11-2008

Technology Acceptance Factors Affecting Adoption of Wireless Data Technology

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DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

Lynn University

By

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Lynn University

2008

Order Number: _____

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Lynn University, 2008

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ABSTRACT

The study of acceptance and use of technology is traditionally based on models designed to identify and test the relationships forged between the user and the technology in question. Models designed to study the relationship of user and technology acceptance tend to integrate experiential criteria, such as the attitude of the user towards technology, as well as criteria found within the environment. As wireless communications become more prevalent, and the forms of wireless technology evolve, understanding the process of acceptance and usage will be of importance as companies compete to offer the most user friendly and sophisticated wireless devices.

The relationship between diffusion of innovation and wireless data technology acceptance is an important issue for any innovative organization. A critical analysis of theoretical and empirical literature is used to explore those factors influencing wireless data technology adoption and will identify areas of future scholarly inquiry. Existing technology acceptance theories provide the framework to research this topic. Models examined in this study include the Technology Acceptance Model, Unified Theory of Acceptance, Use of Technology, Theory of Reasoned Action, and Diffusion of Innovation.

An in-depth study of these models demonstrates that there are flaws both within the underlying rationale used to govern the models and the applications of these models within the study process. These gaps will also be examined.
Recommendations for future areas of study will be suggested. These will be based on the need for modeling efforts to take into account the context in which the modern generation of technology user is situated.

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CHAPTER I - INTRODUCTION TO THE STUDY

Introduction to the Literature Review

Technology Acceptance Factors Affecting Adoption of Wireless Data

An Overview and Purpose

Wireless data transfer, leading a technological revolution, is exploding in the business world. Many businesses, though, remain wary of adopting it, in spite of its numerous benefits. It is expected that by 2009, the mobile telecommunications market will be worth over $254 billion (Research and Markets, 2005). While initially off to a slow start, both in terms of acceptance and performance, wireless data services have become increasingly refined and robust specifically with the introduction of newer technologies known as "3G" and "4G" with much higher speed and throughput. Despite the fact that wireless data technologies are gaining fast acceptance and innovative devices are being adopted, most users restrict themselves to simple data transmission. The reasons for using the powers of wireless data are explored in this literature review which explains the rate of acceptance and diffusion of the wireless data technology.

Research Topic and Questions

The topic of acceptance and adoption of wireless data technology was selected due to the need to understand how significant the effect of wireless data technology use on businesses is.

Some questions to be answered through this critical analysis of the literature are:

1. What are the major theories and empirical studies concerning technology acceptance and diffusion?

2. What factors affect the acceptance of innovative wireless data technology in an organization?

Organization of the Review, Scope, and Library Research Plan

Organization of the Review

An integrative model (Figure 1) is used to guide the library search of this review of theoretical and empirical literature and the impact of technology acceptance on organizational performance and efficiency. The concepts of the review explore the relationship between technology acceptance, diffusion of innovation, theory of reasoned action, unified theory of acceptance and use of technology, and organization performance and efficiency.

The integrative model displays the concepts, theories, and themes as follows:

1. Technology Acceptance Models are the causal (independent and mediating) variables that lead to organization performance and efficiency;
2. The Theory Of Reasoned Action is the contextual variable that impacts technology acceptance; and
3. Diffusion of Innovation and Unified Theory of Reasoned Action are intervening theories that could impact technology acceptance.

Technology Acceptance Theories Affecting Adoption of Technology

Models and Theories

Technology Acceptance Model (TAM)
Theory of Reasoned Action (TRA)
Diffusion of Innovation Model (DOI)
Unified Theory of Acceptance and Use of Technology (UTAUT)

Empirical Studies and Measurement Instruments

Measurement of Technology Acceptance
Measurement of Technology Adoption
Measurement of Technology Innovation and Diffusion
Measurement of Innovation
Measurement of User Acceptance of Information Technology (UTAUT)
Measurement of Diffusion of Innovation

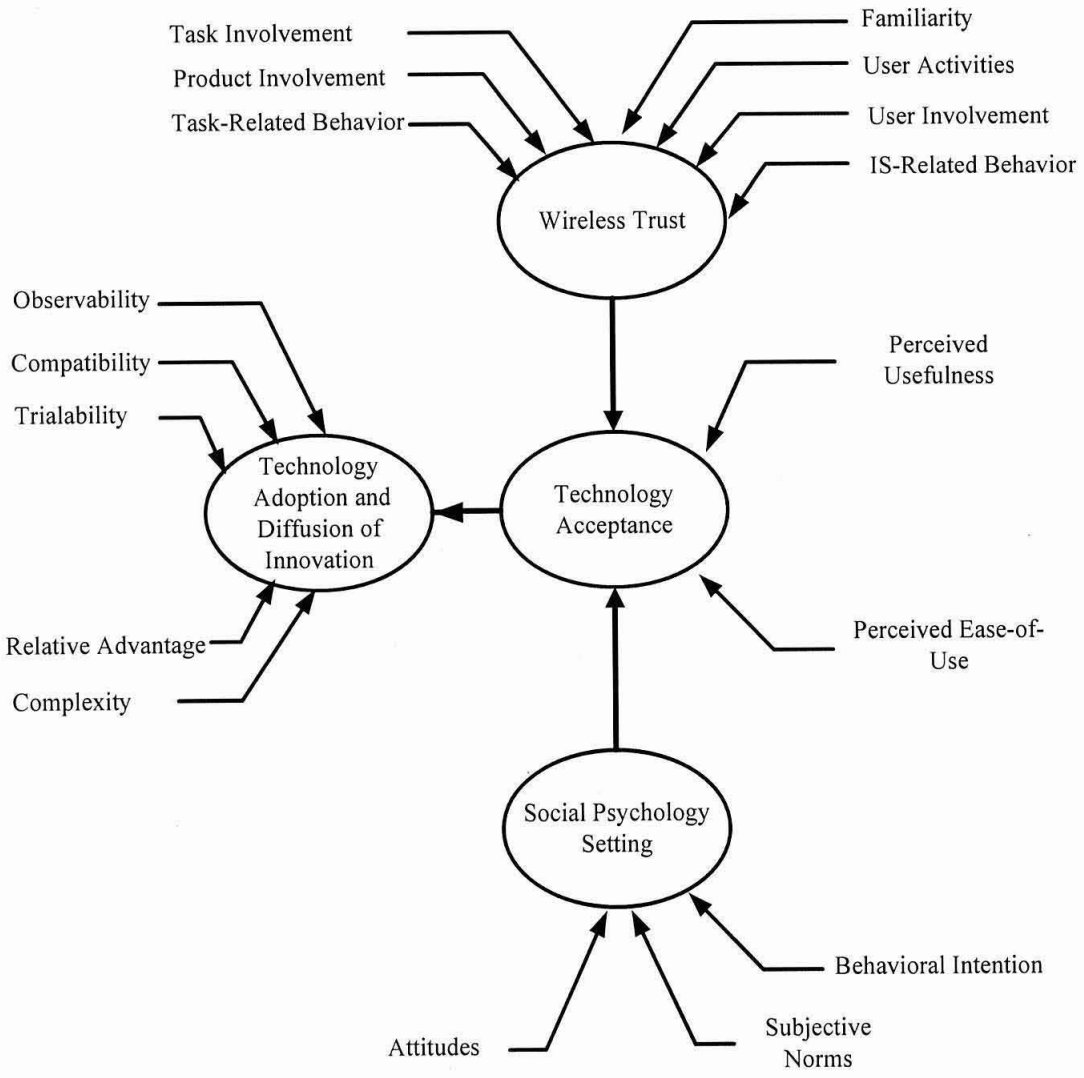


Figure 1-1. Integrative model of the impact of Wireless Trust and Social Psychology Setting on Diffusion of Innovation

Scope and Context

The scope of this literature review encompasses the:

1. theoretical framework of technology acceptance; and
2. factors affecting adoption of wireless data technology.

The different forms of literature included in this review are periodical abstracts in a primary source, abstracts in a secondary source, periodicals (electronic), periodicals (hard copy), government documents, non-periodicals (hard copy), non-periodicals (books), non-periodicals (chapter in a book), doctoral dissertations (including abstracts), and other electronic media. The review focuses on theories from the fields of business strategy, consumer behavior, telecommunications, wireless data and innovation. The literature review covers the period 1967 to 2006 and primarily focuses on American literature.

Definitions of Terms

Wireless data is defined as the transmission of data via air waves. Wireless data includes paging, text messaging, e-mail, Web access, and other specialized data applications, excluding voice transmission. Wireless data typically implies transmission to a mobile terminal such as a smart phone or personal digital assistant (PDA) devices (Ziff, 2006).

Wireless data technology is a wireless wide area network (WWAN) using allocated radio frequencies to transfer data. Some of the industry standards associated with that technology include: General Packet Radio Service (GPRS), Code Division Multiple Access (CDMA), Global System for Mobile communications (GSM), and Cellular Digital Packet Data (CDPD). These cellular technologies are offered regionally,

nationwide, or even globally and are provided by several wireless service providers in the world for a monthly usage fee. Wireless data technology has gone through several evolutions known as generations:

1. First generation (1G) - used in the 1980s. 1G networks were voice centric based on a technology called AMPS (Advanced Mobile Phone Service) and were limited in capacity (Silicon Press, 2006). This technology mainly was used to transmit a small amount of data such as alarm systems notifications.
2. Second generation (2G) - a wireless technology for voice and data used by carriers in the 1990s. These networks used digital technology for a better use of the wireless frequency spectrum (Silicon Press, 2006). This technology was capable of transmitting about 14 kilobits per second (kbps) and was used for low bandwidth applications.
3. Third generation (3G) - wireless network technology intended to be a global standard offering higher bit-rate services comparable to current wire lines services with throughputs of 400 to 700 kbps. Typical applications and services included multimedia, Internet browsing and e-mail messaging (Stavroulakis, 2006).
4. Fourth generation (4G) - a wide-area cellular wireless data network based on IP (Internet Protocol) technology capable of transmitting data at a rate of 100 Mbps. This generation will support QoS (Quality of Service) and high security. The 4th generation will include a collection of several platforms such as Worldwide Interoperability for Microwave Access (WIMAX), Long Term Evolution (LTE) and Wireless Fidelity (Wi-Fi) in local networks.

Technology Acceptance Model (TAM): First developed by Davis, Bagozzi, and Warshaw (1989), TAM was the extension of Ajzen and Fishbein's (1975) Theory of Reasoned Action and Rogers' (1995) Theory of the Diffusion of Innovation. TAM was the prediction of information system acceptance before users have experience with a system. The prediction was determined by two specific variables, perceived usefulness and perceived ease of use. The factors that were affecting technology acceptance were "beliefs, attitudes, norms, intentions, and behavior" (Dillon & Morris, 1996, para. 20).

1. *Perceived usefulness of the technology*: the user's perception of how, and to what extent, the new technology would improve his or her work experience, such as improving time used or enhancing existing job tasks; and
2. *Perceived ease-of-use of technology*: The amount of time and energy that would be required to learn a new technology.

Davis (1989) emphasized that the roles of technology and user acceptance could be improved if there were other conditions involved, such as whether the potential user of the new technology had prior experience with another form of technology that had a similar use, or a previous model of the same type of technology.

Wireless devices have been used in personal life in addition to the workplace, and it is possible that the TAM may not be an accurate reflection of modern technology use. Davis (1989) predicated his theories on the fact that technology use was still edging its way into the workplace and was not fully part of the lives of potential users. Almost two decades later, technology is a significant component of many persons' business and personal lives. Hand held devices used for real time email clients could be perceived as a form of technology that combined the cellular phone with pocket handheld computers

(e.g., Blackberry, Palm Pilot), both of which had been in widespread use. Perception of Blackberries as new but familiar forms of technology helps communicate immediate perceived usefulness, and previous experience with these technologies improved the overall ease-of-use. Similarly, wireless technology on laptop computers integrated the familiar tool of the laptop into a setting that improved its already-convenient attributes.

Diffusion of Innovations: The Theory on Diffusion of Innovations (DoI) suggested that there are differences in the type of persons who approach new technologies, especially in respect to willingness to accept these. Rogers (1962) found that there were five categories of adopters (e.g., persons who use technology), and that these were classified as the readiness to respond to technology:

1. *Innovators* were the first to adopt and did so without background information from other consumers;
2. *Early adopters* were those who responded to the usefulness of technology and read information from innovators concerning performance and outcome;
3. *Early majority* users did so based upon information within the social climate and responsible assessment of performance throughout the previous two groups;
4. The *late majority* formed the largest single group of adopters and were those who responded to general social shifts after others had altered the effectiveness of the climate in respect to technology; and
5. *Laggards* adopted only after all others had done so and society had changed to a point where they needed to conform to these outcomes or face negative consequences.

Assessment of these concepts was done according to the relationships that all potential consumers in all groups associated with technology. Rogers (1995) suggested that the type of relationship forged determined how the consumer would view technology (e.g., advantageous, too expensive for benefits received, etc.). In the case of wireless data devices, these were assessed via:

1. *Relative advantage:* or how the technology compared to others;
2. *Compatibility:* also was important, where the consumer identified how compatible the device was with his or her own lifestyle (e.g. work habits, etc.);
3. The ability to test the technology, or *trialability*, helped to encourage broader use;
4. O*bservability:* referred to the assessment of the technology within specific settings and in correlation to how it functioned as an effective (or ineffective) device; and
5. The *complexity* of technology was significant in its adoption, wherein the degree of time and effort needed to master the device was connected to whether the potential user perceived it as an advantage or a disadvantage.

In wireless technology use, the diffusion of innovation has already passed from the early majority phase and the late majority is currently adopting the use of Blackberries, wireless communications, and wireless laptops as part of their lifestyle. These devices have demonstrated significant improvements over landline systems for innovators, early adopters, and the early majority, and there has been a socio-cultural shift in which the majority of persons are asked to recognize the efficiency and

functionality of these devices. This in turn suggests that the traits associated with DoI have all been resolved among the preceding groups, and the outcomes of wireless devices has in turn been recognized as an advantage. Therefore, it can be said that wireless technology has been successfully diffused into the general population, where only laggards refuse to engage in its use at the current time.

Theory of Reasoned Action: This theory assesses a person's behavior according to specific criteria present in the environmental setting. These were *attitudes*, or the person's unique position towards a concept; the *behavioral intentions*, or the likelihood that the person will perform a specific action; and *subjective norms*, which were the acquired perceptions towards a concept that were acquired or influenced through the positions of others.

1. *Attitudes:* The personal status of the individual, especially his or her concepts and opinions towards technology. A person with a background in wireless technology is more likely to have a favorable attitude towards technology use than someone without it.
2. *Behavioral Intentions*: The outcome the person receives from his or her technology use, such as the benefits that can be attainted through cellular phone use or the negative experience that occurs when a new technology needs to be learned.
3. *Subjective Norms:* Influences within society, such as whether Blackberry is used in the person's job or whether his/her friends are connected via cellular phones.

While Ajzen and Fishbein (1975) did not distinguish between which of the three criteria had the greatest overall influence on the person, these theorists did stress that

attitudes and intentions were acquired through observance of norms. To clarify, the readiness of acceptance of wireless technology would depend largely on the degree to which attitudes, behavioral intentions and subjective norms were present within the environment. If consumers were able to identify that these tools were already in widespread use and demonstrated potential positive outcomes, this would shift the attitudes of the potential consumer. Furthermore, if the potential consumer could recognize that the wireless technology was beneficial to his or her own personal needs, (e.g., a Blackberry would improve communications with business customers, etc.) then this would increase the consumer's desire to own and use this technology.

Unified Theory of Acceptance and Use of Technology: The Unified Theory of Acceptance and Use of Technology (UTAUT) integrated the concepts of the Technology Acceptance Model, the Diffusion of Innovations Model, the Theory of Reasoned Action, along with other models of technology use and acceptance. The purpose of the UTAUT was to help find a single model through which technology could be assessed and outcomes defined based upon known models of user behaviors and past research into other technology use models.

UTAUT was a model used to fully explore the criteria of user acceptance and assess the degree to which a specific type of technology was accepted by a specific user. UTAUT was an effective means of assessing and presenting data on user acceptance, especially when user demographic information was taken into account. In addition, UTAUT helped to integrate and explain the relationships between user behavior and user interactions with technology.

1. *User intentions:* referred to the relationship that the potential user had with the technology in respect to outcome;
2. *Performance expectancy:* referred to how well the technology would perform based upon desired tasks;
3. *Effort expectancy:* referred to the effort of mastering the technology as opposed to the outcome that could be derived from it;
4. *Prior experience:* referred to the initial body of knowledge that the user brought to the new technology and was based on his or her experiences with previous forms of technology; and
5. *Social influences:* referred to the demographic characteristics associated with the user. These factors were interrelated and influenced outcome based upon how, why, and to what extent the user anticipated his or her experience with a specific form of technology.

UTAUT, as it relates to wireless data technology, dealt with the behavior of the individual when introduced to a new technology. An elderly person would not likely have any prior experience with wireless devices, nor does she/he have a reason to use such devices in his/her current lifestyle. The effort it would take to learn this device is significant, as an elderly person has no pre-existing knowledge of its functionality or use.

Conversely, a young working professional has personal and professional experience with similar devices and most likely has a need for a wireless data device (such as Blackberry) in his/her current work setting. This person most likely grew up in a culture in which technology was a desirable and necessary aspect of communications and interpersonal relationships, which means she/he both recognizes the value of the device

and also is familiar with the processes it will take to learn to operate such a device. Such a young professional would therefore be much more likely to adapt to the use of the wireless data devices than an elderly person.

Library Research Plan and Strategy

The library search descriptor themes used to search the relevant databases on the topic about technology acceptance factors affecting adoption of wireless data technology in various types of organizations are: "wireless data technology research," "wireless data technology theory," "wireless data technology measurement," "wireless data technology meta analysis," "wireless data technology critique," "technology acceptance innovation diffusion research," "technology acceptance innovation diffusion theory," "technology acceptance innovation diffusion measurement," "technology acceptance innovation diffusion meta analysis," "technology acceptance innovation diffusion critique," "diffusion and technology," "diffusion, adoption, and technology," "adaptation and adoption in technology," "research in adaptation and adoption of technology," "generations of wireless data technology research," "generations of wireless data technology theory," "generations of wireless data technology measurement," "generations of wireless data technology meta analysis," "generations of wireless data technology critique," "facilitating adoption," "facilitating adoption of technology," "facilitating technological adoption," "wireless data adoption research," "wireless data adoption theory," "wireless data adoption measurement," and "wireless data adoption meta analysis," "wireless data adoption critique," "technology infusion research," "technology infusion theory," "technology infusion measurement," "technology infusion

meta analysis," "technology infusion critique," "technology infusion technology acceptance research," "technology infusion technology acceptance theory," "technology infusion technology acceptance measurement," "technology infusion technology acceptance meta analysis," "technology infusion technology acceptance critique," "technology infusion technology adoption research," "technology infusion technology adoption theory," "technology infusion technology adoption measurement," "technology infusion technology adoption meta analysis," "technology infusion technology adoption critique," "strategies of technology," "strategies of technological adoption," "wireless trust research," "wireless trust theory," "wireless trust measurement," "wireless trust meta analysis," "wireless trust critique."

The ProQuest database was the major source of articles from scholarly, peer reviewed journals. Books and E-Books were retrieved from Lynn University and the University of Phoenix Library Catalog database systems. Types of primary scholarly works included empirical, theoretical, methodological, and analytic literature. The titles of key journals reviewed were: *The Journal of Computer Information Systems, Journal of Systems Management, Journal of American Academy of Business, Cambridge, Decision Sciences Journal of Innovative Education, Journal of Electronic Commerce in Organizations, Journal of Business Research.* The review limited the database search to peer-reviewed journals from 1967 to 2008.

Interest, Significance, and Rationale for the Critical Analysis

The theme of wireless data and technology acceptance is a topic of global interest. While some large organizations eagerly embrace wireless data technology, it has been noted that other organizations hesitate to expand their wireless arena for various reasons such as security of wireless networks, complexity of the wireless solution, reliability, cost, and the speed of connection. Compatibility of networks also has been a serious problem in adoption as wireless technology is a comparatively new form of technology and the churn rate of new technology indicates to the potential user that there may be a new or different form of innovation to occur at a later time (Dillon & Morris, 1996). This discourages use, as the adopter would not only have to pay the initial start-up costs, but would have to engage in deconstruction of a costly infrastructure if a new form of technology was adopted at a later time. As globalization continues to increase and companies with different forms of networks and communication channels emerge, this suggests that adopting a standard of technology that is universally compatible and acceptable to all potential users is a significant priority.

Compared to wire-line, wireless networks may be perceived to be exposed to unwanted hackers who break into sensitive information in the open air. A great deal of complexity is being added to wireless solutions to overcome cellular coverage issues and sudden breaks in communication. The naturally slower speed of connection of wireless data versus wire lines requires the user to create "wireless friendly" applications that transmit and receive minimal amount of data. Comparing to "land lines", the probability that the wireless data network will stay up is lower. The reliability of the network depends on weather and geographical conditions. Finally, the cost to implement a

wireless data solution is much higher in comparison to land lines, as it requires more sophisticated hardware, security equipment, software and applications written specifically for the solution.

It is worth examining the literature about technology acceptance factors that influence technology use and infusion throughout the organization. The next section (Literature Review) explores the importance of wireless data and technology acceptance themes and other factors. This critical analysis of the literature concludes with a synopsis and interpretation of theoretical, empirical, and methodological literature, conclusions, and recommendations for future scholarly inquiry into the influence of wireless data acceptance and adoption.

CHAPTER II - REVIEW OF THE LITERATURE, THEORETICAL FRAMEWORK, RESEARCH QUESTIONS, AND HYPOTHESES

Models and Theories

Theory of Reasoned Action (TRA)

First proposed in 1967, the Theory of Reasoned Action (TRA) was developed by Ajzen and Fishbein as a means of understanding human behavior through identifying and assessing the relationships between personal preferences and behavior. For several years, the pioneers of TRA worked to refine its applicability; in 1980, the authors released their final conceptual position on TRA in their book, *Understanding Attitudes and Predicting Human Behavior*. In the book, Ajzen and Fishbein (1980) grounded the theory in data taken from observational research. The authors stress that TRA was not developed specifically from their own original research, but rather reflected a consistent trend in human-centered or sociological research.

The data from this research consistently indicated that a subject's attitude led to an intention or a purpose, which then resulted in a specific behavior. Azjen and Fishbein (1980) maintained that the continued manifestation of this process throughout multiple disciplines of human-centered research was indicative of an innate pattern in human behavior. Specifically, the data stressed a consistent relationship between a person's internalized thoughts (e.g., beliefs, preferences, attitudes, etc.) and the formation of a subjective relationship between the person and his or her intentions regarding a specific set of circumstances. If there were no impeding variables that precluded the person from following through on his or her internalized thoughts, then a specific relationship would be formed between these thoughts and exhibited behaviors.

It must be noted that this synopsis of TRA was extremely concise and did not express the overall depth of the relationships that were formed at the three critical stages of TRA (attitude, intention, and behavior). The model itself was given significant scope and depth through the associative properties that influenced the three critical stages, as well as the challenges that internal and external variables could bring toward a successful completion of a well-reasoned action.

Azjen and Fishbein (1980) deconstructed many different research efforts, in addition to anecdotal or circumstantial interactions, to demonstrate to the reader how TRA was an effective tool through which the cause of behavior could be assessed. In terms of its applicability within the field of sociological and psychological research, TRA could be used to study both the behaviors of individual persons and groups. Further, TRA could be easily adapted to study the behaviors of populations who shared common attitudes and draw their respective positions from shared intentions. Indeed, TRA was most useful in this latter aspect, as it provided an inquiry methodology that could be applied to a broad population. The only delimiting criteria tended to be whether the population had enough common vectors in order to establish common attitudes. Yet TRA has been challenged in terms of overall validity. If the attitudes were not appropriately isolated, this indicated that the study could instead focus on common points such as cultural norms and suggested that the consistency of norms reflected commonalities within attitude.

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) was first proposed by Davis et al. (1989) and was refined in a follow-up paper in 1993. When used appropriately, TAM helps isolate the link or links between psychological variables that are found in a sample population or in a specific person, and the degree to which these persons are able to interact with technology (specifically, computers). The studies by Davis, Bagozzi, and Warshaw (1989) indicate that attitude plays a significant role in identifying how, and to what extent, the consumer of a technology is able to adapt to that technology.

The initial research was a qualitative study in which the researchers tested the preferences of the sample population and correlated these to their adaptability to new technology. Certain patterns were clear; foremost among these was the discovery that subjects who were familiar with other forms of technology (e.g., had previous experience on a computer) were more likely to express willingness to interact with new forms of technology. This suggested that the attitudes of potential users indicate a level of comfort or familiarity as grounds for increasing future interaction with these devices. Conversely, when the user expressed attitudes against the technology based on previous experience, this suggests a degree of resistance which the researchers correlated to a lower willingness to adapt to new technologies.

In his latter paper, "User acceptance of information technology: system characteristics, user perceptions and behavioral impacts," Davis (1993) suggested that assessment of resistance was necessary in order to better facilitate the integration of new technologies into a specific environment. In application, the TAM can therefore be used as a means of assessing the degree of potential resistance within a target population

through a corresponding qualitative measurement process that identifies existing attitudes (e.g., through the use of a Likert-type survey), and suggests patterns of acceptance through which attitudes can be altered and an increased willingness to participate in new technology can result. However, in order for TAM to be useful in promoting improved acceptance of technology among users, it is first necessary to identify the degree to which technology is resisted or not fully accepted as an option. This means that the researchers have to formulate exacting questions prior to engaging in the research process or they will be unable to effectively isolate preferences among users.

The use of TAM in practice has been connected to other theories of technological longevity. Foremost among these is the product life cycle, which is grounded in principles of economic and innovative technology management issues. The product life cycle is based on the theory that new products enter into the marketplace, experience a period of growth, then experience a period of maturity, and finally endure a period of decline. These periods of change within the life of technology are a response to customer interest, which can be impacted by TAM.

Yet all technology life cycles are precariously finite, arguably more so than any other form of product. When a next generation of technology comes along, the preceding generation is not only less desirable to customers, but is rendered obsolete and swept out of the marketplace altogether. The use of the product life cycle can help manage the perception of technology in the eyes of the consumers, and this process ensures that the consumer will not abandon a specific product if it is appropriately marketed during the late maturity and decline phases. This in turn makes it more likely that the consumer will choose to adopt the next generation of technology because it is advertised as a superior

replacement as opposed to a new form of technology altogether. Such a process occurs even when the successive generation demonstrates qualities that separate it from its predecessor.

TAM is also used in order to identify the perceived usefulness of a given product among consumers. Venkatesh and Davis (2000) expanded the original TAM to incorporate a greater degree of flexibility among the perceptions of change and the user's voluntary participation in the technological adoption process. This helps broaden the original perceived patterns of acceptance, as the researchers indicated that the acceptance and the use of technology can be identified not merely according to the perceived use and outcome, but also through framing the role of the given technology within a socio-cultural framework.

Technology Adoption and Infusion Models. The Technology Acceptance Model is a theoretically sound model that has been identified and tested in terms of validity in multiple studies. The TAM is based on the Theory of Reasoned Action (TRA) developed by Ajzen and Fishbein (1980), which suggests that there are commonalities between the relationships that are formed between the user and a specific form of technology, as well as the user and specific outcomes. Malhotra and Galletta (1999) found that there were "casual linkages between two sets of constructs: (1) Perceived Usefulness (PU) and Perceived Ease of Usefulness (PEOU) and (2) user attitude (A) and behavioral intentions (BI) and actual computer usage behavior." The authors noted that "both PU and PEOU predict attitude toward using the system. A and PU influence the individual's BI to use the system. Actual use of the system is predicted by BI" (p. 1).

Landry, Griffeth, and Hartman (2006) suggested that TAM is effective in measuring technological adoption even among populations that are understudied. They stress that populations who are familiar with technology in general, but may be unfamiliar with a specific form of technology, such as students, can have their corresponding user preferences explored based upon existing knowledge concepts and new areas of study as tested by TAM. The validity and the ease of use of TAM have been established, and it is therefore an exceptional research tool in identifying user preferences.

Usefulness and ease of use. The study of *perceived usefulness* and *ease of use* are considered to be paramount in understanding how an end user interacts with the technology. In their classic study of technological acceptance, Adams, Nelson, and Todd (1992) studied Davis' early theories on adoption and use with the purpose of isolating specific themes and commonalities within the model. Additionally, the researchers sought to identify whether Davis' initial modeling approach contained various processes of internal validity. These researchers believed that Davis' theories were likely to be correct, but that the initial modeling process described by Davis did not contain substantial proof of validity. As a means of testing the model, Adams et al. (1992) developed two distinctive studies that tested two specific types of validity in response to Davis' initial theories on modeling.

