups at the 0.05 significance level.

Table 4.

Difference in means between early and late respondents

Variable	*t*	*P value for sample difference*
Job category	1.120	.277
Years at current job	-2.106	.083
IT hours worked	.362	.500

Profile of Respondents

The demographic characteristics of the respondents were analyzed for gender, age and education. The breakdown of the survey participants by gender is shown in Table 5. The survey results were not evenly distributed. Male employees accounted for 55.9 percent of the responses while female employees accounted for the remaning 44.1 percent.

Table 5

Gender Distribution

Gender Num	*ber of employees*	*Percent*
Male	186	55.9%
Female	147	44.1%
Total	333	100.0%

Tables 6 and 7 display the composition of the respondents by age and education. Approximately half of the respondents (56.5 percent) are between the ages of 30 to 50. Few employees were below the age of 26 (5.5 percent) or over 60 (3.6 percent). Almost half of the respondents have a degree from a 4-year college or graduate school, while 12.3 percent are high school graduates.

The number and rate of responses by department is shown in Table 8. The results come from all 20 departments listed in the survey. Seven employees reported that they worked for a department other than those listed. The largest group of respondents is Public Safety which accounts for 18.0 percent of the responses. This is expected since Public Safety is one of the largest divisions in the City. This is followed by Water, Wastewater & Drainage with 12.3 percent; and Library and Budget & Fiscal Operations with 9.9 percent each.

Table 6

Age Distribution

Years of Age	*Number of respondents*	*Percent*
20-25	18	5.4%
26-30	26	7.8%
31-35	48	14.4%
36-40	51	15.3%
41-45	42	12.6%
46-50	47	14.1%
51-55	59	17.7%
56-60	30	9.0%
Over 60	12	3.6%
Total	333	100.0%

Table 7

Education level

Highest education	*Number of respondents*	*Percent*
High school	41	12.3%
Some college	85	25.5%
2-year college	39	11.7%
4-year college	94	28.2%
Graduate school	68	20.4%
Other	6	1.8%
Total	333	100.0%

Table 8

Distribution of Respondents by Department

Department Number	*of responses*	*Percent of total responses*
Public Safety	60	18.0%
Water, Wastewater & Drainage	41	12.3%
Library	33	9.9%
Budget & Fiscal Operations	33	9.9%
Electric	24	7.2%
Technology Services	18	5.4%
Parks and KDB	15	4.5%
Solid Waste, Landfill & Recycling	14	4.2%
Customer Service	12	3.6%
Community/Downtown/Economic Development	11	3.3%
Planning and Building Inspection	10	3.0%
General Government	10	3.0%
Human Resources	9	2.7%
Facility Management	7	2.1%
Transportation	7	2.1%
Municipal Court and Judge's Office	6	1.8%
Utilities Administration	6	1.8%
Legal	5	1.5%
Safety, Training, and Risk Management	4	1.2%
Motor Pool and Maintenance	1	0.3%
Other	7	2.1%
Total	333	100.0%

Table 9 summarizes the distribution of the respondents by the years of employment with the city. About 29.4 percent have worked at the City between 5 to 10 years. About 26.1 percent have worked for less than 5 years. The average length of employment with the city is 10.4 years.

Table 9

Years with City of Denton

Years with the City	*Number of respondents*	*Percent*
Less than one year	13	3.9%
1 - less than 2 years	14	4.2%
2 - less than 5 years	60	18.0%
5 - less than 10 years	98	29.4%
10 - less than 15 years	49	14.7%
15 - less than 20 years	47	14.1%
20 years or over	52	15.6%
Total	333	100.0%

The distribution of the respondents in terms of the number of years on the current job is presented in Table 10. On average, the respondents have been in the current position for 6.5 years. Six percent of the respondents have been in their current position for less than a year; approximately 40 percent in their current position for 1-5 years; approximately 33 percent in their jobs for 5-10 years and approximately 20 percent in their jobs for over 10 years.

Table 11 summarizes the distribution of the respondents in terms of the number of hours they spend per week using IT. Employees worked about 40.8 hours per week on average. The majority of the respondents -- 68.9 percent of the employees who participated in the study – reported that they use IT for more than 20 hours a week. This finding implies how important IT has become for the employees of the City.

Table 10

Years in Current Job

Number of years at current job	*Number of respondents*	*Percent*
Less than one year	20	6.0%
1 - less than 2 years	43	12.9%
2 - less than 3 years	32	9.6%
3 - less than 4 years	33	9.9%
4 - less than 5 years	20	6.0%
5 - less than 7 years	62	18.6%
7 - less than 10 years	49	14.7%
10 - less than 15 years	39	11.7%
15 - less than 20 years	23	6.9%
20 years or over	12	3.6%
Total	333	100.0%

Table 11

Numbers of Hours Using IT per Week

Number of hours using IT	*Number of respondents*	*Percent*
None	24	7.3%
1 – less than 5	18	5.4%
5 – less than 10	16	4.8%
10 – less than 15	32	9.7%
15 – less than 20	13	3.9%
20 – less than 30	54	16.3%
30 – less than 40	94	28.4%
40 or over	80	24.2%
Total	331	100.0%

The heavy reliance on IT by employees is also shown in Table 12, which summarizes the distribution of the respondents in term of IT dependency ratio. IT dependency ratio is calculated by dividing the number

of hours per week that the employee used IT divided by the total number of working hours per week. Approximately 30 percent of the respondents used IT less than 40 percent of the time while 70 percent of the respondents use IT more than 40 percent of their working time. On average, employees utilize IT about 60.1 percent of the time to perform their tasks.

Table 12

Respondents by the IT Dependency Ratio

IT dependency ratio	*Number of respondents*	*Percent*
Less than 20 percent	54	16.3%
20 – less than 40 percent	44	13.3%
40 – less than 60 percent	35	10.6%
60 – less than 80 percent	68	20.6%
80 – less than 100 percent	47	14.2%
100 percent	83	25.1%
Total	331	100.0%

The survey respondents represent a broad range of job types as shown in Table 13. About 21.9 percent of the responses were classified as professionals, 21.6 percent as technical paraprofessionals, and 19.2 percent as mid-level managers.

Table 13

Job Type Distribution

Type of job	*Number of participants*	*Percent*
Professional	73	21.9%
Technical paraprofessional	72	21.6%
Office/clerical	44	13.2%
Supervisor	26	7.8%
Field service	20	6.0%
Mid-level manager	64	19.2%
Director/ACM	16	4.8%

The five most widely used applications in the City of Denton are GroupWise, Intranet, JDE Peoplesoft, LaserFiche and Trak-it. General business applications such as Word, Excel, PowerPoint, and Microsoft Publisher were not included in the study because of their ubiquitous nature.

The distribution of software applications used by the respondents is presented in Table 14. The two most popular software were Groupwise used by 94.0 percent of those surveyed and Intranet used by 86.5 percent of the respondents. These two applications serve as crucial communication tools for the entire employee population. JDE Peoplesoft -- a software application used to manage financial, accounting, budgeting, purchasing, inventory, payroll and human resources -- was used by 33.9 percent of the respondents. Other applications that were used by more than 10 percent of the respondents include LaserFiche, Trak-It, Harris, VisionAir, Brio and AutoCad.

Table 14

Applications Used by Employees of the City of Denton

Application N	*umber of respondents using application*	*Percent of respondents using application*
Groupwise	313	94.0%
Intranet	288	86.5%
JDE Peoplesoft	113	33.9%
LaserFiche	105	31.5%
Trak-it	63	18.9%
Harris	56	16.8%
VisionAir	49	14.7%
Brio	47	14.1%
ArcView	42	12.6%
AutoCad	32	9.6%
Millennium (Triple I)	32	9.6%
Time Clocks	23	6.9%
Customer Service Call Manager Center	15	4.5%
CityWorks	14	4.2%
Faster (CCG Fleet)	12	3.6%
Paradigm	12	3.6%
Class	11	3.3%
Court Specialists	10	3.0%
Cartegraph	9	2.7%
TaxOffice 2000	7	2.1%
PrintSmith	5	1.5%
Other	49	14.7%

Normality of the demographic data was analyzed in Table 15 using skewness and kurtosis. Skewness is a measure of symmetry (Kvanli, et al., 2002). The value of skewness ranges from -3 to 3. A value of zero indicates perfect symmetry, i.e., the data distribution looks the same from left to right.

Kurtosis is a measure of the peakedness of a distribution. Age, education, gender, years at current job and years at organization are the variables analyzed. Univariate normality test was conducted to test for skewness and kurtosis. In general, the distribution of data did not vary significantly from normality. Skewness was less than 1 for most of the variables except for years in organization which is greater than one. This suggests that years at the current job may be different from normal. Kurtosis is close enough to the accepted level for most of the variables except years at current job which also suggest that there is a high frequency of observations close to the mean and in the tails of the distribution.

Table 15

Skewness and Kurtosis

				Skewness		*Kurtosis*	
	Statistic	*Mean*	*Std Dev*	*Statistic*	*Std. Error*	*Statistic*	*Std. Error*
Age	333	6.02	2.133	-0.085	.134	-0.945	.266
Education	327	3.19	1.360	-0.154	.135	-1.305	.269
Gender	333	0.44	0.497	0.237	.134	-1.956	.266
Years at current job	333	6.48	5.940	1.847	.134	4.861	.266
Years in organization	333	10.37	7.879	0.851	.134	-0.003	.266

CHAPTER 5

DATA ANALYSIS

Introduction

This chapter presents the analysis of the instrument and the assessment of the empirical model. The model used in this dissertation comprises of 12 latent variables which cannot be directly measured. These include system quality, information quality, information satisfaction, system satisfaction, performance expectancy, effort expectancy, social influence, facilitating conditions, attitude, behavioral intention to use, use, and net benefits (organizational impact).

Partial least squares (specifically PLS Graph Version 3.00 build 1126) structural equation analysis was chosen as the analysis tool. Wold and Jöreskog (1982) posits that PLS is an advanced statistical method that allows optimal empirical assessment of a structural and measurement model. The measurement model is also referred to as the outer model and the structural model as the inner model. The measurement model shows the link of each construct with a set of indicators (typically questions) measuring that construct. The structural model shows the causal relationships between multiple constructs. PLS follows the theory of fixed point (FP) estimation in which the residual variances under a fixed point constraint are minimized (Fornell and Bookstein, 1982).

PLS is widely used in IS research (Agarwal and Karahanna,2000; Gefen and Straub, 1997; Igbaria and Iivari, 1995; Karahanna, et al., 1999; Thompson, et al.,1991; Venkatesh and Morris, 2000; Venkatesh, et al., 2003; Wasko and Faraj, 2005). Although the measurement and structural parameters are estimated together, a PLS model is analyzed and interpreted in two stages: (1) the assessment of the reliability and validity of the measurement model, followed by (2) the assessment of the structural model. This ensures that the researcher has a reliable and valid instrument before attempting to draw any conclusions about the relationships.

PLS has some major advantages over covariance-based methods such as LISREL, EQS and AMOS. It avoids two major problems of covariance–based modeling: inadmissible solutions and factor indeterminacy (Fornell and Bookstein, 1982). In addition, it makes minimum demands on measurement scales, sample size and distribution of residuals. Although it makes minimum demands on measurement scales, there should be an adequate sample size to utilize this PLS technique (Marcoulides and Saunders, 2006). PLS requires a sample size consisting of 10 times the number of predictors, using either the indicators of the most complex formative construct or the largest number of antecedent constructs leading to an endogenous construct, whichever is greater (Marcoulides and Saunders, 2006).

Measurement Model Assessment

The adequacy of the measurement model can be demonstrated through measures of (1) convergent validity, (2) discriminant validity and (3) reliability (Hubbard, 1999). PLS simultaneously assesses the reliability and validity of the measures of theoretical constructs and estimates the relationships among these constructs.

Convergent Validity

Convergent validity is assumed when each item correlates strongly on its theoretical construct (Gefen and Straub, 2005). In PLS, convergent validity is shown when each of the measurement items loads with a significant t-value on its construct (Gefen and Straub, 2005). Convergent validity can be assessed by examining: (1) individual item reliability, (2) construct reliability, and (3) average variance extracted (AVE) (Chin, 1998a; Fornell and Larcker, 1981).

To assess convergent validity, a bootstrap technique is used to generate the t-values of the Outer Model loadings. To ensure convergent validity, the t-values must be above 1.96. Tables 16a-c below indicate that the t-value was above 1.96 for each item on their related theoretical construct. This demonstrates the presence of convergent validity.

