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Measuring the Acceptance of Internet Technology by Consumers

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ABSTRACT

This research reviews studies using the Technology Acceptance Model (TAM) to create a modified model and instrument to study the acceptance of Internet technology by consumers. We developed a modified TAM for the acceptance of Internet-based technologies by consumers. We retained the original constructs from the TAM and included additional constructs from previous literature including gender, experience, complexity, and voluntariness. We developed a survey instrument using existing scales from prior TAM instruments and modified them where appropriate. The instrument yielded respectable reliability and construct validity. The findings suggest that the modified TAM is a good predictor of consumer behavior in using the Internet. We found that attitude toward using the Internet acts as a strong predictor of behavioral intention to use, and actual usage of Internet technologies. Future researchers can use the resultant instrument to test how consumers adopt and accept Internet-based applications.

Keywords: *Attitude Toward Using Technology, E-Adoption, Experience, Gender, Internet, Perceived Usefulness, Technology Acceptance Model*

INTRODUCTION

This research develops measures for the acceptance of Internet technologies by consumers. Organizations spend millions of dollars annually on the development and enhancement of their Web sites to attract new customers and retain current customers (Amoroso, 2002). By investing in Web-based technologies, firms become more sophisticated by building Web sites with advanced capabilities and greater levels of personalization and functionality available to their customers (Amoroso & Gardner, 2003). But are consumers accepting these technologies as evidenced by their usage? This paper describes the development and testing of an instrument designed to measure the acceptance of Internet technologies by consumers. We designed this instrument to serve as a tool for the study of the acceptance of Internet-based applications by individuals and an indication of the Internet technology's diffusion from the organization to the consumer.

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Researchers made significant progress over the last decade in explaining and predicting user acceptance of information technologies. In particular, substantial theoretical and empirical support accumulated for the Technology Acceptance Model (TAM) (Davis, Bagozzi, & Warshaw, 1989). Numerous studies found that the TAM consistently explains a substantial proportion of variance in usage intentions and behavior, among a variety of technologies. TAM performs well against alternative models such as the Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB) (Mathieson, 1991; Sun, 2003). TAM theorizes that two beliefs determine an individual's behavioral intention to use a technology: perceived usefulness and perceived ease of use. TAM serves as a well-established and robust model for predicting user acceptance. TAM functions as one of the most influential research models in studies of determinants of information systems/ information technology acceptance (Chau & Hu, 2001).

While increasing numbers of empirical studies on Internet technologies have appeared recently, few studies on determinants of Internet usage and acceptance appeared. Only a small number of these studies focused on Internet technology (Agarwal & Karahanna, 2000, Gefen, Karahanna, & Straub, 2003, Koufaris, 2002, Van der Heijden, 2000, 2003). Much of the research appeared in the marketing area, studying the Internet from the consumer side from the studies using the technology acceptance model. Most studies examined very specific factors, rather than a more comprehensive acceptance model. The current work examines the following objectives:

1. **To review the existing user acceptance models:** This research reviews the current literature on technology acceptance by users and assesses the current state of knowledge with respect to understanding individual acceptance with new information technologies. While some studies look at similarities and differences across acceptance models, this review examines the technologies from which the studies examine findings. We selected studies that contain analyses relevant to Internet technology and constructs appropriate for our technology. We present a review of acceptance literature in the second section.
2. **To develop a model and metrics for Internet-based technologies:** Based upon the theory developed and empirically tested, we create a model that shows the impacts of the TAM constructs and external variables on consumer-based adoption patterns. We developed hypotheses from the theoretical foundation and empirical results of the studies that impact the consumer acceptance of Internet technologies. We subsequently developed and pre-tested an instrument by using and modifying the Technology Acceptance Model. We tested the instrument scales for reliability and validity and used factor analysis as an assessment of construct validity. We present the development of the model, metrics, instrument, and validation in the third and fourth sections.
3. **To empirically validate the TAM for Internet-based technologies:** An empirical test of the TAM for Internet-based technologies provides preliminary support for the hypotheses of the constructs measuring acceptance by users. Correlational analysis determined the significance of independent relationships of items. Multiple regression analysis helped to ascertain the cumulative effects of items on constructs. We present the empirical validation of the research model in the Analysis section.

THEORETICAL BACKGROUND

In this section, we focus on a key set of studies centered on online consumer behavior and technology acceptance constructs. While we realize that a wider set of studies reference technology assimilation and technology acceptance, we focus on those that advance or

modify the Technology Acceptance Model for specific technologies. We report the results of those studies as well as show the models. Based upon this theory, we propose and test a model of customer acceptance of Internet technologies.

Considerable research currently examines consumer behavior on the Web and use of Internet-based technologies. Given the strong growth in e-commerce and Web-based transactions in the past decade, online consumers are becoming more commonplace. Many studies have examined online consumers' behavior. These studies have determined that a variety of factors often influence consumers' intentions to purchase online. In preparing our model, we reviewed numerous articles concerning online consumer behavior to better understand which factors have shown significance in previous work. We have summarized the main findings from 39 of these studies in Appendix A.