The first of the studies by Adams et al. (1992) tested the relationships between ease of use, usefulness, and usage of both voice and electronic email systems. The rationale for associating these two systems was their similarities of function, which

suggested that the users were already familiar with some of the processes involved when they transferred their knowledge from a commonly-used system (i.e., voicemail) to an unfamiliar system (i.e., email). However, the processes used to operate these systems are decidedly different. Therefore, the adoption strategies that help facilitate acquisition and use of email will reflect the users' perception of knowledge acquisition as opposed to actual foreknowledge of the technology. Also, the researchers chose to match these two distinctive forms of technology since they were cross-representational of technologies that had similar value to the user. This term is used to identify the specific role that the technology plays in the user's life and the emphasis that is placed on that role.

In this first study, Adams et al. (1992) used Davis' (1989) initial measurement scales to assess and evaluate usefulness. The researchers noted that no changes were made to the scales and that the same items originally used by Davis (1989) were likewise used in this evaluation study. Measurement of use was done through frequency of use (e.g., number of times per day the technology was utilized, number of items sent, number of items received, etc.). The authors did note that flexibility, which is one of the items on Davis' (1989) original measurement scale, had a "negative item-to-scale correlation," indicating that its inclusion in the study had the potential to significantly undermine the validity and analysis processes. In discarding this item, they also stressed that previous research efforts had determined the same or similar outcomes associated with this one item. Therefore, Adams et al. (1992) believed that it was appropriate to discard the item and still be able to critically review the outcome of Davis' (1989) perception and adoption model.

The methodology chosen for the first study consisted of a questionnaire with 61 items on voice mail and electronic mail use and the users' corresponding work habits. A total of 118 questionnaires were collected and tabulated for the survey results. The results indicate that both types of technology were comparatively new, where the users had utilized voice mail for an average of 28 months and electronic mail for an average of 21 months. The user scores indicated greater familiarity with email, as well as increased tendency to use email over voice services. Adams et al. (1992) suggested that this frequency of use was indicative of the beneficial outcomes associated with email as opposed to voice mail (e.g., convenience, accessibility, etc.) Further, the researchers noted that their findings replicated those of Davis (1989), and therefore helped to validate his model.

In the second study used to test Davis' (1989) perception and adoption model, Adams et al. (1992) tested user adoption rates with three specific forms of software in a business setting. These programs – WordPerfect, Lotus 1-2-3, and Harvard Graphics - had similar capabilities and could be used in a similar setting. The researchers chose to use these programs because they were popular among customers and "based on their popularity it would be reasonable to assume that these packages would be rated relatively high in terms of both ease of use and usefulness" (p. 237).

The instrument used in the second study was the same as that used in the first study, except changes were made to terminology to help compensate for the use of software programs instead of voice mail and electronic mail. Similarly, validity was assessed using the same methods as were used in the previous study.

The researchers collected 73 questionnaires and found that there were correlations between ease of use, usefulness, and usage. This process helps indicate that Davis' (1989) model is appropriate for use in assessing user habits towards technology, as it helps to "reaffirm the validity and reliability of the ease-of-use and usefulness scales". In addition, this model also allows enough overall flexibility to enable the users to distinguish between different types of software and describe clearly-noted preferences. This was demonstrated in the users' results where some forms of software were clearly preferred over others. Such subjectivity was addressed in the tools and the analysis processes.

Diffusion of Innovation Model (DOI)

Theories by Everett M. Rogers were used as the basic premise for the Diffusion of Innovation Model. Rogers (1995) focused on the appropriate delivery of technology as a part of whether or not it was used, not merely the design of technology. This theorist defined the diffusion process as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (p. 5). Here, innovation is "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (p. 11). Rogers' rate of adoption model, which was the theory best applicable to this study, stated that innovations were diffused over time in a pattern that resembled an S-shaped curve. This indicated that a successful type of technology went through a period of slow, gradual growth before experiencing a period of relatively dramatic growth. After this technology had become stabilized, it entered into a period of decline that was indicative of technological process. This rate of adoption was the sum of

the users' decisions regarding their implementation of the innovation and the perceptions of its effectiveness.

Furthermore, Rogers (1995) created five specific categories that were applicable to all potential users of technology: (a) these were innovators (creators and tweakers of technology); (b) early adopters (fast adoption); (c) early majority (fast mainstream); (d) late majority (slow mainstream); and (e) laggards (slow adoption). The key to developing and implementing a new form of technology that would be self-sustaining was to target the early adopters and cater to their willingness to engage with new or untested forms of technology.

Rogers (2003) promoted the concept that the adoption of ideas, concepts, and unfamiliar themes was difficult to integrate into society. However, the foremost challenge was not to integrate these items overall, but instead that these items tended to be absorbed at different rates into the system. The rate of absorption was difficult to monitor as the processes associated with it were perceived differently by different persons; even when exceptionally beneficial, the adoption of unwelcome concepts were often challenged on the grounds of inconvenience or user resistance.

Using this model, Rogers (2003) found that human beings interacted on a linear level and that there were processes of communication that were difficult to turn towards the idea of new or changed thematic processes. Rogers found that there were critical events in the course of all human discourse and that these processes were hard to manage or change, and recommended the diffusion process to achieve this end. He wrote, "diffusion is a special type of communication, in which the messages are about a new idea. The newness of the idea in the message content gives diffusion its special

character. The newness means that some degree of uncertainty is involved in diffusion" (p. 6).

In practice, Rogers' Diffusion of Innovation model has been applied in many distinctive scenarios. This model has been used in settings in which new forms of technology were integrated and the user adaptation to these unfamiliar technologies was charted.

One study in which Rogers' Diffusion of Innovation model was put into practice was conducted by Pearcey and Draper's (1996) assessment of technology within nursing. The authors questioned why there were increasing technological innovations occurring in the field of nursing that often failed to enter clinical practice. Recommendations for improving obvious and persistent shortcomings within the general field of nursing practice typically were well-received in terms of theoretical application, but there appeared to be a gap between theory and integrating these into the nursing setting. Pearcey and Draper (1996) suggested that Rogers' Diffusion of Innovation model could be used to assess why this occurred. In an action research study in which a nursing ward was educated in a new area of nursing technology, the authors charted reaction to training, implementation, and outcomes.

The researchers found that there was a significant resistance level among nurses to new technology and that this resistance was not necessarily attributable to the complexity of the technology, but rather reflected an adherence to old and familiar methods. Moreover, the researchers found that the most intriguing aspect of resistance to integration was that the technology acquired negative connotations because of resistance to management styles.

The action research study approach allowed the researchers to identify specific phenomenon that were common to the sample population. In this study, many of the nurses reported previous experience where management forced them to learn new technologies, new systems, or new work habits. These were rarely permanent and the nurses reported that management would often accept new fads in management strategies or technology, impose these over an already-functioning work environment, and then fail to see these through once the initial novelty had worn off. The nurses stressed an unwillingness to dedicate time or energy to investing in what they identified as management's failure to recognize how their existing resources already were limited. This study was also significant in that it demonstrated how the Rogers' Diffusion of Innovation model could help chart processes through which the integration of technology could avoid such limitations and be structured for the current setting.

Indeed, this latter point was representative of Rogers' original purpose for this model. Rogers initially determined that a lack of willingness to participate in technological innovations was made worse through embedded socio-cultural practices. Diffusion of Innovations consistently demonstrated repeating patterns among members of specific social and cultural groups. This resulted in an extension of the diffusion model in which "The four main elements in the diffusion of new ideas are (1) the innovation, (2) communication channels, (3) time, and (4) the social system" (Rogers & Scott, 1997).

Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT) was first proposed in 2003 by Venkatesh, Morrish, Davis, and Davis in their study, "User Acceptance of Information Technology: Towards a Unified View." The researchers identified that previous models used to study technology, technological acceptance, and technological adoption tended to have conflicting study methods and, ultimately, failed to provide a single comprehensive perspective when used independently of each other to survey the same materials. This was seen as a notable flaw in the models. While Venkatesh et al. (2003) did not state outright that other theories of technology acceptance were wrong, they strongly suggested that there should be greater overall congruency among the models. The lack of congruency suggests that there are persistent validity issues inherent in these studies, since attempts to find the median success rate demonstrated flaws inaccuracy. Their research is discussed in depth in the following section.

As a means of reconciling these differences, as well as to create a single model that could be used to successfully study the acceptance of technology, Venkatesh et al. (2003) proposed the UTAUT model. This process incorporates multiple user variables, including the *intentions of the user*, *performance expectancy, effort expectancy,* and demographic characteristics (age, gender) of the user including *prior experience,* and *social influences* such as willingness to participate in the technology. Venkatesh et al. (2003) also suggested that the demographics of the user could be identified as components of the adoption process if these were constant in the majority of testable experiments, and therefore viewed as independent variables. However, this process

would require caution, because demographic variables may change with socio-cultural norms, therefore rendering specific independent "known" variables, incorrect given time and demographic shifts.

Anderson and Schwager (2004) found that the UTAUT model was extremely useful in identifying the rate of adoption of IT, especially within large sample populations. The UTAUT can be developed into a detailed questioning process that can be transformed into different research instruments, such as detailed questionnaires. Testable hypotheses can be formulated and constructed using the UTAUT constructs, which again are performance expectancy, effort expectancy, social influence, and facilitating conditions. Anderson and Schwager (2004) chose to transform the UTAUT into a tabled analysis process in which gender, age, experience with technology, and the voluntariness of use were used as the defining population variables. This helped the researchers identify patterns of use in twelve specific areas based upon the four constructs and the qualities of the sample population.

Empirical Studies and Measurement Instruments

Measurement of Technology Acceptance

Specific measures of technological acceptance have been aided through improving the focus of the research methods. In Chau's (1996) "An Empirical Assessment of a Modified Technology Acceptance Model," the author suggested that the "Technology Acceptance Model (TAM) is one of the most influential research models in studies of the determinants of information systems/information technology acceptance" but that the TAM was limited unless specific criteria were met (p. 185). Chau (1996) suggested that TAM assessed perceived acceptance as opposed to actual acceptance, wherein the user approached the new technology in an analytical fashion and could not separate the concepts of using the technology from the idea of using the technology.

To clarify, Chau (1996) found that subjects approached technology in terms of: (a) how it could be useful to them; and (b) if the degree of perceived use differed significantly from the actual perceptions formed through interacting with technology. Therefore, a self-reporting willingness to interact with technology could not accurately represent the long-term outcomes resulting from that person's interaction with the technology. What was necessary, Chau (1996) suggested, was a model that tested the interactions between short-term and long-term use of technology and contrasted the perceptions of users against the actual use of technology.

The researcher sought to test this through a mixed-method study in which 285 administrative/clerical staff in a large organization were tested against the modified model using the structural equation modeling approach. The results indicated that the intention to use technology corresponded closely with the subject's overall success in

using technology. However, the technology did not become any easier to use for a candidate who expressed willingness to learn and still had to undergo education and training in how to use the technology.

In a follow-up study designed to further test the parameters of TAM, Chau worked with several researchers to identify the specific limitations on TAM within existing modeling systems. In their article, "Examining the Technology Acceptance Model Using Physician Acceptance of Telemedicine Technology," Hu, Chau, Sheng, and Tam (1999) sought to test the degree to which TAM could measure the attitudes of persons active within information technology. The researchers found that earlier studies tended to confuse the variables in question, especially in regard to "different technologies, user populations, and/or organizational contexts" (p. 91). This created a setting in which previous research efforts may have confused specifics within the methodological process. In order to appropriately measure the correlation between TAM and user preference, the researchers focused on clarification of variables and the identification of components associated with psychological formation of attitudes. They assessed these using a case study approach that explored the modeling processes of telemedicine within a closed environment. The measurement process was done through identifying the perceptions of adoption through the use of TAM, which were already reported by the case study during the measurement and the analysis process.

Hu et al. (1999) then applied these strategies to a qualitative assessment of physicians learning information technologies within a structured telemedicine environment in Hong Kong. The researchers found that the "technology, the user group, and the organizational context" all helped form the core context of preferences associated

with the end relationship with the user, and also that these associative variables played a significant role in the adaptation of technology (p. 91). Hu et al. (1999) concluded in noting that TAM was effective when parameters of use were specific. If these limitations were not imposed, then TAM merely assessed trends as opposed to specific patterns.

Measurement of Technology Adoption

Measures of technological adoption help assess the degree to which a given sample population is able to integrate technological change into their lifestyle. Basanini and Scarpetta (2002) found that the path to full technological adoption was difficult to quantify, unless there were standards of uniformity and consistency among the sample population and the type of technology that was to be adopted. Reliability and validity of assessment were particularly difficult; small, limited case studies were able to provide a concise look at the adoption of technology within certain populations. However, large-scale technology change across diverse populations with very few limiting characteristics or qualifiers was difficult to accomplish.

In 2002, Basanini and Scarpetta published their findings on growth and technological change within countries united by the Organization for Economic Co-operation and Development (OECD). This data sample necessitated a broad methodology to study productive growth patterns of gross domestic product (GDP) and technological adoption. The researchers determined that three characteristics common to all populations in the study could be used to triangulate the relationship between GDP and technological adoption. These were "improvements in labor utilization, a generalized enhancement in human capital; and rapid shifts in the composition of

physical capital towards information and communication technology (ICT) equipment" (p. 324). Each of these three characteristics shared properties corresponding to growth, use of resources, and integration of technology in these studies.

Karahanna, Straub, and Chervany (1999) found that technological adoption could be measured using historical markers which indicated the preferences of users. In contrast to the study by Bassanini and Scarpetta (2002), this study utilized a case study method in which technological adaptation was measured according to the perceptions of the sample population. In this qualitative phenomenological study, "beliefs and attitudes" were used as the variables to determine the degree to which a specific item of technology (in this instance, Microsoft's "Windows" product) had been acquired by the sample population. The instrumentation process was a survey-based attitude assessment survey that collected the responses of the participants.

Karahanna et al. (1999) recorded the phenomena both prior to and following the implementation of the technology and sought to measure changes in preferences. The methods used were innovation diffusion (a model similar to that proposed by Rogers) and phenomenological studies drawn from self-reporting beliefs and attitudes. The researchers were able to identify the degree to which adoption of technologies occurred through using these methods. Moreover, they also recognized that certain patterns of user preference and behaviors could be observed. The researchers stated that "whereas pre-adoption attitude is based on perceptions of usefulness, ease-of-use, result demonstrability, visibility, and trialability, post-adoption attitude is only based on instrumentality beliefs of usefulness and perceptions of image enhancements" (p. 183). The researchers were intrigued by this finding; the degree to which adaptation had

occurred appeared to be so absolute that initial pre-adoption concerns ceased to exist for users. This outcome was highly suggestive for technological adoption, indicating that once the limiting barriers that prevent adoption are overcome, the outcome is potentially total adoption.

Measurement of Technology Innovation and Diffusion

As with adoption of new forms of technologies, it is difficult to adequately measure the diffusion of new or innovative forms of technology. Specific limitations on methodology help to create a framework through which innovation and diffusion can be quantified. However, without these limits to impose feasible boundaries, measurement of innovation and diffusion could not occur.

In his article "The Diffusion and Assimilation of Information Technologies," Fichman (1999) presented his theory that there are serious complications associated with diffusion and assimilation when a new form of technology is presented to an organization and whether or not the new technology should be added to the environment in the first place. Fichman (1999) bases his theory on the observation that resistance to new technologies was historically high and that there were specific patterns common to such resistance. The majority of Fichman's (1999) arguments to this end had already been voiced in this current research study and did not need to be restated. Based on components of resistance and unwillingness to engage in the integration of technology into a given environment, Fichman (1999) declared that the first phase in any single technological adoption process must be based in the measurement of whether the technology should actually be introduced in the first place.

Fichman's (1999) theory was sound, as it identified a serious limitation in technology adoption strategies and justified a strategy that purposefully avoided this limitation. He found that generalization was a large component of the problem, where management or the end consumer recognized the potential use for new technology but did so in an abstract, non-specific way.

Change leaders were those persons who could successfully integrate technology and diffuse it into the population. A predominant characteristic of such persons was that these individuals not only recognized the abstract merits of new technology but could communicate and/or demonstrate its effectiveness and value to others. Without a change leader, however, the concept of new technology was resisted to varying degrees. As a result, the author stressed that there was a distinction made between innovation and diffusion of technology in different types of environments; measuring the degree to which innovation and diffusion occurs needed to take into account the type of leadership that existed before technology was introduced at all.

Chatterjee and Eliashberg (1990) engaged in a micromodeling approach to assess "initial perceptions, preference characteristics, and responsiveness to information" within a pilot study of four companies that were ready to implement the same form of technology (p. 1057). This pilot study used methods of modeling technology integration and adoption that charted patterns of sales growth before, during, and after the integration of technology. The researchers chose the sample population in the four companies on the grounds that these expressed similar traits and therefore should respond to the diffusion process by expressing similar socio-cultural patterns, allowing for quantitative assessment of commonalities expressed in diffusion.

The reliability of this method was questionable; while the companies in the pilot study were similar in that these engaged in the same industry, had comparable size, and were located within the same basic political and economic forces, the researchers did not do any detailed sampling to survey and assess the demographic quantities of the sample population and there is no real mention of leadership or discussion of the setting preceding the implementation of technology. It was highly likely that the modeling process used by the researchers was effective, but required a delimiting process to further isolate those areas that were relevant to the sample population.

Measurement of Innovation

Measurement of innovation within information technologies is subjective. The aforementioned theories indicated that there were processes involved in assimilation of technology that were based in the users' response as opposed to the overall applicability of the type of innovation used. This indicated that the usefulness of the technology was dependent mainly on whether or not it would be used. Aggregation measurement of innovation helped identify the overall use of a given form of the technology in a specific environment.

In his study, "The Role of Aggregation in the Measurement of IT-Related Organizational Innovation," Fichman (2001) conducted a methodological study about the role of aggregation in the measurement of IT-related organizational innovation. He used a non-experimental, correlational, quantitative design to study IT departments located in the United States. A probability sample of 1,500 sites was extracted from a list, maintained by International Data Corporation, of 40,000 U.S. sites with computers

installed. Fichman's (2001) literature review was thorough and current in comparing and contrasting theories about innovation, diffusion, and aggregation. A probability sampling plan resulted in the data producing sample of 608 usable responses for a 45% response rate. The OLS regression was used to measure the "adoption of three software process innovations: (1) relational database management systems (RDB), (2) computerized software engineering tools (CASE), and (3) object-oriented programming languages (OOP)" (Fichman, 2001, p. 436). Reliability estimates were 0.85 for internal consistency, and construct and criterion related validity were established. Data collection procedures were clearly described. However, ethical aspects during data collection were not described, including whether the study was approved by an IRB committee.

Findings supported the study of the role of aggregation in the measurement of IT-related organizational innovation using a Theoretical Model of Innovation with Software Process Technologies. Fichman's (2001) interpretation of these findings was consistent with the generalizations of the conceptual analysis. This led to the conclusions that aggregating across as few as three innovations produced more than a doubling of variance explained in models predicting organizational innovation with software process technologies. The researcher also found that aggregating across assimilation stages had a slight positive effect on predictive validity. Fichman (2001) concluded that the effects of aggregation would be across broader classes of IT innovations and would remain a question for future study.

The aforementioned study by Karahanna et al. (1999) is also relevant to the current discussion. As stated, the researchers conducted a study in which they measured the adoption of Windows information technology into a single organization. The

researchers used an experimental qualitative case study method through which user behaviors and user attitudes were surveyed. The phenomena reported by the users were explored using the Theory of Reasoned Action.

The literature review presented in the study was comprehensive and discussed methods of adoption and assessment. Empirical studies focusing on known case studies in technological adoption and methods through which successful adoption and integration had occurred within specific populations were included. Of note was the authors' focus on patterns of behavior that were expressed among populations with shared commonalities, suggesting that outcome of potential adopter behavior could be predicted within reason given known variables. However, the literature review was less comprehensive in terms of determining measurement strategies that were useful to chart the process of assessing innovation. Indeed, the focus of the paper reflects this; the researchers concentrate on utilizing a traditional case study method that measures the attitudes of populations prior to and following the introduction of a changed variable (i.e., the Windows operating system).

Karahanna et al. (1999) found that the behaviors and attitudes of users differed dramatically from the researchers' initial hypothesis. Instead of reflecting a gradual abandonment of feelings of anxiety and other forms of antipathy or aversion towards technology, the researchers marked an almost immediate cessation of such feelings once adoption occurred. Persons who were more likely to willingly engage in technology (potential adopters) expressed feelings of acceptance towards technology and adoption. Yet the findings suggested that the views of those who did not have a favorable attitude towards technology were ultimately similar to those expressed by potential adopters.

Measurement of User Acceptance of Information Technology (UTAUT)

Venkatesh, Morris and Davis (2003) conducted a study concerning user acceptance of information technology. These researchers used a non-experimental, causal comparative, corelational, quantitative design to study employees over three time periods across four different types of organizations: (a) entertainment; (b) telecom services; (c) banking; and (d) public administration. Venkatesh et al's. (2003) literature review was thorough, current, and significant in comparing and contrasting theories about user acceptance of information technology. Empirical studies of Unified Theory of Acceptance and Use of Technology (UTAUT) were examined, leading to a finding that there were several theoretical models for information systems available for managers.

This resulted in Venkatesh al's. (2003) study testing the proposition of using a unified view of user acceptance. A probability systematic sampling plan resulted in the data producing sample of 215 employees. In this empirical study Venkatesh et al. (2003) introduced six hypotheses. Two of them were broken down to particular issues totaling nine hypotheses.

1. Hypothesis 1: as expected, the effect of performance expectancy was in the form of a three-way interaction--the effect was moderated by gender and age such that it was more salient to younger workers, particularly men, thus supporting H1;
2. Hypothesis 2: the effect of effort expectancy was via a three-way interaction--the effect was moderated by gender and age (more salient to women and more so to older women). Based on Chow's test of beta differences ($p < .05$), effort expectancy was more significant with limited

exposure to the technology (effect decreasing with experience), thus supporting H2;

3. Hypothesis 3: the effect of social influence was via a four-way interaction--with its role being more important in the context of mandatory use, more so among women, and even more so among older women. Chow's test of beta differences ($p < .05$) indicated that social influence was even more significant in the early stages of individual experience with the technology, thus supporting H3;
4. Hypothesis 4a: facilitating conditions were non-significant as a determinant of intention, thus supporting H4a;
5. Hypothesis 5a, 5b, and 5c: as expected self-efficacy, anxiety, and attitude did not have any direct effect on intention, thus supporting H5a, H5b, and H5c;
6. Hypothesis 4b and 6: Since these two hypotheses were about non-significant relationships, the supportive results should be interpreted with caution after consideration of the power analyses reported in the text.

These results led to the conclusions that UTAUT explains as much as 70% of the variance in intention and provides a refined view of how the determinants of intention and behavior evolve over time. However, it was possible that they might have approached the practical limits of their ability to explain individual acceptance and usage decisions in organizations.

One limitation concern reported by Venkatesh et al. (2003) was the scales used to measure the core constructs. Although Venkatesh et al. (2003) were thorough; they did

not provide the population of the survey. Therefore, the response rate was unknown. The Partial Least Squares (PLS) was used to test eight models at three points of measurement (three time periods). Reliability estimates were greater than .70 for internal consistency, and construct and criterion related validity were established. Data collection procedures were clearly described. However, ethical aspects during data collection were not described, including whether the study was approved by an IRB committee.

Venkatesh et al. (2003) found five limitations in previous technology acceptance theories:

1. Technology studied – the technologies that have been studied in previously were conceptually simpler. As time evolves, technologies have become more complex in nature;
2. Participants - most of the studies conducted were based on students in various schools rather then a wide range of employees in different types organizations;
3. Timing of measurement – in most of the studies, the time of the measurement was after the technology was introduced to the users participating in the survey;
4. Nature of measurement – previous studies are not taking into consideration the experience of the participants; and
5. Voluntary vs. mandatory contexts – most of the model tests were conducted in a voluntary usage base, thus, did not take into consideration when a technology was being forced on the users.

Venkatesh et al. (2003) recommended that future research should focus on identifying constructs that could add to the prediction of intention and behavior over and above what was already known and understood.

Measurement of Diffusion of Innovation

Cheng, Kao, and Ying-Chao Lin (2004) conducted a study that applied Rogers' diffusion of innovation (DOI) theory to online gamers in Taiwan. These researchers used a non-experimental, causal comparative, quantitative design of Taiwan residents between 13 and 50 years of age. The literature review was thorough in describing Rogers' DOI theory, however, it was not thorough in regards to Moore and Bass' models. Empirical studies of diffusion of innovation testing propositions were examined. This led to a discussion of the lack of research in the gamer behavior when introducing a diffusion of online games. This resulted in the investigation of Taiwan's current online game diffusion stage and online gamer profiles within each stage. In addition, a comparison of innovative attitudes of online gamers towards these games and general products was also examined.

A probability, systematic sampling plan resulted in the data producing a sample size of 350. Cheng et al. (2004) collected the data from Taipei MRT stations (Mass Rapid Transit stations), sampling one out of 10 people who were intercepted when walking through the entrance. The authors did not report the number of people who agreed to participate (response rate), thus there may be selection bias.

Cheng et al. (2004) reported a pilot testing of a four part scale. The first part was used to determine the current diffusion rate of online games. A second part was used to

subgroup the gamers based on their knowledge of new games, patterns in the gaming market, their purchasing behavior, and if they were early adopters. The third part contained questions in regard to their socioeconomics, personalities, and communication behaviors. The fourth part included innovative attitude measurements associated with general products. The researchers did not report reliability and validity of their questionnaire. Data collection procedures were clearly described. However, ethical aspects were not described, including whether the study was approved by an IRB committee.

Based on the results, the adoption rate of online games among Taiwan residents between the ages of 13 and 50 was 38.57%. This adoption rate supported Rogers' DOI theory that online game diffusion had reached the early majority stage, and Rogers's idea that three categories of online gamers had formed: (a) the innovators; (b) the early adopters; and (c) the early majority. Furthermore, a comparison of the three categories indicated that Roger's theory could predict the personalities of online gamers, such as earlier players were likely to be young males with low income who were more innovative toward online games. However, adoption behavior of general products failed to follow the DOI theory due to the fear of innovators to purchase new products without prior knowledge.

Cheng et al. (2004) recommended that future studies to concentrate on the perceived attributes of the innovativeness of online games as a modern entertainment device, "such as their relative advantages, compatibility, triability, observaility, and complexity" (Cheng et al., 2004, p. 445).

Similarly, Kappelman (1995) recommended that specific concepts be included into all instrumentation efforts used to measure DOI. These included a 20-instrument process involvement scale that could be applied to demonstrate empirical involvement between the user and the system, a process that could be broken down into a taxonomy of preference and use in which behavioral and attitudinal components form the core of the research process. These included further deconstruction to isolate the differences between user activities and user involvement, task-related behavior and task involvement, and IS-related behavior and product involvement. When this differentiation was carried out, it was possible to identify and test the validity of user process involvement and user system involvement in a research experiment. However, Kappelman (1995) did not indicate whether this taxonomy was feasible for non-experimental research designs, such as assessment of case studies or completed data sets that were not under the direct control of the researcher.

Factors Affecting Wireless Data Technology

A problem area of technology acceptance of wireless data has been identifying the factors that affected the adoption of wireless data technology in various types of organizations. Some problems observed were the concerns of business clients about unsecured networks that might be hacked into by unwanted people. At times, business clients accepted the technology; however, due to an inability to distribute to non-metropolitan areas, the technology could not be adopted. Cellular coverage has focused only in the metropolitan areas where there has been a high population concentration.

Implementation of wireless data required complex designs and tools to overcome service gaps due to coverage.

Another problem that might affect technology acceptance and adoption is the instability of networks. Network stability of wireless systems is not as reliable as land lines due to their dependence on weather, terrain and geographical conditions. The immediate cost to implement a wireless data solution is much higher in comparison to land lines as it requires more sophisticated hardware, security equipment, software, and applications to be written specifically for the solution, thus affecting the return on investment (ROI).

The factors that affect the acceptance and adoption of wireless data technology are not only about the technological issues in IT development, but also about business practices of IT firms in understanding service needs and concerns of customers, consumer behavior, formulating business strategies, marketing, and promoting capabilities in organizations, thus cutting across a variety of major fields of study. The purpose of this critical analysis of theoretical and empirical literature is to examine technology acceptance factors that affected adoption of wireless data technology in organizations, and to identify areas of future scholarly inquiry.