Table 16a

T-Statistic for the Individual Indicators – Full Model

Construct Item	*s*	*T-Statistic*
Information Quality	IQ1	**148.696**
	IQ2	**202.798**
	IQ3	**144.477**
System Quality	SQ1	**162.044**
	SQ2	**465.773**
	SQ3	**365.009**
Information Satisfaction	ISAT1	**428.003**
	ISAT2	**374.859**
System Quality	SS1	**331.747**
	SS2	**299.345**
Performance Expectancy	PE1	**66.291**
	PE2	**162.249**
	PE3	**131.843**
	PE4	**111.880**
Effort Expectancy	EE1	**72.271**
	EE2	**73.004**
	EE3	**57.049**
	EE4	**41.819**
Social Influence	SI1	**17.599**
	S2	**38.364**
	S3	**28.902**
	S4	**29.349**
Facilitating Conditions	FC1	**10.975**
	FC2	**22.976**
	FC3	**3.568**
	FC4	**7.6838**
Behavioral Intention	BI1	**271.707**
	BI2	**146.529**
	BI3	**432.483**
Use	U1	**14.481**
	U2	**35.251**
Individual Impact	II1	**0.000**
Organizational Impact	OI1	**81.264**
	OI2	**124.298**
	OI3	**68.787**
	OI4	**83.424**
	OI5	**84.994**
	OI6	**63.391**
Attitude	A1	**42.862**

	A2	**46.251**
	A3	**99.419**
	A4	**124.781**

Table 16b

T-Statistic for the Individual Indicators – DeLone and McLean Model

Construct	*Items*	*T-Statistic*
Information Quality	IQ1	**163.743**
	IQ2	**189.256**
	IQ3	**146.538**
System Quality	SQ1	**159.552**
	SQ2	**452.028**
	SQ3	**350.950**
Behavioral Intention	BI1	**320.481**
	BI2	**169.264**
	BI3	**509.488**
Use	U1	**7.816**
	U2	**10.384**
User Satisfaction	SAT1	**69.363**
	SAT3	**63.254**
	SAT2	**41.346**
	SAT4	**81.850**
Individual Impact	II1	**0.000**
Organizational Impact	OI1	**78.802**
	OI2	**117.835**
	OI3	**67.340**
	OI4	**90.798**
	OI5	**88.057**
	OI6	**66.067**

Table 16c

T-Statistic for the Individual Indicators – UTAUT Model

Construct	*Items*	*T-Statistic*
Performance Expectancy	PE1	**71.247**
	PE2	**173.924**
	PE3	**134.195**
	PE4	**122.480**
Effort Expectancy	EE1	**74.471**
	EE2	**75.089**
	EE3	**49.591**
	EE4	**51.958**
Social Influence	SI1	**19.026**
	S2	**40.697**
	S3	**24.611**
	S4	**30.693**
Facilitating Conditions	FC1	**36.674**
	FC2	**20.296**
	FC3	**16.234**
	FC4	**24.120**
Behavioral Intention	BI1	**274.722**
	BI2	**164.674**
	BI3	**439.391**
Use	U1	**2.922**
	U2	**4.029**

Item reliabilities

The item reliabilities are measured by examining the loadings or simple correlations of the measures on their respective construct. Composite reliability developed by Fornell and Lacker (1981) is used to measure the composite reliability. These reliabilities take into account the actual loadings used to construct the factor score and are considered a better measure of internal consistency. The general heuristic is to accept items with loadings

of 0.7 or higher. This implies that more than 50 percent of the variance in the observed variable (i.e, the square of the loading) is due to the construct (Hubbard, 1999). Tables 17a-c below show that there is high individual item reliability which is an indication of convergent validity. Most of the composite reliability values are greater than .80, which suggests good internal consistency. All the items were retained in the study.

Composite Reliability = $\rho_c = (\Sigma\lambda_i)^2 / (\Sigma\lambda_i)^2 + \Sigma_i var(\varepsilon_i)$

Table 17a (i)

Internal Consistency Factor Loading Analysis

Construct Var	*iable*	*Weight*	*Model IC Factor*
Performance Expectancy	PE1	0.2649	0.9206
	PE2	0.2669	0.9637
	PE3	0.2573	0.9594
	PE4	0.2662	0.9474
Effort Expectancy	EE1	0.2911	0.9189
	EE2	0.2545	0.9349
	EE3	0.3041	0.918
	EE4	0.2461	0.8752
Social Influence	SI1	0.2692	0.7875
	S2	0.3181	0.8619
	S3	0.2505	0.7970
	S4	0.3811	0.8245
Facilitating Conditions	FC1	0.3298	0.8483
	FC2	0.4983	0.8669
	FC3	0.0590	0.5752
	FC4	0.3310	0.7685
Behavioral Intention to Use	BI1	0.3389	0.9927
	BI2	0.3304	0.9923
	BI3	0.3373	0.9953
Use	U1	0.4566	0.8579
	U2	0.6520	0.9330
Information Satisfaction	ISAT1	0.5116	0.9874
	ISAT2	0.5014	0.9869
System Satisfaction	SS2	0.5047	0.9802
	SS1	0.5151	0.9810
Information Quality	IQ1	0.3371	0.9672
	IQ2	0.3458	0.9778
	IQ3	0.3489	0.9626
System Quality	SQ1	0.3365	0.9743
	SQ2	0.3414	0.9886
	SQ3	0.3403	0.9832
Organizational Impact	OI1	0.1832	0.9164
	OI2	0.1867	0.9409
	OI3	0.1683	0.9010
	OI4	0.1798	0.9340
	OI5	0.1867	0.9169

Table 17a(ii)

Internal Consistency Factor Loading Analysis – Full Model

Construct	*Variable*	*Weight*	*Model IC Factor*
	OI6	0.1837	0.9025
Individual Impact	II1	1	1
Attitude	A1	0.3105	0.8477
	A2	0.2524	0.8789
	A3	0.2624	0.9238
	A4	0.2896	0.9411

Table 17b

Internal Consistency Factor Loading Analysis – DeLone and McLean Model

Construct Var	*iable*	*Weight*	*Model IC Factor*
Information Quality	IQ1	0.3437	0.9678
	IQ2	0.3418	0.9775
	IQ3	0.3463	0.9622
System Quality	SQ1	0.3359	0.9742
	SQ2	0.3412	0.9886
	SQ3	0.3411	0.9833
Behavioral Intention to Use	BI1	0.3407	0.9927
	BI2	0.3287	0.9923
	BI3	0.3372	0.9953
Use	U1	0.4319	0.847
	U2	0.6744	0.9403
User satisfaction	SAT1	0.2692	0.9104
	SAT3	0.2693	0.9157
	SAT2	0.2642	0.9016
	SAT4	0.2999	0.9007
Individual Impact	II1	1	1
Organizational Impact	OI1	0.1856	0.9171
	OI2	0.1874	0.941
	OI3	0.1721	0.9021
	OI4	0.181	0.9344
	OI5	0.1795	0.9153
	OI6	0.1826	0.9018

Table 17c

Internal Consistency Factor Loading Analysis – UTAUT Model

Construct	*Variable*	*Weight*	*Model IC Factor*
Performance Expectancy	PE2	0.2666	0.9637
	PE3	0.2542	0.9586
	PE4	0.2611	0.9461
Effort Expectancy	EE1	0.3056	0.9194
	EE2	0.2541	0.936
	EE3	0.2537	0.9061
	EE4	0.2836	0.8861
Social Influence	SI1	0.2692	0.7875
	S2	0.318	0.8619
	S3	0.2505	0.797
	S4	0.3811	0.8245
Facilitating Conditions	FC1	0.3298	0.8484
	FC2	0.4976	0.8666
	FC3	0.0597	0.5759
	FC4	0.3312	0.7688
Behavioral Intention to Use	BI1	0.3392	0.9927
	BI2	0.33	0.9923
	BI3	0.3375	0.9953
Use	U1	0.4485	0.8544
	U2	0.6594	0.9354

Construct Reliability

Reliability refers to the degree to which the variables are consistent with what they are supposed to be measuring. The Cronbach alpha is one of the most common measures used to measure reliability of the construct. It is recommended that the alpha value should be greater than 0.70 (Nunnally, 1970; Straub, 1989). Table 18 below lists the reliability scores of the constructs used in the model. All the construct reliabilities are above the threshold of 0.70 which suggests that the instrument is reliable.

Table18

Reliability Scores of the Constructs

Constructs Cronbac	*h's Alpha Scores*
Performance Expectancy	0.973
Effort Expectancy	0.952
Social Influence	0.890
Facilitating Conditions	0.853
Behavioral intention to use	0.996
Use	0.891
Information Satisfaction	0.987
System Satisfaction	0.980
Information Quality	0.979
System Quality	0.988
Organizational Impact	0.970
Attitude	0.944
Individual Impact	1.000

Discriminant Validity

Discriminant validity is assumed when the items correlates weakly with all other constructs except the one it is theoretically associated. Discriminant validity can be assessed by; (1) examining the loadings and cross-loadings between the individual indicators and the constructs to ensure that each indicator loads more highly with its own construct than with other constructs, and (2) examining the Average Variance Extracted (AVE) of the latent constructs to see if they are greater than the square of the correlations among the latent constructs (Chin, 1998a). AVE, created by Fornell and Larcker (1981), attempts to measure the amount of variance that a latent variable component captures from its indicators relative to the

amount due to measurement error (Chin, 1996). It is recommended that the AVE should be greater than 0.50 meaning that 50% or more variance of the indicators should be accounted for. In addition, the AVEs of the latent variable should be higher than any correlation among any pair of latent construct (Chin, 1998a).

$$AVE = \Sigma\lambda_i^2 / \Sigma\lambda_i^2 + \Sigma_i var(\varepsilon_i).$$

All the measures are reflective, therefore the individual loadings for each block of indicators are examined. There are two types of indicators – reflective and formative indicators. Reflective indictors are used in classical test theories and factor analysis models. They are used in an attempt to account for observed variances. Formative indicators, however, are used to minimize residuals in the structural relationship and are not designed to account for observed variances (Fornell and Bookstein, 1982). In additions, Fornell and Bookstein (1982) also suggest that constructs such as personality and attitude, which are viewed as underlying factors that give rise to something that is observed, should be considered reflective. Therefore, in this study, since I intend to account for the observed variances, the indicators are reflective.

A bootstrap resampling (200 resamples) was used throughout the study. The item loadings to construct correlations were examined. The item loadings on the constructs or latent variables were then generated. These scores are correlated with the original data file and a bivariate was then run using Statistical Package for Social Sciences (SPSS). The correlation

matrix is shown in Tables 19a-c below with the bold-faced formatting emphasizing the loading of the measurement items on the constructs to which they are assigned in the confirmatory factor analysis. The results suggest that each indicator loaded higher with its respective latent variable. As a result, no items were dropped form the measurement model.

Discriminant validity is further assessed by calculating the AVE and compares it to the square of the correlations among constructs. Table 20a-c below provides this information with the square root of the AVE given in the diagonals. The results also show that the square root of the AVE is higher than the correlation among the constructs which further strengthen the presence of discriminant validity. As shown in the Table 20a-c below, the AVE measures of all the constructs exceeded the minimum level, ranging from .773 to 1 for the three models. These results demonstrate that the constructs met the criteria for adequate discriminant validity.

Overall, the reliability and validity analyses demonstrate that there is significant confidence in the quality of the survey instrument.

Table 19a

Loadings and Cross-Loadings for the Measurement (Outer) Model – Full Model

	IQ	*SQ*	*IS*	*SS*	*PE*	*EE*	*SI*		*FC*	*BI*	*Use*	*II*	*OI*	*Att*
PE1	0.76	0.76	0.74	0.76	**0.92**	0.69	0.62	0.57	0.47	0.05	0.48	0.74	0.77	
PE2	0.75	0.76	0.74	0.77	**0.96**	0.70	0.61	0.61	0.46	0.12	0.48	0.76	0.79	
PE3	0.71	0.69	0.71	0.72	**0.96**	0.69	0.59	0.60	0.44	0.10	0.47	0.74	0.76	
PE4	0.74	0.71	0.73	0.73	**0.95**	0.69	0.63	0.62	0.45	0.12	0.51	0.77	0.79	
PU1	0.77	0.71	0.76	0.74	**0.92**	0.69	0.63	0.63	0.45	0.10	0.56	0.77	0.79	
PU2	0.75	0.70	0.75	0.72	**0.90**	0.65	0.58	0.56	0.42	0.07	0.50	0.75	0.77	