For the purposes of this research, the online consumer can also be considered a user of technology. Assimilation is defined as the extent to which the use of a technology diffuses across organizational processes or society and becomes an integral part of the tasks associated with those processes (Cooper & Zmud, 1990; Gefen & Straub, 1997). Many researchers have focused on the importance of the causality between the adoption of an information technology and its impacts on business performance. The Technology Acceptance Model (TAM) is an adaptation of TRA specifically tailored for modeling user acceptance of information systems (Davis et al., 1989). The model provides a basis for tracing the impact of external factors on internal beliefs, attitudes, and intentions.

The two main constructs of TAM are perceived usefulness and perceived ease of use. Perceived usefulness is defined as the extent to which a person believes that using a technology will enhance her/his productivity and perceived ease of use is the extent to which a person believes that using a technology will be free of effort. TAM posits that behavioral intention determines actual systems use and behavioral intention is determined by both attitude and perceived usefulness. Perceived usefulness and perceived ease of use have both been found to have an effect on behavioral intention. Perceived ease of use also affects perceived usefulness. Behavioral intentions are influenced indirectly by external variables through perceived usefulness and perceived ease of use (Davis et al., 1989). The relative strength of the usefulness-usage relationship versus the ease of use-usage relationship is a significant finding and particularly important for designers. Users need to perceive the system as being useful or they will not attempt to use it regardless of how easy or difficult it is to use. Ease of use is less important because difficulty in using a system can be overcome if the user thinks that the system will be useful to them. Overall the model explained 47% of the overall model's variance. Davis modified his original TAM model (corroborating the finding of Mathieson (1991) where he found a stronger support of perceived ease of use construct with perceived usefulness rather than with intention to use.

Mathieson (1991) compared two models: the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB). Both models can be used to predict intention to use an IS. The models were compared on three criteria: (1) how well do they predict the user's intention to use an IS; (2) how valuable is the information provided by the model; and (3) how difficult are the models to apply. Three main differences were found to exist between TAM and TPB. First, the degree of generality varies. The beliefs that are involved in the TPB model are specific to each situation, whereas, the TAM assumes that beliefs about usefulness and ease of use are always primary determinants of use decisions. The second difference is the lack of social variables in TAM. Davis (1986) argues that social norms will be taken into account in the outcome evaluations. However, TPB may be able to account for some variance in intention by including social variables. Third, each model treats behavioral control differently. TAM's ease of use construct encompasses behavioral control, but only the internal control

factors. TPB includes the control variables for each situation independently. Mathieson (1991) found that both models explain intention well, but that TAM explained more variance than TPB; however these results were not significant enough statistically to consider one model better than the other. Mathieson concludes that TAM explained attitude much better than TPB. TAM is quick and inexpensive, but provides more general information, whereas TPB provides more specific information.

Chau and Hu (2001) compared three models in their study; the Technology Acceptance Model (TAM), the Theory of Planned Behavior (TPB), and a decomposed TPB model that is potentially adequate in the targeted healthcare professional setting in Hong Kong. The results indicated that TAM is superior to TPB in explaining the physicians' intention to use telemedicine technology. The decomposed TPB performed slightly better than TAM. Perceived usefulness emerged as the most significant factor for the physicians' technology acceptance while perceived ease of use did not emerge as a significant factor. Subjective norms showed no significant influence on behavioral intention. However, perceived behavioral control significantly affected behavioral intention. Compatibility emerged as a significant factor for perceived usefulness, but not for perceived ease of use.

Sun (2003) conducted a study analyzing the TAM model research models. He found that perceived ease of use shows significant effect on perceived usefulness in 15 studies, but is not studied in direct relationship with attitude toward using, behavioral intention to use or actual system use, as in most of the research findings. Experience using mediated the relationships between ease of use and perceived usefulness. Perceived usefulness emerged as the most important factor affecting all of the constructs related to user acceptance of a variety of technologies. Both gender and experience exerted mediating effects on perceived usefulness on user acceptance. Overall, Sun found that behavioral intention to use is a good predictor of usage; however it should be noted that many studies did not measure the actual system use construct. Attitude toward using cannot be considered a reliable predictor of behavioral intention to use, since in the seven studies analyzed, only three found a significant relationship to behavioral intention to use. They found a significant number of antecedents, expressed as external factors, for both perceived usefulness and perceived ease of use. Some of these factors served as mediators of certain constructs within the TAM model.