Wireless Trust (Trustworthiness and Adoption)

Siau, Sheng, and Nah (2003) prepared their paper, "Development of a Framework for Trust in Mobile Commerce" for the *Trust in Mobile Commerce* meetings The paper emphasized the role between consumer acceptance of technology within the framework of mobile communications and mobile commerce. The assessment of adoption in

wireless technologies was tested in this study using a "value-focused thinking approach" which tested the perceptions of interview subjects (p. 85). The researchers used this tool to assess the degree of trust exhibited among consumers towards new technologies, but chose to present the concept of trust in a scenario that suggested that users would see actual value (e.g., financial, reduced investment of time, etc.) from the use of these wireless technologies.

The concept of a value-added modeling process drew upon research that had established that technology was more likely to be successfully adopted by consumers if there was an overt, tangible benefit – or set of benefits – to doing so. Value-focused assessment of technology compared the features of a specific form of technology to the perceptions held by consumers. This consisted of four key processes, which included: (a) identification of values; (b) conversion of values to objects; (c) separation of means and objectives; and (d) "build means-ended objective network" (p. 85). This last point referred to the integration of technology that was purposeful into an objective adoption strategy.

In a critical review of the literature, Siau et al. (2003) explored these connections by drawing on previous research conducted in the areas of value, perceived value, and adoption according to these criteria. Through using value-focused thinking, the researchers developed a model that showed the steps to be taken from the development of technology, through its implementation in the marketplace, to its adoption and use by consumers. This study was significant in that it demonstrated the link between technology and consumers in terms of adoption, with an emphasis on encouraging consumers to *want* to adopt technology through education and incentives. The

researchers concluded that the consumer was the end user of technology and that if the consumer engages with technology, but does not fully see the invested value therein, this reduced the longevity of the product.

Lu, Yu, and Liu (2005) conducted a study about facilitating conditions, wireless trust and adoption intention. They used a non-experimental, corelational, quantitative design, with a sample of 357 MBA students from a regional university in Texas. Lu et al's. Structural Equation Modeling (SEM) was used to measure the model-fitting program. Findings supported the two hypotheses described in this study, the effect on intention to adopt Wireless Internet Services via Mobile Technology (WIMT) from wireless trust, and a stronger support for the effect on user-perceived wireless trust of WIMT from facilitating conditions in terms of technical assistance and legal and regulatory frameworks.

Lu et al.'s (2005) interpretations of these findings indicated that there was a strong causal relationship between wireless trust and facilitating conditions. Three construct items were measured in this empirical study: (a) intention to adopt WIMT; (b) wireless mobile trust; and (c) facilitating conditions. Cronbach's Alpha was used as a test for internal consistency, which was greater than .7, indicating a good estimate of reliability. Furthermore, the factor loading for the most part was greater than .5, which indicates good contrast validity. "This finding points out the direction for businesses to actively move for strengthening trust perceptions toward the wireless mobile environment - developing targeting policies and regulations to govern the wireless mobile part of the Internet and providing active management and guidance to the mobile users" (Lu et al., 2005, p. 21).

The researchers identified one implication for practice which was to gather more specific and useful information in the WIMT field to be used for business practitioners and the academy. Limitations reported by Lu et al. (2005) included the sample which concentrated on students only, in one school located in Texas.

Lu et al. (2005) generated areas of future study, which included that this study needed to be replicated using a larger scale, beyond the limit of student sample and use corporate users, non-users, and users based on random sampling procedures to generate higher credibility and stronger persuasive results.

The literature review was not thorough, current and could have been more accurate in comparing and contrasting theories about Technology Acceptance Models (TAM) and intention adoption. Empirical studies of TAM were examined, leading to the major gap and conflict in the literature about facilitating the condition to use wireless data technology. This resulted in Lu et al.'s (2005) study testing the effect of facilitating conditions on the user perceived wireless trust of WIMT developed in 1979 by Triandis (as cited in Lu et al., 2005).

Data collection procedures were poorly described, and ethical aspects during data collection were not described, including whether the study was approved by an IRB committee. A sampling plan resulted in the data producing a sample of 357 students. However, the response rate was not provided.

Information Technology and Telecommunications Acceptance

The integration of telecommunications theory and acceptance has helped to chart the strategies that affected the success of telecommunications within certain markets.

Telecommunications theory and acceptance has been used to emphasize the link between the type of telecommunications provided and the market in which these telecommunications were generated and used.

In his article, "Developing New Rules for New Markets," John H. Roberts (2000) explored these issues through a general examination of emerging technologies and how markets responded and – ideally – received new technologies. Roberts (2000) placed an emphasis on the entry of technology into new markets (e.g., developing countries) in which there were no previous comparable forms of technology to affect the population. This, he suggested, helped to form an appropriate analysis of technology within a new setting as there were no extraneous factors that would preclude or otherwise compromise effective integration.

In a critical review of new markets, Roberts (2000) found that there were two specific points of correlation found within all forms of new technology as these became established. The first of these was an understanding of the market, which Roberts explored as defining the needs of the local community, culture, and driving economic forces prior to product rollout. If there was no assessment of the community, then it was impossible to fully cultivate a market strategy that attracted all potential consumers. Moreover, Roberts (2000) argued that many markets were simply not ready to accept new technology and it was necessary to recognize this. The impulse to establish a claim to the market by being the first manufacturer of its kind was tempting but ultimately failed to take into consideration that this had a strong likelihood of failure if there were: (a) no demand for the product; and (b) competition from unrecognized sources. Identifying the rules which governed the community helped to avoid these problems.

Roberts' (2000) second criterion for market success was that of exploitation of market understanding. He separated these two very similar criteria as the majority of research in this field tended to focus on blending recognition of new markets into processes that could be used to exploit these. The author purposefully separated these as previous literature on these subjects mistakenly overlooked grounds for success based on a sequential order inherent within; (a) comprehension; and (b) development of market strategies. When this occurs, patterns of acceptance could be seen. While telecommunications theory and acceptance was not the principle focus of Roberts' (2000) article, the emphasis on telecommunications as a significant and desirable commodity was used to guide the study.

Wilde and Swatman (1999) explored these trends within Telecommunications Enhanced Communities (TECs), wherein the gradual acceptance of new technologies by communities suggested patterns of behavior that did not have anything to do with market forces per se. In their study of TECs, the researchers drew connections between the emergence of new or next-generation forms of telecommunications and the impact of these on the community. The study took place in Australia and measured the impact of telecommunications in communities that were rural and did not have access to much new technology, and in urban settings in which communities had become socially networked due to technological networking.

In a theoretical assessment of observed patterns of behavior in TECs, Wilde and Swatman (1999) noted that there were six dimensions of social networking as tied to technological networking. These were: (a) *density,* or the overall population within a given area; (b) *boundaries*, or the limits placed on technology; (c) *exclusivity*, or

the degree to which the overall population can access the technology; (d) *range*, or the limits imposed by the technology itself on its utility; (e) *social control*, or the degree to which certain social norms such as legislation curb the use of the device; and (f) *tie strength*, or the type of manifestation of contact and communication between members of the group. Therefore, capturing a market in order to ensure acceptance of telecommunications in this setting needed to take into account the social influences that are prevalent. It was probable that these social influences might become part of marketing strategies as a means of enhancing willingness to accept and use these technologies.

Discussion of the Literature

Summary and Interpretations

The purpose of this critical analysis of theoretical and empirical literature was to examine technology acceptance factors that affected adoption of wireless data technology, and to identify areas of future scholarly inquiry. The major findings of this literature review were technology acceptance factors that were affecting the use of the wireless data technology in various types of organizations, such as diffusion of innovation, facilitating conditions, and wireless trust. While wireless data technologies have gained fast acceptance by many organizations, it has been noted that other organizations hesitated to expand their wireless arena for various reasons such as speed of connection, reliability and technology evolution.

The following synopsis of the state of the art of theoretical and empirical literature lets the reader know what is known and what gaps exist. Themes that have emerged within the study of the literature stressed that researchers and market analysts

have been able to draw patterns between existing consumer behaviors and the adoption of technologies.

Theoretical Literature

Summary of the Various Theoretical Models

There are several theoretical models discussed in the literature which explore determinants of technology acceptance. The models discussed in the literature review include the Technology Acceptance Model (TAM); the Theory of Reasoned Action (TRA); the Diffusion of Innovation (DOI), and the Unified Theory of Acceptance and Use of Technology (UTAUT).

The first model discussed was the Technology Acceptance Model (TAM) developed by Davis et al. in 1989. TAM has been widely used as a framework for designing empirical research. TAM emphasizes the link between the user and technology, wherein the user is more likely to acquire and assimilate the technology in question into his/her personal repertoire of favored technologies if there is: (a) an evident benefit that occurred from the use of this technology; and (b) the technology was easy to use. Researchers have used TAM as a means of clarifying how, and under what conditions, users are likely to accept new forms of technology.

The second model explored was the Theory of Reasoned Action (TRA). This model proposes that there is a consistent relationship between a person's internalized thoughts (e.g. believes, attitudes, preferences, etc.) and the formation of a subjective relationship between the person and his or her actions regarding a specific set of circumstances. In other words, personal preferences are drivers of individual behavior.

The third model, Diffusion of Innovation (DOI), explores the process through which a specific type of technology moves within a user population. The social system in which communications occurred help facilitate and transmit information, and this affects the processes in which a specific form of technology is accepted, integrated, and ultimately used by a specific population. Rogers (1995 and 1997) presented the idea of DOI as a means of identifying: (a) the *relative advantage* of a specific form of technology; (b) the *compatibility* of that technology to other items and constructs that may be familiar to the user; (c) the *trialability* of the technology as an important component of the user's life; and (d) *observability* of the ultimate impact and outcome of the technology. In follow-up assessments of the Diffusion of Innovation model, Rogers (2003) suggested that the rate of growth and the adoption processes experienced by users could be explored through thematic processes. Consumers tend to identify a specific genre of technology as a themed concept, and it is difficult to turn their interest towards a new form of technology once habits towards use had been formed. As a result, those seeking to implement new technologies need to identify and assess how the technology is framed by the users and the habits that could potentially evolve from their use.

The last model explored in the literature review was the Unified Theory of Acceptance and Use of Technology (UTAUT) which was developed by Venkatesh et al. (2003). This model is used to fully explore the criteria of user acceptance and assess the degree to which a specific type of technology was accepted by the user. Venkatesh et al. (2003) explored eight independent models on technology and user acceptance and found that these did not sufficiently demonstrate congruence among theories or in treatment of data. However, the UTAUT did demonstrate congruence and maintained validity when

tested against existing data sources, although there were some questions raised towards limitations on UTAUT and its implications for ongoing research. Anderson and Schwager (2004) affirmed that the UTAUT was an effective means of assessing and presenting data on user acceptance, especially when user demographic information is taken into account.

Empirical Literature

Summary of Factors Affecting Wireless Data Technology Acceptance

A review of the literature identified several factors that may be associated with acceptance of wireless data technology. The majority of work surrounding this area of study is either empirical (based on self-report through survey) or theoretical.

Eight factors affecting wireless data technology acceptance have been empirically studied: coverage, network stability, environment, market, value, perceived usefulness, perceived ease of use, and facilitating conditions.

Coverage and stability of the wireless data networks are major parts in the decision making to use wireless technology. An unstable and/or faulty network makes it difficult for a potential client to choose to invest significant dollars in sophisticated technology.

Within business organizations, business acumen, vision and environment are also factors that may affect wireless data technology acceptance. Organizations' leaders with visions of long term benefits of investment in technology generate stronger acceptance to new technologies.

From an individual standpoint, the perceived value of technology also contributes to engagement, adoption and acceptance of wireless technology. Perceived value from wireless technology drives an individual to want to adopt technology. Value is defined both in terms of long-term vision and short-term incentives. Other individual variables include attitude, age, gender and profession.

Perceived usefulness and perceived ease of use are also very important factors. Users will always evaluate new technologies based on the benefit, and improvement that the new technology will add to existing job tasks, as well as the amount of time and energy they need to spend in order to learn and adopt the new technology.

Another important factor that has been shown to be related to acceptance of wireless data technology includes facilitating conditions and intention to adopt. That is the level of support and training given to individuals, to influence their perception and use of technology before they are introduced to the technology

Market factors may also drive wireless technology. Understanding market conditions and market needs and directing a marketing strategy which targets and responds to local needs and conditions may be an important factor in acceptance of wireless data technology. One important example that was explored in the literature review is how wireless data technology can support social networking. These social implications are channeled into marketing strategies that capture markets and result in greater acceptance of wireless data technology.

Finally, willingness to accept is facilitated by market conditions such as density in a given area, limits placed on technology, access, utility of the technology, social controls and networking within the group.

Conclusions

In the study of user adoption and acceptance of technology, it is clear that there were similarities within the models used to study user behaviors and the actual outcome of user behaviors. These patterns reflected a clear link between the motivation to use technology within the environment, the traits associated with that type of technology, and the users' perceptions associated with that specific form of technology. It is now possible to examine the following points:

1. *As technology evolved over time, it became harder to cross reference to older models of technology acceptance.*

   The technology studied in many of the models was relatively simple, mainly because at the time in which the model was developed. They were individually-oriented technologies as opposed to more complex and sophisticated technologies that were the focus of managerial concern in today's world (Venkatesh et al., 2003). This reflected the nature of the era in which these were created. Davis (1993), for example, was working with rudimentary computer systems at the time he first proposed TAM.

   It could be concluded that technology acceptance models in the 21st century needed to be refined to reflect the Internet era, but this was an overly simplistic summarization. The average consumer is more likely to have a greater acceptance of the presence of technology today than twenty years ago, suggesting that familiarization with technology may be easier today in comparison to the past. Older technology acceptance models did not take that fact into consideration, thus, the results of the studies may be inaccurate.

However, even with this limitation noted as a having a likely influence on the adoption of technology, the same patterns of behavior that influenced the initial construction of these models still exist and persist. A unifying constant of the models was that the link between human beings and technology needed to be taken into account. This typically had to be framed in respect to how the technology could benefit the user.

Coercive or forced assimilation of technology into a given population did not easily achieve diffusion. Most certainly, it did not achieve infusion of technology within a specific member of the population. Rather, it was evident that the models studied in this paper emphasized a need to encourage users to learn new technologies, to accept new technologies, and to use this basis of knowledge to prepare for encountering more sophisticated technologies in the future.

These appeared to be constants regardless of the complexity of the technology involved. Therefore, while it must be concluded that the models needed to take the degree of exposure to technology into account, the models themselves were still effective as the majority of these could be adapted to compensate for favorable attitudes towards technology.

2. *The participants' age range and lack of geographical spread were areas of concern in this literature review.*

The studies conducted to explore modeling and the impact of technology on user populations tended to be geographically limited in nature. While there had been several studies of each model in organizational setting, they were concentrated on students or on business persons active within a specific company. Diversity of

sampling, therefore, might be a serious limitation within these studies. This suggested that the data might reflect the norms associated with a limited population instead of those associated with a broader, more diversified population.

For example, Kappelman (1995) stressed that the empirical literature on measuring user involvement was difficult to identify in context, where studies tended to group the users according to past experience with a specific type of technology. This in turn indicated that these persons were able to access the technology in a context feasible for the researcher's access, and by extension, indicated that the majority of persons within the specific population pool came from similar backgrounds. To clarify, a study in which an organization was researched would have a population of employees who had skills and attributes that were valuable to that organization, which in turn indicated that the organization hired employees who had shared backgrounds (e.g., all persons had attained a specific level of education, etc.). This indicated that the user populations reviewed in studies did not represent widely diverse populations.

Similarly, Lu, Yu, and Liu (2003) approached the study of wireless internet in schools and found that many of the persons in the sample population shared core commonalities, which in turn, indicated close approximation of users with similar experiences. It was not known whether this was a limitation or an asset in the study of technology acceptance, as it was necessary to enter into the study of these processes from the perspective that not all persons would use a given form of technology unless that technology was exceptional (e.g., television, refrigerators, etc.). Further, shared backgrounds among those populations who were studied might

potentially contribute to the understanding of why certain technologies were better received than others. Again, this was not known, nor was it fully understood, it seems to be a valuable area for theoretical exploration concerning the validity of these studies and the significance of outcome.

3. *The participants' pre-existing experience and knowledge of the technology might affect the end results of the surveys conducted.*

Another limitation of the modeling strategies studied in this paper was that these models tended to be applied in a retrospective mode. According to Venkatesh et al. (2003), most of the studies were done with participants who were somewhat familiar with the technology in question rather then during the technology adoption process. This indicated that the data collected and transformed into modeling strategies was done after the fact, wherein the participants in the studies might have transformed or recreated their experience with the data.

Furthermore, the data collected in these studies indicated that the sample population tended to be seen as a collective. There was very little distinguishing information used to classify the degree of familiarity that the population had regarding technology in general or the type of technology under scrutiny. This indicated that the diffusion process was considered a core aspect of interest in these studies but that the infusion process was rarely studied in detail. This had the potential to significantly skew results.

As stated in this research paper, a computer savvy person would have a higher acceptance rate for new technology than an individual who was not familiar with the use of computers. The degree of previous experience with technology needed to be

taken into account in conducting the studies, and perhaps needed to be integrated into the data tested during the modeling processes.

4. *The participants for the surveys in most cases were volunteers who elected to answer the questionnaires.*

The models that used survey-based sampling techniques did so through compiling data sets that were representative of persons who elected to take the surveys. This suggests that self-sampling was involved, where willingness to participate in the survey process was likely to serve as a representative sample of a population that did not reflect persons who abstained from technology. The model did not take into consideration the cases in which a new technology was forced to the employees on an organizational level. Innovative companies in the 21st century tend to require their employees to use rather than giving them the choice of use. Therefore, the results of these self-sampling data sets may not reflect the real life experience of the population as a whole, particularly in terms of willingness to use a product (Venkatesh et al., 2003).

Recommendations

The literature collected and presented in this paper strongly suggests that modeling strategies used to facilitate adoption of technology present a generally accurate synopsis of the population handling technology, but ultimately do not reflect the specifics of the environment or the user population. Limitations or failures of the models are more evident within the study of the sampling procedures. It seems foolhardy to use the rationale of the study as one in which different attitudes and behaviors reflect outcome,

because these attitudes and behaviors are not fully cultivated within the study process. As a result, a series of recommendations can be made for those seeking to conduct research using the modeling strategies discussed in this paper, or as suggestions for persons seeking to develop new analytical models that can be used to test the acceptance, adoption, diffusion, and infusion of technology.

The instruments that are recommended for the study are assessment strategies using TAM and UTAUT, as well as WIMT and outcomes evaluated according to the DOI. These modeling tools have proven effective in past research studies and would help in acquiring and addressing the content of empirical data collected for the research phase.

Proposed Theme of the Research

It is recommended that wireless technologies and the adoption of same comprise the core of the research process. These technologies have already been adopted by multiple users and organizations, but there appears to be a gap between the existing use of the technology and the perceived usefulness of the technology in diverse settings. To clarify, wireless technology is used in recreational or non-private matters to a great extent, but there is resistance to use wireless technologies when moving data that needs to remain secure or uncorrupted. This aversion to wireless technologies appears to remain constant despite the fact that wireless technologies are increasingly secure and have a low failure rate for corruption.

Wireless technologies have a high potential for use, as these devices reduce the overall limitations that have in the past hampered communication and data transmission (e.g., connectivity to a landline, etc.). Yet resistance to their use indicates certain

problems with complete adoption among potential, or even current, users. The proposed study addressed these issues in terms of the preferences and attitudes of users of wireless technologies, preferences and attitudes of non-users of wireless technologies, and the rate of diffusion of innovation of wireless technology use.

Theoretical Framework

Two critical reformations are needed to the theoretical research process. The first is to recognize that there is a need to unify the theoretical formulations proposed by Venkatesh et al. (2003) into a theoretical model that captures the essential elements of previously established models. These researchers have already explored many of the themes present in this paper and have made recommendations based upon what they perceive to be gaps between the purpose of the literature and modeling systems that are broadly used to test and retest the habits and perceptions of the population in respect to technology.

The second critical reformation is that technology acceptance studies need to be expanded geographically, across a larger age spread, and among different industries and organizations. Most of the studies that were done are concentrated in schools in a very limited model, or within organizations that were concentrated in a single geographic region. This suggests that there is a detailed, in-depth understanding of persons within these sectors who volunteered to participate in the survey process. This is, however, not a broad sampling of the population.

Critical or Analytic Reviews

Future areas of scholarly inquiry using critical analyses of the theoretical and empirical literature are needed in the areas of technology acceptance and diffusion of innovation. Analytical reviews of theories and studies examine the impact of diffusion of innovation on technology adoption in any industry. The review should contain recent studies (after 1995), and should be based on similar theories and measurement tools.

Empirical Studies

Empirical studies are needed in studying technology acceptance of wireless data technology. There are few empirical studies regarding wireless data acceptance. Future studies should provide detailed informational about research questions, hypotheses, data collection procedures and instrument validity. Research also needs to show adequately sized samples, representative sample studies, broad target population, and should focus on different types of organizations.

Methodological Studies

The methodologies of the studies have already been addressed concerning the limitations of the selected sample and the geographic area of the sample. Yet methodological study is another area of future scholarly inquiry where design, sample size, populations studied, and measurement of variables, such as competitive advantage and diffusion of innovation, are needed. Recommendations include broadening the size, location, and focus of the sample. Further, diversity in comparison among population samples would be helpful.

Most importantly, there is a need to assess the perceptions, attitudes, and beliefs associated with persons who have had past experience with technology. The context in which the modeling process was developed is different in the current technologically-dependent era. The modern generation of workers and consumers is more likely to have familiarity with technology based upon the environmental setting. As familiarity increases among the population, this in turn requires increased focus on how familiarity may have shifted attitudes among users. New modeling strategies have to take into account these factors, as well as investigate how, why, and to what extent the perception of a single piece of new technology might be affected by previous experience with technology in general. This is distinctive from the process of finding out how and why familiarity with first-generation technologies affects diffusion and inclusion of next-generation technologies.

Research Questions

Research Question 1: What are the rates of wireless trust, technology acceptance (perceived usefulness and perceived ease of use), and diffusion of innovation (relative advantages, compatibility, trialability, observability, and complexity), for enterprises, public sector organizations and individual wireless users?

Research Question 2: How do factors such as technology acceptance, adoption, and organizational diffusion of innovation, affect acceptance of wireless data technology?

Research Hypotheses

H1. Wireless trust (familiarity, user activities, user involvement, task-related behavior, task involvement, IS-related behavior, and product involvement) and technology acceptance (perceived usefulness and perceived ease of use) are significant explanatory variables of the rate of diffusion of innovation (influencing relative advantages, compatibility, trialability, observability, complexity) for enterprises, public sector organizations and individual wireless users.

H2. Social Psychology Setting (attitudes, subjective norms, behavioral intention) and technology acceptance (perceived usefulness and perceived ease of use) are significant explanatory variables of the rate of diffusion of innovation (influencing relative advantages, compatibility, trialability, observability, complexity) for enterprises, public sector organizations and individual wireless users.

Based on TAM, DOI and UTAUT, a hypothesized model was developed to identify the impact of Wireless Trust and Social Psychology Setting on Diffusion of Innovation. Through surveying the perception of IT managers and day to day users of wireless data technology on perceived usefulness and perceived ease of use RQ1 were answered.

RQ2 was answered by adopting the UTAUT instrument to identify the perception of the participants in five different parts which include attitude towards using technology, social influence, facilitating conditions, self efficacy and anxiety.

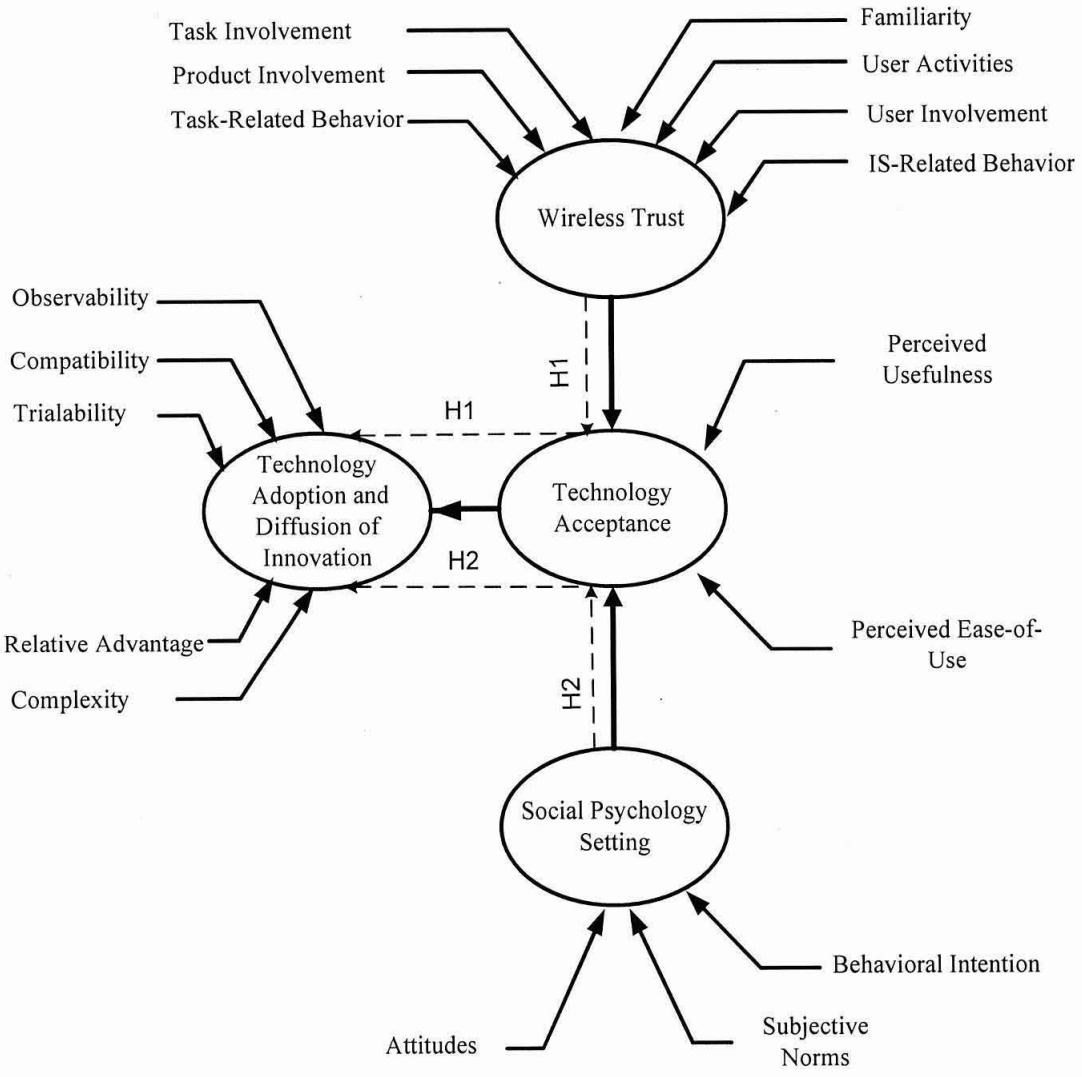


Figure 2-1. Hypothesized model about the impact of Wireless Trust and Social Psychology Setting on Diffusion of Innovation

Chapter II provided the review of the literature and the theoretical framework of the relationships between Wireless Trust, Social Psychology Setting and Diffusion of Innovation was reviewed. Critical analyses of theoretical and empirical literature revealed a literature gap. In addition the literature provided a direction to build a theoretical framework to guide this study. The theoretical framework was organized around Davis (1989) and

Venkatesh et al. (2003). In order to examine specific propositions, the hypotheses were developed. Based on the theoretical framework and research hypotheses, a hypothesized model was generated for this non-experimental quantitative research design.

Chapter III presents the methodology employed in answering the research questions and testing the hypotheses for this study about the impact of Wireless Trust and Social Psychology Setting on Diffusion of Innovation.

CHAPTER III - RESEARCH METHODOLOGY

The purpose of the current study is to examine the technology acceptance factors affecting adoption of wireless data technology. This is accomplished by using a non-experimental quantitative research design that collects information from a number of businesses or other types of organizations. The main source for the types of organizations used in the study includes schools, large corporations and small scale businesses. The use of the different types of organizations allows for a diverse representation of the different perspectives and acceptance factors that affect the adoption of wireless data technology. The remaining layout of this chapter is as follows; first there is a discussion of the research design that is used in the study, next there is a description of the instruments that are used to collect the data and then finally there is a discussion about the methods used in the data analysis of the current study.

Research Design

The research design for the current study is that of a non-experimental quantitative research design. The research design for the current study is non-experimental since the data is collected using questionnaires. This does not allow the researcher to go out and manipulate different settings of the study which would allow for a comparison between the levels of the settings. Rather the researcher is only able to administer the questionnaires to the participants in hopes of receiving information that is pertinent to the objectives of the study.