EE1	0.67	0.68	0.67	0.69	0.73	**0.92**	0.56	0.71	0.43	0.13	0.46	0.66	0.70
EE2	0.56	0.58	0.59	0.63	0.63	**0.93**	0.48	0.68	0.35	0.18	0.42	0.57	0.60
EE3	0.72	0.74	0.68	0.77	0.75	**0.92**	0.54	0.68	0.35	0.12	0.45	0.69	0.73
EE4	0.53	0.54	0.56	0.59	0.53	**0.88**	0.46	0.68	0.40	0.13	0.35	0.52	0.57
A1	0.78	0.78	0.75	0.75	0.80	0.65	0.61	0.55	0.50	0.04	0.46	0.77	**0.85**
A2	0.63	0.62	0.64	0.65	0.67	0.56	0.59	0.51	0.35	0.13	0.43	0.68	**0.88**
A3	0.70	0.72	0.75	0.75	0.69	0.65	0.59	0.56	0.33	0.09	0.48	0.74	**0.92**
A4	0.79	0.81	0.79	0.83	0.76	0.71	0.59	0.61	0.37	0.11	0.52	0.80	**0.94**
SI1	0.35	0.34	0.36	0.32	0.39	0.27	**0.79**	0.32	0.31	0.13	0.29	0.42	0.36
S2	0.45	0.45	0.47	0.44	0.48	0.36	**0.86**	0.43	0.36	0.13	0.39	0.51	0.49
S3	0.68	0.65	0.67	0.69	0.56	0.57	**0.80**	0.55	0.29	0.12	0.47	0.68	0.65
S4	0.66	0.66	0.63	0.67	0.65	0.61	**0.82**	0.61	0.44	0.11	0.41	0.69	0.64
SQ1	0.84	**0.97**	0.79	0.88	0.75	0.69	0.62	0.65	0.41	0.02	0.53	0.80	0.80
SQ2	0.86	**0.99**	0.81	0.89	0.76	0.69	0.65	0.65	0.42	0.04	0.52	0.83	0.82
SQ3	0.85	**0.98**	0.82	0.89	0.76	0.69	0.65	0.65	0.41	0.05	0.54	0.84	0.82
FC1	0.61	0.65	0.63	0.65	0.62	0.67	0.52	**0.85**	0.43	0.14	0.44	0.61	0.55
FC2	0.43	0.43	0.43	0.46	0.44	0.64	0.43	**0.87**	0.43	0.21	0.28	0.43	0.44
FC3	0.66	0.72	0.65	0.70	0.63	0.56	0.56	**0.58**	0.29	0.03	0.46	0.67	0.66
FC4	0.59	0.59	0.59	0.60	0.53	0.54	0.53	**0.77**	0.34	0.14	0.54	0.60	0.55
IQ1	**0.97**	0.85	0.84	0.83	0.75	0.67	0.64	0.63	0.43	0.05	0.56	0.83	0.80
IQ2	**0.98**	0.85	0.86	0.83	0.73	0.66	0.63	0.61	0.43	0.05	0.55	0.82	0.77
IQ3	**0.96**	0.82	0.87	0.83	0.78	0.66	0.65	0.63	0.41	0.06	0.58	0.85	0.78
BI1	0.44	0.42	0.47	0.42	0.48	0.42	0.44	0.50	**0.99**	0.09	0.31	0.46	0.44
BI2	0.43	0.41	0.45	0.40	0.46	0.41	0.43	0.47	**0.99**	0.10	0.31	0.45	0.43
BI3	0.44	0.42	0.46	0.41	0.49	0.42	0.43	0.48	**1.00**	0.09	0.31	0.46	0.44
SS1	0.85	0.90	0.83	**0.98**	0.78	0.74	0.63	0.67	0.41	0.11	0.54	0.83	0.82
SS2	0.83	0.87	0.85	**0.98**	0.76	0.71	0.66	0.67	0.41	0.10	0.57	0.84	0.82
OI1	0.80	0.79	0.81	0.82	0.74	0.65	0.64	0.61	0.43	0.09	0.53	**0.92**	0.79
OI2	0.80	0.78	0.83	0.81	0.74	0.63	0.66	0.64	0.44	0.12	0.54	**0.94**	0.79
OI3	0.77	0.75	0.79	0.77	0.70	0.61	0.63	0.59	0.36	0.06	0.51	**0.90**	0.76
OI4	0.81	0.78	0.84	0.80	0.72	0.62	0.66	0.61	0.38	0.10	0.56	**0.93**	0.78
OI5	0.78	0.75	0.82	0.75	0.75	0.60	0.64	0.58	0.43	0.04	0.55	**0.92**	0.74
OI6	0.78	0.78	0.84	0.76	0.73	0.61	0.66	0.58	0.46	0.05	0.51	**0.90**	0.74
ISAT1	0.88	0.81	**0.99**	0.85	0.77	0.68	0.65	0.65	0.46	0.08	0.59	0.89	0.81
ISAT2	0.87	0.81	**0.99**	0.85	0.75	0.68	0.64	0.65	0.45	0.07	0.58	0.88	0.81
SAT5	0.54	0.54	0.58	0.57	0.49	0.48	0.45	0.54	0.33	0.02	0.87	0.56	0.51
II1	0.58	0.54	0.59	0.56	0.51	0.46	0.48	0.49	0.31	0.04	**1.00**	0.58	0.53
OI7	0.61	0.58	0.62	0.58	0.56	0.47	0.51	0.52	0.35	0.02	0.95	0.62	0.56
U1	0.04	0.02	0.07	0.07	0.10	0.12	0.13	0.14	0.04	**0.86**	0.04	0.08	0.08
U2	0.06	0.07	0.07	0.12	0.09	0.16	0.15	0.21	0.11	**0.93**	0.03	0.08	0.10
SAT1	0.71	0.73	0.72	0.77	0.79	0.85	0.55	0.68	0.39	0.15	0.49	0.72	0.75
SAT3	0.69	0.75	0.72	0.77	0.72	0.76	0.60	0.68	0.40	0.12	0.48	0.73	0.74
SAT2	0.73	0.77	0.72	0.85	0.72	0.72	0.61	0.65	0.43	0.11	0.43	0.72	0.71
SAT4	0.80	0.80	0.84	0.87	0.76	0.70	0.65	0.64	0.37	0.12	0.53	0.86	0.83

Table 19b

Loadings and Cross-Loadings for the Measurement (Outer) Model -DeLone and McLean

	IQ	***SQ***	***BI***	***Use***	***Usersat***	***II***	***OI***
SQ1	0.844	**0.974**	0.414	0.021	0.816	0.532	0.803
SQ2	0.855	**0.989**	0.417	0.044	0.831	0.524	0.833
SQ3	0.854	**0.983**	0.407	0.048	0.836	0.543	0.836
FC1	0.609	0.647	0.426	0.143	0.698	0.444	0.608
FC2	0.425	0.426	0.431	0.215	0.535	0.276	0.427
FC3	0.662	0.721	0.293	0.027	0.675	0.463	0.674
FC4	0.593	0.592	0.340	0.143	0.584	0.535	0.604
IQ1	**0.968**	0.854	0.429	0.054	0.780	0.564	0.832
IQ2	**0.978**	0.847	0.426	0.052	0.777	0.548	0.823
IQ3	**0.961**	0.816	0.408	0.062	0.784	0.576	0.846
BI1	0.444	0.422	**0.993**	0.094	0.442	0.312	0.457
BI2	0.431	0.407	**0.992**	0.098	0.418	0.307	0.449
BI3	0.439	0.423	**0.995**	0.090	0.434	0.306	0.456
SS1	0.853	0.900	0.406	0.115	0.889	0.537	0.831
SS2	0.826	0.866	0.406	0.098	0.881	0.570	0.845
OI1	0.804	0.791	0.434	0.090	0.794	0.530	**0.917**
OI2	0.797	0.777	0.445	0.125	0.796	0.537	**0.941**
OI3	0.768	0.751	0.363	0.059	0.744	0.509	**0.902**
OI4	0.813	0.775	0.377	0.100	0.770	0.560	**0.934**
OI5	0.782	0.750	0.430	0.043	0.736	0.550	**0.915**
OI6	0.783	0.781	0.465	0.055	0.769	0.508	**0.902**
II1	0.580	0.543	0.311	0.035	0.533	**1.000**	0.580
OI7	0.610	0.583	0.347	0.020	0.553	0.946	0.619
U1	0.036	-0.016	0.043	**0.847**	0.095	0.041	0.081
U2	0.062	0.067	0.113	**0.940**	0.144	0.025	0.079
SAT1	0.705	0.730	0.388	0.146	**0.910**	0.490	0.721
SAT3	0.687	0.753	0.397	0.124	**0.916**	0.477	0.726
SAT2	0.726	0.766	0.428	0.109	**0.902**	0.433	0.717
SAT4	0.801	0.804	0.366	0.121	**0.901**	0.529	0.856

Table 19c

Loadings and Cross-Loadings for the Measurement (Outer) Model –

UTAUT Model

	PE EE SI			*FC BI*		*Use*
PE1	**0.9225416**	0.6875375	0.6151895	0.5748926	0.4728617	0.0466515
PE2	**0.9637208**	0.6912411	0.6088048	0.6115142	0.4607737	0.1245096
PE3	**0.9586226**	0.6859901	0.5916278	0.5984599	0.4392936	0.1006331
PE4	**0.946117**	0.6826107	0.6271327	0.6204841	0.4513145	0.1230939
PU1	**0.9216964**	0.6824275	0.6275131	0.627731	0.4482882	0.1039386
PU2	**0.9003458**	0.6431029	0.584646	0.5560122	0.4246194	0.0743109
EE1	0.7341782	**0.9194523**	0.558066	0.715068	0.4268727	0.1345203
EE2	0.6310966	**0.9360197**	0.4836027	0.6798815	0.3549076	0.177873
EE3	0.7488894	**0.9060547**	0.5426752	0.6765204	0.3544822	0.1235694
EE4	0.5296718	**0.8861096**	0.461865	0.679135	0.3962223	0.1331301
SI1	0.3859188	0.2734765	**0.7875162**	0.3228473	0.3073946	0.1343558
S2	0.4764282	0.3613459	**0.8618949**	0.4276041	0.3631738	0.1325163
S3	0.5572545	0.5665655	**0.7970479**	0.5521953	0.2860728	0.1237134
S4	0.6552914	0.6077846	**0.8245506**	0.6126655	0.4351486	0.1153182
FC1	0.6165212	0.6683326	0.5239709	**0.8484412**	0.4258352	0.1419904
FC2	0.4355731	0.6482379	0.4279263	**0.8665382**	0.4309402	0.2141881
FC3	0.6334105	0.5480656	0.558655	**0.575905**	0.2926394	0.0257071
FC4	0.5329876	0.5430323	0.5303167	**0.76885**	0.3404408	0.1425507
BI1	0.4822313	0.4250484	0.4396127	0.498892	**0.9927067**	0.092979
BI2	0.464539	0.4155944	0.4299266	0.4669089	**0.9922844**	0.0966366
BI3	0.4888225	0.4194648	0.4288349	0.4791037	**0.9952535**	0.0890638
U1	0.0994506	0.1144768	0.1255154	0.1419255	0.0428642	**0.8543523**
U2	0.0895174	0.1578011	0.1470514	0.2100449	0.1126935	**0.9354388**

Table 20a

Correlation among Construct Scores (AVE Extracted in Diagonals) – Full Model

	IQ	*SQ*	*IS SS*		*PE*	*EE*	*SI FC*		*BI Us*	*e*	*II*	*OI*	*Att*
IQ	**0.97**												
SQ	0.87	**0.98**											
IS	0.89	0.82	**0.99**										
SS	0.86	0.90	0.86	**0.98**									
PE	0.78	0.77	0.77	0.79	**0.95**								
EE	0.69	0.71	0.69	0.74	0.73	**0.91**							
SI	0.66	0.65	0.65	0.66	0.64	0.56	**0.82**						
FC	0.65	0.66	0.66	0.68	0.63	0.75	0.59	**0.77**					
BI	0.44	0.42	0.46	0.41	0.48	0.42	0.44	0.49	**0.99**				
Use	0.06	0.04	0.08	0.11	0.10	0.15	0.15	0.20	0.09	**0.89**			
II	0.58	0.54	0.59	0.56	0.51	0.46	0.48	0.49	0.31	0.04	**1.00**		
OI	0.86	0.84	0.90	0.85	0.80	0.68	0.71	0.65	0.46	0.09	0.58	**0.92**	
Att	0.81	0.82	0.82	0.83	0.82	0.72	0.66	0.62	0.44	0.10	0.53	0.84	**0.90**

Table 20b

Correlation Among Construct Scores (AVE Extracted in Diagonals) -- DeLone and McLean

	IQ	***SQ***	***BI***	***Use***	***Usersat***	***II***	***OI***
IQ	**0.969**						
SQ	0.867	**0.982**					
BI	0.441	0.420	**0.993**				
Use	0.057	0.038	0.095	**0.895**			
Usersat	0.807	0.843	0.434	0.138	**.0907**		
II	0.580	0.543	0.311	0.035	0.533	**1.000**	
OI	0.861	0.839	0.457	0.088	0.836	0.580	.**919**