Venkatesh, Morris, Davis, and Davis (2003) reviewed the user acceptance literature empirically comparing eight models including TAM, theory of reasoned action (TRA), motivational model, theory of planned behavior (TPB), model of PC utilization, innovation diffusion theory, and social cognitive theory. They conducted longitudinal field studies at four organizations to measure the behavior of the acceptance models, thus enabling the formulation of a unified theory of acceptance and use of technology (UTAUT) model. The new model of acceptance in essence removes the traditional attitude toward using technology and introduces four attitudinal constructs: (1) performance expectancy, (2) effort expectancy, (3) social influence, and (4) facilitating conditions. They included moderating variables in their model such as gender, age, experience, and voluntariness of use. The post-training data pooled across studies (n=215) allowed for the testing of the UTAUT model, where they found a high degree of model significance for the measurement of model estimation in both the preliminary test and cross-validation test. The authors discovered a significant effect for men and younger workers for the performance expectancy construct on the behavioral intention to use. They also found a stronger effect for women, older workers, and those with limited experience on their expectation of effort required on behavioral intention to use. As well, they found a stronger effect for women, older workers, and those with limited experience, where mandatory usage occurred in the moderation of social influence on behavioral intention. They also discovered a strong relationship

between behavioral intention and usage. From a theoretical perspective, this study provides a comprehensive view of the determinants of intention and use behavior, aggregating many of the empirical studies investigating acceptance of technologies.

Dishaw, Strong, and Bandy (2004) suggest adding constructs from the task-technology fit (TTF) model (Goodhue & Thompson, 1995), such as technology functionality, task requirements, individual characteristics, and fit, to the UTAUT model in order to improve the explanatory power of UTAUT. Featherman (2001) suggested extending the technology acceptance model by including perceived risk.

Since 1994, there has been a large block of studies that have used the technology acceptance model for empirically based research. A number of these studies add one or more predictors to the model in order to try to increase its explanatory power. We reviewed many of these articles to examine which additional constructs add the most value to the traditional Technology Acceptance Model. A summary of 35 of these articles is provided in Appendix B. In the following sections of our paper, we provide support from these studies for the constructs we use in our proposed model.

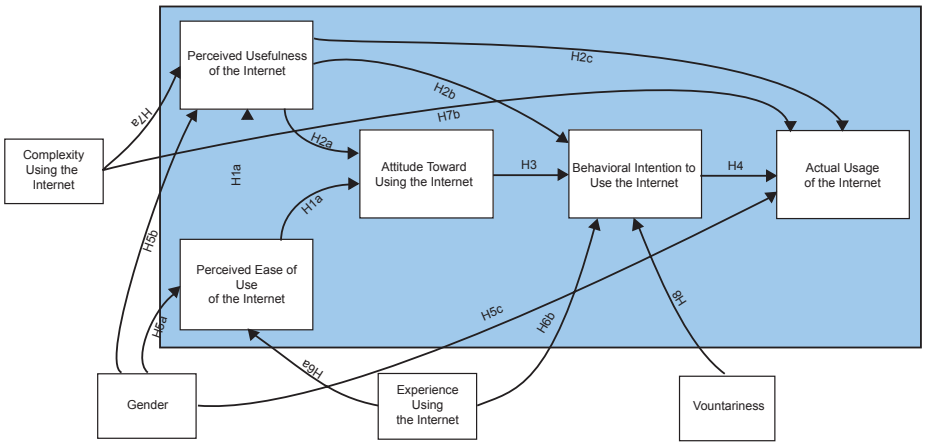
RESEARCH MODEL

The Technology Acceptance Model has tested the degree of acceptance of a wide variety of technologies. It could be argued that TAM provides a better overall fit with certain technologies than with others. Overall, the relationships may differ between constructs in TAM based upon the technology being studied. et al. Gefen et al. (2003) argue that a Web site is, in essence, an information technology and therefore TAM can explain online purchase intentions. Also shown in previous research (Gefen et al., 2003; Koufaris, 2002), the paths predicted by TAM also apply to e-commerce. The more useful and easy to use a Web site in enabling consumers to accomplish their tasks, the more it will be used. Based upon the empirical research of TAM constructs, a model is proposed from which to study the impacts of these constructs on the consumer-based adoption patterns. The research model (see Figure 1) consists of the original TAM with the external variables broken down into four items: (1) perceived complexity, (2) experience, (3) gender, and (4) voluntariness. We hypothesize that each of the four items will have a significant effect on Internet usage. Prior studies (Davis, 1986; Gefen & Straub, 1997; Taylor & Todd, 1995b; Venkatesh & Davis, 2000) showed the individual influence of each of these items (Davis et al., 1989; Gefen and Straub, 1997; Taylor & Todd, 1995a; Venkatesh & Davis, 2000). The considerable amount of research conducted on TAM varies in scope from extensions of the model to specific applications of the model. We present a modified research model for studying Internet-based applications. We offer the following related hypotheses based on the TAM theoretical foundation of research.