What makes the research design for the current study a quantitative design is that the data collected from the instruments is then put together to give an overall

measurement of the construct one was trying to examine. In this regard the quantitative design is able to directly gather information with respect to the objective of the study by using individual items on the questionnaire or a combination of items to give a latent variable or construct. The quantitative analyses that were conducted for the current study included descriptive statistics and multiple regression analysis.

Descriptive statistics are appropriate for the current study since they allow one to see the distribution of the variables in the model, as well as to illustrate the frequency in which a participant selects a certain item. As for multiple regression, this is appropriate since the objective of the study is to see what factors affect the adoption of wireless data technology in a number of different organizations including schools, large corporations and small scale businesses. By using multiple regression analysis, one is able to compare a number of different independent variables to a dependent variable at the same time. This means that one is able to see the effect each one of the independent variables have on the dependent variable while accounting for the other variables in the model.

The questionnaire used to gather this information is one that has been slightly adapted from Venkatesh (2003) and Davis (1989). There are four parts to the questionnaire which consist of *demographic* information, *technology acceptance, social psychology,* and user's *wireless trust*. In the *demographic* portion of the survey data is collected on the participants' background information. The *technology acceptance scores* (used to evaluate H1 and H2) was assessed by using a questionnaire designed after Venkatesh's (2003) *user acceptance of information technology* scale. *Social psychology* (used to evaluate H2) was assessed by using information gathered from the same *user acceptance of information technology* scale by Venkatesh (2003). *Wireless trust* (used to

evaluate H1) was obtained from a questionnaire designed by Davis (1989) which consisted of two portions: *perceived usefulness* scale and *perceived ease of use* scale.

Population and Sampling Plan

Target Population

The population for the study included organizations that use wireless data technology in their everyday business. The types of organizations used in the study include schools, large corporations and small scale businesses. The types of wireless communication they use may be provided by any of the large scale telecommunication corporations, such as AT&T, Sprint or Verizon. It does not matter which carrier is used as long as the organization uses wireless data technology. The organizations selected for the study are located overseas as well as throughout the United States, and the overall target population consists of schools, large corporations and small scale businesses that have access to wireless data technology.

Accessible Population

The accessible population will consist of all schools, large corporations and small businesses that have access to wireless data technology.

Sampling Plan

The schools, large corporations and small scale businesses were selected based on a list of IT professionals, managers, and organizations provided by a panel survey aggregator. A randomly selected group of individuals then was selected from the list to

participate in the study and received questionnaires. Questionnaires were created and sent to all the individuals through an online tool. In total it was expected that the response rate to the questionnaire would be approximately 2 to 5% of the questionnaires that are distributed. This means that thousands of questionnaires were distributed to the potential participants in the study in order to obtain the minimum number of participants required to make appropriate conclusions. There is a brief description of the study included in the online survey so that the potential participants know how the information was used. There is also an online consent form that was used so that the potential participant can continue on with the questionnaire or quit if he/she wanted to end their participation. By agreeing to participate in the study the participant was taken to the survey where they were able to start filling it out. Once the participant finished filling out the survey the results were sent back to the researcher where they were recorded and placed in an electronic spreadsheet for future analyses.

Sample Size

Based on the means of statistical analysis being conducted a sample size for the current study was devised. In multiple regression analysis the sample size depends on three items: the desired power for the study, the number of independent variables used in the model and the effect size. For a given study, the effect size is the strength of the relationship between the independent and dependent variables. The size of the effect between the independent and dependent variables can be expressed as being small (f^2 = 0.02), medium (f^2 = 0.15) or large (f^2 = 0.35). The power of a study on the other hand is the probability of not making a type II error. As a guideline, the statistical power of the

study is set equal to 0.80. The last factor that is involved in the calculation of the sample size is the number of independent variables in the model. For this reason, in the current study the largest number of independent variables included in the model at any time is nine. These nine variables are related to wireless trust (familiarity, user activities, user involvement, task-related behavior, task involvement, IS-related behavior, and product involvement) and technology acceptance (perceived usefulness and perceived ease of use). Since there are at most nine independent variables in the model and assuming that a medium effect is going to be detected as well as a power of 0.80, the minimum sample size required would be approximately 113. Since it was expected that only 2 to 5% of the questionnaires would be completed, in order to obtain the minimum sample size required for the study, a total of 15,000 questionnaires were distributed to the individuals selected for this study.

Eligibility Criteria

Due to the nature of the study the eligible participants were:

- IT professionals, managers, and organizers within schools, large corporations, public sector organizations and small scale businesses.
- There was no limitation on the gender or ethnicity of the individual.
- Participants must be 18 years of age or older.

Exclusion Criteria

- Individuals that are not IT professionals, managers, and organizers within schools, large corporations, public sector organizations and small scale businesses.
- If the individual is less than 18 years of age.

Study Instrumentation

Questionnaires were developed using items from the UTAUT put forth by Venkatesh (2003) and the TAM model put forth by Davis (1989), which focus on wireless technologies and the perceived outcomes associated with the use of the technology. There are two different components to the TAM model and they consist of the following: *Perceived Usefulness* and *Perceived Ease of Use* (presented in Appendix I). The UTAUT questionnaire was used to obtain information on the user's acceptance towards information technology (presented in Appendix I).

TAM Scale

Perceived Usefulness

Description: The perceived usefulness scale from the study of Davis (1989) consists of six questions that were adapted to fit accordingly to the current study. The six questions that are on the current version of the survey tool focus on the use of the wireless technology. These questions include information regarding whether the use of the device would allow one "to accomplish tasks more quickly", "increase productivity", "enhance effectiveness on the job", "would make it easier to do the job", and "would find it useful at the job". These questions were slightly changed in order to incorporate the inclusion of wireless technology on the job.

The six questions that make up the perceived usefulness construct have a Likert type scale that has seven different options. The options range from likely to unlikely which are then broken into seven different categories of extremely, quite, slightly,

neither, slightly, quite and extremely with the lowest being extremely unlikely and the highest being extremely likely.

Perceived Ease of Use

Description: The perceived ease of use scale from the study of Davis (1989) consists of six questions that were adapted to fit the current study. The six questions on the current version of the survey tool include questions on the use of the wireless technology. These questions included information regarding whether the device would be easy for the person to learn, whether they found it was easy to make it do what they wanted it to do, whether their interaction with the device would be clear and understandable, whether it would be flexible to work with, whether it would be easy for them to become skillful at using the device, and whether they would find it easy to use. These questions were then modified in order to incorporate the inclusion of wireless technology on the job.

The six questions that make up the perceived usefulness construct have a Likert type scale that has seven different options. The options range from likely to unlikely which are then broken into seven different categories of extremely, quite, slightly, neither, slightly, quite and extremely with the lowest being extremely unlikely and the highest being extremely likely.

Validity

The validity of the instrument was proven by using discriminant and convergent validity. These were tested by using multitrait-multimethod (MTMT) analysis (Campbell and Fisk, 1959 as referenced by Davis, 1989). The MTMT calculates the correlations

between each one of the traits that comprise the different constructs of interest. For the perceived usefulness and perceived ease of use scales there was a total of 90 traits for each of the constructs, which means that the MTMT would calculate 90 correlations for each of the different constructs. The idea behind the matrix is that the intercorrelations between each item on the survey are presented in matrix notation, where the diagonal element of the matrix represents the intercorrelations between the traits that comprise the perceived usefulness and perceived ease of use scales. For there to be convergent validity between the items it would be assumed that the correlation between each item would be quite high. Therefore each one of the traits that make up the different constructs on the survey should rate highly with one another. For the perceived usefulness scale, all 90 of the monotrait-heteromethod correlations were highly significant ($p < 0.05$) (Davis, 1989). This means that the 90 traits that the perceived usefulness scale was comprised of were highly correlated with one another based on the monotrait-heteromethod correlation. As for the perceived ease of use, 86 of the 90 monotrait-heteromethod correlations were highly significant ($p < 0.05$) (Davis, 1989).

The discriminant validity of the instrument is used to show that the ability of the measurement item to distinguish between the different objects that are being measured (Davis, 1989). In Davis (1989) the discriminant validity was shown using two different methods, one was an electronic mail device and the other was XEDIT which is another type of mailing device. In order to show discriminant validity on the constructs the correlation between each one of the before mentioned devices should not be highly correlated with one another (Davis, 1989). The idea behind this is that an item for one of the devices should be more highly correlated with another item for the same device than

with an item used on another device. For the perceived usefulness scale there were 1800 different comparisons that were made, with respect to the correlation between items, and of the 1800 different comparisons all 1800 were found to follow the above criteria. As for the perceived ease of use, there were also 1800 different comparisons made with only 58 comparisons being an exception to the above mentioned correlations (Davis, 1989). Therefore, this provides strong evidence that the two constructs are in fact considered to be a valid source to make inferences on the perceived usefulness and the perceived ease of use.

Reliability

The reliability of each one of the constructs used in the study is presented in Davis (1989). It was found that for the perceived usefulness and the perceived ease of use were both reliable measures. This was determined by using Cronbach's alpha for reliability. For the perceived usefulness it was found that a reliability measure of 0.97 was obtained for both the electronic mail and XEDIT devices. As for the perceived ease of use it was found that a reliability score of 0.86 was observed for electronic mail while a reliability score of 0.93 was observed for the XEDIT device. In all cases, the reliability score was greater than 0.70 which indicates that these constructs provide a great amount of reliability. Furthermore, when the data was combined for the electronic mail and the XEDIT device it was found that the perceived usefulness had a reliability score of 0.97 while the perceived ease of use had a reliability score of 0.91 (Davis, 1989).

UTAUT Scale

Description: The UTAUT questionnaire consists of five different parts which include attitude towards using technology, social influence, facilitating conditions, self

efficacy and anxiety. The attitude towards technology scale is made up of four questions that rank on a Likert type scale from 1 to 7, with 1 being extremely unlikely to 7 being extremely likely. The social influence scale is made up of four questions that rank on a Likert type scale from 1 to 7, with 1 being extremely unlikely to 7 being extremely likely. The facilitating conditions scale is made up of four questions that rank on a Likert type scale from 1 to 7, with 1 being extremely unlikely to 7 being extremely likely. The self efficacy scale is made up of four questions that rank on a Likert type scale from 1 to 7, with 1 being extremely unlikely to 7 being extremely likely. The anxiety scale is made up of four questions that rank on a Likert type scale from 1 to 7, with 1 being extremely unlikely to 7 being extremely likely.

Validity

The validity of the UTAUT was shown using 48 separate validity tests (two studies, eight models, three time periods each) (Venkatesh, Morris,G.B. Davis, and F.D. Davis, 2003). These tests were run to examine the convergent and discriminant validity of the given survey. In the discriminant analysis portion of the validity, it was found that the loading patterns were acceptable with the majority of the loadings being .70 or higher (Venkatesh, Morris,G.B. Davis, and F.D. Davis, 2003).

Reliability

The reliability measures for the constructed questionnaire were measured by internal consistency alpha scores. After the reliability scores were run for each one of the constructs it was found that every one of the internal consistency reliabilities were greater than 0.70 (Venkatesh, Morris,G.B. Davis, and F.D. Davis, 2003).

Since several questionnaires are being used in this study, the validation and reliability of the instruments were examined in order to make sure that each instrument that was combined is still valid and reliable. Therefore, in order to determine whether the combined instruments are still valid tools there was an exploratory factor analysis conducted in order to determine whether the items on the instruments measure the same constructs. Similarly, to explore the reliability of the instruments internal consistency/reliability measures were implemented. This was accomplished by calculating Cronbach's alpha coefficients for internal consistency.

Procedures: Ethical Considerations and Data Collection

In order to meet IRB approval the following procedures were conducted so that the ethical considerations of the participants were taken into consideration:

1. Permission from each one of the authors of the survey instruments was obtained via e-mail messages.
2. An application was submitted to the IRB of Lynn University in order to gain permission to conduct the study.

Methods of Data Analysis

In a spreadsheet, each one of the rows corresponds to individual participants' responses. The data for each one of the responses on the survey were recorded and placed as the column headings in the spreadsheet. In order to maintain confidentiality of the participants, any personal information that would allow one to determine the identity

of the individual was removed. Therefore, in order to maintain the confidentiality of the participants, they were recorded with identification numbers.

Descriptive statistics was used on all the independent and dependent variables included in this study. This allowed, among other things, examination of the distribution of the continuous variables including the perceived usefulness scores and the perceived ease of use scores. This was accomplished by calculating the mean, median, minimum, maximum and standard deviation for each of the items in the questionnaire using SPSS. By presenting the mean median, minimum, maximum and standard deviation for each of the items on the questionnaire this would allow one to be able to describe the distribution of each one of the variables in order to determine whether they are normally distributed. If they are normally distributed then one would be able to use normal statistical procedures in the analysis. Otherwise, if it is found that the distributions are not normally distributed then a transformation may be necessary.

For the remaining variables in the study, frequency tables were created to show summary statistics for each variable. Included in the frequency tables are the percentage of times each one of the variables were selected giving evidence of the distribution of each item. This indicated whether each one of the categories was evenly distributed and therefore had a representative sample.

Regression analysis was conducted for the independent and dependent variables in the model after the descriptive statistics were performed. This was done so that all the variables in the analysis examined simultaneously with the dependent variable. An advantage of the multiple regression model is that it can determine the individual effect each one of the independent variables have on the dependent variable while accounting

for the other variables in the model. In other words, multiple regression provided the ability to assess the contribution of each one of the independent variables on the overall model when it came to explaining the variation in the rate of diffusion.

The regression model is appropriate for this study, since the objectives are to see whether different independent variables have an effect on the different rates of diffusion. By using multiple regression analysis one is also able to better control for multicolinearity since one would be able to examine the relationships between multiple variables in order to see whether or not there is a significant relationship between the variables. If it is found that there is in fact a significant relationship between one or more of the independent variables then one would be able to adjust the model accordingly so that the multicolinearity is removed from the model.

Evaluation of Research Methods

In the case of the hypotheses where the five rates of diffusion (relative advantages, compatibility, trialability, observability, complexity) are assessed at the same time, the appropriate means of analysis is univariate analysis. The models that were used to assess the effects the independent variables have on each one of the dependent variables for H1 are:

$$\text{Relative Advantages} = a + b_i * x_i$$

a = intercept

b_i = coefficient for each independent variable

x_1 = familiarity

x_2 = user activities

x_3 = user involvement

x_4 = task-related behavior

x_5 = task involvement

x_6 = IS-related behavior

x_7 = and product involvement

x_8 = perceived usefulness

x_9 = perceived ease of use

This model allows one to see if the Wireless Trust variables or the Social Psychology variables have an effect on the Relative Advantages. The coefficients bi and bj represent the effect each variable has on the dependent variable, where i is the number of variables that make up the Wireless Trust variable and j is the number of variables that make up the Social Psychology variable.

The next regression model that was used is for the compatibility construct. This model is presented as:

$$\text{Compatibility} = a + b_i * x_i$$

a = intercept

b_i = coefficient for each independent variable

x_1 = familiarity

x_2 = user activities

x_3 = user involvement

x_4 = task-related behavior

x_5 = task involvement

x_6 = IS-related behavior

x_7 = and product involvement

x_8 = perceived usefulness

x_9 = perceived ease of use

This model allows one to see if the Wireless Trust variables or the Social Psychology variables have an effect on the Compatibility Advantages. The coefficients bi and bj represent the effect each variable has on the dependent variable, where i is the number of variables that make up the Wireless Trust variable and j is the number of variables that make up the Social Psychology variable.

The next regression model that was used is for the triability construct. This model is presented as:

$$\text{Trialability} = a + b_i * x_i$$

a = intercept

b_i = coefficient for each independent variable

x_1 = familiarity

x_2 = user activities

x_3 = user involvement

x_4 = task-related behavior

x_5 = task involvement

x_6 = IS-related behavior

x_7 = and product involvement

x_8 = perceived usefulness

x_9 = perceived ease of use

This model allows one to see if the Wireless Trust variables or the Social Psychology variables have an effect on the Trialability Advantages. The coefficients bi and bj represent the effect each variable has on the dependent variable, where i is the number of variables that make up the Wireless Trust variable and j is the number of variables that make up the Social Psychology variable.

The next regression model that was used is for the obsevability construct. This model is presented as:

$$\text{Observability} = a + b_i * x_i$$

a = intercept

b_i = coefficient for each independent variable

x_1 = familiarity

x_2 = user activities

x_3 = user involvement

x_4 = task-related behavior

x_5 = task involvement

x_6 = IS-related behavior

x_7 = and product involvement

x_8 = perceived usefulness

x_9 = perceived ease of use

This model allows one to see if the Wireless Trust variables or the Social Psychology variables have an effect on the Observability Advantages. The coefficients bi and bj represent the effect each variable has on the dependent variable, where i is the number of

variables that make up the Wireless Trust variable and j is the number of variables that make up the Social Psychology variable.

The next regression model was be used is for the complexity construct. This model is presented as:

$$\text{Complexity} = a + b_i * x_i$$

a = intercept

b_i = coefficient for each independent variable

x_1 = familiarity

x_2 = user activities

x_3 = user involvement

x_4 = task-related behavior

x_5 = task involvement

x_6 = IS-related behavior

x_7 = and product involvement

x_8 = perceived usefulness

x_9 = perceived ease of use

This model allows one to see if the Wireless Trust variables or the Social Psychology variables have an effect on the Complexity Advantages. The coefficients bi and bj represent the effect each variable has on the dependent variable, where i is the number of variables that make up the Wireless Trust variable and j is the number of variables that make up the Social Psychology variable.

The models that were used to assess the effects the independent variables have on each one of the dependent variables for H2 are:

$$\text{Relative Advantages} = a + b_i * x_i$$

a = intercept

b_i = coefficient for each independent variable

x_1 = attitude

x_2 = subjective norms

x_3 = behavioral intention

x_4 = perceived usefulness

x_5 = perceived ease of use

This model allows one to see if the Wireless Trust variables or the Social Psychology variables have an effect on the Relative Advantages. The coefficients bi and bj represent the effect each variable has on the dependent variable, where i is the number of variables that make up the Wireless Trust variable and j is the number of variables that make up the Social Psychology variable.

The next regression model that was used is for the compatibility construct. This model is presented as:

$$\text{Compatibility} = a + b_i * x_i$$

a = intercept

b_i = coefficient for each independent variable

x_1 = attitude

x_2 = subjective norms

x_3 = behavioral intention

x_4 = perceived usefulness

x_5 = perceived ease of use

This model allows one to see if the Wireless Trust variables or the Social Psychology variables have an effect on the Compatibiltiy Advantages. The coefficients bi and bj represent the effect each variable has on the dependent variable, where i is the number of variables that make up the Wireless Trust variable and j is the number of variables that make up the Social Psychology variable.

The next regression model that was used is for the triability construct. This model is presented as:

$$\text{Trialability} = a + b_i * x_i$$

a = intercept

b_i = coefficient for each independent variable

x_1 = attitude

x_2 = subjective norms

x_3 = behavioral intention

x_4 = perceived usefulness

x_5 = perceived ease of use

This model allows one to see if the Wireless Trust variables or the Social Psychology variables have an effect on the Trialability Advantages. The coefficients bi and bj represent the effect each variable has on the dependent variable, where i is the number of variables that make up the Wireless Trust variable and j is the number of variables that make up the Social Psychology variable.

The next regression model that was used is for the obsevability construct. This model is presented as:

$$\text{Observability} = a + b_i * x_i$$

a = intercept

b_i = coefficient for each independent variable

x_1 = attitude

x_2 = subjective norms

x_3 = behavioral intention

x_4 = perceived usefulness

x_5 = perceived ease of use

This model allows one to see if the Wireless Trust variables or the Social Psychology variables have an effect on the Observability Advantages. The coefficients bi and bj represent the effect each variable has on the dependent variable, where i is the number of variables that make up the Wireless Trust variable and j is the number of variables that make up the Social Psychology variable.

The next regression model that was used is for the complexity construct. This model is presented as:

$$\text{Complexity} = a + b_i * x_i$$

a = intercept

b_i = coefficient for each independent variable

x_1 = attitude

x_2 = subjective norms

x_3 = behavioral intention

x_4 = perceived usefulness

x_5 = perceived ease of use

This model allows one to see if the Wireless Trust variables or the Social Psychology variables have an effect on the Complexity Advantages. The coefficients bi and bj

represent the effect each variable has on the dependent variable, where i is the number of variables that make up the Wireless Trust variable and j is the number of variables that make up the Social Psychology variable. In each one of the before specified models, demographic characteristics may be considered in the models if it is found that based on the summary statistics there are representative samples for each category. This would include controlling for the age and gender of the participant, for the purpose that there may be a significant relationship between these variables and the dependent variables.

Internal Validity Strengths

1. For non-experimental studies a quantitative explanatory analysis is better at explaining certain results than a descriptive study.
2. A quantitative study obtains better validity and reliability scores than does a qualitative study.
3. The internal validity was increased by using instruments that have been proven to be valid and reliable in the past.

Internal Validity Weakness

1. The study adopted a non-experimental design so that the validity of the design was not controlled by the researcher.

External Validity Strengths

1. Due to the size of the sample obtained for the study, generalizations towards the target population can be made more readily.

2. Since the sample is coming from industries possibly located throughout the world, even more generalization could be made towards the target population.

3. The questionnaires sent to participants were sent via e-mail so that they would feel more comfortable to fill out the surveys at time convenient to them.

External Validity Weaknesses

1. The sampling method that was employed in the study may not be able to gather information from a number of different corporations limiting the chances of obtaining a random sample of the entire population.

2. Since the sample is coming from managers and IT professionals a generalization to the other people in the organization may not be made.

Conclusions

Chapter III depicted the research methodology examining research questions and hypotheses associated with the assessment of technology acceptance factors affecting adoption of wireless data technology. This included trust (familiarity, user activities, user involvement, task-related behavior, task involvement, IS-related behavior, and product involvement), social psychology setting (attitudes, subjective norms, behavioral intention) and technology acceptance (perceived usefulness and perceived ease of use). Chapter IV will present the findings of this study.

CHAPTER IV - DISCUSSION

This chapter analyzes and presents the results on whether technology acceptance factors (perceived usefulness and perceived ease of use), have an effect on the adoption of wireless data technology (as measured by the UTAUT). The data were analyzed statistically by the SPSS 16.0® program, which included frequency distributions, means, standard deviations, analysis of variance (ANOVA) and multiple regression analyses, to answer the research questions and to test the hypotheses. This chapter is divided into two sections. The first section provides the descriptive statistics for the subjects in the study, while the second section presents the results and findings for the relationships between the technology acceptance factors and the adoption of wireless data technology.

Descriptive Statistics

In this section descriptive statistics for the participants are presented. This included the gender, age, education level, ethnicity, years at current position, job title and organization to which the participants belonged. To examine these variables frequency distributions for the demographic variables are presented in Table 4-1.

Table 4-1

Frequency Distribution of Demographic Characteristics

Variable	Frequency (N = 394)	Percent
Gender		
Female	117	29.7
Male	277	70.3

Variable	Frequency (N = 394)	Percent
Age		
18 – 25	14	3.6
26 – 35	56	14.2
36 – 45	179	45.4
46 – 55	107	27.2
56 – 65	32	8.1
66 and older	6	1.5
Education		
Associate's Degree	47	11.9
Bachelor's Degree	170	43.1
Doctoral Degree	16	4.1
High School Diploma	47	11.9
Master's Degree	97	24.6
Other	17	4.4
Ethnicity		
Asian	21	5.3
Black	14	3.6
Caucasian	303	76.9
Hispanic	42	10.7
Other	14	3.5

Both male (70.3%) and female (29.7%) respondents were adequately represented in this study. The largest age group of respondents was 36 to 45 years of age (45.4%),

which was followed by 46 to 55 years of age (27.2%). As for the education of the participants, the most frequent response was that the participant had received a Bachelor's Degree (43.1%). The majority of the participants were Caucasian (76.9%). The descriptive statistics for the participants work related demographic characteristics is presented in Table 4-2.

Table 4-2

Frequency Distribution of Work Related Demographic Characteristics

Variable	Frequency (N = 394)	Percent
Job Title		
Computer Specialist	8	2.0
IT Professional	80	20.3
Manager	170	43.1
Other (please specify)	136	34.6
Years at Current Position		
0 – 2 years	103	26.1
3 – 5 years	94	23.9
6 – 10 years	88	22.3
11 – 15 years	56	14.2
16 – 20 years	25	6.3
21 years or greater	28	7.2
Organization Type		
Corporation	255	64.7
Government Agency	24	6.1

Variable	Frequency (N = 394)	Percent
Other	33	8.4
School	21	5.3
Small Business	61	15.5

The surveys were answered most frequently by participants who were considered as being managers (43.1%), which was followed by those who responded with an "Other" job title (34.5%). The majority of the participants in the sample had less than 10 years or less of experience at their current position (72.3%), while the majority of the participants were from corporations (64.7%), followed by small businesses (15.5%). For each of the variables there were no missing observations. The following results are the measures of central tendency, which include the mean, standard deviation, and minimum and maximum statistics for the wireless data technology experience variable (Table 4-3).

Table 4-3

Summary Statistics for Wireless Data technology Experience

	Min	Max	M	SD
Experience	1	7	4.79	1.92

From the results of Table 4-3, the mean amount of experience the participants had with wireless data technology was equal to 4.79 (*SD* = 1.92), which indicated that the sample of participants had a moderate amount of experience with wireless data technology.

Results and Findings

Prior to analyzing the research questions and hypotheses for this study, an exploratory factor analysis was conducted on the items of the TAM and UTAUT questionnaires used in this study. This was done in order to determine if there were any other underlying factors on the survey instrument, as well as to determine whether the items for each component were still found to comprise the desired outcome variables. This meant that, since there were several instruments used in the study the validation and reliability of the instruments would have to be examined in order to make sure that each instrument that is combined are still valid and reliable.

For the factor analysis, only factor loadings (correlations between the questions and the factors) that were observed to be greater or equal to .30 were retained in the analysis (Tabachnick & Fidell, 2001). Similarly, only those factors that were observed to have eigen values greater or equal to 1.00 were retained in the model.

To better illustrate each of the factors a varimax rotation was used on the variables which essentially maximizes the variation between the items and the factors (Tabachnick & Fidell). This meant that smaller factor loading became smaller and larger factor loadings were made larger for ease of interpretation. The results of the factor analysis for the entire sample are presented in Table 4-4.

Table 4-4

Factor Loadings for the Factor Analysis on the TAM and UTAUT Survey Instruments

	Factor					
	1	2	3	4	5	6
PUS4	.892					
PUS6	.888					
PUS3	.875					
PUS2	.870					
PUS5	.867					
PUS1	.857					
ATUT1	.639					
PEU4		.867				
PEU6		.855				
PEU2		.848				
PEU3		.847				
PEU5		.818				
PEU1		.799				
FC2		.614	.426			
SI4			.764			
SI3			.741			
FC1			.717			
FC4			.691			
FC3		.493	.573			
A3				-.890		
A2				-.866		
A4				-.857		
A1				-.735		
SE3					.882	
SE2					.870	
SE4					.842	
SE1		.488			.568	
ATUT3						.766
ATUT2	.464					.631
ATUT4						.620
SI2			.497			.590
SI1			.525			.559

Based on the results of the factor analysis there were a total of six different factors observed. These six factors were able to explain 82.4% of the variation between the questions included in the analysis. The first factor primarily consisted of the *perceived usefulness scores* which had factor loadings that ranged from .857 to .892. The second factor was then primarily comprised of the *perceived ease of use scores* which had factor loadings from .799 to .867. The third factor was then comprised of the facilitating conditions dimension as well as the social influence dimension from the UTAUT. As for the fourth factor, this was comprised of the anxiety dimension from the UTAUT, while the fifth factor represented the self-efficacy dimension of the UTAUT. Finally, the sixth factor represented the attitudes towards using technology dimension of the UTAUT. There was, however, overlap between some of the items on the survey instrument. In particular, certain items were found to have higher factor loadings on two factors. Even though this is the case, it was found that the questions on the survey instrument did measure the variables that they were intended to measure. For this reason, a reliability analysis for the *perceived usefulness scores, perceived ease of uses scores* and five UTAUT variables are presented in Table 4-5. To illustrate the reliability between the items on the survey instrument, Cronbach's alpha statistics were computed for each underlying variable.

Table 4-5

Reliability Analysis for TAM and UTAUT Variables

Variable	Alpha	Items
Perceived Usefulness	.984	6
Perceived Ease of Use	.974	6
Attitudes	.902	4
Social Influence	.911	4
Facilitating Conditions	.887	4
Self-Efficacy	.908	4
Anxiety	.907	4

For the purpose of this study, the reliability coefficients were computed using only the questions that were provided on the survey instrument for the perceived usefulness scores, perceived ease of use scores, attitudes towards using technology, social influence, facilitating conditions, self-efficacy and anxiety dimensions. Based on the internal consistency/reliability measurements using Cronbach's alpha statistics, it was observed that each of the seven underlying variables that were being measured by the survey instrument resulted in very reliable estimates. This is because the lowest coefficient was observed to be equal to .887 (for the facilitating conditions variable), while the highest coefficient was observed with an alpha coefficient of .984 (for the perceived usefulness score). This indicated that the questions used on the survey instrument did measure the desired constructs.