Table 20c

Correlation among Construct Scores (AVE Extracted in Diagonals) – UTAUT Model

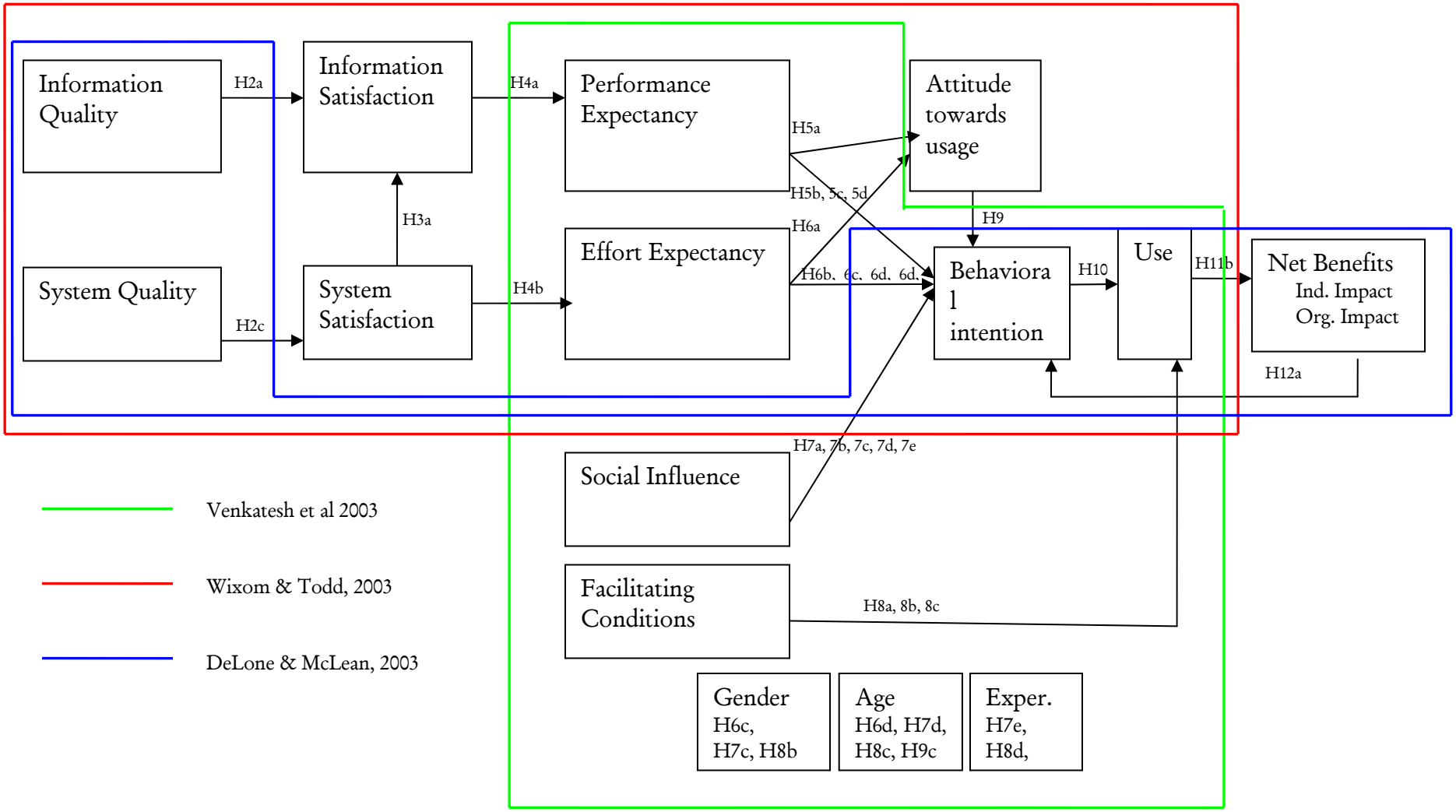
	PE EE SI			*FC BI*		*Use*
PE	**0.948**					
EE	0.7249449	**.965**				
SI	0.6447268	0.5620971	**.819**			
FC	0.634404	0.7555265	0.594715	**.773**		
BI	0.4816502	0.4229564	0.4357555	0.4850573	**.993**	
Use	0.1036352	0.1554084	0.1532565	0.2021679	0.0935536	**.895**

Revision of Proposed Model

The proposed model presented in Chapter 3 was modified. Firstly, upon further review of the literature (Wixom and Todd, 2005), the researcher recognized that information satisfaction and system satisfaction were both dimensions of the user satisfaction model. These two dimensions were measuring essentially the same constructs in the model. Thus, to avoid redundancy, the user satisfaction construct was deleted from the conceptual model. In addition, the stakeholders of the study did not want service quality include in this study. They shared the views of Wixom and Todd (2005) that service quality focuses on the broader target of the IS function rather than on the individual application. Hence this construct was also removed from the model. Analysis of the measurement model revealed that the remaining variables loaded on the appropriate construct. Therefore,

they were kept in the study. The revised conceptual model is shown in Figure 6 below.

Figure 6
Revised Conceptual Model



Structural Model Analysis

The research model and its related hypotheses were assessed with PLS-Graph. The models in PLS are estimated by loadings or weights which describe how the observations relate to the unobservables. They are also estimated by the structural relations, whereby values of the unobservables influence values of other unobservables in the model. A bootstrapping procedure with two hundred resamples was used to generate the t-statistics for the structural paths. Chin suggests that two hundred resamples is reasonable to obtain adequate standard error estimates (Chin 1998a).

The explanatory power of the structural model is evaluated by examining the squared multiple correlation (R^2) value in the final dependent construct. The R^2 measures the percentage of variation that is explained by the model. The R^2 for the overall model is 0.3168. The R^2 for each of the dependent variables are Information Satisfaction (0.82), System Satisfaction (0.81), Performance Expectancy (0.59), Effort Expectancy (0.55), Behavioral Intention (0.27), Attitude (0.70), Use (0.04), Individual Impact (.001) and Organizational Impact (0.16). The structural model and the outer loadings, and the explained variances (R-squares) are presented in Figure 7 below. The numbers in the middle of the arrows represent the contribution of each independent construct to the dependent constructs. The number below the dependent constructs is the percent of variation of that construct explained by the model. Table 21 below is used to test the research hypotheses. Table 22 explains which hypotheses were supported.

Figure 7.

Structural Model – Full Model

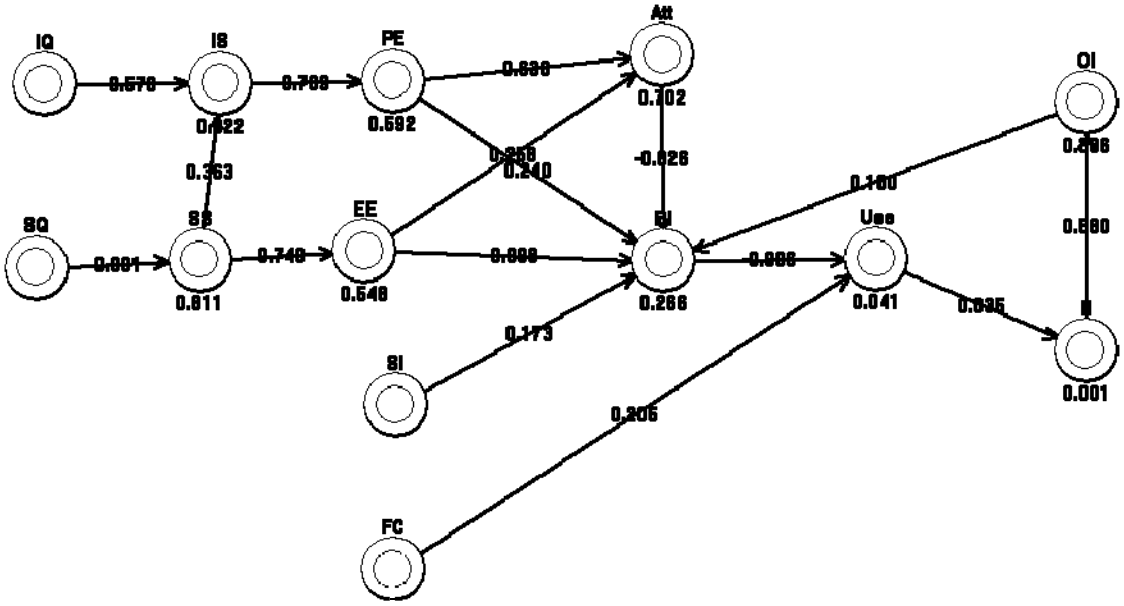


Table 21

Statistical Significance of the Coefficients

Endogenous Variables	R^2	Independent Variables	Standardized coefficients	T-statistic
Performance Expectancy	0.592	Information Satisfaction	0.769	27.0941
Effort Expectancy	0.548	System Satisfaction	0.74	24.6113
Behavioral Intention to Use	0.266	Performance Expectancy	0.24	1.7776
		Effort Expectancy	0.098	1.4053
		Social Influence	0.173	2.3145
		Attitude	-0.026	0.2624
		Organizational Impact	0.1	0.7079
Use	0.041	Behavioral Intention	-0.006	0.0695
		Facilitating Conditions	0.205	3.2952
Information Satisfaction	0.822	Information quality	0.576	8.7536
		System Satisfaction	0.363	5.5371
System Satisfaction	0.811	System Quality	0.901	65.6614
Attitude	0.702	Performance Expectancy	0.63	10.28
		Effort Expectancy	0.258	4.2329
Individual Impact	0.001	Use	0.035	0.8038
Organizational Impact	0.336	Individual Impact	0.58	11.7632

Table 22

Research Hypotheses

H2a	Information quality is significantly related to information satisfaction	Supported
H2b	Service quality is significantly related to system satisfaction	Eliminated
H2c	System quality is significantly related to satisfaction	Supported
H3	System satisfaction is significantly related to information satisfaction	Supported
H4a	Information satisfaction is significantly related to on performance expectancy	Supported
H4b	System satisfaction is significantly related to effort expectancy	Supported
H5a	Performance expectancy is significantly related to attitude towards attitude towards use	Supported
H5b	Performance expectancy is significantly related to behavioral intention use	Not supported (significant at 0.10 level)
H6a	Effort expectancy is significantly related to attitude towards use	Supported
H6b	Effort expectancy is significantly related to behavioral intention use	Not supported
H7a	Social influence is significantly related to behavioral intention to use	Supported
H8a	Facilitating condition is significantly related to use	Supported
H9	Attitude towards use is significantly related to use	Not supported
H10	Behavioral intention to use is significantly related to use	Not supported
H11a	Use is significantly related to user satisfaction	Eliminated
H11b	Use is significantly related to Individual Impact	Not supported
H12a	Organization impact is significantly related to behavioral intention to use.	Not supported
H12b	Organizational impact is significantly related to user satisfaction.	Eliminated

To test the moderator gender, two models were generated for the male and female respondents as shown in Figure 8 and 9. The R^2 for the both models was very similar. For the male subgroup, the R^2 was 0.3223 whereas the R^2 for the female was 0.3186 which suggest that the male group is predicting less than 1 percent more of the variation of IS success in the government organization. Further tests were conducted to examine the differences in the path coefficients between the two models. Cohen and Cohen's (1983, pp. 55-56) procedure was used to calculate the difference between the paths. This yielded the following results shown in Table 23 below.

Table 23

Gender Differences

		T- Statistics	*p-Value*	*Hypothesis*
H6c	PE-BI	-0.645	0.5190	Not supported
H7c	EE-BI	0.957	0.3390	Not supported
H8b	SI-BI	-1.308	0.1918	Not supported
	FC-Use	2.260	0.0242	Supported
	PE_Att	-1.910	0.0570	Partially supported
	EE-Att	1.822	0.0693	Partially supported

Figure 8

Structural Model – Full Model --Female

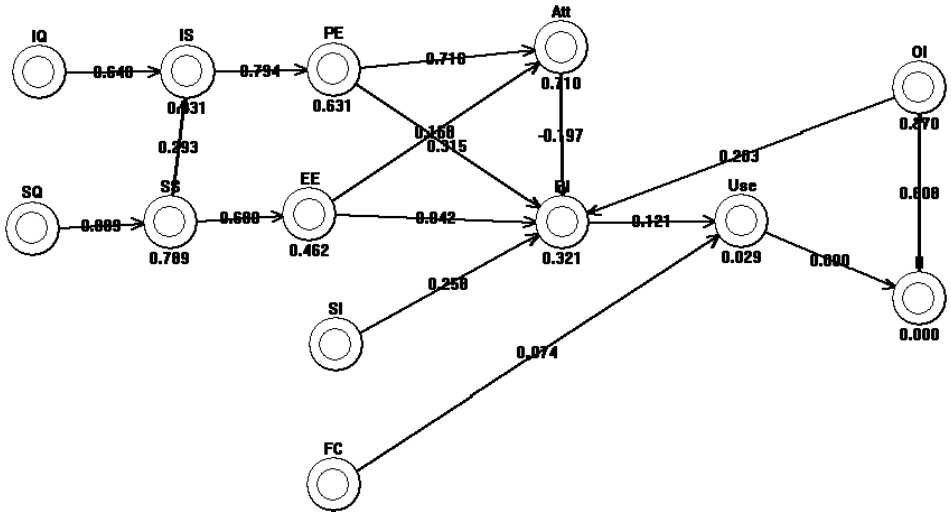
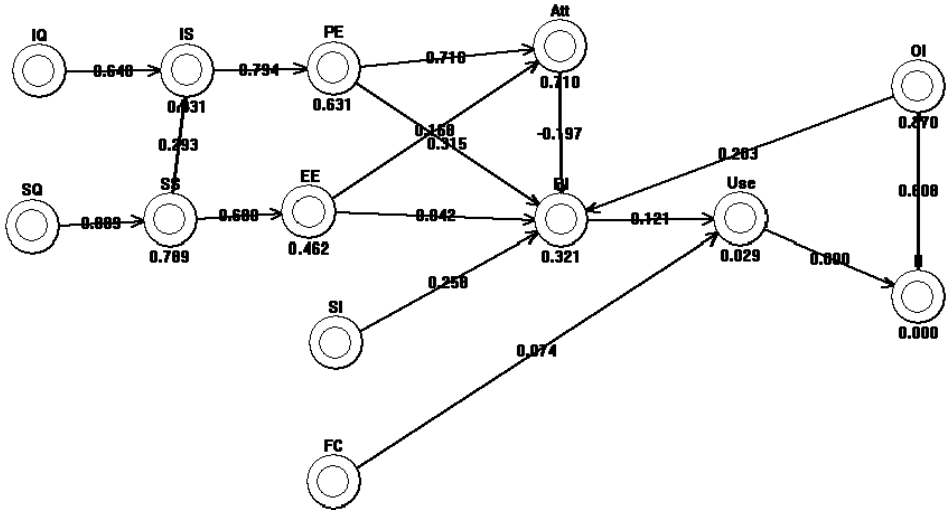


Figure 9

Structural Model – Full Model-- Male



To test the moderator age, two models were generated for the young and old respondents, as shown in Figure 10 and 11. Young respondents included employees under age 40 while old respondents included employees whose age is 40 and above. The R^2 for the models was the same with an R^2 of 0.3068 which indicate that there are no differences in the young and old employees in predicting IS success in the government organization. Tests of the individual parts are shown in Table 24 below.