Perceived Ease of Use of the Internet

Perceived ease of use is defined as the degree to which an individual believes that using a particular system would be free of physical and mental effort. Previous studies suggest that perceived ease of use influences usefulness, attitude, intention, and actual use (Chau, 1996). Davis et al. (1989) found that perceived ease of use directly and indirectly affects usage through its impact on perceived usefulness through the attitude toward using the Internet. Davis et al. also found that perceived ease of use is a significant secondary determinant of people's intentions to use computers. Chau's study (1996) also showed that perceived ease of use significantly affected near-term usefulness, but did not significantly affect intention to use. Venkatesh and Davis (2000) discovered that TAM2 retains perceived ease of use from TAM as a direct determinant of perceived usefulness. The importance of perceived ease of use increased (Gefen & Straub, 1997) when an online shopper buys a product online as opposed to just

Figure 1. Research model for Internet-based applications



gathering information about a product. Van der Heijden (2004) found that perceived ease of use strongly determines intention to use a hedonic Web site. Lohse and Spiller (1998) stated that consumers prefer easy-to-navigate Web sites. Interestingly, Wu and Wang (2005) found that perceived ease of use did not significantly affect behavioral intention in a study concerning the acceptance of mobile commerce. However, we still propose that perceived ease of use remain an important variable in our study.

H1: *Perceived ease of use of the Internet is positively and significantly correlated to perceived usefulness of the Internet and attitude toward using the Internet.*

Perceived Usefulness of the Internet

Perceived usefulness, based on expectancy theory, is concerned with an individual's beliefs in the decision making process (Venkatesh & Davis, 2000). Perceived usefulness is defined as the degree to which an individual believes that using a particular system would enhance his or her performance. Davis et al. (1989) found that a stronger and more consistent relationship between perceived usefulness and usage than between other variables reported in prior studies. Individuals evaluated the consequences of their behavior in terms of perceived usefulness and base their choice of behavior on the desirability of the usefulness (Chau, 1996). Usefulness emerged as most important factor affecting user acceptance with few exceptions (Sun, 2003). Szajna (1994) found a significant relationship between perceived usefulness and self-report usage in her study of 61 graduate business students, however not hypothesized in her revised TAM. In studying personal computing acceptance in small firms, Igbaria, Zinatelli, Cragg, and Cavaye (1997) found that perceived usefulness exerted a strong direct effect on usage. Sun (2003) found perceived usefulness to emerge as the most important factor affecting the constructs related to user acceptance of a variety of technologies. Pikkarainen, Pikkarainen, Karjaluoto, & Pahnila (2004) found that perceived usefulness was one of the main factors influencing acceptance of online banking. Carey and Day (2005) found a strong relationship between perceived usefulness and attitude. Van der Heijden (2004) found that perceived usefulness loses its predictive power for hedonic Web sites, however.

H2: *Perceived usefulness of the Internet is positively and significantly correlated to attitude toward using the Internet, behavioral*

intention to use the Internet, and actual usage of the Internet.

Attitude toward Using the Internet

Attitude toward using is defined as the user's evaluation of the desirability of his or her using the system. The attitude toward using is an individual's positive or negative feelings about performing the target behavior (Davis et al., 1989). Davis et al. (1989) found that user's attitudes significantly affected behavioral intention after a group of 107 users completed a one-hour introduction to a computer system. Fourteen weeks later, however, the relationship did not remain significant. Sun (2003) found that attitude does not reliably predict behavior to use or usage. Although many previous studies focused on behavior rather than attitude as an indicator of user acceptance, Mathieson (1991) found that the attitude construct was statistically valid for explaining intention to use, comparing the Theory of Planned Behavior with the TAM. Taylor and Todd (1995a) found that attitude is not a significant determinant of behavioral intention although the relationship between attitude and behavioral intention is more significant for experienced users. Chau and Hu (2001) reported perceived usefulness to be a significant determinant of attitude as well as behavioral intention. These findings show that users are likely to have a positive attitude if they believe that usage of a technology will increase their performance and productivity. Wu (2003) found that consumers who shop online have higher attitude scores, which are directly related to online purchase decisions. Athiyaman (2002) found that consumers may avoid online purchasing items such as airline tickets because of their attitudes concerning the security of the Internet. Since we are measuring the experience with which users interact with the Internet, we include attitude toward using in our modified TAM.

H3: *Attitude toward using the Internet is positively and significantly correlated to behavior toward using the Internet.*

Behavioral Intention to Use the Internet

Behavioral intention is defined as a measure of the strength of one's intention to perform a specified behavior. Sun and Zhang (2003) reported that behavioral intention does well in predicting actual usage of a technology. Prior studies also report similar findings (Davis et al., 1989; Taylor & Todd, 1995b; Venkatesh & Davis, 2000). Intentions predict people's computer use reasonably well from (Davis et al., 1989). Therefore, any factors that influence behavior act as indirect influences through behavioral intention. The results of Taylor and Todd's study (1995b) of inexperienced and experienced users confirmed a stronger correlation between behavioral intention and behavior (usage) for experienced users.

H4: *Behavioral intention toward using the Internet is positively and significantly correlated to actual usage of the Internet.*

Gender

Gender differences exist in many disciplines, including technology. In studying the gender differences in the perception and use of e-mail, Gefen and Straub (1997) found that women's and men's perceptions of technology differ. Women view e-mail as higher in social presence than men, and women placed a higher value on perceived usefulness than men. Also, their study supported the idea that men tend to feel more comfortable with computers. In another study by Venkatesh and Morris (2000), perceptions of usefulness strongly influenced men's decisions, whereas perceptions of ease of use and subjective norm affected women more. However, they concluded that men consider perceived usefulness to a greater extent than women in making their decisions regarding the use of a

new technology. This study showed that men perceive that more experience with the system makes it easier to use. Sun (2003) found that gender mediates perceived usefulness and user acceptance. Stafford, Turan, and Raisinghani (2004) found no differences between men's and women's involvement in online shopping across the United States, Finland, and Turkey, however.