For this reason, the scores from each of the questions were averaged to give an overall score for each of the seven variables. For example, if a participant provided responses of 5, 6, 7, 6, 5 and 7 for the six questions for the perceived usefulness variable, then their overall score would be equal to 6. In the context of this study, a higher average value for any of the variables would indicate more acceptance of wireless technology. To examine the distributions of these newly constructed variables, summary statistics are presented in Table 4-6.

Table 4-6

Summary Statistics for Seven Constructed Variables from Survey Instrument

	Min	Max	M	SD
Perceived Usefulness	1.00	7.00	5.60	1.62
Perceived Ease of Use	1.00	7.00	5.69	1.33
Attitudes	1.00	7.00	5.65	1.30
Social Influence	1.00	7.00	4.95	1.68
Facilitating Conditions	1.00	7.00	5.42	1.49
Self-Efficacy	1.00	7.00	5.52	1.49
Anxiety	1.00	7.00	2.03	1.37

Based on the results presented in Table 4-6 the constructed variable that was observed to have the highest average value was that of the perceived ease of use, which had an average of 5.69 (SD = 1.33), while the variable with the lowest average score was the anxiety of using wireless technology data, which had an average score of 2.03 (SD =

1.37). With the newly constructed variables for the study, the research questions are addressed. It was observed that there were several missing values for these variables. This is because some of the participants did not fully complete the survey instrument and answer all of the questions. For this reason, the subsequent analyses were based on the number of observations for each of the different variables defined above.

Findings of Research Questions

Research Question 1

What are the rates of wireless trust, technology acceptance (perceived usefulness and perceived ease of use), and diffusion of innovation (relative advantages, compatibility, trialability, observability, and complexity), for enterprises, public sector organizations and individual wireless users?

In order to address this research question the following hypothesis was examined.

H1 Wireless trust (familiarity, user activities, user involvement, task-related behavior, task involvement, IS-related behavior, and product involvement) and technology acceptance (perceived usefulness and perceived ease of use) are significant explanatory variables of the rate of diffusion of innovation (influencing relative advantages, compatibility, trialability, observability, complexity) for enterprises, public sector organizations and individual wireless users.

To address the hypothesis an ANOVA was conducted in order to determine whether there were statistically significant differences between the wireless trust, technology acceptance of the participants based on the type of organization in which they belonged. A breakdown for each of the constructed variables by each organization is presented in Table 4-7.

Table 4-7

Wireless Trust and Technology Acceptance by Organization

	Corporation		Government		School		Small Business		Other	
	M	SD	M	SD	M	SD	M	SD	M	SD
PU	5.97	1.45	5.24	1.76	4.63	1.86	5.09	1.45	4.47	1.96
PEU	6.01	1.07	6.03	1.04	4.96	1.98	4.81	1.54	4.89	1.40
ATUT	5.93	1.18	5.27	1.29	5.18	1.66	5.13	1.19	4.85	1.56
SI	5.43	1.49	4.34	1.62	3.50	1.69	4.08	1.61	4.07	1.74
FC	5.82	1.30	5.19	1.03	4.43	1.83	4.54	1.52	4.62	1.66
SE	5.78	1.39	5.51	1.36	4.72	1.76	4.88	1.59	5.06	1.49
A	1.68	1.03	2.00	1.34	2.77	1.64	2.90	1.83	2.84	1.57

Note: PU = perceived usefulness, PEU = perceived ease of use, ATUT = attitudes towards using technology, SI = social influence, FC = facilitating condition, SE = self-efficacy, A = anxiety

To better illustrate the average scores for each of the different types of organizations, bar plots for each of the seven variables are presented in Figure 3. The values for each of the seven variables can be seen to be different for each of the organization type in the study. For instance, the anxiety level of the participants was

observed to be lowest for individuals in corporations, while the anxiety was the highest within small businesses. However, overall the anxiety score was the lowest for each of the different organizations, which did not appear to be as much anxiety in the organizations when it came to using wireless data technology. Alternatively, the social influence scores were highest for corporations while the social influence scores were lowest for individuals from schools. In fact, organizations had the highest scores for each of the variables in the study. In order to determine if these differences are significant the results for each of the ANOVAs are presented below.

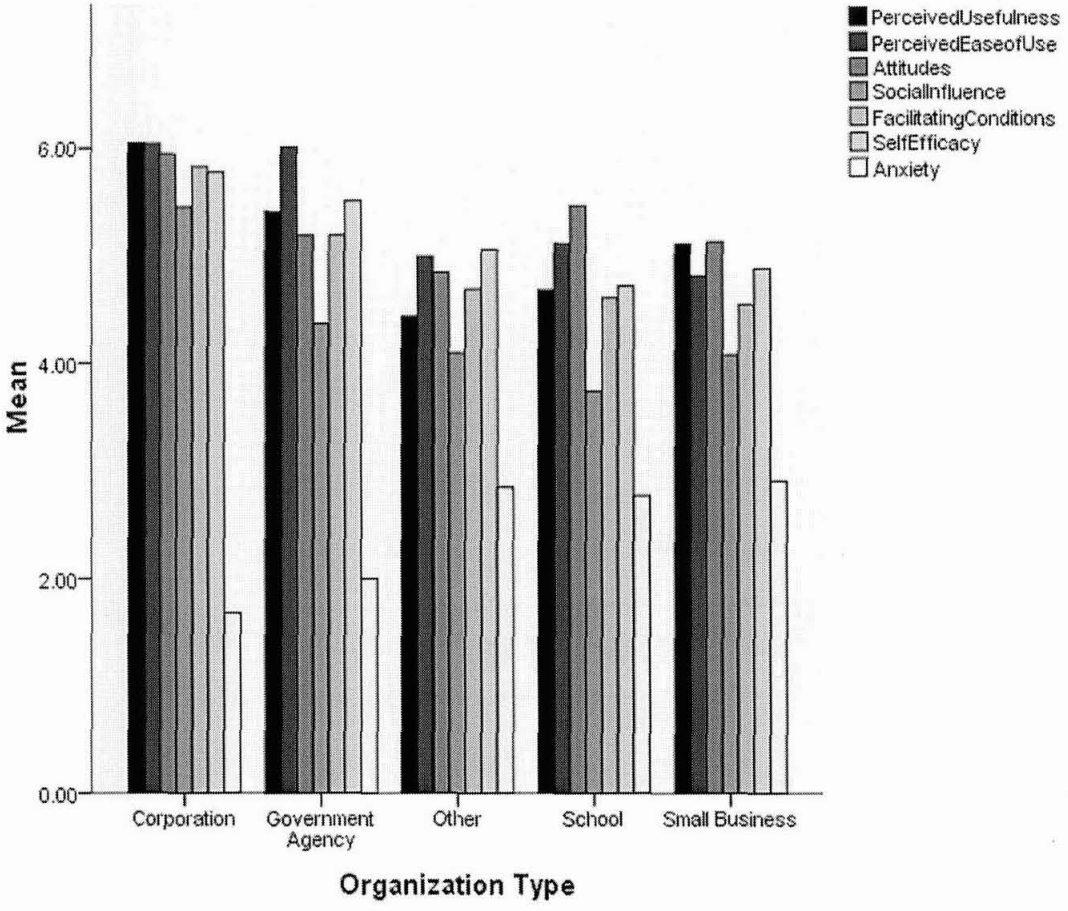


Figure 4-1. Plot of perceived usefulness, perceived ease of use, attitudes towards using technology, social influence, facilitating condition, self-efficacy and anxiety for different organization types.

Table 4-8

Analysis of Variance Results for Perceived Usefulness

Source	SS	df	MS	F	p	η^2
Organization Type	111.536	4	27.884	11.797	.000	.110
Error	898.168	380	2.364			

R Squared = .110 Dependent Variable = Perceived Usefulness

There was a significant difference between the perceived usefulness scores by the different organizations included in the study ($F(4, 380) = 11.78$, $p < .001$). This meant that the type of organization significantly explained the variation in the dependent variable. In fact, this model was able to explain 11.0% of the variation in the dependent variable. Since there was a difference related to organization type,, a post hoc analysis was conducted. This consisted of using the Least Significant Differences (LSD) test. Based on the results of the LSD test, those subjects who belonged to corporations would score significantly higher than the other organizations in the study ($p < .05$). This indicated that individuals in corporations find wireless data technology to be more useful than other organizations sampled in this study. None of the other organization types were significantly different from one another. The results for the perceived ease of use are presented in Table 4-9.

Table 4-9

Analysis of Variance Results for Perceived Ease of Use

Source	SS	df	MS	F	p	η^2
Organization Type	99.779	4	24.945	16.370	.000	.151
Error	562.298	369	1.524			

R Squared = .151 Dependent Variable = Perceived Ease of Use

There was a significant difference between the perceived ease of use scores by the different organizations included in the study ($F(4, 369) = 16.37$, $p < .001$). This meant that the type of organization significantly explained the variation in the dependent variable. In fact, this model was able to explain 15.1% of the variation in the dependent variable. Since there was a difference between the various types of organizations, a post hoc analysis was conducted. This consisted of using the Least Significant Differences (LSD) test. Based on the results of the LSD test, those subjects who belonged to corporations or government agencies would score significantly higher than the other organizations in the study ($p < .05$). This indicated that individuals in corporations and government agencies find wireless data technology to be easier to use than individuals in other organizations sampled in this study did. There was no significant difference between individuals in corporations or government agencies. The results for the attitudes towards using technology are presented in Table 4-10.

Table 4-10

Analysis of Variance Results for Attitude Towards Using Technology

Source	SS	df	MS	F	p	η^2
Organization Type	59.779	4	14.945	9.610	.000	.095
Error	567.590	365	1.555			

R Squared = .095 Dependent Variable = Attitudes towards using technology

There was a significant difference between the attitudes towards using technology scores by the different organizations included in the study ($F(4, 365) = 14.95, p < .001$). This meant that the type of organization significantly explained the variation in the dependent variable. In fact, this model was able to explain 9.5% of the variation in the dependent variable. Since there was a difference between the various types of organizations, a post hoc analysis was conducted. This consisted of using the Least Significant Differences (LSD) test. Based on the results of the LSD test, those subjects who belonged to corporations would score significantly higher than the subjects in other organizations in the study ($p < .05$). This indicated that individuals in corporations had higher or more positive attitudes towards using technology than other organizations sampled in this study. There was no significant difference between any of the remaining organizations in the study. The results for the social influence are presented in Table 4-11.

Table 4-11

Analysis of Variance Results for Social Influence

Source	SS	df	MS	F	p	η^2
Organization Type	169.297	4	42.324	17.670	.000	.164
Error	864.702	361	2.395			

R Squared = .164 Dependent Variable = Social Influence

There was a significant difference between the social influence scores by the different organizations included in the study ($F(4, 361) = 17.67$, $p < .001$). This meant that the type of organization significantly explained the variation in the dependent variable. In fact, this model was able to explain 16.4% of the variation in the dependent variable. Since there was a difference between the different types of organizations, a post hoc analysis was conducted. This consisted of using the Least Significant Differences (LSD) test. Based on the results of the LSD test, those subjects who belonged to corporations would score significantly higher than subjects in the other organizations in the study ($p < .05$). This indicated that individuals in corporations had higher or more positive social influence than individuals in other organizations sampled in this study. There was no significant difference between any of the remaining organizations in the study. The results for the facilitating conditions are presented in Table 4-12.

Table 4-12

Analysis of Variance Results for Facilitating Conditions

Source	SS	df	MS	F	p	η^2
Organization Type	117.649	4	29.412	15.393	.000	.147
Error	682.157	357	1.911			

R Squared = .147 Dependent Variable = Facilitating Conditions

There was a significant difference between the facilitating conditions scores by the different organizations included in the study ($F(4, 357) = 15.39$, $p < .001$). This meant that the type of organization significantly explained the variation in the dependent variable. In fact, this model was able to explain 14.7% of the variation in the dependent variable. Since there was a difference between the different types of organizations, a post hoc analysis was conducted. This consisted of using the Least Significant Differences (LSD) test. Based on the results of the LSD test, those subjects who belonged to corporations would score significantly higher than subjects in the other organizations in the study ($p < .05$). This indicated that individuals in corporations had higher or more positive facilitating conditions than individuals in other organizations sampled in this study. There was no significant difference between any of the remaining organizations in the study. The results for the self-efficacy are presented in Table 4-13.

Table 4-13

Analysis of Variance Results for Self-Efficacy

Source	SS	df	MS	F	p	η^2
Organization Type	54.413	4	13.603	6.494	.000	.069
Error	735.306	351	2.095			

R Squared = .069 Dependent Variable = Self-Efficacy

There was a significant difference between the self-efficacy scores by the different organizations included in the study ($F(4, 351) = 6.49$, $p < .001$). This meant that the type of organization significantly explained the variation in the dependent variable. In fact, this model was able to explain 6.9% of the variation in the dependent variable. Since there was a difference between the different types of organizations, a post hoc analysis was conducted. This consisted of using the Least Significant Differences (LSD) test. Based on the results of the LSD test, those subjects who belonged to corporations would score significantly higher than subjects who belonged to the other organizations in the study ($p < .05$) with the exception of governmental agencies. This indicated that individuals in corporations had higher or more positive self-efficacy than individuals in other organizations sampled in this study,e xcept for those who were from governmental agencies. The results for the anxiety scores are presented in Table 4-14.

Table 4-14

Analysis of Variance Results for Anxiety

Source	SS	df	MS	F	p	η^2
Organization Type	97.453	4	24.363	14.924	.000	.145
Error	573.016	351	1.633			

R Squared = .145 Dependent Variable = Anxiety

There was a significant difference between the anxiety scores by the different organizations included in the study ($F(4, 351) = 14.92$, $p < .001$). This meant that the type of organization significantly explained the variation in the dependent variable. In fact, this model was able to explain 14.5% of the variation in the dependent variable. Since there was a difference between the different types of organizations, a post hoc analysis was conducted. This consisted of using the Least Significant Differences (LSD) test. Based on the results of the LSD test, those subjects who belonged to corporations would score significantly lower than subjects in the other organizations in the study ($p < .05$) with the exception of governmental agencies. This indicated that individuals in corporations had lower or less anxiety than individuals in other organizations sampled in this study, except for those who were from governmental agencies. Similarly, those from government agencies were observed to have less anxiety when compared to individuals from other organizations and small businesses. There was no significant difference between any of the remaining organizations in the study. Therefore, this provides evidence against the null hypothesis since there were significant relationships between the independent variable and the dependent variable.

Research Question 2

How do factors such as technology acceptance, adoption, and organizational diffusion of innovation, affect acceptance of wireless data technology?

In order to address this research question the following hypothesis was examined.

H2. Social Psychology Setting (attitudes, subjective norms, behavioral intention) and technology acceptance (perceived usefulness and perceived ease of use) are significant explanatory variables of the rate of diffusion of innovation (influencing relative advantages, compatibility, trialability, observability, complexity) for enterprises, public sector organizations and individual wireless users.

To address the hypothesis, multiple regression analyses was conducted. The independent variables that were included in the model were the perceived usefulness and perceived ease of use scores, along with the amount of experience the subjects had in wireless data technology. The dependent variables that were used in the models were then the five dimensions measured from the UTAUT survey instrument. The results for the first multiple regression analysis, where the attitudes towards using technology was used as the dependent variable are presented in Table 4-15.

Table 4-15

Multiple Regression Results for Attitudes Towards Using Technology

Variable	B	SE	β	t	p
(Constant)	1.386	.200		6.926	.000
Perceived Usefulness	.459	.033	.571	14.126	.000
Perceived Ease of Use	.268	.042	.274	6.386	.000
Experience	.033	.030	.049	1.103	.271

R Squared = .610, Dependent Variable = Attitude towards using technology

The overall regression model was a significant fit ($F(3, 366) = 190.78$, $p < .001$) explaining a total of 61.0% of the variation in the attitudes towards using technology variable. As for the variables included in the model the perceived usefulness and perceived ease of use were both statistically significant ($t(366) = 14.13$, $p < .001$ and $t(366) = 6.39$, $p < .001$, respectively). In fact, the model predicted that for every unit increase in the perceived usefulness scores, the attitudes towards using technology increased by .459 units, while the model predicted for that for every unit increase in the perceived ease of use scores, the attitudes towards using technology increased by .268 units. However, there was not a significant relationship between the amount of experience the participant had and the attitudes towards using technology ($t(366) = 1.10$, $p = .271$). Therefore, this provides some evidence against the null hypothesis since there were significant relationships between the independent and dependent variables.

The results for the next multiple regression analysis, where the social influence was used as the dependent variable are presented in Table 4-16.

Table 4-16

Multiple Regression Results for Social Influence

Variable	B	SE	β	t	p
(Constant)	.356	.296		1.205	.229
Perceived Usefulness	.546	.048	.526	11.364	.000
Perceived Ease of Use	.157	.062	.124	2.529	.012
Experience	.134	.045	.153	3.012	.003

R Squared = .495, Dependent Variable = Social Influence

The overall regression model was a significant fit ($F(3, 362) = 118.09$, $p < .001$) explaining a total of 49.5% of the variation in the social influence variable. As for the variables included in the model the perceived usefulness and perceived ease of use were both statistically significant ($t(362) = 11.36$, $p < .001$ and $t(362) = 2.53$, $p = .012$, respectively). In fact, the model predicted that for every unit increase in the perceived usefulness scores, the social influence increased by .546 units, while the model predicted for that for every unit increase in the perceived ease of use scores, the social influence increased by .157 units. Similarly, there was a significant relationship between the amount of experience the participant had and the social influence ($t(362) = 3.01$, $p = .003$). In fact, the model predicted that for every unit increase in experience, the social influence increased by .134 units. The results for the next multiple regression analysis,

where the facilitating conditions was used as the dependent variable are presented in Table 4-17.

Table 4-17

Multiple Regression Results for Facilitating Conditions

Variable	B	SE	β	t	p
(Constant)	.562	.234		2.399	.017
Perceived Usefulness	.203	.038	.221	5.338	.000
Perceived Ease of Use	.490	.049	.438	9.954	.000
Experience	.194	.035	.250	5.478	.000

R Squared = .599, Dependent Variable = Facilitating Conditions

The overall regression model, was a significant fit ($F(3, 358) = 177.99$, $p < .001$) explaining a total of 59.9% of the variation in the facilitating conditions variable. As for the variables included in the model the perceived usefulness and perceived ease of use were both statistically significant ($t(358) = 5.34$, $p < .001$ and $t(358) = 9.95$, $p < .001$, respectively). In fact, the model predicted that for every unit increase in the perceived usefulness scores, the facilitating conditions increased by .203 units, while the model predicted for that for every unit increase in the perceived ease of use scores, the facilitating conditions increased by .490 units. Similarly, there was a significant relationship between the amount of experience the participant had and the facilitating conditions ($t(358) = 5.48$, $p < .001$). In fact, the model predicted that for every unit increase in experience, the facilitating conditions increased by .194 units. The results for

the next multiple regression analysis, where the self-efficacy was used as the dependent variable are presented in Table 4-18.

Table 4-18

Multiple Regression Results for Self-Efficacy

Variable	B	SE	B	t	p
(Constant)	1.495	.301		4.965	.000
Perceived Usefulness	.218	.049	.237	4.445	.000
Perceived Ease of Use	.514	.063	.459	8.119	.000
Experience	-.025	.045	-.033	-.556	.579

R Squared = .350, Dependent Variable = Self-Efficacy

The overall regression model was a significant fit ($F(3, 352) = 63.26$, $p < .001$) explaining a total of 35.0% of the variation in the self-efficacy variable. As for the variables included in the model the perceived usefulness and perceived ease of use were both statistically significant ($t(352) = 4.45$, $p < .001$ and $t(352) = 8.12$, $p < .001$, respectively). In fact, the model predicted that for every unit increase in the perceived usefulness scores, the self-efficacy increased by .218 units, while the model predicted for that for every unit increase in the perceived ease of use scores, the self-efficacy increased by .514 units. However, there was not a significant relationship between the amount of experience the participant had and the self-efficacy ($t(352) = -.556$, $p = .579$). The results for the next multiple regression analysis, where anxiety was used as the dependent variable are presented in Table 4-19.

Table 4-19

Multiple Regression Results for Anxiety

Variable	B	SE	B	t	p
(Constant)	5.149	.277		18.596	.000
Perceived Usefulness	-.014	.045	-.016	-.309	.758
Perceived Ease of Use	-.345	.058	-.335	-5.933	.000
Experience	-.225	.042	-.315	-5.392	.000

R Squared = .353, Dependent Variable = Anxiety

The overall regression model was a significant fit ($F(3, 352) = 177.99$, $p < .001$) explaining a total of 35.3% of the variation in the anxiety variable. As for the variables included in the model the amount of experience the participant had and perceived ease of use were both statistically significant ($t(352) = -5.39$, $p < .001$ and $t(352) = -5.93$, $p < .001$, respectively). In fact, the model predicted that for every unit increase in the amount of experience, the anxiety decreased by .225 units, while the model predicted for that for every unit increase in the perceived ease of use scores, anxiety decreased by .345 units. However, there was not a significant relationship between the perceived usefulness and the anxiety ($t(352) = -.309$, $p = .758$. Therefore, this provides some evidence against the null hypothesis since there were significant relationships between the independent and dependent variables.

Additional Analyses

To further explore the technology acceptance factors and the adoption of wireless data technology, demographic characteristics of the participants in the study. This was done in order to determine whether there were differences in the acceptance and adoption of wireless data technology for the position, the age, ethnicity and tenure of the participants included in the study. To determine whether there were significant differences in the demographic characteristics of the subjects, ANOVA were conducted with each acceptance and adoption of wireless data technology variables. The first analysis that is presented is for the perceived ease of use as the dependent variable and the demographic characteristics as the independent variables. The results for the ANOVA are presented in Table 4-20.

Table 4-20

Analysis of Variance for Perceived Ease of Use and Demographic Characteristics

Source	SS	df	MS	F	p	η^2
Age	23.802	5	4.760	3.076	.010	.041
Ethnicity	9.002	4	2.250	1.454	.216	.016
Job Title	54.764	3	18.255	11.796	.000	.090
Years in Current Position	18.148	5	3.630	2.345	.041	.032
Error	550.918	356	1.548			

R Squared = .168 Dependent Variable = Perceived Ease of Use

There was a significant difference between the perceived ease of use scores for the age groups of the participants ($F(5, 356) = 3.08$, $p = .010$). There was also a significant difference between those participants with different job titles, ($F(3, 356) = 11.80$, $p < .001$) as well as the number of years the participants had been in their current position ($F(5, 356) = 2.35$, $p = .041$). There was, however, not a significant difference in the ethnicity of the participants ($F(4, 356) = 1.45$, $p = .216$). This model was able to explain 16.8% of the variation in the dependent variable. Since there was a difference between the different age groups, years in current position and the job title of the participant, a post hoc analysis was conducted. This consisted of using the Least Significant Differences (LSD) test. Based on the results of the LSD test, younger subjects (26 to 55 years) would score higher on the perceived ease of use scores than older subjects (56 years and over, $p < .05$). As for the position of the subject, those who were IT professional scored significantly higher on the perceived ease of use score when compared to the managers, computer specialists and other positions. Similarly, those who were in their current position for 0 – 2 years scored higher on the perceived ease of use scores when compared to those who were in their current position for 3 – 10 years. The second analysis that is presented is for the perceived usefulness as the dependent variable and the demographic characteristics as the independent variables. The results for the ANOVA are presented in Table 4-21.

Table 4-21

Analysis of Variance for Perceived Usefulness and Demographic Characteristics

Source	SS	df	MS	F	p	η^2
Age	27.592	5	5.518	2.238	.050	.030
Ethnicity	15.528	4	3.882	1.574	.180	.017
Job Title	36.407	3	12.136	4.922	.002	.039
Years in Current Position	17.588	5	3.518	1.427	.214	.019
Error	904.906	367	2.466			

R Squared = .104 Dependent Variable = Perceived Usefulness

There was a moderately significant difference between the perceived usefulness scores for the age groups of the participants ($F(5, 367) = 2.24$, $p = .050$). There was also a significant difference between those participants with different job titles, ($F(3, 367) = 4.92$, $p = .002$). There was not a significant difference for the number of years the participants had been in their current position ($F(5, 367) = 1.43$, $p = .214$). There was also not a significant difference in the ethnicity of the participants ($F(4, 367) = 1.57$, $p = .180$). This model was able to explain 10.4% of the variation in the dependent variable. Since there was a difference between the different age groups and the job title of the participant, a post hoc analysis was conducted. This consisted of using the Least Significant Differences (LSD) test. Based on the results of the LSD test, younger subjects (18 to 25 years) would score higher on the perceived usefulness scores than older subjects (26 to 55 years, $p < .05$). As for the position of the subject, those who were IT professionals and managers scored significantly higher on the perceived usefulness score when compared

to other positions. The third analysis that is presented is for the attitudes as the dependent variable and the demographic characteristics as the independent variables. The results for the ANOVA are presented in Table 4-22.

Table 4-22

Analysis of Variance for Attitudes and Demographic Characteristics

Source	SS	df	MS	F	p	η^2
Age	20.868	5	4.174	2.616	.024	.036
Ethnicity	7.508	4	1.877	1.177	.321	.013
Job Title	20.936	3	6.979	4.375	.005	.036
Years in Current Position	14.285	5	2.857	1.791	.114	.025
Error	561.526	352	1.595			

R Squared = .168 Dependent Variable = Attitudes

There was a significant difference between the attitudes towards technology scores for the age groups of the participants ($F(5, 352) = 2.62$, $p = .024$). There was also a significant difference between those participants with different job titles, ($F(3, 352) = 4.38$, $p = .005$). There was not a significant difference for the number of years the participants had been in their current position ($F(5, 352) = 1.79$, $p = .114$). There was also not a significant difference in the ethnicity of the participants ($F(4, 352) = 1.18$, $p = .321$). This model was able to explain 10.5% of the variation in the dependent variable. Since there was a difference between the different age groups and the job title of the participant, a post hoc analysis was conducted. This consisted of using the Least Significant

Differences (LSD) test. Based on the results of the LSD test, subjects 26 to 35 years old would score higher on the attitudes towards technology scores than subjects 18 – 25, 46 – 55 and 66 years and older. As for the position of the subject, those who were computer specialists scored significantly lower on the attitudes towards technology score when compared to IT professionals, managers and other positions. The fourth analysis that is presented is for the social influence as the dependent variable and the demographic characteristics as the independent variables. The results for the ANOVA are presented in Table 4-23.

Table 4-23

Analysis of Variance for Social Influence and Demographic Characteristics

Source	SS	df	MS	F	p	η^2
Age	28.866	5	5.773	2.187	.055	.030
Ethnicity	7.096	4	1.774	.672	.612	.008
Job Title	44.224	3	14.741	5.584	.001	.046
Years in Current Position	17.003	5	3.401	1.288	.268	.018
Error	918.689	348	2.640			

R Squared = .112 Dependent Variable = Social Influence

There was not a significant difference between the social influence scores for the age groups of the participants ($F(5, 348) = 2.19$, $p = .055$). There was a significant difference between those participants with different job titles, ($F(3, 348) = 5.58$, $p = .001$). There was not a significant difference for the number of years the participants had been in their current position ($F(5, 348) = 1.29$, $p = .268$). There also was not a

significant difference in the ethnicity of the participants ($F(4, 348) = .672$, $p = .612$). This model was able to explain 11.2% of the variation in the dependent variable. Since there was a difference between the job title of the participant, a post hoc analysis was conducted. This consisted of using the Least Significant Differences (LSD) test. Based on the results of the LSD test, those who were computer specialists scored significantly lower on the social influence score when compared to IT professionals and managers. The fifth analysis that is presented is for the facilitating conditions as the dependent variable and the demographic characteristics as the independent variables. The results for the ANOVA are presented in Table 4-24.