Table 24

Age Differences

		T- Statistics	*p-Value*	*Hypothesis*
H5d	PE-BI	0.311	0.756	Not supported
H6d	EE-BI	0.072	0.943	Not supported
H7c	SI-BI	-0.301	0.764	Not supported
H8b	FC-Use	0.344	0.731	Not Supported
	PE_Att	-1.685	0.093	Partially supported
	EE-Att	1.794	0.072	Partially supported

Figure 10

Structural Model – Full Model - Young

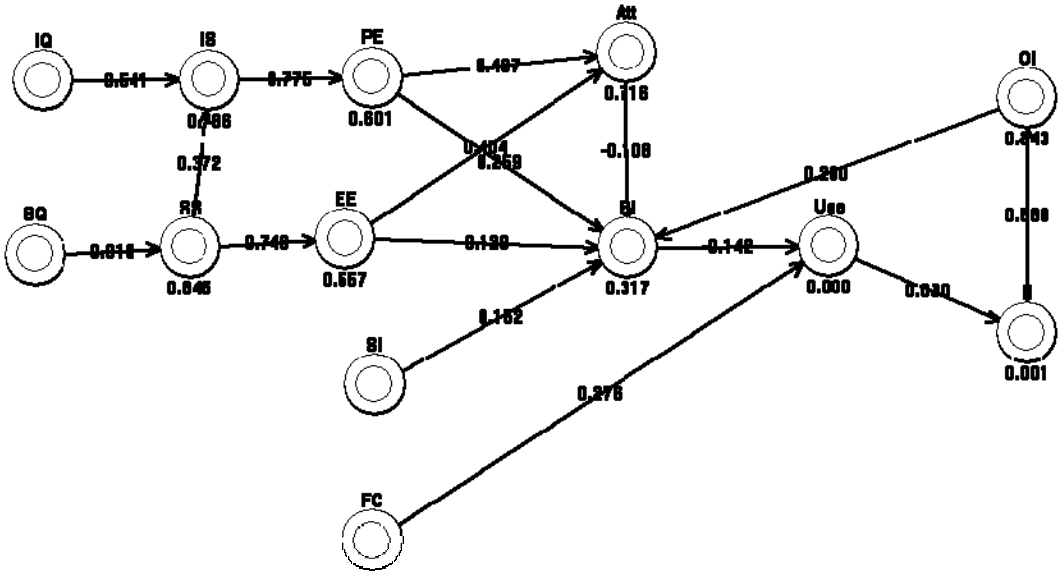
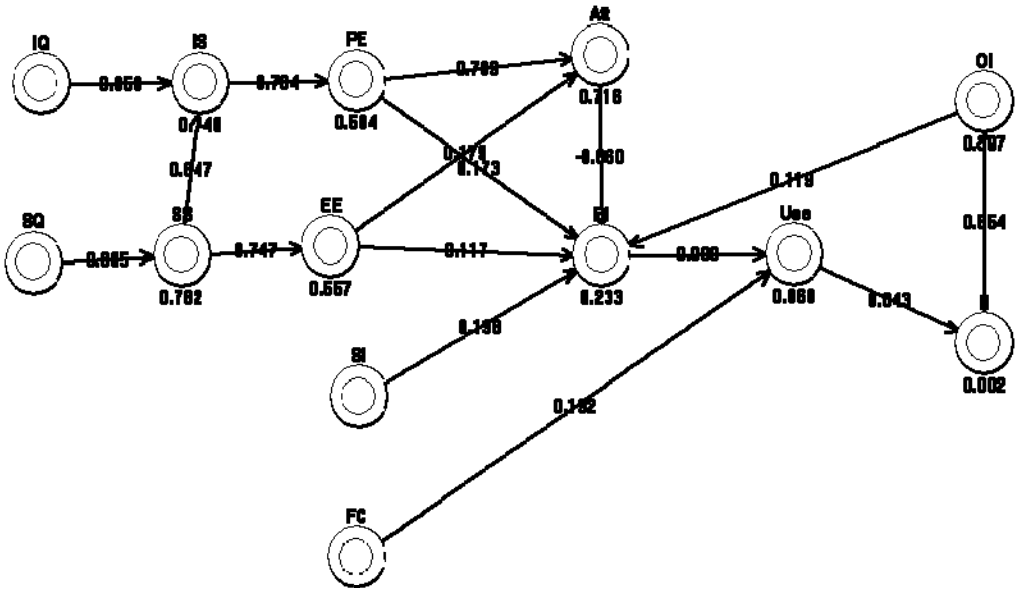


Figure 11

Structural Model – Full Model - Old



To test the moderator experience, three models were generated for the three groups – high, medium and low experience, as shown in Figure 12, 13 and 14. Low experience included employees with 10 or less years of computer experience. Medium experience included employees with 11-19 years of computer experience. High experience included employees with 20 or more years of computer experience. The R^2 for the employees with low experience was 0.2822. The R^2 for the employees with medium experience was 0.3598. The R^2 for the employees with high experience was 0.3298. The results indicate that the level of experience provides no differences in

predicting IS success in the government organization. Tests of the individual parts are shown in Table 25a - c below.

Table 25a

High to Medium Experiences Comparisons

		T- Statistics	p-Value	Hypothesis
	PE-BI	-2.11126	**0.0359**	Supported
H7d	EE-BI	0.630129	0.5293	Not supported
H8d	SI-BI	-0.21549	0.8296	Not supported
H9c	FC-Use	-0.52289	0.6016	Not supported
	PE_Att	0.685075	0.4941	Not supported
	EE-Att	-1.19889	0.2322	Not supported

Table 25b

High to Low Experiences Comparisons

		T- Statistics	*p-Value*	*Hypothesis*
	PE-BI	-1.195287144	0.2334	Not supported
H6d	EE-BI	0.666482787	0.5059	Not supported
H7d	SI-BI	-0.217093401	0.8284	Not supported
H8c	FC-Use	0.246192407	0.8058	Not supported
	PE_Att	0.734163463	0.4637	Not supported
	EE-Att	-0.555260482	0.2897	Not supported

Table 25c

Medium to Low Experiences Comparisons

		T- Statistics	p-Value	Hypothesis
	PE-BI	0.790461	0.4300	Not supported
H7d	EE-BI	0.054184	0.9568	Not supported
H8d	SI-BI	-0.01196	0.9905	Not supported
H9c	FC-Use	0.826446	0.4094	Not supported
	PE_Att	0.054995	0.9562	Not supported
	EE-Att	0.691943	0.4896	Not supported

Figure 12

Structural Model – Full Model - Low Experience

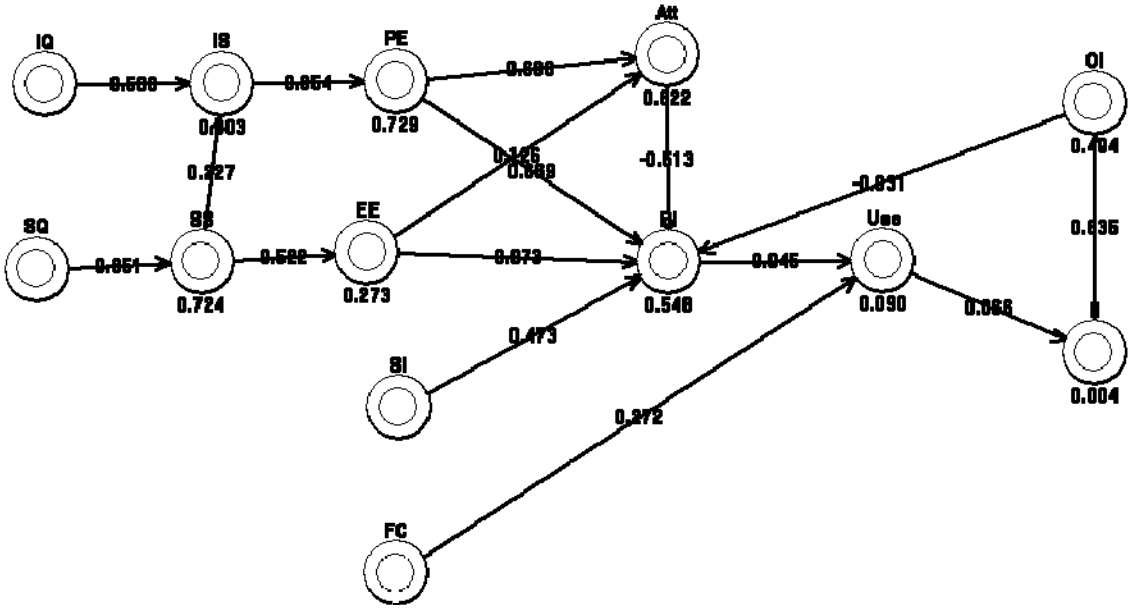


Figure 13

Structural Model – Full Model - Medium Experience

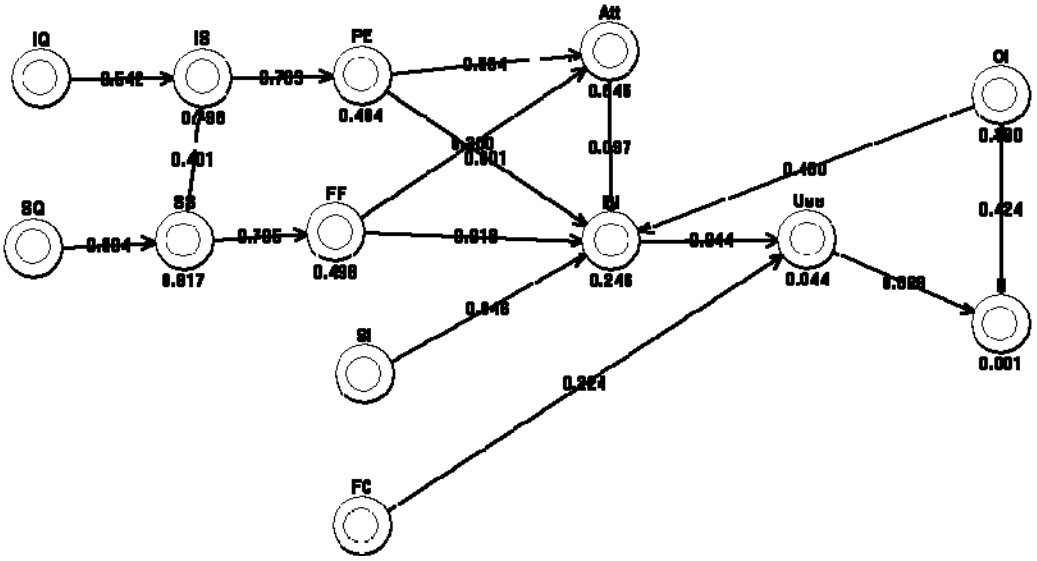
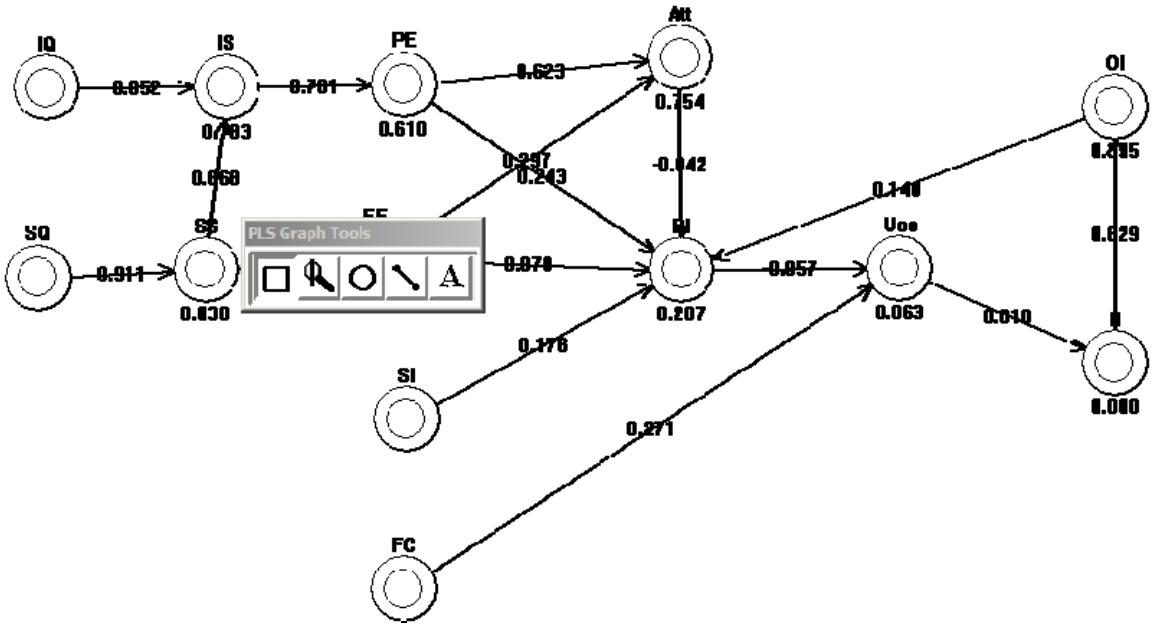


Figure 14

Structural Model – Full Model - High Experience



The R^2 for each of the dependent variables for the DeLone and McLean model are Behavioral Intention (0.213), Use (.011), User Satisfaction (0.774), Individual Impact (0.001), and Organizational Impact (0.336).The structural model and the outer loadings, and the explained variances (R-squared) are presented in Figure 15 below. The research hypotheses are shown in Table 26 below.