H5: *Gender will significantly influence the perceived use of the Internet, perceived usefulness of the Internet, and actual usage of the Internet.*

Experience

Prior research suggests that experience is a determinant of behavior (Ajzen & Fishbein, 1980). Significant differences exist between experienced users and inexperienced users. For experienced users, a stronger link between intentions and usage exists (Taylor & Todd, 1995a). Also, perceived usefulness emerged as the strongest predictor of intention for the inexperienced group in the same study. The results of Taylor and Todd's study (1995a) of inexperienced and experienced users confirmed a stronger correlation between behavioral intention and behavior (usage) for experienced users. Venkatesh and Morris (2000) found that as direct experience with technology increases over time, individuals possess a better assessment of the benefits and costs associated with using that technology. They suggested that in the absence of direct behavioral experience with the target object, individuals anchor their perceptions to general abstract criteria, which in this case is the perceived usefulness of the Internet. Igbaria, Guimaraes, and Davis (1995) found that computer experience will directly and indirectly affect usage through beliefs. They found that individual skills and expertise relate to user beliefs and usage. They found computer experience and user training positively associated with perceived ease of use and perceived usefulness. Igbaria, Parasuraman, and Baroudi (1996) found that the use of computer technology depends on the technology itself and the level of skill or expertise of the individual using it. Mathieson's study empirically supported the relationship between experience, expressed as skills or expertise (1991). Venkatesh and Davis (2000) found that the perceived ease of use of a system measured after hands-on experience will be system specific and hence, significantly different from measures taken before hands-on experience. Agarwal and Prasad (1999) reported a strong relationship between an individual's prior experience with similar technologies and her/his behavior to use that technology. Szajna (1994) found that as an individual becomes more experienced with the information technology, usefulness directly determines not only intentions to use but also the usage behavior. Miyazaki and Fernadez (2001) found that higher levels of Internet experience lead to lower risk perceptions regarding online shopping. Sun (2003) found experience to mediate the relationships between ease of use and perceived usefulness.

H6: *Experience using the Internet will be positively and significantly correlated to perceived usefulness of the Internet and the behavioral intention to use the Internet.*

Complexity

Complexity is defined as the degree to which the user expects the technology to be free of effort. Perceived complexity is defined as the degree to which computer technology is perceived as relatively difficult to understand and use (Pitt, Berthon, & Watson, 1996). Davis et al. (1989) and Igbaria et al. (1996) measured complexity in terms of time taken to perform tasks, integration of computer results into existing work, and vulnerability. Igbaria et al. (1996) found strong relationships between perceived complexity and perceived usefulness and with usage. Chau and Hu (2001) reported that the more complex the technology, the less relevant experience and subsequently a weaker link exists between

perceived usefulness and behavioral intention to use. We hypothesize a negative relationship between complexity and Internet usage.

H7: *Perceived complexity of using the Internet will be negatively and significantly correlated to perceived usefulness of the Internet and the actual usage of the Internet.*

Voluntariness

The level of voluntariness is defined as the extent to which potential adopters perceive the adoption decision to be non-mandatory (Venkatesh & Davis, 2000). Organizations often require their employees to use a certain technology. However, some people will not agree to follow such regulations. In the Venkatesh and Davis study (2000), they found that voluntariness moderates the relationship between subjective norm and intention to use. Therefore, behavioral intentions vary between mandatory and voluntary usage (Sun & Zhang, 2003). Moore and Benbasat (1991) suggested that it is not necessarily actual voluntariness which will influence behavior, but rather a perception of voluntariness. Innovations diffuse because of the cumulative decisions of individuals to adopt them. It is not the potential adopters' perception of the innovation itself but their perceptions of using the innovation that are key to how rapidly the innovation diffuses. Venkatesh and Morris (2000) found that in the context of technology acceptance in voluntary usage settings, the influence of other users will diminish to non-significance over time with increasing experience with the target system. Sun and Zhang (2003) found that voluntariness is considered a moderating factor in shaping behavioral intention to use.

H8: *Voluntariness of using the Internet is positively and significantly related to the behavioral intention to use the Internet.*

Actual Usage of the Internet

Straub, Limayen, and Karahanna-Evaristo (1995) found that system usage demonstrates a notable practical value for managers interested in evaluating the impact of information technology. Igbaria et al. (1995) defined perceived usage as the amount of time interacting with a technology and the frequency of use. They found strong relationships with behavioral intent to use the technology. Igbaria et al. (1997) found individuals likely to use a system if they believe it is easy to use and will increase their performance productivity. Actual usage, as originally conceptualized in the Davis et al. study (1989), is measured by the frequency of use and the length of time of use. It is difficult to obtain objective measures of actual use for Internet-based technologies; consequently, many of the TAM studies either left out usage as a dependent variable, focusing solely on behavioral intention or else moved to perceived usage. Szajna (1994) recommended the examination of self-reported usage.