Table 4-24

Analysis of Variance for Facilitating Conditions and Demographic Characteristics

Source	SS	df	MS	F	p	η^2
Age	17.556	5	3.511	1.691	.136	.024
Ethnicity	6.981	4	1.745	.841	.500	.010
Job Title	40.404	3	13.468	6.486	.000	.054
Years in Current Position	6.833	5	1.367	.658	.655	.009
Error	714.309	344	2.076			

R Squared = .107 Dependent Variable = Facilitating Conditions

There was not a significant difference between the facilitating conditions scores for the age groups of the participants ($F(5, 344) = 1.69$, $p = .136$). There was a significant difference between those participants with different job titles, ($F(3, 344) = 6.49$, $p <$

.001). There was not a significant difference for the number of years the participants had been in their current position (F(5, 344) = .658, p = .655). There also was not a significant difference in the ethnicity of the participants (F(4, 344) = .841, p = .500). This model was able to explain 10.7% of the variation in the dependent variable. Since there was a difference between the job title of the participant, a post hoc analysis was conducted. This consisted of using the Least Significant Differences (LSD) test. Based on the results of the LSD test, those who were in other positions had facilitating conditions scores that were significantly lower when compared to IT professionals and managers. The sixth analysis that is presented is for the self-efficacy as the dependent variable and the demographic characteristics as the independent variables. The results for the ANOVA are presented in Table 4-25.

Table 4-25

Analysis of Variance for Self-Efficacy and Demographic Characteristics

Source	SS	df	MS	F	p	η^2
Age	8.403	5	1.681	.797	.553	.012
Ethnicity	16.155	4	4.039	1.915	.108	.022
Job Title	18.758	3	6.253	2.965	.032	.026
Years in Current Position	26.743	5	5.349	2.536	.029	.036
Error	712.877	338	2.109			

R Squared = .097 Dependent Variable = Self-Efficacy

There was not a significant difference between the self-efficacy scores for the age groups of the participants (F(5, 338) = 797, p = .553). There was a significant difference between those participants with different job titles, (F(3, 338) = 2.97, p = .032). There

also was a significant difference for the number of years the participants had been in their current position ($F(5, 338) = 2.54$, $p = .029$). There was not a significant difference in the ethnicity of the participants ($F(4, 338) = 1.92$, $p = .108$). This model was able to explain 9.7% of the variation in the dependent variable. Since there was a difference between the job title of the participant and years in current position, a post hoc analysis was conducted. This consisted of using the Least Significant Differences (LSD) test. Based on the results of the LSD test, those who were in other positions had self-efficacy scores that were significantly lower when compared to IT professionals and managers. Those who had been in their current position for 0 – 2 years would score significantly higher than those who had been in their current position for 6 – 10 years and 21 years or over. The final analysis that is presented is for the anxiety as the dependent variable and the demographic characteristics as the independent variables. The results for the ANOVA are presented in Table 4-26.

Table 4-26

Analysis of Variance for Anxiety and Demographic Characteristics

Source	SS	df	MS	F	p	η^2
Age	7.070	5	1.414	.789	.558	.012
Ethnicity	3.350	4	.838	.467	.760	.006
Job Title	46.739	3	15.580	8.694	.000	.072
Years in Current Position	2.767	5	.553	.309	.908	.005
Error	605.680	338	1.792			

R Squared = .097 Dependent Variable = Anxiety

There was not a significant difference between the anxiety scores for the age groups of the participants ($F(5, 338) = 789$, $p = .558$). There was a significant difference between those participants with different job titles, ($F(3, 338) = 8.69$, $p < .001$). There was not a significant difference for the number of years the participants had been in their current position ($F(5, 338) = 309$, $p = .908$). There was also not a significant difference in the ethnicity of the participants ($F(4, 338) = .467$, $p = .760$). This model was able to explain 9.7% of the variation in the dependent variable. Since there was a difference between the job title of the participant, a post hoc analysis was conducted. This consisted of using the Least Significant Differences (LSD) test. Based on the results of the LSD test, those who were in other positions had anxiety scores that were significantly lower when compared to IT professionals and managers.

Summary of Findings

When comparing the perceived usefulness, perceived ease of use, attitudes towards using technology, social influence, facilitating condition, self-efficacy and anxiety scores for the different organization types of the participants in the study, there was a statistically significant difference between the organizational positions of the participants in the study. This indicated that depending on the position of the participant, different perceptions for the perceived usefulness, perceived ease of use, attitudes towards using technology, social influence, facilitating condition, self-efficacy and anxiety scores would be obtained. In fact, for the perceived usefulness scores, those who were in corporations would score higher than those in any of the other organizations (i.e. government agency, school, other and small business). As for the perceived ease of use,

those who were either in corporations or government agencies would score higher than those who were in schools, other organizations or small businesses. Similarly, those who were in corporations or government agencies would have less anxiety when it came to wireless data technology when compared to those who were in schools, other organizations or small businesses.

As for the remaining scores, those who were from corporations would score higher than those in government agencies, schools, other organizations and small businesses when it came to the attitudes towards using technology, social influence and facilitating conditions, but were significantly different between those in schools, other organizations and small businesses when it came to the self efficacy scores of the participants. For the ANOVAs that were conducted in this study it was found that the perceived usefulness and perceived ease of use were significant predictors of the attitudes towards using technology. In fact, each of the relationships was positive indicating that when the perceived usefulness and perceived ease of use increased, the attitudes towards technology increased as well.

The perceived usefulness, perceived ease of use and length of experience were significant predictors of the social influence of the participant. The relationships between the independent and dependent variables were all positive, which indicated that when the perceived usefulness, perceived ease of use and length of experience increased the social influence increased as well. Similarly, there were significant positive relationships between the perceived usefulness, perceived ease of use and length of experience and the facilitating conditions of the participant. The perceived usefulness and perceived ease of use were significant positive predictors of the self-efficacy scores of the participant,

while the perceived ease of use and experience were significant predictors for the anxiety of the participants.

CHAPTER V: DISCUSSION AND CONCLUSIONS

Discussion

The purpose of the current study was to examine the technology acceptance factors affecting adoption of wireless data technology. This was accomplished by using a nonexperimental quantitative research design that collected information from a number of businesses or other types of organizations. The main types of organizations used in the study included schools, large corporations, and small scale businesses. The use of the different types of organizations allowed for a diverse representation of the different perspectives and acceptance factors that affect the adoption of wireless data technology. This chapter will provide a discussion of the results from Chapter 4 within the framework of the past literature. In this way, the research questions will be answered in order to gain better understanding about the acceptance of technology in an organization.

The research questions related to the major theories and empirical studies concerning technology acceptance and diffusion, as well as the factors that affect the acceptance of innovative wireless data technology in an organization. The conclusions drawn about these questions will help to better understand the reasons behind the aversion that some people have for wireless technology. The kind of solutions that can be engineered from this information will enable technology to be designed in such a way that better encourages its use and further enhances an organization's efficiency.

Interpretations

The first hypothesis probes the quantifiable rates of wireless trust, technology acceptance, and diffusion of innovation for enterprises, public sector organizations, and individual wireless users. Within the technology acceptance category, measures of

perceived usefulness and perceived ease of use were observed in the current study to ascertain any significant differences among the different types of organizations. Within the diffusion of innovation category, measures of relative advantages, compatibility, trialability, observability, and complexity were observed in the current study to ascertain any significant differences among the different types of organizations. The second research question addressed the factors of technology acceptance, adoption, and organizational diffusion of innovation with respect to how they affected the acceptance of wireless data technology. The current study's findings with regard to these measures will be discussed within the framework of the findings from past research.

Wireless Trust

Technology acceptance was measured in past research in terms of perceived usefulness and perceived ease of use. The current study investigated wireless trust using a similar approach. The current study found that the variance among the perceived usefulness scores among different organizations can be attributed to the organization's type. More specifically, it was found that corporations perceived wireless data technology to be more useful than any other organizational type. Past research revealed that wireless trust received stronger support for perceived usefulness due to facilitating conditions in terms of technical assistance as well as legal and regulatory frameworks (Lu et al., 2005). This aligns with the current study's findings in that corporations are likely to have support for users of technology in terms of technical assistance and legal/regulatory frameworks. However, this was not specifically investigated in the study, so the current study's findings cannot wholly support Lu et al.'s findings that there is a strong causal relationship between wireless trust and facilitating conditions.

Siau et al. (2003) found that if the consumer engages with technology but does not fully see the invested value therein, the longevity of the use of the technology product was reduced. This concept of a consumer's perceived value of technology is similar to the current study's measurement of perceived usefulness of technology. As already mentioned, the current study found that corporations perceived wireless technology to be more useful than any other organizational type. This finding relates to Siau et al.'s study in that a corporation may be more likely to implement education and incentives for the use of technology. However, the current study did not specifically examine this aspect of corporations.

The other component of technology acceptance that the current study investigated was perceived ease of use. The findings showed that the variance in perceived ease of use scores among different types of organizations could be attributed to the differences in organizational type. More in-depth analysis revealed that corporations and government agencies had higher scores that showed that their members perceived wireless technology as easier to use than members of other organizational types. Additionally, there was no significant difference between the scores of government agencies and corporations. This suggests that there could be a similarity between government agencies and corporations that is the cause for both organizational types having similar perceptions on the ease of use of wireless technology. Siau et al. (2003) found that education about wireless technology led to more longevity. This finding relates to the current study in that having an educational background with respect to a certain technology will likely result in a person or organization perceiving that technology as easy to use.

Diffusion of Innovation

The second aspect of the first hypothesis investigated diffusion of innovation with respect to scores of attitudes, social influence, facilitating conditions, self-efficacy, and anxiety. Again, the data used to ascertain these scores was collected from different organizational types including corporations, government agencies, schools, and small businesses. Malhotra and Galletta (1999) concluded that the factors of perceived usefulness and perceived ease of use contributed to the attitudes about using technology. The current study's results showed that the variance in attitude scores among the different organizations could be attributed to the type of the organization. Further analysis revealed that individuals from corporations had higher attitude scores than individuals from any other organizational type. In other words, these individuals had the most positive attitudes about using wireless technology. This finding is consistent with Malhotra and Gelletta's assertions in that the perceptions about the usefulness and ease of use of technology contribute to one's attitude about using technology. The current study revealed high scores in both of these categories for individuals from corporations, so it makes sense that they also had high attitude scores about using technology.

The next measurement regarding the diffusion of innovation that the current study gauged was that of social influence. The results showed that the variations in scores among the different organizations could be explained by the type of an organization. Further analysis revealed that the individuals from corporations had higher social influence scores than individuals from any other organizational type. More specifically, this meant that individuals from corporations experienced a more positive social influence with respect to using wireless technology. Venkatesh et al. (2003) asserted that

social influences are one of the constructs of the UTAUT model. More positive social influences will foster willingness to participate in technology use among individuals; this leads to higher degrees of technology acceptance according the UTAUT model. The high social influence scores of individuals from corporations in the current study is consistent with Venkatesh et al.'s UTAUT model in that positive social influences lead to higher level of technology acceptance.

Facilitating conditions was another measurement of technology acceptance and diffusion of innovation observed in the current study. The current study's findings revealed that there was a significant difference in the facilitating conditions scores among the different types of organizations. Further analysis indicated that individuals in corporations had higher or more positive facilitating conditions than individuals in other organizations sampled in this study. The past research indicated that facilitating conditions is one of the constructs in the UTAUT model (Venkatesh et al., 2003). This is consistent with the current study's findings in that higher scores indicating better facilitating conditions in using technology led to higher levels of technology acceptance and diffusion of innovation. Lu et al. (2005) also used facilitating conditions as a measurement of technology acceptance and diffusion of innovation with respect to wireless technology. The findings from Lu et al. were consistent with the current study in that a strong relationship between facilitating conditions and technology acceptance was found.

Scores of self-efficacy were also collected from the different types of organizations with respect to wireless technology acceptance and diffusion of innovation. The current study's results indicated that there were significant differences among the

self-efficacy scores of individuals from different types of organizations. In other words, individuals from corporations were found to have significantly higher self-efficacy scores than individuals from other types of organizations with the exception of government agencies. Scores of individuals from corporations were higher than those from government agencies, but not significantly higher. Self-efficacy was one of the components of Venkatesh et al.'s (2003) UTAUT model (its validity has been tested), which shows that self-efficacy is associated with technology acceptance and diffusion of innovation. This finding from past research is consistent with the current study's findings in that the scores of individuals with higher self-efficacy scores exhibited a higher degree of technology acceptance and diffusion of innovation.

Anxiety was the last measure of diffusion of innovation with respect to wireless technology. Again, there was a significant difference found among the scores of the different organizations investigated in this study. Again, it was the individuals from organizations who scored the best. Specifically, these individuals scored significantly lower than individuals from other types of organizations when it came to their level of anxiety involved with wireless technology use. With respect to past research about feelings of anxiety, , Karahann (1999) found that the behaviors and attitudes of technology users differed from the researcher's initial thoughts that there was a gradual abandonment of anxiety and aversion to technology. Rather, Karahann found that there was an immediate cessation of anxious feelings once adoption of technology had occurred. This is interesting given the results of the current study. The current study revealed that individuals from corporations had lower anxiety scores than any other type of organization when it came to using wireless technology. This may be because

corporations could be more likely to completely adopt a technology much quicker than other types of organizations.

Overall, the findings from the current study with respect to research question 1 revealed that individuals from corporations had the highest scores associated with technology acceptance. However, two variables revealed that corporation scores were not significantly higher than the scores from government agencies. These variables were perceived ease of use and self-efficacy. It is interesting to observe that these variables could be related given that they were the only two variables that showed government agencies as not having significantly lower scores than corporations.

The scores from this study indicate that corporations are unique compared to other types of organizations with respect to technology acceptance and diffusion of innovation. The results suggest that corporations that encourage leading edge technology receive a higher level of technology acceptance and diffusion of innovation. Individuals from corporations reported higher scores than individuals from other types of organizations on almost every measurement of technology acceptance and diffusion of innovation. Given the results, a better understanding of the components that foster higher levels of technology acceptance and diffusion of innovation could come through further study of the characteristics of corporations in terms of how they integrate new technology into their organizations.

Factors Affecting Wireless Data Technology Acceptance

The second hypothesis investigated the effects of three factors on wireless data technology on a broader scale. More specifically, the second research question asked: How do factors such as technology acceptance, adoption, and organizational diffusion of

innovation affect acceptance of wireless data technology. These dependent variables were the five instruments from the UTAUT survey instrument, which are attitudes, social influence, facilitating conditions, self-efficacy, and anxiety. Each of these dependent variables were analyzed using three independent variables, which were perceived usefulness, perceived ease of use, and experience with wireless data technology.

With respect to attitudes towards using technology, the regression model constructed was a significant fit. Increases in perceived usefulness and perceived ease of use scores were found to have a positive significant effect on the attitudes of individuals about using technology. The independent variable experience, was not found to have a significant effect on an individual's attitude towards using technology. This finding indicates that when it comes to attitudes about using technology, the nature of the technology and how it is presented matters more than the predispositions of the individual engaging with the technology. In other words, the perceptions of usefulness and ease of use dictate an individual's attitude about using technology while their experience does not. This finding is related to Davis et al.'s (1989) assertion that attitude plays a significant role in identifying how, and to what extent, the consumer of a technology is able to adapt to that technology. Overall, the findings from past and current research reveal a possible delineation of cause and effect on an individual's acceptance of technology. Positive perceptions of usefulness and ease of use positively affect attitudes and positive attitudes about technology use leads to more acceptance of technology.

Social influence was another dependent variable analyzed in the context of the three independent variables. The model generated in the analysis was found to be a significant fit. Increases in the scores of all three independent variables were found to

yield a significant increase in the social influence score. One interesting outcome to note is that perceived usefulness was the strongest in relation to social influence followed by perceived ease of use and experience. This was the same pattern found in the attitude dependent variable (although experience was not significant). Wilde and Swatman (1995) conducted a study that investigated telecommunication enhanced communities. They found six dimensions of social networking as they related to technological networking. All six dimensions related to social influences directly or indirectly. In the end, social influences were identified as being quite important for inducing the willingness to use technology and enhance the level of technology acceptance as well as the diffusion of innovation. This is consistent with the current study's findings in that there is much emphasis placed on social influences in determining an individual's technology acceptance and adoption.

Facilitating conditions is the next dependent variable that was analyzed in terms of the three independent variables. The model was found to be a significant fit in explaining the variations in the facilitation conditions variable. In fact, when perceived usefulness and perceived ease of use scores were increased, there was a significant increase in the facilitating condition score. The same result was found for the experience independent variable. One item of interest was that perceived ease of use had the strongest relationship with the facilitation conditions dependent variable rather than perceived usefulness. This could be because the facilitating conditions can help in the understanding of using a technology, but they may not always have an as strong effect on the perceived usefulness variable. This is consistent with past literature in that the level of support and training individuals receive will have an influence on their perceptions and

use of technology before they are even introduced to it (Lu et al., 2005). Facilitating conditions are another factor that has a positive effect on the acceptance and adoption of wireless data technology.

Self-efficacy was the fourth dependent variable analyzed with respect to the three independent variables. The model produced was a significant fit in explaining the variation in the dependent self-efficacy variable. Scores of perceived usefulness and ease of use were both found to have a positive, significant relationship with scores of self-efficacy. Like the facilitating conditions independent variable, the perceived ease of use had the strongest relationship with the independent self-efficacy variable. Unlike the facilitating conditions variable, an individual's experience with technology was not found to have a significant relationship with one's self-efficacy. This is interesting because the facilitating conditions and self-efficacy variables were similar in that they demonstrated a strong relationship with perceive ease of use, yet they differed in their relationship with experience. This is interesting because both of these variables are items on the UTAUT instrumental survey and have been known to be associated with technology acceptance and diffusion of innovation. More specific differences between these variables could be further investigated to gain a better insight as to how they affect an individual's wireless data technology acceptance.

The anxiety dependent variable is unique from the other variables discussed in that lower scores tend to be associated with higher levels of technology acceptance and adoption as well as diffusion of innovation. The model produced in the analysis was a significant fit in explaining the variation in the anxiety variable. More specifically, the experience and perceived ease of use variables were found to be statistically significant

while the perceived usefulness variable was not significantly related to the anxiety variable. The findings here make this variable unique from the rest in that it was the only one where the independent perceived usefulness variable was not related to the dependent variable. Karahanna et al.'s (1999) study revealed feelings of anxiety about using technology almost immediately went away after technology was adopted. This is consistent with the current study's findings that perceived ease of use and experience help to curb anxiety about using technology. Another possibility here is that one can realize the usefulness of a technology, yet still be intimidated by the prospect of using technology. Overall, it seems that acquiring knowledge and experience about using wireless data technology allows the individual to perceive the technology as easier to use.

Practical Implications

Wireless data technology acceptance has become a topic of global interest. Many organizations have already embraced wireless technology while others have balked at the opportunity for various reasons. These reasons include security of wireless networks, complexity of the wireless solution, reliability, cost, and the speed of connection. One main issue is compatibility. The potential for another technology to come out and leave one's current wireless technology obsolete is a discouraging factor in the adoption of technology. Individuals are left discouraged because of the costs involved to start-up the new technology and deconstruct the old one. The results from this study could help in solving the compatibility issue by designing better avenues to diffuse innovation and induce technology acceptance. In all, this study provided a better understanding of the components that are effective in encouraging technology wireless data technology acceptance. The findings of this research along with future research should help to curb

the negative pulls that individuals experience in terms of accepting technology. The results should also help to design better avenues for diffusing innovations so that individuals are less apprehensive about accepting technology use.

Conclusion

This chapter provided an overview of the major theories that served as a foundation for this study. There was also a discussion of the findings and past research that revealed any similarities and differences that may be helpful for future research and agents in the field.

Individuals from corporations were found to be the most prone to accept technology. This general finding was consistent across many variables. Another general finding was that perceived usefulness and perceived ease of use were consistently related to the constructs of the UTAUT survey instrument. Experience was not consistently related to these constructs. These findings indicate that an individual's acceptance of technology does not necessarily depend on their previous exposure to technology; rather it is the nature of the technology in terms of its presentations that seems to matter more. This is consistent with the concept of diffusion of innovation. In all, useful knowledge about technology acceptance is important for the efficient implementation of new technology and improving the efficiency of organizations of all sizes.

Limitations

The limitations here refer to the internal and external weaknesses in the validity of the study. The study adopted a non-experimental design so that the validity of the design

was not controlled by the researcher. The sampling method that was employed in the study was not able to gather information from a number of different corporations limiting the chances of obtaining a random sample of the entire population. Because the sample is coming from managers and IT professionals, a generalization to the other people in an organization may not be made. Another limitation includes the fact that the models that provided the foundation for this research have had their own validity issues. Overall, improvements could be made in order to increase the applicability of research results and conclusion.

Recommendations for Future Study

There are several suggestions for future research. First, the demographics that are used in the sample population could be more closely examined. There could be some revealing information regarding different demographics with respect to their levels of technology acceptance. Second the population could be more varied in future research. A majority of the sample population in this study were white males. The results from this study may not necessarily represent the all the factors affecting technology acceptance among a more diverse population. Another suggestion for future research would be to more closely investigate the nature of the different types of organizations from which individuals report. This study found that individuals from corporations were by far the most accepting of technology. Further research should investigate this finding to figure out why this happens. Last, further research should take into account different types of technology. There may be some nuances of technology acceptance when it comes to

different types of technology. This may provide a better understanding for those designing technology that will help to diffuse innovation more effectively.

REFERENCES

Adams, D., A., Nelson, R., R., & Todd, P., A. (1992). Perceived usefulness, ease of use, and usage of information. *MIS Quarterly, 16*(2), 227-247. Retrieved February 16, 2006 from ProQuest database.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211. Retrieved January 19, 2006, from ProQuest database.

Anderson, J. E., & Scwager, P. H. (2004). SME adoption of wireless LAN technology: Applying the UTAUT model. Paper presented at the 7th Annual Conference of the Southern Association for Information Systems. Retrieved November 14, 2006 from http://sais.aisnet.org/sais2004/Anderson%20&%20Schwager.pdf.

Bagozzi, R., Davis, F., & Warshaw, P., R. (1992). Development and test of a theory of technological learning and usage. *Human Relations, 45*(7), 659-686. Retrieved January 19, 2006 from ProQuest database.

Basanini, A., & Scarpetta, S. (2002). Growth, technological change, and ICT diffusion: Recent evidence from OECD countries. *Oxford Review of Economic Policy. 18* (3). 324-244.

Chatterjee, R., & Eliashberg, J. (1990). The innovation diffusion process in a heterogeneous population: A micromodeling approach. *Management Science.* Vol 36 (9). 1057-1079.

Chau, P. Y. K. (Fall, 1996). An Empirical Assessment of a Modified Technology Acceptance Model. *Journal of Management Information Systems.* Vol 13 (2). 185 – 204.

Cheng, J., M., S., Y Kao, L., L., & Lin, J., Y. (2004). An investigation of the diffusion of online games in Taiwan: an application of Roger's diffusion of innovation Theory. *Journal of American Academy of Business, l.5*(1/2), 439-445. Retrieved January 16, 2006 from ProQuest database.

Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly, 13*(3), 319-340. Retrieved January 19, 2006 from ProQuest database.

Davis, F. D. (1993). User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. *International Journal of Man and Machine Studies*, Vol 38. 475 - 487.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management Science*, Vol 35, 982 - 1003.

Dillon, A., & Morris, M. (1996). User acceptance of new information technology: theories and models. In M. Williams (ed.) *Annual Review of Information Science and Technology*, Vol. 31, Medford NJ: Information Today, 3-32.

Fichman, R. G. (1999). Diffusion and assimilation of information technologies innovations. In *Framing the Domains of IT Management: Projecting the Future Through the Past* (Ed. R. W. Zmud). Cincinnati (OH): Pinnaflex Educational Resources, Inc.

Fichman, R. G. (2001). The role of aggregation in the measurement of it-related organizational. *MIS Quarterly, 25*(4), 427-455. Retrieved January 16, 2006, from ProQuest database.

Garcia, S., G. (2002). Accelerating CMMI implementation with technology adoption tools. *Carnegie Mellon University.* Retrieved January 19, 2006 from http://www.sei.cmu.edu/news-at-sei/features/2002/3q02/feature-1-3q02.htm#footnote1

Hart, J., & Hannan, M. (2004). The future of mobile technology and mobile wireless computing. *Campus - Wide Information Systems, 21*(5), 201-204. Retrieved January 16, 2006 from ProQuest database.

Hayes, J. (2001). National weather service science and technology infusion plan. *U.S. Department Of Commerce.* Retrieved January 19, 2006 from http://www.nws.noaa.gov/ost/NWS_TIP.pdf

Hu, P. J., Chau, P. Y. K., Sheng, O. R. L., & Tam, K. Y. (Fall, 1999). Examining the Technology Acceptance Model using physician acceptance of telemedicine technology. *Journal of Management Information Systems.* Vol 16 (2). 91 – 112.

Kappelman, L. A. (1995). A diffusion of innovation perspective. Retrieved December 19, 2006 from http://courses.unt.edu/kappelman/aboutwork/articles/database.htm

Karahanna, E., Straub, D. W., & Chervany, N.L. (1999). Information technology adoption across time: A cross-sectional comparison of pre- and post-adoption beliefs. *MIS Quarterly. 23*(2). 183-213.

Katz, M., & Fitzek, F. H. P. (2005). On the definition of the fourth generation wireless communications networks: The challenges ahead. *International workshop on convergent technologies.* Retrieved January, 19, 2006 from http://kom.aau.dk/~ff/documents/IWCTKatzFitzek2005.pdf

Keat, T. K., & Mohan, A. (2004). Integration of TAM based electronic commerce models for trust. *Journal of American Academy of Business, 1.5*(1/2), 404-410. Retrieved January 16, 2006 from ProQuest database.

Keil, M., Beranek, P. M., & Konsynski, B. R. (1995). Usefulness and ease of use: Field study evidence regarding task considerations. *Decision Support Systems, 13(1),* 75-92. Retrieved February 16, 2007 from ProQuest database.

Landry, B. J., Griffeth, R., & Hartman, S. (2006). Measuring student perceptions of Blackboard using the Technological Acceptance Model. *Decision Sciences Journal of Innovative Education.* Vol 4 (1). 87 – 99.

Liao, H. (2005). Communication technology, student learning, and Diffusion of Innovation. *College Quarterly.* Vol 8 (2). Retrieved December 21, 2006 from http://www.senecac.on.ca/quarterly/2005-vol08-num02-spring/liao.html

Lu, J., Yu, C., & Liu, C. (2005). Facilitating conditions, wireless trust and adoption intention. *The Journal of Computer Information Systems, 46*(1), 17-24. Retrieved January 16, 2006 from ProQuest database.

Lu, J., Yu, C., Liu, C., & Yau, J. (2003). Technology acceptance model for wireless internet. *Internet Research. Bradford, 13*(3), 206-222. Retrieved January 16, 2006 from ProQuest database.

Malhotra, Y., & Galletta, D. F. (1999). Extending the Technological Acceptance Model to account for social influence: Theoretical bases and empirical validation. Proceedings of the 32nd Hawaii International Conference on Social Systems. Retrieved December 12, 2006 from http://www.brint.org/technologyacceptance.pdf

Marez, D. L., & Verleye, G. (2004). Innovation diffusion: The need for more accurate consumer insight. Illustration of the PSAP scale as a segmentation instrument. *Journal of Targeting, Measurement and Analysis for Marketing, 13*(1), 32-49. Retrieved January 16, 2006, from ProQuest database.

Pearcey, P., & Draper, P. (1996). Using the diffusion of innovation model to influence practice: a case study. *Journal of Advanced Nursing. 23*(4). 714-21.

Perez, M. P., Sanchez, A. M., Luis, P. D., Jose, C. M., & Jimenez, V. (2004). A technology acceptance model of innovation adoption: the case of teleworking. *European Journal of Innovation Management, 17*(4), 280-291. Retrieved January 16, 2006 from ProQuest database.

Research and Markets. *World Telecom Equipment Market. (2005).* Retrieved January 17, 2008, from http://www.researchandmarkets.com/reports/c32898

Roberts, J. H. (2000). Developing new rules for new markets. *Journal of the Academy of Marketing Science.* 28(1). 31 – 44.

Rogers, E. M. (1995). *Diffusion of Innovations* (Fourth Ed.). New York: Free Press.

Rogers, E. M. (1997). Diffusion of human factors design: Resistances and how to overcome them. *Proceedings of the Human Factors and Ergonomics Society, l*(1), 1-3. Retrieved January 16, 2006 from ProQuest database.

Rogers, E. M. (2003). *Diffusion of Innovations* (Fifth Ed.). New York: Free Press.

Rogers, E. M., & Scott, K. L. (1997). The diffusion of innovations models and outreach from the National Network of Libraries of Medicine to Native American Communities. Paper prepared for the National Network of Libraries of Medicine.

10 December 1997. Retrieved 3 September 2006 from http://nnlm.gov/archive/pnr/eval/rogers.html

Siau, K., Sheng, H., & Nah, F. (2003). Development of a framework for trust in mobile commerce. *Trust in Mobile Commerce*: Proceedings of the Second Annual Workshop on HCI Research in MIS. Retrieved October 16, 2006 from http://sigs.aisnet.org/SIGHCI/Research/ICIS2003/HCI03_14.pdf

Stavroulakis, P. (2006). *Third generation mobile telecommunication systems: UMTS and IMT-2000.* (1st ed.). Chania, Greece: Die Deutsche Bibliotheck – CIP – Einheitsaufnahme.