Figure 15

Structural Model – De Lone and McLean

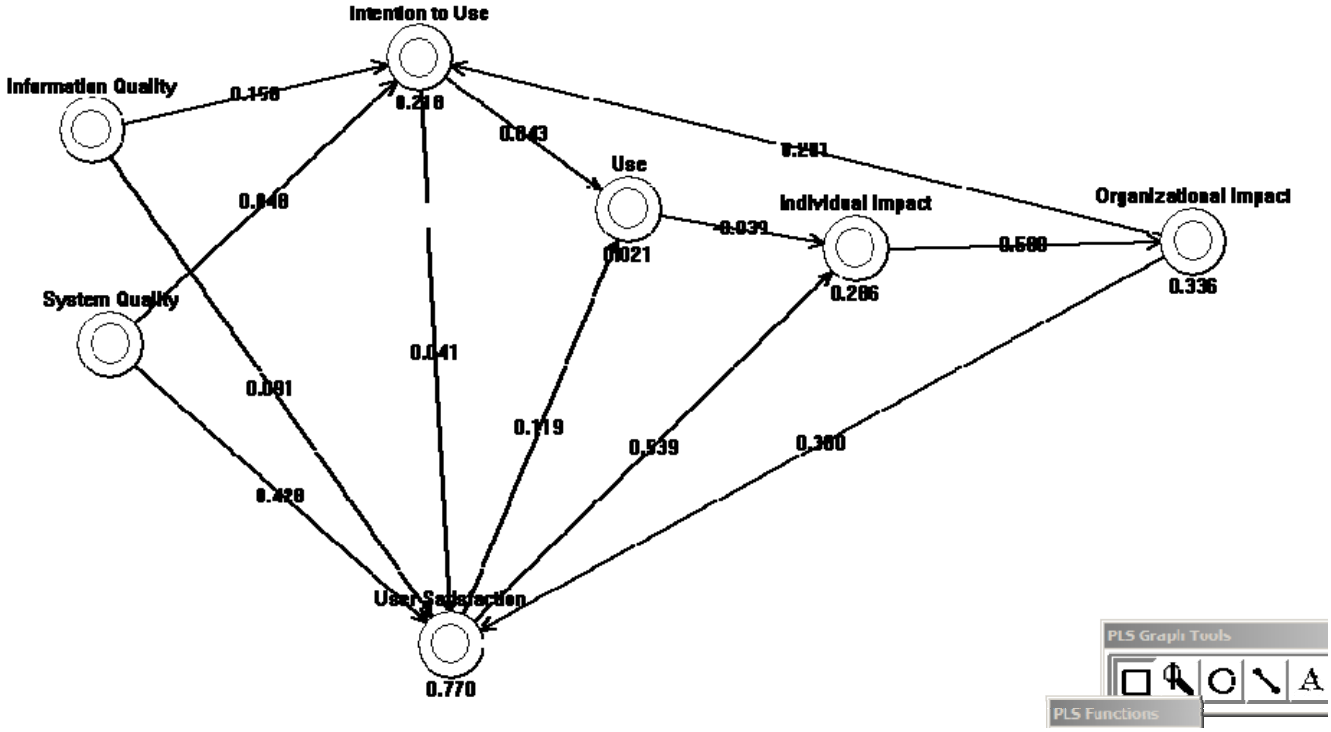


Table 26

Research Hypotheses – DeLone and McLean Model

		T-statistic	
	Information quality has an impact on user satisfaction	0.893	Not Supported
	Information quality has an impact on behavioral intention to use the system	2.260	Supported
	System quality has an impact on user satisfaction	4.802	Supported
	System quality has an impact on behavioral intention to use the system	0.240	Not Supported
H10	Behavioral intention has an impact on use	0.7512	Not Supported

H11b	Use has an impact on net benefits (individual impact)	0.7797	Not supported
H11a	Use has an impact on user satisfaction	2.825	Supported
H12a	Net benefits (organizational impact) has an effect on behavioral intention to use	0.920	Not Supported
H12b	Net benefits (organizational impact) has an effect on user satisfaction	5.542	Supported
	User satisfaction has an effect on behavioral intention to use	2.299	Supported

The R^2 for the UTAUT model is 0.2329. The R^2 for each of the dependent variables are Behavioral Intention (0.27) and Use (.04). The structural model and the outer loadings, and the explained variances (R-squares) are presented in Figure 16 below. Research hypotheses H6b, H8a and H9a were supported. However, researcher hypotheses H7b and H11 were not supported. This is shown in Table 27 below.

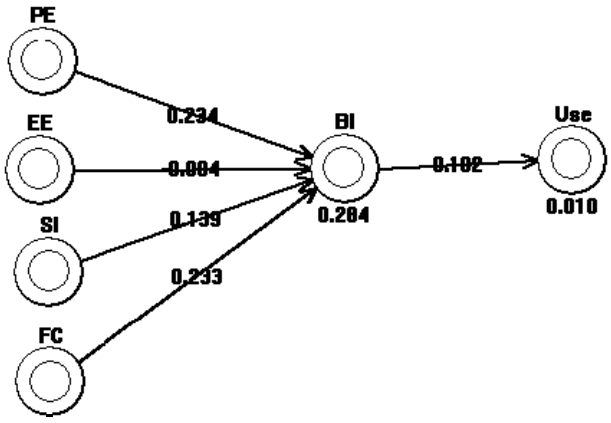
Table 27

Research Hypotheses – UTAUT Model

		T-statistic	
H5b	Performance expectancy is significantly related to behavioral intention use	2.66	Supported
H6b	Effort expectancy is significantly related to behavioral intention to use	.048	Not Supported
H7a	Social influence is significantly related to behavioral intention to use	2.21	Supported
H8a	Facilitating condition is significantly related to use	2.89	Supported
H10	Behavioral intention to use is significantly related to use	1.291	Not supported

Figure 16

Structural Model – UTAUT Model



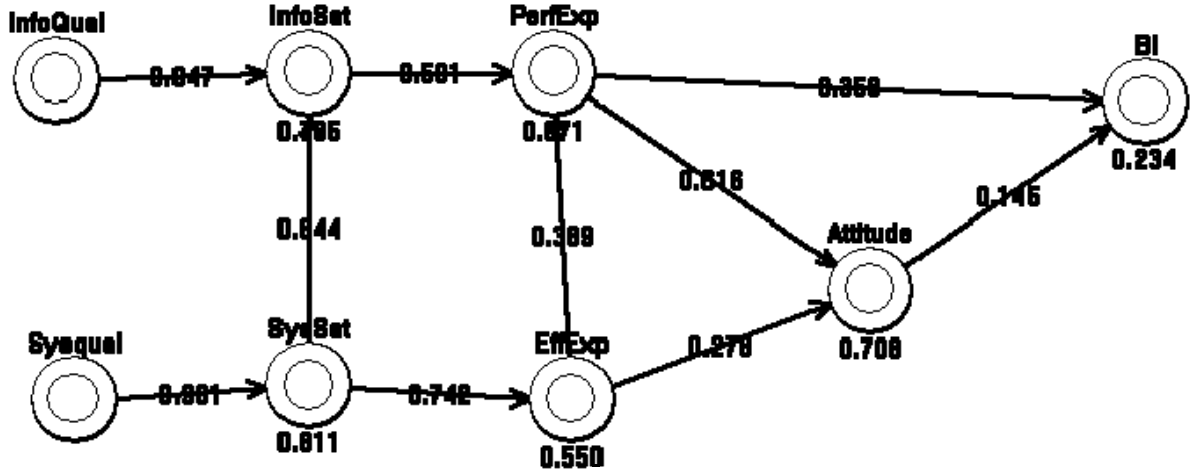
The R^2 for the Wixom and Todd model is 0.3168. The R^2 for each of the dependent variables are Information Satisfaction (0.73), System Satisfaction (0.81), Performance Expectancy (0.67), Effort Expectancy (0.55), and Behavioral Intention (0.23). Performance expectancy was the strongest contributor to attitude (path = 0.62) and behavioral intention (path = 0.36). The structural model and the outer loadings, and the explained variances (R-squares) are presented in Figure 17 below. All of the research hypotheses were supported. This is summarized in Table 27 below

Table 28

Research Hypotheses – Wixom and Todd Model

		T-statistic	
H2a	Information quality is significantly related to information satisfaction	71.84	Supported
H2c	System quality is significantly related to system satisfaction		Supported
H3	System satisfaction is significantly related to information satisfaction	7.10	Supported
H4a	Information satisfaction is significantly related to on performance expectancy	8.415	Supported
H4b	System satisfaction is significantly related to effort expectancy	23.12	Supported
H5a	Performance expectancy is significantly related to attitude towards attitude towards use	9.92	Supported
H5b	Performance expectancy is significantly related to behavioral intention use	2.65	Supported
H6a	Effort expectancy is significantly related to attitude towards use	4.47	Supported
H6b	Attitude is significantly related to Behavioral intention to use	1.3537	Not significant

Figure 17 *Structural Model – Wixom and Todd Model*



CHAPTER 6

FINDINGS AND DISCUSSIONS

This chapter presents and discusses the findings of the study. A summary of results and support for the hypotheses are presented. Finally, limitations of the study and implications and recommendations for future research are discussed.

Summary of the Study

In this study a new model for examining IS Success in government organizations was proposed. This model is based on three established IS success assessment frameworks – the DeLone and McLean (2003) model, Venkatesh, et al. (2003) UTAUT model and Wixom and Todd (2005) model. An on-line survey was conducted at the City of Denton, Texas for data collection. A total of 333 responses were received, resulting in a response rate of 30.3%. An analysis of the response bias between early and late respondents showed no significant difference.

The survey was taken by 55.9 percent male and 44.1 percent female respondents. The average age of the respondents was 40. About half of the participants have a degree from a four-year college or graduate school. About half of them held a managerial or professional position. On average, the respondents worked over 40 hours per week and utilized Information System for about 24.7 hours per week. These results suggest

the respondents are well qualified for the survey participant group in this study.

Summary of the Findings

A number of findings related to IS Success in a government setting are identified in this study. The findings are discussed below. Four of the hypothesis were fully supported five were not supported, and four were partially supported.

Hypothesis 1: The proposed conceptual model.

Hypothesis 1 measured whether the proposed model is statistically significant. This hypothesis was supported and its R^2 is slightly higher than any of the other three models. The percentage of variance explained by the overall model is 32 percent. In this model, only 27 percent of the variance of behavioral intention was explained; while 70 percent of the variance of attitude was explained. This suggests that in a mandatory setting, greater emphasis should be placed on individual's attitude than on behavioral intention which has been the focus of many studies on technology acceptance. This supports Nah et al. (2004) claim that behavioral intention may not be the best predictor in mandatory settings.

Hypothesis 2: The impact on satisfaction.

H2a, which looked at how information quality impacts information satisfaction, indicated strong support for this hypothesis. This supports prior research of Wixom and Todd which asserts that when employees believe that the quality of the information generated from the system is favorable, they are more likely to be satisfied with the information.

H2b looked at the impact of service quality. However, this was eliminated from the study since the stakeholders wanted to test the success of individual application and felt that service quality was too broad in scope for this study.

H2c examined the impact of system quality on system satisfaction. This finding supports both the Wixom and Todd and the newly proposed model. This suggests that the greater the user's perception of the quality of the system quality, the more likely they are to be satisfied with the system.

Overall, this hypothesis shows that quality is a strong antecedent of satisfaction. Thus, government organizations must ensure that the quality of the system is high if they expect employees to be satisfied with the system.

Hypothesis 3: System satisfaction on information satisfaction.

This hypothesis is supported in both the proposed model and the Wixom and Todd model. Results from this study suggest that as employees become satisfied with the system, they are more likely to be

satisfied with the information generated from the system. Thus, the ability to effectively interface with your system is a prerequisite for obtaining useful resources from such system (Wixom and Todd, 2005).

Hypothesis 4: Satisfaction on performance expectancy.