RESEARCH DESIGN

Measurement Scales

We operationalized theoretical constructs for the revised TAM based upon Internet technologies by using validated items from prior research (see Appendix C). After extensive research of TAM, we found that prior TAM studies used several common scales (Agarwal & Karahanna, 2000; Chau, 1996; Davis et al., 1989; Igbaria et al., 1996, 1997; Legris, Ingham, & Collerette, 2002; Van der Heijden, 2000; Venkatesh & Davis, 2000). We measure perceived usefulness, perceived ease of use, and behavioral intention using scales adapted from Davis et al. (1989) and Chau (1996). Perceived usefulness of the Internet included measuring the enablement of the ability to accomplish tasks more quickly, improvement in performance, using the Internet to increase productivity and enhancing effectiveness. Perceived ease of use measured

easiness to learn to use the Internet, getting what is needed, interacting with the Internet in a clear and concise manner, ease of flexibility, and respondents' ease to become skillful. We derived measures of attitude toward using the Internet primarily from the Agarwal and Karahanna study (2000) where they looked at fun and enjoyment interacting with the technology. We examined the behavioral intention to use the Internet as a combination of carrying out the task and planned utilization in the future (Agarwal & Prasad, 1999; Chau, 1996). To examine behavioral inclinations now (T1) and in the future (T2), we used the Venkatesh and Davis (2000) measures.

The external variables include the perceived complexity using the Internet, experience, voluntariness using the Internet, and gender. We derived the perceived complexity construct from Igbaria et al. (1997) where they measured the amount of time it takes to perform a task, the integration of the results into existing work, and the exposure of the Internet to the vulnerability of computer breakdowns and a loss of data. We operationalized the experience construct from the research of Venkatesh and Davis (2000) and Legris et al. (2002) where the perceived experience using the Internet is measured in conjunction with the number of years using the Internet. We derived voluntariness using the Internet from the Venkatesh and Davis (2000) research where they looked at the requirement to use the technology for work or school and where it enhances tasks where there is not a requirement to use it. We measured gender as a single-item as suggested by Gefen and Straub (1997). We used a perceptual measure for the actual usage variable for this technology due to the difficulty in obtaining actual logged data. Though some research suggests that self-reported usage measures are biased (Moore & Benbasat, 1991), other research suggests that self-reported usage measures correlate well with actual usage measures (Taylor & Todd, 1995a, 1995b; Venkatesh & Davis, 2000). As suggested by Venkatesh and Davis (2000), we minimized this potential problem by using the common-method variance resulting from measuring both self-reported usage and its determinants (intention, perceived usefulness, etc.) with single-item measures.

Survey Instrument

We developed a survey instrument for pre-test to ensure content validity. Davis et al. (1989) pointed out that psychometricians emphasize the validity of a measurement scale is built from the outset (Davis, 1986). To ensure content validity of the scales, the items selected must represent the concept about which generalizations are to be made. First, all items identified in existing instruments were categorized according to the various TAM scales published in the literature. This generated an initial item pool for each construct. To keep the length of the instrument reasonable, we selected three to six scales for the measurement of each of the constructs, keeping the wording similar to the original studies. The typical item in previous instruments tended to ask respondents to indicate a degree of agreement. We used this approach for this study, with a five-point Likert scale ranging from "strongly disagree" to "strongly agree" chosen as the response format. After creating the item pools for each construct, we re-evaluated these items to eliminate those that appeared redundant or ambiguous, which might load on more than one factor in subsequent research. We pre-tested the instrument with a respondent pool of 30 students. As appropriate, we modified the question formats based upon the statistical results of their responses and a set of interviews.

Data Sample

Subjects for this study included 192 students who were using Internet technologies in classes across four different departments at a major university in the United States. The sample included a fairly broad range of departments including management, computer science, geological science, and arts and letters. Of the 240 students requested to participate in this study,

192 agreed to complete the survey instrument, yielding a response rate of 80%.

Assessing Reliability and Validity

We found strong support for construct validity and reliability by examining Cronbach alpha reliability coefficients and by factor analysis using principal components measures. The measurement scales for this instrument showed strong psychometric properties. All measurement scales showed relatively high Cronbach alpha coefficients (see Figure 2) at α>=0.80 for all the measures with the exception of perceived complexity which is slightly below the lower bounds set for this study, near the α>=0.70 (Moore & Benbasat, 1991). This pattern of high scale reliability is consistent with much of the prior research dealing with the technology acceptance model.

We used factor analysis as an assessment of construct validity. Moore and Benbasat state that, where possible, data analysis ought to be grounded in a strong a priori theory set (1991). This research fits the approach where the constructs related to the acceptance of Internet technologies by consumers are based on a substantial body of prior research and where the scale development fits the construct's conceptual meaning as a method of ensuring construct validity. We conducted principal components analysis with varimax rotation yielding a seven-factor solution (see Figure 3) with eigenvalues greater than 1.0, explaining 72.2% of the variance in the data set.