Tabachnick, B.G., & Fidell, L.S. (2001). Using multivariate statistics. *Needham Heights, MA: Allyn and Bacon*

Trafimow, D., & Fishbein, M. (1994). The moderating effect of behavior type on the subjective norm-behavior relationship. *The Journal of Social Psychology, 134*(6), 755-763. Retrieved January 16, 2006 from ProQuest database.

Venkatesh, V., Morris, G. M., Davis, B., G. & Davis, D. F. (2003). User acceptance of information technology: toward a unified view. *MIS Quarterly, 27*(3), 425-478. Retrieved January 19, 2006 from ProQuest database.

What is 3G. (2006). What is 3G. *Silicon Press.* Retrieved January 19, 2006 from http://www.silicon-press.com/briefs/brief.before3g/

Wilde, D. W., & Swatman, P.A. (1999). A preliminary theory of telecommunications enhanced communities. Global Networked Organizations. A publication of the Twelfth International Bled Electronic Commerce Conference.

Ziff, D. (2006). Wireless data. *Encyclopedia*. Retrieved January 19, 2006 from http://www.pcmag.com/encyclopedia_term/0,2542,t=wireless+data&i=54766,00.asp

BIBLIOGRAPHY

Alghalith, N. (2005). Competing with it: the UPS case. *Journal of American Academy of Business, 7*(2), 7-15. Retrieved January 16, 2006 from ProQuest database.

Azjen, I., & Fishbein, M. (1980). *Understanding Attitudes and Predicting Human Behavior*. New York: Harper Collins.

Chau, P. Y. K. (Fall, 1996). An Empirical Assessment of a Modified Technology Acceptance Model. *Journal of Management Information Systems*. Vol 13 (2). 185 – 204.

Chen, L., & Nath, R. (2005). Nomadic Culture: cultural support for working anytime, anywhere. *Information Systems Management, 22*(4), 56-64. Retrieved January 16, 2006 from ProQuest database.

Johnson, S. D., & Bharadwaj, S. (2005). Digitization of selling activity and sales force performance: An empirical investigation. *Academy of Marketing Science, 33*(1), 3-18. Retrieved January 16, 2006 from ProQuest database.

Karahanna, E., Straub, D. W., & Chervany, N. L. (1999). Information technology adoption across time: A cross-sectional comparison of pre-adoption and post-adoption beliefs. *MIS Quarterly, 23*(2), 183-213. Retrieved January 16, 2006 from ProQuest database

Leventhal, M. (2002). The Golden Age of Wireless. *Intellectual Property & Technology Law Journal. Clifton, 14*(1), 1-6. Retrieved January 16, 2006, from ProQuest database.

Olla, P., & Atkinson, C. (2004). Developing a wireless reference model for interpreting complexity in wireless projects. *Industrial Management + Data Systems, 104*(3/4), 262-272. Retrieved January 16, 2006 from ProQuest database.

Venkatesh, V., & Brown, S. A. (2001). A longitudinal investigation of personal computers in homes: Adoption determinants and emerging challenges. *MIS Quarterly, 25*(1), 71-102. Retrieved January 16, 2006 from ProQuest database.

APPENDICES

Appendix A - IRB Approval

Lynn University

Principal Investigator: Igal Hebron
Project Title: Technology Acceptance Factors Affecting Adoption of Wireless Data Technology

IRB Project Number: 2008-019 Request for Expedited Review of Application and Research Protocol for a New Project

IRB Action by the IRB Chair or Another Member or Members Designed by the Chair:

Expedited Review of Application and Research Protocol and Request for Expedited Review (FORM 3): Approved X

COMMENTS:

Consent Required: No _____ Yes X Not Applicable _____ Written X Signed____.

Consent forms must bear the research protocol expiration date of 08/08/09

Application to Continue/Renew is due:

1) For an Expedited IRB Review, one month prior to the due date for renewal X .
2) Other:

Name of IRB Chair: Farideh Farazmand

Signature of IRB Chair [redacted] Date: 08/08/08

Cc. Dr. Cipolla

Institutional Review Board for the Protection of Human Subjects
Lynn University
3601 N. Military Trail Boca Raton, Florida 33431

Appendix B - Authorization for Voluntary Consent

http://www.surveymonkey.com - [SURVEY PREVIEW MODE] [illegible]

File Edit View Favorites Tools Help

Technology Acceptance Factors Affecting Adoption of Wireless Data Technology

Exit this survey >>

1. Informed Consent

Institutional Review Board for the Protection of Human Subjects
Lynn University
3601 N. Military Trail Boca Raton, Florida 33431

Lynn University
THIS DOCUMENT SHALL ONLY BE USED TO PROVIDE AUTHORIZATION FOR VOLUNTARY CONSENT

PROJECT TITLE: Technology Acceptance Factors Affecting Adoption of Wireless Data Technology
Project IRB Number ______ Lynn University 3601 N. Military Trail Boca Raton, Florida 33431
2008-019

I, Igal Hebron am a doctoral student at Lynn University. I am studying Global Leadership, with a specialization in Corporate and Organizational Management. One of my degree requirements is to conduct a research study.

DIRECTIONS FOR THE PARTICIPANT:

You are being asked to participate in my research study. Please read this carefully. This form provides you with information about the study. The Principal Investigator (Igal Hebron) will answer all of your questions. Ask questions about anything you don't understand before deciding whether or not to participate. Your participation is entirely voluntary and you can refuse to participate without penalty or loss of benefits to which you are otherwise entitled. You acknowledge that you are at least 18 years of age, and that you do not have medical problems or language or educational barriers that preclude understanding of explanations contained in this authorization for voluntary consent.

PURPOSE OF THIS RESEARCH STUDY: The study is about acceptance and adoption of wireless data technology. There are approximately 10,000 people invited to participate in this study. Participants are individuals from different types of organizations including schools, large corporations and small scale businesses who use wireless data technology.

PROCEDURES:
After reading this consent form you may click on the "I agree" button at the end of this form. You will need to complete a eight part questionnaire including 40 questions. The questionnaire should not take you more than 15 minutes to complete using the online tool. After completing the questionnaire. Be assured that your questionnaire will be received without any personal information, such as your email address, your name, or your IP address. Do not leave any identifiers on the questionnaire.

POSSIBLE RISKS OF DISCOMFORT: This study involves minimal risk. You may find that some of the questions are sensitive in nature. In addition participation in this study requires a minimal amount of your time and effort.

POSSIBLE BENEFITS: There may be no direct benefit to you in participating in this research. But knowledge may be gained, which may help the telecommunication industry in the U.S. to increase their competitive advantage, and the key point to consider before deciding to invest in a particular country.

FINANCIAL CONSIDERATIONS: There is no financial compensation for your participation in this research. There are no costs to you as a result of your participation in this study.

ANONYMITY: Anonymity will be maintained to the degree permitted by the technology used. Specifically, no guarantees can be made regarding the interception of data sent via the Internet by any third parties. The researcher will not identify you and data will be reported as "group" responses. Participation in this survey is voluntary. Clicking on the "I agree" button will constitute your informed consent to participate. All information will be held in strict confidence and will not be disclosed unless required by law or regulation.

RIGHT TO WITHDRAW: You are free to choose whether or not to participate in this study. There will be no penalty or loss of benefits to which you are otherwise entitled if you choose not to participate.

CONTACTS FOR QUESTIONS/ACCESS TO CHART: [illegible] or any time in the future, will be answered by Igal Hebron who may be reached at: [illegible] and Dr. [illegible], faculty advisor who may be reached at: 561-237-7164. For any questions regarding your rights as a research subject, you may call Dr. Farideh Farazmand, Chair of the Lynn University Institutional Review Board for the Protection of Human Subjects, at 561-237-7847.

INVESTIGATOR'S AFFIDAVIT: I hereby certify that a written explanation of the nature of the above project has been provided to the person participating in this project. A copy of the written documentation provided is attached hereto. By the person's consent to voluntary participate in this study, the person has represented that he/she is at least 18 years of age, and that he/she does not have a medical problem or language or educational barrier that precludes his/her understanding of my explanation. Therefore, I hereby certify that to the best of my knowledge the person participating in this project understands clearly the nature, demands, benefits, and risks involved in his/her participation.

Sincerely,

Igal Hebron

* 1. Please check below

- Disagree
- Agree

Date of IRB Approval: 8/8/08
IRB Expiration Date: 8/8/09 [redacted]
The one Posted on the
Web should have
the IRB number
and dates. F.F.

Next >>

Done

should not post stamped one
on the Web. F.F.

48

Institutional Review Board for the Protection of Human Subjects
Lynn University
3601 N. Military Trail Boca Raton, Florida 33431

Lynn University
THIS DOCUMENT SHALL ONLY BE USED TO PROVIDE AUTHORIZATION FOR VOLUNTARY CONSENT

PROJECT TITLE: Technology Acceptance Factors Affecting Adoption of Wireless Data Technology.

Project IRB Number: _____ Lynn University 3601 N. Military Trail Boca Raton, Florida 33431

I Igal Hebron , am a doctoral student at Lynn University. I am studying Global Leadership, with a specialization in Corporate and Organizational Management. One of my degree requirements is to conduct a research study.

DIRECTIONS FOR THE PARTICIPANT:

You are being asked to participate in my research study. Please read this carefully. This form provides you with information about the study. The Principal Investigator (Igal Hebron) will answer all of your questions. Ask questions about anything you don't understand before deciding whether or not to participate. You are free to ask questions at any time before, during, or after your participation in this study. Your participation is entirely voluntary and you can refuse to participate without penalty or loss of benefits to which you are otherwise entitled. You acknowledge that you are at least 18 years of age, and that you do not have medical problems or language or educational barriers that precludes understanding of explanations contained in this authorization for voluntary consent.

PURPOSE OF THIS RESEARCH STUDY: The study is about acceptance and adoption of wireless data technology. There are approximately 4000 people invited to participate in this study. Participants are individuals from different types of organizations including schools, large corporations and small scale businesses who use wireless data technology.

PROCEDURES:
This email was sent to you as a blind copy. Protection of privacy of respondents includes encryption, security, and protection of IP addresses is used. If you agree to participate in this study after reading this consent form you may click on the "I agree" button at the end of this form. You will need to complete a eight part questionnaire including 39 questions. The questionnaire should not take you more than 15 minutes to complete using the online tool. After completing the questionnaire. Be assured that your questionnaire will be received without any personal information, such as your email address, your name, or your IP address. Do not leave any identifiers on the questionnaire.

POSSIBLE RISKS OR DISCOMFORT: This study involves minimal risk. You may find that some of the questions are sensitive in nature. In addition, participation in this study requires a minimal amount of your time and effort.

POSSIBLE BENEFITS: There may be no direct benefit to you in participating in this research. But knowledge may be gained, which may help the telecommunication industry in the U.S. to

increase their competitive advantage, and the key points to consider before deciding to invest in a particular country.

FINANCIAL CONSIDERATIONS: There is no financial compensation for your participation in this research. There are no costs to you as a result of your participation in this study.

ANONYMITY: Anonymity will be maintained to the degree permitted by the technology used. Specifically, no guarantees can be made regarding the interception of data sent via the Internet by any third parties. The researcher will not identify you and data will be reported as "group" responses. Participation in this survey is voluntary, clicking on the "I agree" button will constitute your informed consent to participate. All information will be held in strict confidence and will not be disclosed unless required by law or regulation.

RIGHT TO WITHDRAW: You are free to choose whether or not to participate in this study. There will be no penalty or loss of benefits to which you are otherwise entitled if you choose not to participate.

CONTACTS FOR QUESTIONS/ACCESS TO CONSENT FORM: Any further questions you have about this study or your participation in it, either now or any time in the future, will be answered by Igal Hebron who may be reached at: [redacted] and Dr. John Cipolla, faculty advisor who may be reached at: [redacted]. For any questions regarding your rights as a research subject, you may call Dr. Farideh Farazmand, Chair of the Lynn University Institutional Review Board for the Protection of Human Subjects, at [redacted] If any problems arise as a result of your participation in this study, please call the Principal Investigator Igal Hebron and the faculty advisor Dr. John Cipolla immediately.
A copy of this consent form will be given to you.

IVENSTIGATOR'S AFFIDAVIT
I hereby certify that a written explanation of the nature of the above project has been provided to the person participating in this project. A copy of the written documentation provided is attached hereto. By the person's consent to voluntary participate in this study, the person has represented that he/she is at least 18 years of age, and that he/she does not have a medical problem or language or educational barrier that precludes his/her understanding of my explanation. Therefore, I hereby certify that to the best of my knowledge the person participating in this project understands clearly the nature, demands, benefits, and risks involved in his/her participation.

[redacted]
Signature of Investigator

Date of IRB Approval: _____
Date of Expiration: _____

☐ I Agree

☐ I don't Agree

Appendix C - Survey Monkey Security Policy

Privacy Policy

Information Collection

We will not use the information collected from your surveys in any way, shape, or form. In addition, any other material you provide us (including images, email addresses, etc.) will be held in the strictest confidence.

In addition, we do not collect personally identifiable information about you except when you specifically provide this information on a voluntary basis. We will make every effort to ensure that whatever information you provide will be maintained in a secure environment.

However, even if you opt out of receiving any communications from SurveyMonkey.com, we reserve the right to contact you regarding your account status or any other matter that might affect our service to you and/or our records on you.

Information Use

SurveyMonkey.com reserves the right to perform statistical analyses of user behavior and characteristics. We do this in order to measure interest in and use of the various areas of the website.

SurveyMonkey.com collects IP addresses for system administration and record keeping. Your IP address is automatically assigned to your computer when you use the World Wide Web. Our servers record incoming IP addresses. The IP addresses are analyzed only in aggregate; no connection is made between you and your computer's IP address. By tracking IP addresses, we can determine which sites refer the most people to SurveyMonkey.com. (Think of an IP address like your zip code; it tells us in general terms where you're from.)

Cookies

"Cookies" are small text files a website can use to recognize repeat users. SurveyMonkey.com uses cookies to recognize visitors and more quickly provide personalized content or grant you unimpeded access to the website. With cookies enabled, you will not need to fill in password or contact information.

Information gathered through cookies also helps us measure use of our website. Cookie data allow us to track usage behavior and compile data that we can use to improve the site. This data will be used in aggregate form; no specific users will be tracked.

Generally, cookies work by assigning a unique number to the user that has no meaning outside of the Web site that he or she is visiting. You can easily turn off cookies. Most browsers have a feature that allows the user to refuse cookies or issues a warning when cookies are being sent. However, our site will not function properly without cookies. Enabling cookies ensures a smooth, efficient visit to our website.

Opting Out

Upon request, SurveyMonkey.com will allow any user to opt out of our monthly newsletter. Also, upon your request, SurveyMonkey.com will delete you and your personal information from our database; however, it may be impossible to delete all of your information without some residual data because of backups and records of deletions.

For more information regarding opting out of any mailing from SurveyMonkey.com, please visit our Help Center.

Safe Harbor and EU Data Protection Requirements

We have met the Safe Harbor requirements on 11/29/2004 02:29:37 PM SurveyMonkey.com has been placed on the Safe Harbor list of companies accordingly. This list can be found at:

http://web.ita.doc.gov/safeharbor/SHList.nsf/WebPages/Oregon.

General Security Policy

SurveyMonkey.com is aware of your privacy concerns and strives to collect only as much data as is required to make your SurveyMonkey experience as efficient and satisfying as possible, in the most unobtrusive manner as possible.

The foregoing policies are effective as of April 4, 2000. SurveyMonkey.com reserves the right to change this policy at any time by notifying users of the existence of a new privacy statement. This statement and the policies outlined herein are not intended to and do not create any contractual or other legal rights in or on behalf of any party.

Appendix D - Print Outs of E-Mail Invitation and Follow-Up E-Mails

Dear Participant,

My name is Igal Hebron. I am a student at Lynn University in Boca Raton, Florida, pursuing a PhD in Global Leadership, with a specialization in Corporate and Organizational Management. The purpose of this email is to invite you to participate in an online survey about technology acceptance factors affecting adoption of wireless data technology. The questionnaire consists of demographic questions, as well as questions regarding technology acceptance and other factors affecting the use of new technology. Ten thousand randomly selected IT managers and wireless data technology users are being asked to participate in this survey. The Lynn University Institutional Review Board has approved this study. This is an anonymous questionnaire and, upon submission, neither your name nor e-mail address will be attached to your answers.

Whether or not you participate, I would appreciate you forwarding this e-mail to your peers and subordinates who are at least 18 years or older, so they may participate in the study. Your knowledge and opinions regarding this topic makes your input invaluable. I invite you to please take a few minutes to review the informed consent and complete the anonymous questionnaire.

To begin, click this link:
http://www.surveymonkey.com/s.aspx?sm=0s9MPiJyQb7bl99KN_2f0zMA_3d_3d

PLEASE NOTE: Your firm's internet security system may prevent you from accessing the site directly. If you are unable to access the link above, please copy and paste the following address into your web browser.

http://www.surveymonkey.com/s.aspx?sm=0s9MPiJyQb7bl99KN_2f0zMA_3d_3d

Thank you for your time and consideration.

Sincerely,

Igal Hebron
Ph.D. Candidate
Lynn University
3601 N. Military Trail
Boca Raton, FL 33431
[redacted]

Appendix E - Permission to Use UTAUT Instrument from Dr. Venkatesh

January 29, 2008

Dear Dr. Venkatesh,

My name is Igal Hebron and I am a doctoral candidate in a Ph.D. program at Lynn University in Boca Raton, Florida. My major is Global Leadership, with a specialization in corporate and organizational management. My dissertation proposal focuses on technology acceptance, theory of reasoned action and diffusion of innovation, as it relates to wireless data technology. The topic of my research is Technology Acceptance Factors Affecting Adoption of Wireless Data Technology. I plan to examine the impact of several variables such as wireless trust, ease of use, usefulness, behavioral intention and attitudes on the diffusion of the technology

While doing my literature search for the dissertation, I read an excellent article by you, Mr. Venkatesh, V., Mr. Morris, G., M., Mr. Davis, B., G., and Mr. Davis, D., F. "User acceptance of information technology: toward a unified view".

I am writing to request permission to obtain (and purchase if necessary) the survey and the scales of the survey.

I am also requesting permission to reproduce the above scales and related materials in my dissertation. In addition, I am requesting permission to modify the above scales for my research study. Furthermore, ProQuest Information and Learning may supply copies of the dissertation on demand and may make the dissertation accessible in electronic formats.
If you do not control the copyright for any of the above materials, it would be most appreciated if you could provide me with contact information of who might be the proper rights holder(s), including current address(es). Otherwise, your permission confirms that you hold the right to grant the permission requested here. If you control the copyright for some of the aforementioned materials, you may list the permission for this material at the end of this letter.

Permission includes non-exclusive world rights to translate the scales to use the material and will not limit any future publications-including future editions and revisions-by you or others authorized by you. If permission is granted, I will include any statement of authorization for use that you request on all scales, or provide an APA note of permission. The copyright holder will be given full credit.

I would greatly appreciate your consent to my request. If you require any additional information, please do not hesitate to contact me., I can be reached at the below postal mail address, [redacted] or [redacted]

A duplicate copy of this request has been provided for your records. If you agree with the terms as described above, please sign the release form below and fax to [redacted].

Sincerely,

Igal Hebron
[redacted]
Mobile [redacted]
Fax [redacted]

Permission for instrument was received by Dr. Venkatesh on 2/20/2008

You have my permission to use the instrument for non-commercial purposes. Please cite the source appropriately.

If you mean using the scales and "reproducing them" as in typing them up--I believe you can cite the source and that is sufficient. If you intend to make copies of any materials, consult the copyright information published in the journal.

On a related matter, I have a paper on mobile adoption that appeared in MIS Quarterly in 2006 and a Communications of the ACM paper (not sure of the year) that I believe may be of interest to you. You can find the information on my web site.

Sincerely,
Viswanath Venkatesh
Professor and George and Boyce Billingsley Chair in Information Systems Information Systems Department Walton College of Business
University of Arkansas Fayetteville, AR 72701
Phone: [redacted]; Cell: [redacted]; Fax: [redacted]
Email: [redacted]; Website: http://vvenkatesh.com <http://vvenkatesh.com/>

Appendix F - Permission to Use TAM Instrument from Dr. Davis

From: Igal Hebron [mailto[redacted]
Sent: Monday, February 04, 2008 9:39 PM
To: Davis, Fred
Cc:[redacted]
Subject: Permission for instrument

February 4, 2008

Dear Dr. Davis,
My name is Igal Hebron and I am a doctoral candidate in a Ph.D. program at Lynn University in Boca Raton, Florida. My major is Global Leadership, with a specialization in corporate and organizational management. My dissertation proposal focuses on technology acceptance, theory of reasoned action and diffusion of innovation, as it relates to wireless data technology. The topic of my research is Technology Acceptance Factors Affecting Adoption of Wireless Data Technology. I plan to examine the impact of several variables such as wireless trust, ease of use, usefulness, behavioral intention and attitudes on the diffusion of the technology

While doing my literature search for the dissertation, I read an excellent article by you "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology".
I am writing to request permission to obtain (and purchase if necessary) the survey and the scales of the survey.

I am also requesting permission to reproduce the above scales and related materials in my dissertation. In addition, I am requesting permission to modify the above scales for my research study. Furthermore, ProQuest Information and Learning may supply copies of the dissertation on demand and may make the dissertation accessible in electronic formats.

If you do not control the copyright for any of the above materials, it would be most appreciated if you could provide me with contact information of who might be the proper rights holder(s), including current address(es). Otherwise, your permission confirms that you hold the right to grant the permission requested here. If you control the copyright for some of the aforementioned materials, you may list the permission for this material at the end of this letter.

Permission includes non-exclusive world rights to translate the scales to use the material and will not limit any future publications-including future editions and revisions-by you or others authorized by you. If permission is granted, I will include any statement of authorization for use that you request on all scales, or provide an APA note of permission. The copyright holder will be given full credit.

I would greatly appreciate your consent to my request. If you

require any additional information, please do not hesitate to contact me., I can be reached at the below postal mail address, [redacted], or [redacted]

If you agree with the terms as described above, please sign the release form below and fax to [redacted].

Sincerely,

Igal Hebron
[redacted]
Mobile [redacted]
Fax [redacted]

Permission for instrument was received by Dr. Davis on 2/12/2008

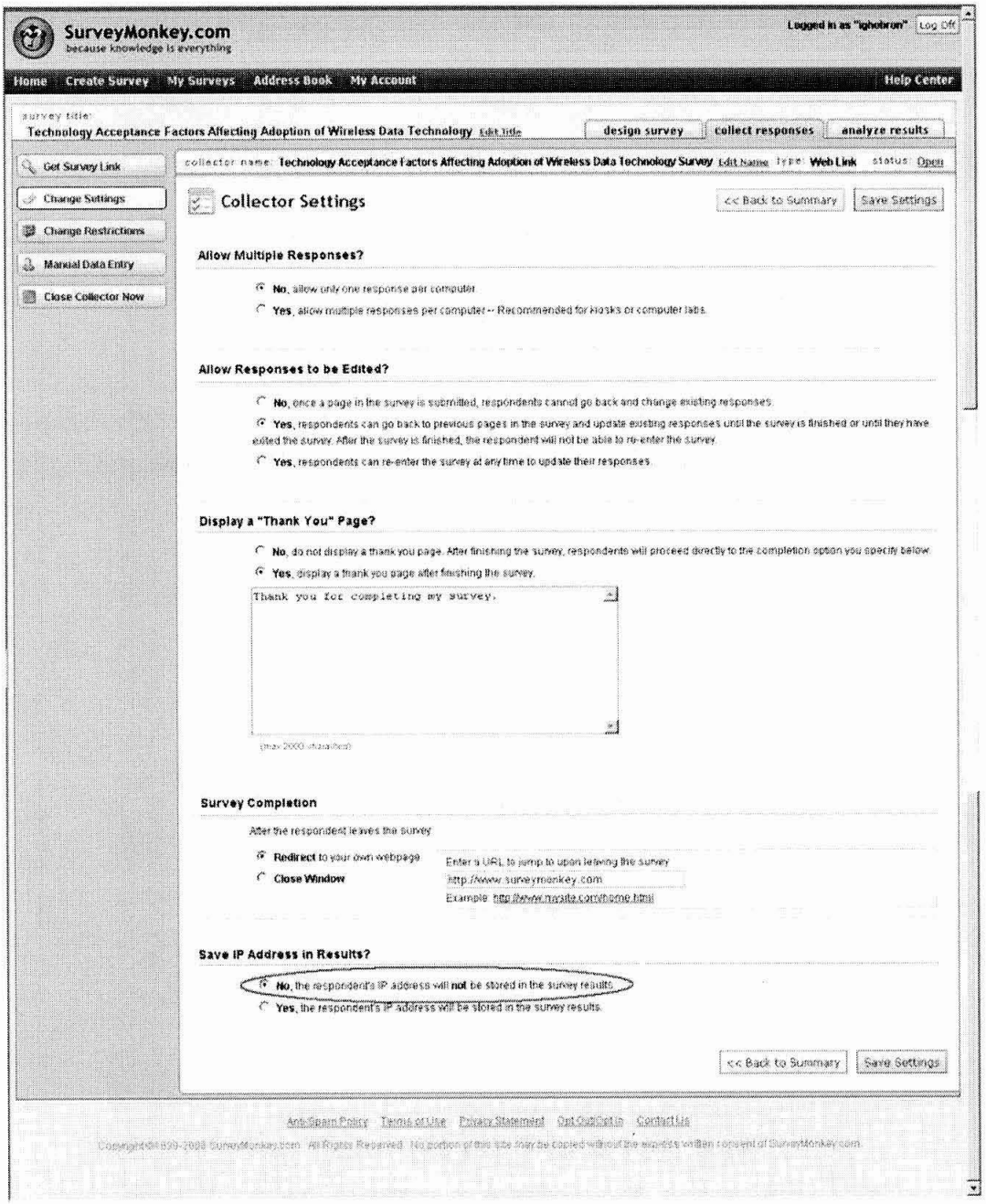
Dear Igal
The paper you mention appeared in MIS Quarterly, and the journal holds the copyright. It is okay with me if you adapt and use the scales from the paper as long as you cite the MISQ paper in any written reports or articles based on the study. There is no charge from me for this.

I am sending the contact information for MIS Quarterly.
http://www.misq.org/
Best wishes in your research.