H4a examined the impact of information satisfaction on performance expectancy. This hypothesis is supported by both the Wixom and Todd and the proposed model. As individuals become satisfied with the reports and other pertinent information produced by the system, the more likely is their possibility of receiving extrinsic rewards.

H4b examined the impact of system satisfaction on effort expectancy. Both Wixom and Todd and the proposed model support this hypothesis. This suggests that in the workplace, as individual's appreciation of the system grows, they would consider the system easy to use and free of any antagonistic effort. Overall, this hypothesis suggests that the more individuals are satisfied with the information and the overall system, the more likely they would anticipate extrinsic rewards and overall ease of use of the system.

Hypothesis 5: The impact of performance expectancy.

H5a examines the impact of performance expectancy on attitude towards use of the system. Both Wixom and Todd and the proposed model support this hypothesis. This indicates that when users believe that

the software application is useful, their favorable attitude towards using that application also increases.

H5b examined the impact of performance expectancy on behavioral intention to use. Performance expectancy is considered the major predictor of intention to use the system (Davis, 1992; Venkatesh et al., 2003).This is partially supported in the proposed model (significant at the 0.10 level but not significant at the 0.05 level). However, it was significant in the DeLone and McLean and Wixom and Todd's model. The partial support means that for the hypothesis to be effectual, it may need to meet certain conditions. Brown et al., (2002) suggest that when use is mandatory, employees may feel that they have no choice in their future use of the system. Thus, since top management mandates the technology to be used, behavioral intention to use the technology becomes insignificant. In fact, attitude, and not behavioral intention to use the technology, becomes the major predictor of technology acceptance (Brown et al., 2002).

In this study, performance expectancy was moderated by gender and age. H5c looks at whether performance expectancy has a higher positive effect on behavioral intention for men than women. This hypothesis was not supported by the study. Brown et al. (2002) propose that in mandatory conditions, the conceptualization of perceived usefulness should change from being important in attaining extrinsic rewards, to one that encourage positive attitudes about use. Thus, being more task-oriented

was not enough to provide a significant difference between male and female users.

H5d looks at whether the effect of performance expectancy on behavioral intention to use will be stronger for younger persons. This hypothesis was not supported by the study. When users are in a work environment where use of the application is mandatory, intrinsic motivation may be more important than extrinsic motivation (Brown et al, 2002). Extrinsic motivation refers to how individual acts "because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself, such as improved job performance, pay, or promotions" (Davis et al. 1992, p. 1112). Intrinsic Motivation however refers to how users act "for no apparent reinforcement other than the process of performing the activity per se" (Davis et al. 1992, p. 1112). Younger workers focus more on the importance of extrinsic rewards whereas older workers focus more on intrinsic rewards (Venkatesh et al, 2003, Davis et al., 1992). Thus, since younger workers focus more on the importance of extrinsic rewards than older workers, (Venkatesh et al., 2003); age would not have an impact on job performance.

The overall hypothesis suggests that although performance expectancy has impact on both attitude and behavioral intention to use, the effect is much stronger for attitude. This result is different from most studies which posit that the effect of performance expectancy is stronger for behavioral intention to use (Venkatesh et al., 2002). This suggests that

when employees are not given a choice in the use of software applications, management must stimulate its employees' attitude to gain a favorable response. As Melone (1990) posits, a benefit from information technology is only realized when the user responses favorably to the system.

Hypothesis 6: The impact of effort expectancy.

H6a examines the impact of effort expectancy on attitude towards use. This hypothesis is supported in both the Wixom and Todd and the proposed model. This supports prior studies which states that when employees perceive that little or no effort is needed to use the system, they develop more positive attitudes towards using the system.

H6b looks at the impact of effort expectancy on behavioral intention to use. This is not supported in the Wixom and Todd, UTAUT or the proposed model. This result is different from most prior research which suggests that effort expectancy would have a greater impact on behavioral intention to use than attitude (Venkatesh et al., 2003; Davis, 1989).

A possible explanation may be that unlike many of the prior studies which are student-oriented and centers on the expected use of a system; this study utilizes members of an organization who are currently using the technology to self-report on the future use of the technology based on trends in the organization. Hence, whereas prior studies are reporting based on their short term usage; in this study, the members of the

organization are reporting based on long term usage with a clear understanding of the corporate culture. As a result, they may report differently on the effect of ease of use on behavioral intention to use the system than previous studies where the technology has been used for a shorter period of time.

Another possibility may be that the applications used are mandatory. Thus employees may think that since they are afforded no choice in the use of the software application, whether or not it is easy to use would not be a determining factor in their future use of the application. This suggests that managers should focus more on developing positive attitudes towards using the system by having supportive mechanisms such as user groups, formal announcements, testimonials, and bulletin boards in place (Brown et al. 2002).

Effort expectancy is also moderated by gender, age and experience. H6c looked at whether the effect of effort expectancy on behavioral intention will be stronger for women. This hypothesis was not supported by the proposed model. A possible reason for this finding is that the number of women entering the workforce is increasing. As a result, the effect of gender roles decreases over time (Morris and Venkatesh, 2005; Venkatesh et al., 2003).

H6d examined whether the effect of effort expectancy on behavioral intention will be stronger for older persons. Studies have shown that older individuals experience a higher level of difficulty in dealing with complex

situations (Plude and Hoyer 1985; Venkatesh et al, 2003). Thus, effort expectancy will have a higher positive effect on behavioral intention for older workers (Morris and Venkatesh 2000; Venkatesh et al., 2003). However, this hypothesis was not supported. This may be because users are required to use the software application, they believe that their age or complexity of the application will have no impact on future use of the system. As a result, they would continue to use the system even if it is difficult to use.

H6e suggest that the effect of effort expectancy on behavioral intention to use will be stronger for individuals with limited experience. When a user is new to a technology, ease of use is expected to be more relevant to their intention to use the technology in the future. However, as the user becomes more skilled in using the technology other issues such as usefulness become more important (Venkatesh et al., 2003). Thus, if the user initially didn't consider the technology to be useful, then ease of use would have no impact on one's intention to use the technology (Szajna, 1996). This hypothesis was not supported because of the mandatory environment.

The overall hypothesis suggests that effort expectancy has a significant impact on attitude but not behavioral intention to use the technology. Even when moderating variables were included in the relationship between effort expectancy and behavioral intention, the result was still insignificant. This suggests that in mandatory situations,

companies need to concentrate on the importance of the user's attitude towards using the system to ensure technology acceptance. In addition, behavioral intention may not be the best dependent variable for measuring technology acceptance in such conditions.

Hypothesis 7: The impact of social influence.

H7a measures the effect of social influence on behavioral intention to use. This hypothesis is supported by the Wixom and Todd, UTAUT and the proposed model. This suggest that the more individuals within the organizations felt that their peers, supervisors and others intend to use the system, the more likely they are to also use the application.

Social influence is also moderated by gender, age, experience and voluntariness. H7b looks at whether the effect of social influence on behavioral intention to use will be stronger for women. This hypothesis was not supported. Although generally women tend to be more sensitive to others' opinions, in this study both men and women are required to use the system to complete their job. As a result, there is no significant difference between the genders.

H7c examines whether the effect of social influence on behavioral intention will be stronger for older persons. This hypothesis is not supported. Although older workers have a greater need for affiliation, this did not have a significant impact in determining whether or not the current software application would be used in the future.

H7d looks at whether the effect of social influence on behavioral intention will be stronger for users with limited experience. This hypothesis was not supported. Here both experienced and inexperienced users would utilize the system since they have no choice in the utilization of the software application.

H7e measures whether the effect of social influence on behavioral intention will be stronger in mandatory settings. This hypothesis was eliminated since all of the applications used by the city were mandatory.

The overall synthesis of this hypothesis suggests that social influence has a strong significant effect on behavioral intention to use. However, when the impact of social influence on behavioral intention is moderated by age, gender or experience, the effect was not significant. A major reason lies in the fact that when use is mandatory, the various moderators do not have a significant impact since behavioral intention as stated above may not be the strongest dependent variable of technology acceptance. In addition, refusal to use the system may lead to dismissal from the organization because job functions are not completed (Brown et al., 2002). Thus, employees' gender, age or experience, would have little or no impact on their intent to use the technology.

Hypothesis 8: The impact of facilitating conditions.

Hypothesis 8a measured the effect of facilitating conditions on use. This hypothesis was strongly supported by the Wixom and Todd, UTAUT,

and the proposed model. This suggests that when employees believe that the technical and organizational infrastructure is in place, they would actually use the system.

Hypothesis 8b examined whether the effect of facilitating conditions on usage will be stronger for younger persons. This hypothesis was not supported. This is because although older workers generally place greater emphasis on receiving help and assistance on the job (Venkatesh, et al., 2003), they need to utilize the technology to complete their job whether or not such assistance is provided.

Hypothesis 8c looked at whether the effect of facilitating conditions on usage will be stronger with increased experience. This hypothesis was not supported. This again suggests that regardless of the experience level, employees would have to use the technology to do the job in this mandatory environment.

Overall, this hypothesis suggests that facilitating conditions have a strong significant effect on use. However, when the impact of facilitating conditions is moderated, the difference in the effect between the moderating values was not significant. This occurs because members of the organization have to use the technology whether or not the environmental conditions are favorable.

Hypothesis 9: The impact of attitude.

Hypothesis 9 measures the impact of attitude on behavioral intention to use the technology. This hypothesis was not supported in the DeLone and McLean, UTAUT, and the proposed model. A possible explanation may be that when users have no choice in whether or not they would use the system, they develop negative attitudes towards the system they were required to use (Adamson and Shine, 2003). Thus, their attitudes have no impact on whether or not they intend to use the system.

Hypothesis 10: The impact of behavioral intention.

Hypothesis 10 measures the impact of behavioral intention on use. This hypothesis was not supported in the DeLone and McLean, UTAUT or the proposed model. In mandatory environments behavioral intention may not guarantee actual behavior since it is not the user's decision (Adamson and Shine, 2003). In addition, intention to use may not be such an important factor (Rawstorne et al., 2000). Instead, symbolic adoption which is the mental acceptance of an idea may be a better variable to include in the model. Rawstorne et al. (2000) suggests that instead of measuring users' expected use of the technology when they have no control over the technology used, rating their excitement and enthusiasm of the technology would be a better alternative.

Hypothesis 11: The impact of use.

Hypothesis 11a examined the effect of use on user satisfaction. This hypothesis was eliminated in the proposed model. Instead, this study examined two dimensions of user satisfaction—information satisfaction and system satisfaction.

Hypothesis 11b looked at whether or not use predicts individual impact. This hypothesis was not supported in the DeLone and McLean and the proposed model. System use was measured using frequency of use while individual impact was measured in terms of job performance. Most of prior studies that found support for this hypothesis measured system use in a voluntary setting. The results indicate that employees' use of the technology may not be a good indicator of whether or not the employee's job performance is improving. Management must therefore ensure that they develop training and support programs to ensure that employees are actually performing their task.

Hypothesis 12: The impact of net benefits.

Hypothesis 12a measured the effect of net benefits (organizational impact) on behavioral intention to use. The hypothesis was not supported in both the DeLone and McLean and the proposed research model. This suggests that how organization performs may have little or no impact on the user's intention to use the technology. As stated above, users are given no choice. Therefore the benefits they receive from using the system will have no impact on their behavior.

Hypothesis 12b examined the effect of net benefits (organizational impact) on user satisfaction. This was eliminated from the proposed model because two dimensions of user satisfaction – information satisfaction and system satisfaction—were examined. In the individual models, however, this hypothesis was tested and supported in the DeLone and McLean model. This suggests that as organizational performance increases, employees would be more satisfied with the system since it is achieving the desired outcome. Overall, net benefits have a significant positive effect on user satisfaction but an insignificant effect on behavioral intention to use the technology. This occurs because improved performance would result in overall satisfaction of individuals; but does not necessarily translate into their intention to use the technology in the future.

Limitations

Although the findings of the study provided some interesting and valuable insights into how IS applications are accepted and used by users, these results need to be treated carefully because of inherent limitations. A major limitation of this study is that the study relied on participants who self-reported their use of IS applications. Self-reported studies carry inherent risk of bias due to various adverse factors such as dishonest responses and respondents swayed by social desirability or motivated to provide thoughtful responses, all of which are a significant threat to

internal validity (Huck, 1998; Campbell 1969; Campbell and Stanley, 1963). DeLone and McLean (2003) suggest that utilizing computer programs to determine systems use, in addition to the self report, may be a better approach since these two may not necessarily correlate.

Selection bias is another potential issue that may have been inadvertently introduced into the study. The use of an online survey may have prevented those employees of the City with inadequate computer access or experience from participating in the survey. However, since this study focuses on technology acceptance, the use of an online survey enhances the representativeness of the sample as only the qualified employees who actually use the technology would complete the survey instrument.

Finally, there may be a problem of generalizability. This study was conducted in a local government organization and as such the findings of the study may not be applicable to other organizations. Other local government may provide different results. Therefore, this study needs to be replicated in other local municipal governments, state governments, federal governments, and private organizations before general conclusions are drawn.

Recommendations for future research

This study has the potential for research in various areas. Firstly, this study can be replicated in various local government settings to determine its predictive validity. Furthermore, the study can be replicated in state governments, federal government, private and public organizations to examine whether this comprehensive model would be a more effective in measuring of technology acceptance and information success simultaneously.