We examined the rotated factor matrix (see Figure 4) for items that did not load strongly on any factor (<0.40), that loaded on another factor greater than the intended component, or that loaded relatively equally on more than one factor. All of the items from the perceived

Figure 2. Cronbach alpha coefficients

	Alpha	*Standardized item alpha*
Perceived Usefulness	0.909	0.909
Perceived Ease of Use	0.928	0.929
Attitude Toward Using	0.931	0.931
Behavioral Intention	0.874	0.901
Perceived Complexity	0.678	0.682
Voluntariness	0.846	0.848
Actual Usage	0.818	0.817

Figure 3. Principal components analysis

	Eigenvalues		
Component	*Total*	*% of Variance*	*Cumulative %*
1	13.114	38.571	38.571
2	3.155	9.279	47.850
3	2.604	7.659	55.508
4	1.909	5.614	61.123
5	1.606	4.725	65.848
6	1.108	3.260	69.108
7	1.066	3.136	72.244

Figure 4. Principal components analysis – factor loadings

	Component						
	1	2	3	4	5	6	7
Using the Internet can enable me to accomplish tasks more quickly	0.726	0.243	-0.049	0.228	0.151	0.056	0.145
Using the Internet can improve my performance	0.820	0.116	0.184	0.119	0.125	-0.026	0.062
Using the Internet can make it easier to do my tasks	0.798	0.200	0.026	0.168	0.231	-0.005	0.117
Using the Internet in my job/school can increase my productivity	0.786	0.147	0.053	0.133	0.145	-0.097	0.085
Using the Internet can enhance my effectiveness	0.839	0.200	0.077	0.126	0.072	-0.082	0.166
I find the Internet useful in my job/school	0.621	0.139	0.011	0.402	0.322	0.097	0.091
Learning to use the Internet is easy for me	0.132	0.766	0.276	0.111	0.270	0.066	0.114
I find it easy to get what I need from the Internet	0.424	0.677	0.024	0.198	0.159	0.068	0.156
My interaction with the Internet is clear and understandable	0.251	0.752	0.271	0.081	0.176	0.115	0.137
I find the Internet to be flexible to interact with	0.442	0.691	0.111	0.270	0.082	0.029	0.111
It is easy for me to become skillful at using the Internet	0.194	0.767	0.363	0.104	0.207	0.057	0.094
I find the Internet easy to use	0.103	0.811	0.233	0.127	0.169	0.101	0.108
How often do you use the Internet	0.137	0.207	0.672	0.300	0.197	-0.113	0.117
On average, how frequently do you use the Internet	0.006	0.321	0.591	0.345	0.020	-0.095	0.069
Indicate how frequently you use the Internet	0.104	0.219	0.718	0.164	0.081	-0.060	0.077
How many different Websites do you visit	0.027	0.124	0.707	0.119	0.005	0.004	-0.011
Number of different Internet tasks used	0.169	0.224	0.596	0.200	0.083	-0.066	-0.047
I have fun interacting with the Internet	0.335	0.315	0.246	0.727	0.208	-0.007	0.120
Using the Web provides me with a lot of enjoyment	0.286	0.277	0.279	0.746	0.122	-0.037	0.095
I enjoy using the Web	0.292	0.127	0.316	0.772	0.211	-0.013	0.055
Using the Web bores me	-0.330	-0.006	-0.273	-0.540	-0.090	-0.027	-0.292
I always try to use the Internet in as many cases/occassions as possible	0.437	0.273	0.113	0.330	0.347	-0.042	0.331
I always try to use the Internet to do a task whenever it has a feature to help me perform it	0.252	0.361	0.065	0.357	0.587	-0.048	0.210
I plan to use the Internet in the future	0.270	0.217	0.243	0.092	0.833	-0.065	-0.025
I intend to continue using the Web in the future	0.331	0.317	0.179	0.211	0.790	-0.051	-0.042
I expect my use of the Web to continue in the future	0.274	0.292	0.236	0.166	0.833	-0.019	-0.046
Using the Internet is voluntary as far as work/school is concerned	-0.157	0.108	0.089	0.037	0.062	0.822	0.001
I am not required to use the Internet for work/school	0.031	0.087	-0.089	0.003	-0.049	0.890	-0.031
While the Internet enhances my effectiveness, it is not required that I use it	0.049	0.040	-0.084	-0.070	-0.097	0.875	-0.042
Using the Internet can take up too much of my time when performing many tasks	-0.201	-0.213	-0.061	-0.307	0.053	0.109	-0.747
When I use the Internet, I find it difficult to integrate the results into my existing work	-0.031	-0.316	-0.124	-0.146	-0.166	0.114	-0.749
Using the Internet exposes me to the vulnerability of computer breakdowns and loss of	-0.245	-0.007	-0.054	0.047	0.093	-0.082	-0.622