Fred D Davis
Distinguished Professor and David D Glass Chair
Information Systems Department
Sam M. Walton College of Business
University of Arkansas

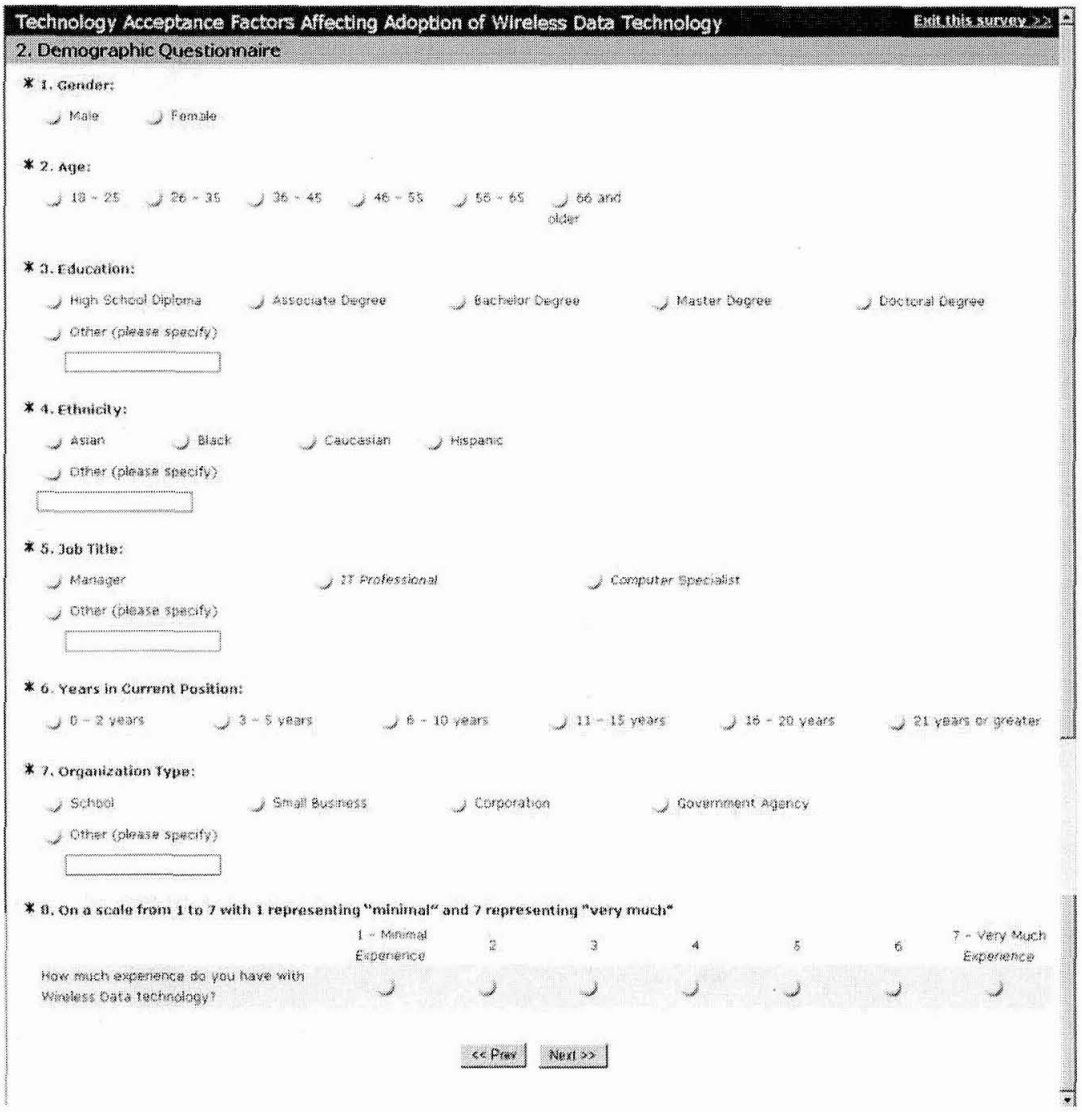
US mail
Attn: Fred Davis
BADM 204
1 University of Arkansas
Fayetteville, AR 72701-1201
phone [redacted]
fax [redacted]
email [redacted]

Appendix G - Survey Monkey Confirmation of IP tracking feature turned off during data collection


SurveyMonkey.com
because knowledge is everything
Logged in as "ighobron" Log Off
Home Create Survey My Surveys Address Book My Account Help Center
survey title:
Technology Acceptance Factors Affecting Adoption of Wireless Data Technology Edit Title
design survey collect responses analyze results
Get Survey Link
Change Settings
Change Restrictions
Manual Data Entry
Close Collector Now
collector name: Technology Acceptance Factors Affecting Adoption of Wireless Data Technology Survey Edit Name type: Web Link status: Open
Collector Settings
<< Back to Summary Save Settings
Allow Multiple Responses?
No, allow only one response per computer
Yes, allow multiple responses per computer -- Recommended for kiosks or computer labs.
Allow Responses to be Edited?
No, once a page in the survey is submitted, respondents cannot go back and change existing responses.
Yes, respondents can go back to previous pages in the survey and update existing responses until the survey is finished or until they have exited the survey. After the survey is finished, the respondent will not be able to re-enter the survey.
Yes, respondents can re-enter the survey at any time to update their responses.
Display a "Thank You" Page?
No, do not display a thank you page. After finishing the survey, respondents will proceed directly to the completion option you specify below.
Yes, display a thank you page after finishing the survey.
Thank you for completing my survey.
Survey Completion
After the respondent leaves the survey:
Redirect to your own webpage
Close Window
Enter a URL to jump to upon leaving the survey:
http://www.surveymonkey.com
Example: http://www.mysite.com/home.html
Save IP Address in Results?
No, the respondent's IP address will not be stored in the survey results.
Yes, the respondent's IP address will be stored in the survey results.
<< Back to Summary Save Settings
Anti-Spam Policy Terms of Use Privacy Statement Opt Out/Opt In Contact Us
Copyright © 1999-2008 SurveyMonkey.com. All Rights Reserved. No portion of this site may be copied without the express written consent of SurveyMonkey.com.

Appendix H - Survey Instrument

Demographic Questionnaire



Technology Acceptance Factors Affecting Adoption of Wireless Data Technology — Exit this survey >>

2. Demographic Questionnaire

* 1. Gender:

Male Female

* 2. Age:

18 - 25 26 - 35 36 - 45 46 - 55 56 - 65 66 and older

* 3. Education:

High School Diploma Associate Degree Bachelor Degree Master Degree Doctoral Degree

Other (please specify)

* 4. Ethnicity:

Asian Black Caucasian Hispanic

Other (please specify)

* 5. Job Title:

Manager IT Professional Computer Specialist

Other (please specify)

* 6. Years in Current Position:

0 - 2 years 3 - 5 years 6 - 10 years 11 - 15 years 16 - 20 years 21 years or greater

* 7. Organization Type:

School Small Business Corporation Government Agency

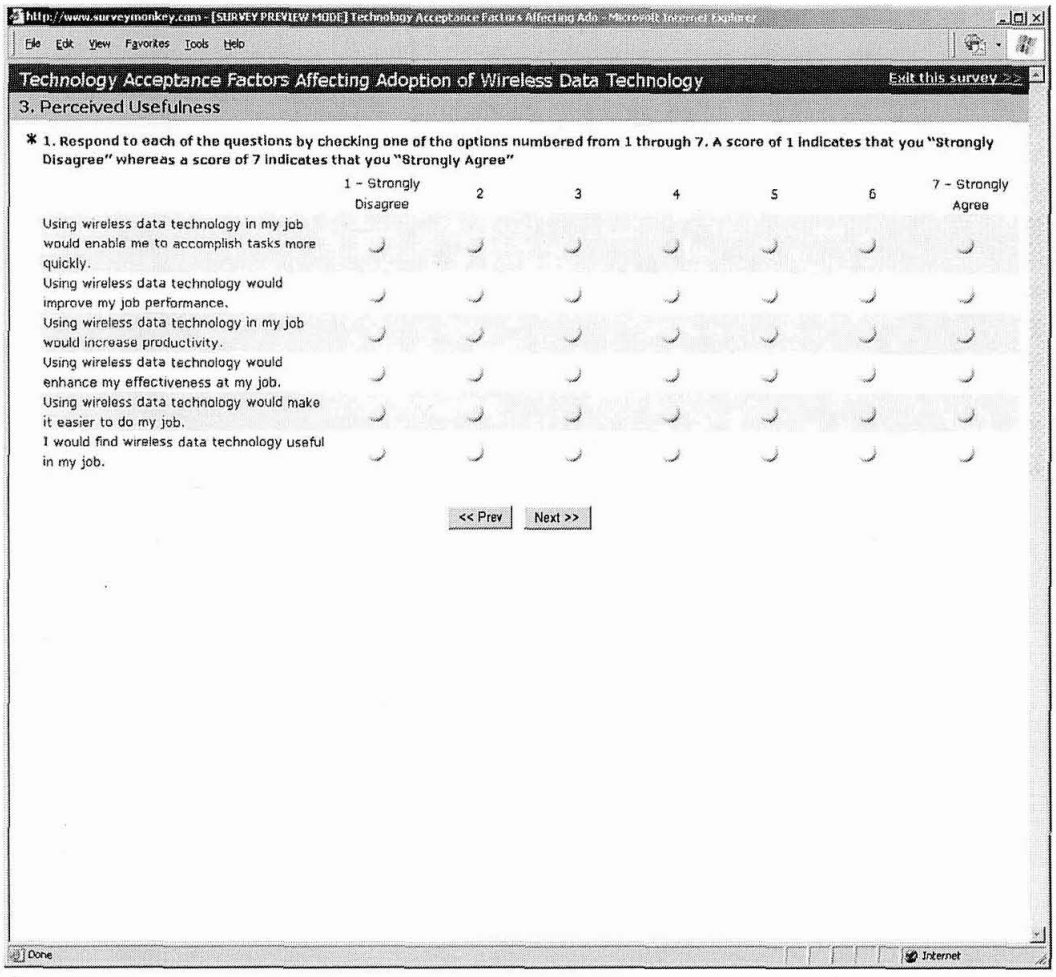
Other (please specify)

* 8. On a scale from 1 to 7 with 1 representing "minimal" and 7 representing "very much"

	1 - Minimal Experience	2	3	4	5	6	7 - Very Much Experience
How much experience do you have with Wireless Data Technology?							

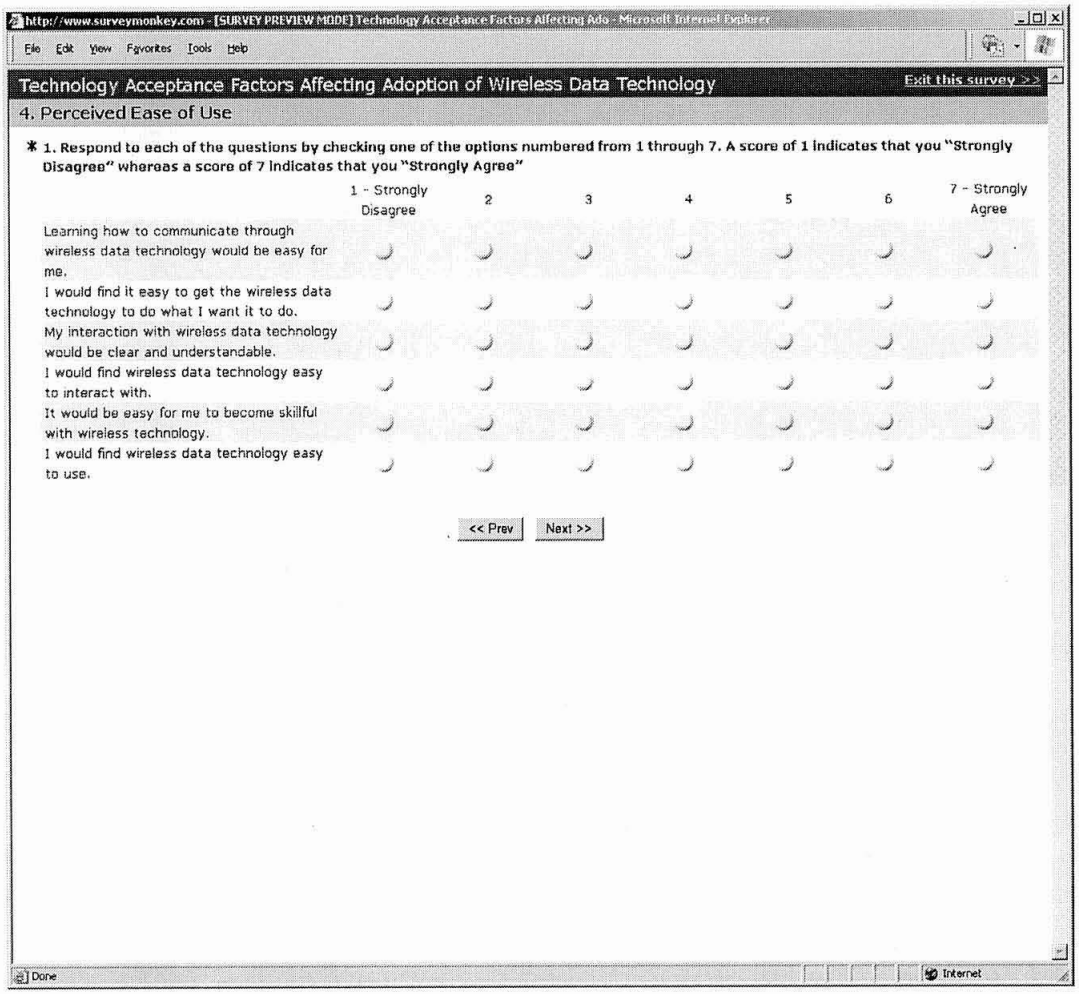
<< Prev Next >>

Perceived Usefulness Score



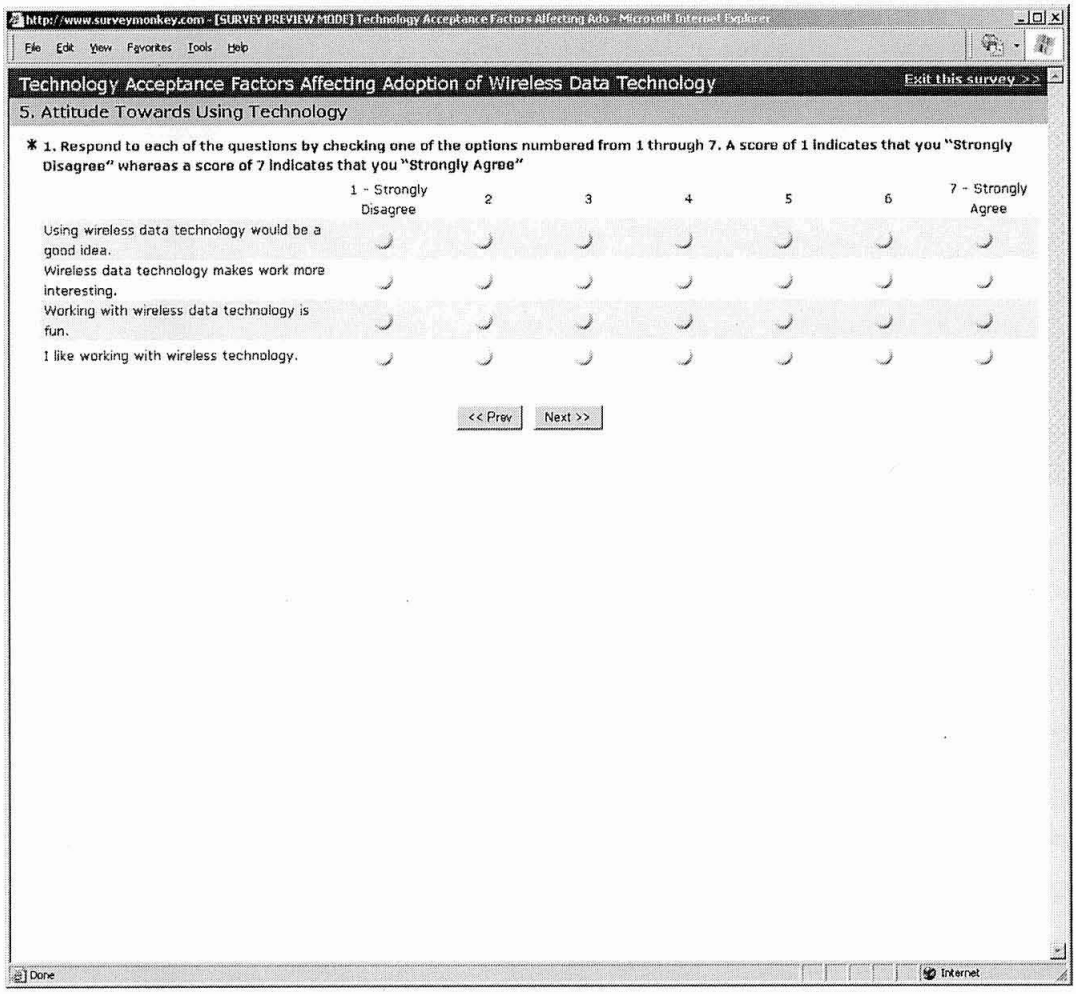
Adapted from: *Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology by Fred D. Davis, 1989.*

Perceived Ease of Use



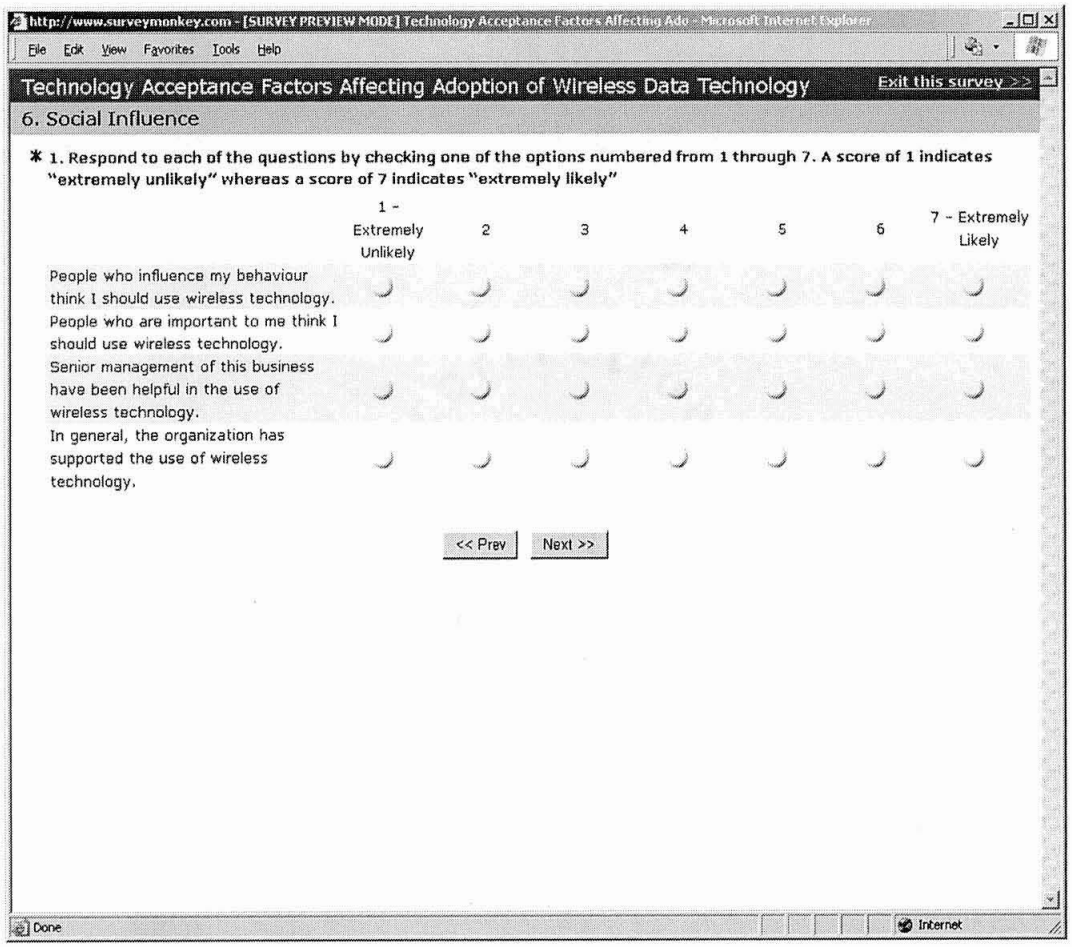
Adapted from: *Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology by Fred D. Davis, 1989.*

Attitude Towards Using Technology



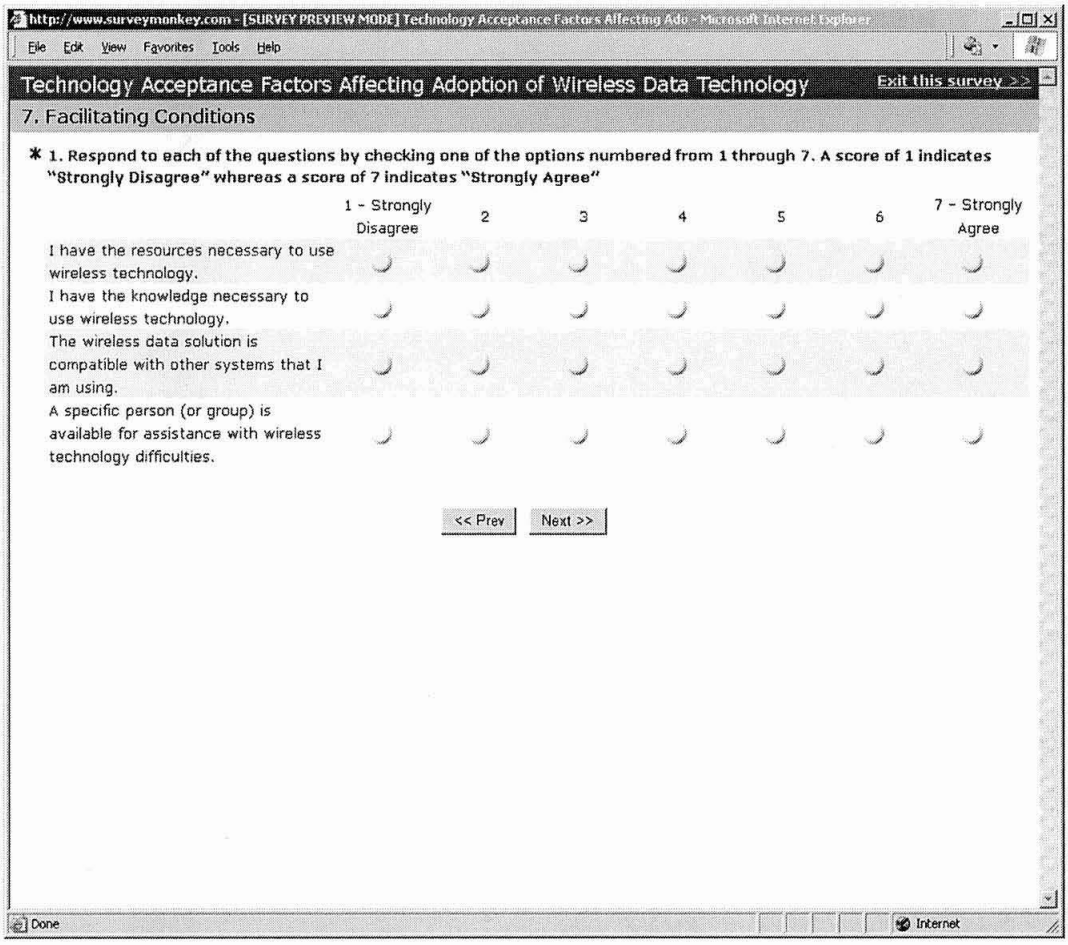
Adapted from: *User acceptance of information technology: toward a unified view by* Venkatesh, V., Morris, G., M., Davis, B., G., and Davis, D., F. (2003).

Social Influence



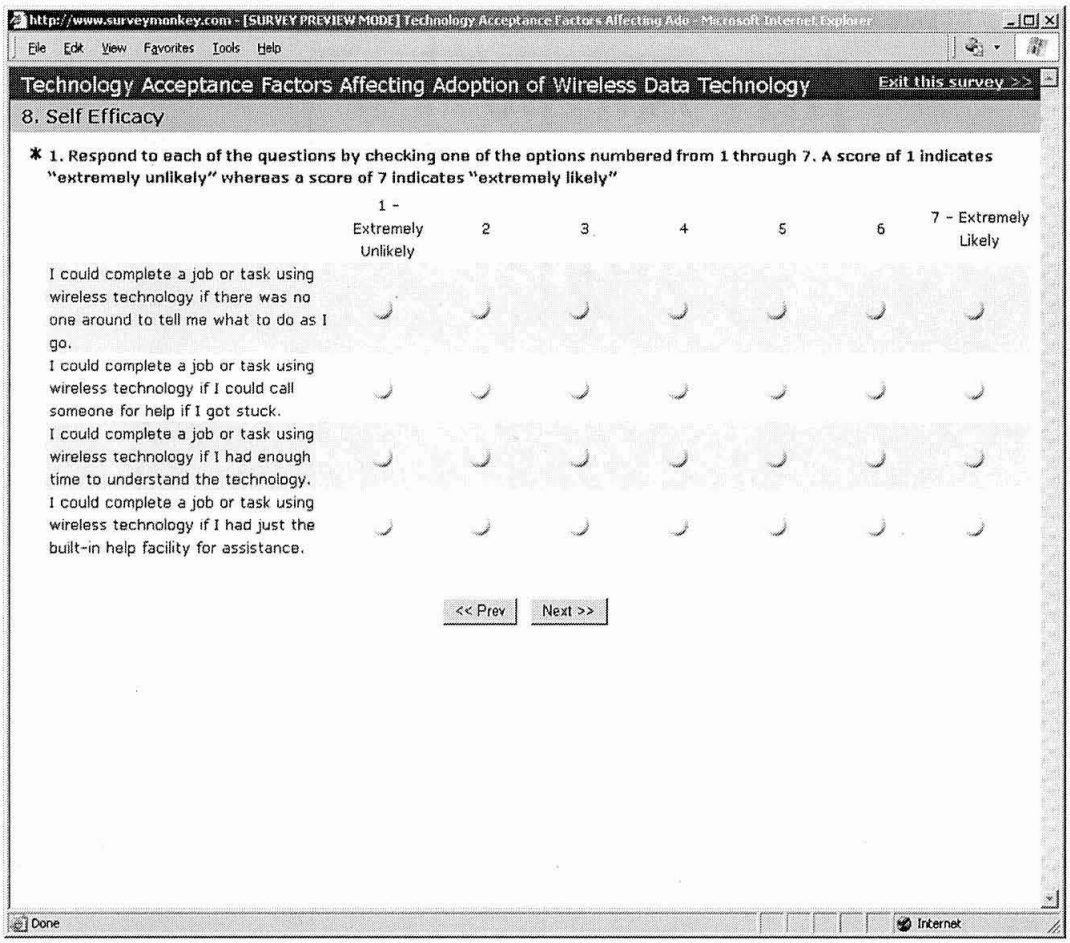
Adapted from: *User acceptance of information technology: toward a unified view by* Venkatesh, V., Morris, G., M., Davis, B., G., and Davis, D., F. (2003).

Facilitating Conditions



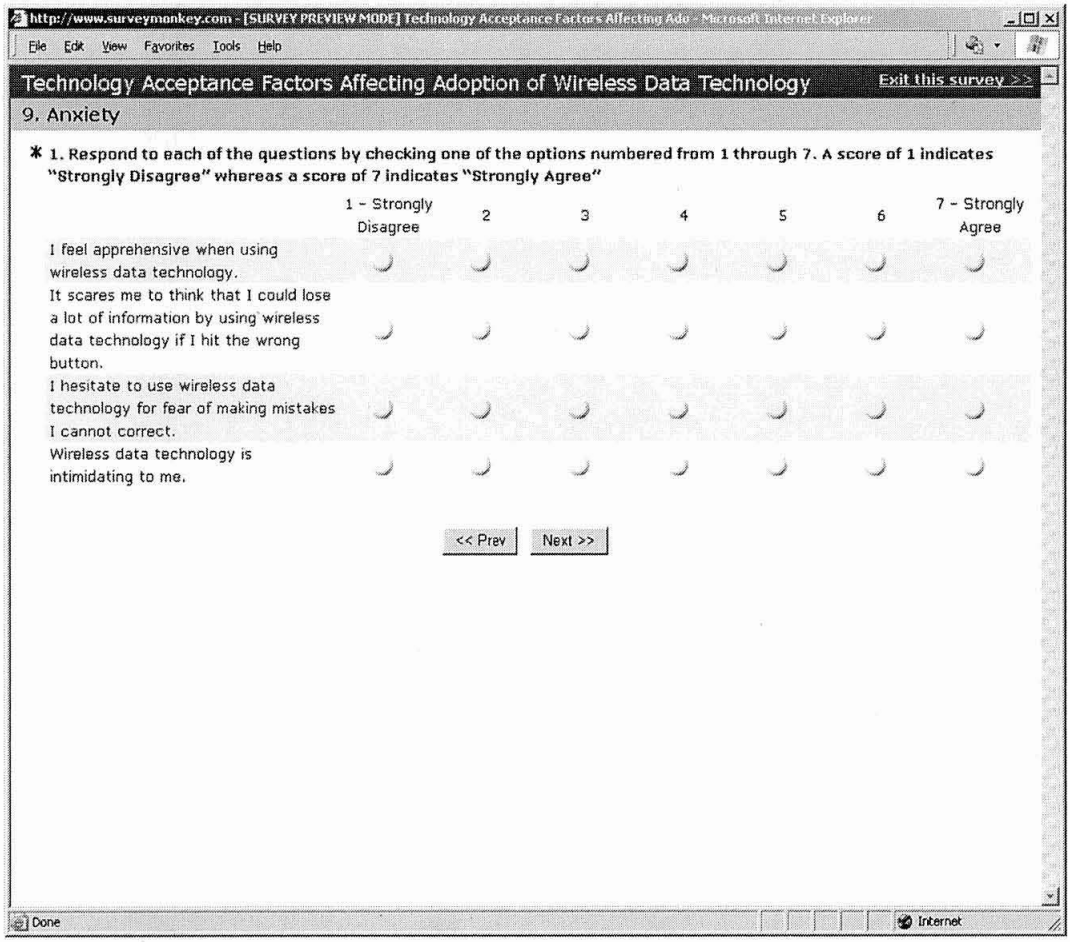
Adapted from: *User acceptance of information technology: toward a unified view by* Venkatesh, V., Morris, G., M., Davis, B., G., and Davis, D., F. (2003).

Self Efficacy



Adapted from: *User acceptance of information technology: toward a unified view by* Venkatesh, V., Morris, G., M., Davis, B., G., and Davis, D., F. (2003).

Anxiety



Adapted from: *User acceptance of information technology: toward a unified view by* Venkatesh, V., Morris, G., M., Davis, B., G., and Davis, D., F. (2003).