A second area of future research is the changing the dependent variable of technology acceptance. The low impact of performance expectancy and effort expectancy on behavioral intention to use suggest that behavioral intention to use may not have been the best construct to measure the acceptance of the technology. Such claim is supported by Nah et al. (2004) who suggested that when predicting users' acceptance of technology in a mandatory setting, behavioral intention may not be the most appropriate measure. A better construct is symbolic adoption which is the mental acceptance of one's idea (Klonglan and Coward, 1970; Rawstorne et al., 1998; Karahanna, 1999). This construct will examine individual's excitement and enthusiasm of the technology in relation to their expected use instead of simply asking end-users to rate their intention of their use of IS. Thus, acting as a better predictor of user acceptance.

A third area of future research is the inclusion of other moderating variables. Some of these variables should include the differences in the

type of software used (horizontal versus vertical software); occupation; education; and length of time in the current job.

Implications and Concluding Remarks

Understanding the factors which affect technology acceptance and IS success in a government setting is an important area of research. Evidence was provided in this study to support the view that a combination of the UTAUT, DeLone and McLean's (2003) Updated Model of Success and the Wixom and Todd's (2005) model present a more comprehensive measure of acceptance of technology in a government setting.

The proposed model offers managers, project champions and other stakeholders within the organization, a convenient means of determining which factors they need to pay attention to in order to gain the highest return on their technology investment while ensuring that users accept the technology. This model, which is based on a mandatory setting and numerous application software, offers managers a new perspective on dealing with IS acceptance by suggesting to these managers that behavioral intention to use the technology may not be the best indicator of IS success, rather, attitude towards use of the technology may be more important. In addition, the moderating conditions of gender, experience and age, had no impact on use or behavioral intention to use. This also suggest

that managers should spend less time dealing with such demographic issues since the employees already understand that use of the technology is required. Instead, more emphasis should be placed on ensuring that the employees use the technology efficiently and effectively as user satisfaction led to increase job performance which had a positive impact on the overall performance of the organization.

APPENDIX

CITY OF DENTON SURVEY INSTRUMENT

Welcome to the City of Denton Information Technology Survey

Thank you for agreeing to participate in this survey. As part of the City of Denton's efforts to improve its performance, they are working with a research team from the University of North Texas (UNT) to conduct a study about how effectively information technology (IT) is utilized. Your candid answers are important to help improve your work environment.

When the survey is complete, the UNT research team will analyze the data and share only summaries to help the City of Denton enhance its ability to utilize IT to improve its performance. The UNT research team will keep your identity and individual responses confidential and anonymous.

The survey asks your opinions about the information systems applications that you use in your employment, as well as about other organizational and demographic characteristics. There are no right or wrong responses. The survey should take no more than 15 minutes to complete. To access the survey, you have to use the personal code that was provided to you via email. The purpose of this code is to ensure the security and integrity of the survey. Only the UNT researchers have access to this code and it will not be disclosed. If you have not received the code or have any questions, please call Dr. Chang Koh at (940) 565-3625 or email to kohce@unt.edu.

Your participation in this study is voluntary, not required, and your refusal to participate will not adversely affect you in any way (other than your opinion will not be counted). In addition, you may withdraw from this study at any time; although, once you participate your contribution cannot be taken back. Participation in this study does not require you to reveal any personal information, aside from some demographics about things like your education and the information systems applications that you use at work. Do not put your name or address on any portion of the survey.

Your efforts and those of your colleagues will be used to help the City of Denton become a better place to work. Thank you for your time and assistance.

This project has been reviewed and approved by the UNT Institutional Review Board (940) 565-3940. Contact the UNT IRB with any questions regarding your rights as a research subject.

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1) Please check the department in which you work:

- ○ 1. Budget & Fiscal Operations (including Accounting, Warehouse, Purchasing, Tax, & Treasury)
- ○ 2. Planning and Bldg. Inspection
- ○ 3. Community Dev./Downtown Dev./Economic Dev.
- ○ 4. Customer Service
- ○ 6. Electric
- ○ 7. Facility Management
- ○ 8. General Govt. (including CMO, PIO, & Internal Audit)
- ○ 9. Human Resources
- ○ 10. Legal
- ○ 11. Library
- ○ 12. Motor Pool and Maintenance (including Vehicles & Parts)
- ○ 13. Municipal Court and Judge's Office
- ○ 14. Parks and KDB
- ○ 15. Public Safety (including Police, Fire, Animal Control , & Code Enforcement)
- ○ 16. Safety, Training, and Risk Management
- ○ 17. Solid Waste, Landfill, & Recycling
- ○ 18. Technology Services
- ○ 19. Transportation (including Traffic Control, Street, & Airport
- ○ 20. Utilities Administration
- ○ 21. Water, Wastewater, & Drainage
- ○ Other (please specify)

If you selected other, please specify:

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2) Please check all applications that you use at work.

- [ ] 1. ArcView
- [ ] 2. AutoCad
- [ ] 3. Brio
- [ ] 4. Cartegraph
- [ ] 6. CityWorks
- [ ] 7. Class
- [ ] 8. Court Specialists
- [ ] 10. Customer Service Call Manager Center
- [ ] 11. Faster (CCG Fleet)
- [ ] 12. Groupwise
- [ ] 13. Harris
- [ ] 14. Intranet
- [ ] 15. JDE Peoplesoft
- [ ] 16. LaserFiche
- [ ] 19. Millennium (Triple I)
- [ ] 21. Paradigm
- [ ] 23. PrintSmith
- [ ] 24. TaxOffice 2000
- [ ] 26. Time Clocks
- [ ] 27. Trak-it
- [ ] 29. VisionAir
- [ ] None
- [ ] Other (please specify)

If you selected other, please specify:

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3) How many hours per week do you work for the City of Denton (CoD)?

hours

4) How many hours per week do you use IT to perform your CoD work?

hours

5) How long have you worked for the CoD?

years

6) How long have you been in your current job?

years

7) How many years of experience do you have using Information Technology?

years

8) Please check the type of your job.

- Field Service
- Mid-level managers
- Office/Clerical
- Professionals
- Supervisors
- Technical paraprofessionals
- Director/ACM
- Other (please specify)

If you selected other, please specify:

9) What is the highest formal schooling you have completed?

- High School
- Some college
- 2-year college
- 4-year college
- Graduate school
- Other (please specify)

If you selected other, please specify:

10) What is your age?

- Under 20
- 20-25
- 26-30
- 31-35
- 36-40
- 41-45
- 46-50
- 51-55
- 56-60
- Over 60

11) What is your gender?

- Male
- Female

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12) Please select ONE APPLICATION that you use primarily at work.

Select One

13) Please read each question carefully and check the response that best expresses your view about the application you selected in question 12.

1 = Strongly Disagree
2 = Disagree
3 = Weakly Disagree
4 = Neutral
5 = Weakly Agree
6 = Agree
7 = Strongly Agree

	Strongly Disagree 1	Disagree 2	Weakly Disagree 3	Neutral 4	Weakly Agree 5	Agree 6	Strongly Agree 7
1. I find the application useful to accomplish tasks	○	○	○	○	○	○	○
2. Using the application enables me to accomplish tasks more quickly	○	○	○	○	○	○	○
3. Using the application increases my productivity	○	○	○	○	○	○	○
4. Using the application improves my job performance	○	○	○	○	○	○	○
5. Using the application enhances my effectiveness on the job	○	○	○	○	○	○	○
6. Using the application makes it easier to do my job	○	○	○	○	○	○	○
7. My interaction with the application is clear and understandable	○	○	○	○	○	○	○
8. It was easy for me to become skillful at using this application	○	○	○	○	○	○	○
9. I am pleased with my use of the application	○	○	○	○	○	○	○
10. I find the application easy to use	○	○	○	○	○	○	○

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14) Please read each question carefully and check the response that best expresses your view about the application you selected in question 12.

1 = Strongly Disagree
2 = Disagree
3 = Weakly Disagree
4 = Neutral
5 = Weakly Agree
6 = Agree
7 = Strongly Agree

	Strongly Disagree 1	Disagree 2	Weakly Disagree 3	Neutral 4	Weakly Agree 5	Agree 6	Strongly Agree 7
11. Learning to operate the application was easy for me	○	○	○	○	○	○	○
12. Using the application is a good idea	○	○	○	○	○	○	○
13. The application makes work more interesting	○	○	○	○	○	○	○
14. Working with the application is fun	○	○	○	○	○	○	○
15. I like working with the application	○	○	○	○	○	○	○
16. I am satisfied with my use of the application	○	○	○	○	○	○	○
17. People who influence my behavior think that I should use the application	○	○	○	○	○	○	○
18. People who are important to me think that I should use the application	○	○	○	○	○	○	○
19. The senior management of this organization has been helpful in the use of the application	○	○	○	○	○	○	○
20. In general, the organization has supported the use of the application	○	○	○	○	○	○	○

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15) Please read each question carefully and check the response that best expresses your view about the application you selected in question 12.

1 = Strongly Disagree
2 = Disagree
3 = Weakly Disagree
4 = Neutral
5 = Weakly Agree
6 = Agree
7 = Strongly Agree

	Strongly Disagree 1	Disagree 2	Weakly Disagree 3	Neutral 4	Weakly Agree 5	Agree 6	Strongly Agree 7
21. In terms of system quality, I would rate the system highly	○	○	○	○	○	○	○
22. Overall, the application is of high quality	○	○	○	○	○	○	○
23. Overall, I would give the quality of the application a high rating	○	○	○	○	○	○	○
24. I have the resources necessary to use the application	○	○	○	○	○	○	○
25. I have the knowledge necessary to use the application	○	○	○	○	○	○	○
26. The application is compatible with other applications	○	○	○	○	○	○	○
27. A specific person (or group) is available for assistance with the application	○	○	○	○	○	○	○
28. Overall, I would give the information from the application high marks	○	○	○	○	○	○	○
29. Overall, I would give the information provided by the application high ratings in terms of quality	○	○	○	○	○	○	○
30. In general, the application provides me with high-quality information	○	○	○	○	○	○	○

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16) Please read each question carefully and check the response that best expresses your view about the application you selected in question 12.

1 = Strongly Disagree
2 = Disagree
3 = Weakly Disagree
4 = Neutral
5 = Weakly Agree
6 = Agree
7 = Strongly Agree

	Strongly Disagree 1	Disagree 2	Weakly Disagree 3	Neutral 4	Weakly Agree 5	Agree 6	Strongly Agree 7
31. I intend to use the system in the next 12 months	○	○	○	○	○	○	○
32. I predict I would use the system in the next 12 months	○	○	○	○	○	○	○
33. I plan to use the system in the next 12 months	○	○	○	○	○	○	○
34. I am content with my use of the application	○	○	○	○	○	○	○
35. All things considered, I am very satisfied with the application	○	○	○	○	○	○	○
36. Overall, my interaction with the application is very satisfying	○	○	○	○	○	○	○
37. The application provides a competitive organizational advantage	○	○	○	○	○	○	○
38. The application provides improved client relationships	○	○	○	○	○	○	○
39. Overall the application is cost effective	○	○	○	○	○	○	○
40. The application provides improved organizational image	○	○	○	○	○	○	○

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17) Please read each question carefully and check the response that best expresses your view about the application you selected in question 12.

1 = Strongly Disagree
2 = Disagree
3 = Weakly Disagree
4 = Neutral
5 = Weakly Agree
6 = Agree
7 = Strongly Agree

	Strongly Disagree 1	Disagree 2	Weakly Disagree 3	Neutral 4	Weakly Agree 5	Agree 6	Strongly Agree 7
41. The application provides improved customer service	○	○	○	○	○	○	○
42. The application keeps up with the organization's business requirements	○	○	○	○	○	○	○
43. Overall, the information I get from the application is very satisfying	○	○	○	○	○	○	○
44. I am very satisfied with the information I receive from the application	○	○	○	○	○	○	○
45. I am delighted with my use of the application	○	○	○	○	○	○	○

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18) Please read each question carefully and check the response that best expresses your view about the application you selected in question 12.

1 = Strongly Disagree
2 = Disagree
3 = Weakly Disagree
4 = Neutral
5 = Weakly Agree
6 = Agree
7 = Strongly Agree

	Strongly Disagree 1	Disagree 2	Weakly Disagree 3	Neutral 4	Weakly Agree 5	Agree 6	Strongly Agree 7
1. Overall, I am satisfied with the CoD's Information Technologies	○	○	○	○	○	○	○
2. Overall, there has been a positive impact as to how much my performance was improved by the aid of CoD's Information Technologies	○	○	○	○	○	○	○
3. Overall, there has been a positive impact as to how much the CoD's performance was improved by the aid of Information Technologies.	○	○	○	○	○	○	○

19) How much time do you spend with the system during the ordinary day when you use computers?

○ Scarcely at all
○ Less than ½ hour
○ ½- 1 hour
○ 1-2 hours
○ 2-3 hours
○ More than 3 hours

20) How often on average do you use the system?

○ Less than once a month
○ Once a month
○ A few times a month
○ A few times a week
○ Once a day
○ Several times a day

Thank you for completing the survey.

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