usefulness construct loaded cleanly on a factor with all loadings >= 0.621. Perceived ease of use items all loaded at or above 0.677 showing strong excellent factor patterns. Actual utilization of Internet technologies showed loadings about 0.591 with all items remaining in the various scales loading together. The construct known as attitude toward using the Internet also showed strong component cohesion with all items loading together on the same factor, with loadings at or exceeding 0.727 in general, with the item where the "Web bores me" to have an expected negative loading at -0.540. We found behavioral intention to use the Internet to have performed in general as good with loadings above 0.587, while one item, "I always try to use the Internet in as many case/occasions as possible" loaded on another factor to a greater degree that the one that contained the other relative factors. The voluntariness construct showed strong construct validity with each item loading above 0.822. Finally, the construct revolving around the perceived complexity all showed negative loadings less than -0.622, as expected.

We then looked at the construct correlation matrix among the item in a particular construct (see Figure 5). We examined the correlations for each of the constructs in the study and found relatively good cohesiveness for most of the items. Moore and Benbasat (1991) suggested that a "good" range for a set of items in a factor cluster should be at 0.55 or higher, but at least 0.45 to be considered "fair" and reasonable for measuring new constructs. Perceived usefulness and perceived ease of use exhibited strong correlations between the items, with the lowest correlation at 0.565 and 0.586, respectively. The attitude toward using items were also strongly related, with the lowest correlation of 0.797. In the behavioral intent to use items, BI3 appears to more strongly correlated with BI4 (r =.849) and BI5 (r =.922) rather than with BI1 (r =.493) and BI2 (r =.436). This seems logical since BI4 and BI5 also concern the future usage of the Internet. The perceived complexity items were not all strongly related as the PC3 vari-

Figure 5. Construct correlation matrices

Perceived Usefulness Correlation Matrix

	PU1	PU2	PU3	PU4	PU5
PU1	1.000				
PU2	0.565	1.000			
PU3	0.738	0.700	1.000		
PU4	0.619	0.619	0.673	1.000	
PU5	0.603	0.726	0.713	0.713	1.000

Perceived Ease of Use Correlation Matrix

	PE1	PE2	PE3	PE4	PE5	PE6
PE1	1.000					
PE2	0.613	1.000				
PE3	0.680	0.693	1.000			
PE4	0.586	0.685	0.731	1.000		
PE5	0.737	0.624	0.771	0.682	1.000	
PE6	0.771	0.584	0.692	0.628	0.795	1.000

Attitude Toward Using Correlation Matrix

	AT1	AT2	AT3
AT1	1.000		
AT2	0.824	1.000	
AT3	0.797	0.836	1.000

Behavioral Intention Correlation Matrix

	BI1	BI2	BI3	BI4	BI5
BI1	1.000				
BI2	0.687	1.000			
BI3	0.493	0.436	1.000		
BI4	0.592	0.516	0.849	1.000	
BI5	0.542	0.470	0.922	0.941	1.000

Perceived Complexity Correlation Matrix

	PC1	PC2	PC3
PC1	1.000		
PC2	0.674	1.000	
PC3	0.310	0.265	1.000

Voluntariness Correlation Matrix

	VU1	VU2	VU3
VU1	1.000		
VU2	0.612	1.000	
VU3	0.594	0.745	1.000

Actual Usage Correlation Matrix

	AU1	AU2	AU3	AU4
AU1	1.000			
AU2	0.552	1.000		
AU3	0.745	0.535	1.000	
AU4	0.433	0.483	0.417	1.000

able on the vulnerability of using the Internet was suggested by Igbaria et al. (1997) as a measure of complexity was supported in their research. The voluntariness items all appeared to be strongly correlated with each other, where the lowest correlation is 0.594. The actual correlation items tended to be strongly correlated with the exception of AU4 (r =0.417) where the respondent was asked how many Web sites they had visited.

RESULTS

Descriptive Statistics

Figure 6 presents the descriptive statistics for the constructs and the statistics for individual items. An examination of perceived usefulness shows extremely strong scores on all items. It appears that most of the respondents in this study felt the Internet is useful in enabling them to accomplish tasks more efficiently (μ=4.48) and

Figure 6. Descriptive statistics

Perceived Usefulness	Mean	Median	Std. Dev.	Skewness	Minimum	Maximum
PU1 Using the Internet can enable me to accomplish tasks more quickly	4.48	5	0.686	-1.564	1	5
PU2 Using the Internet can improve my performance	4.17	4	0.786	-0.842	1	5
PU3 Using the Internet can make it easier to do my tasks	4.34	4	0.735	-1.201	1	5
PU4 Using the Internet in my job/school can increase my productivity	4.35	4	0.752	-1.136	1	5
PU5 Using the Internet can enhance my effectiveness	4.16	4	0.790	-0.736	1	5
PU6 I find the Internet useful in my job/school	4.54	5	0.662	-1.688	1	5
Perceived Ease of Use	**Mean**	**Median**	**Std. Dev.**	**Skewness**	**Minimum**	**Maximum**
PE1 Learning to use the Internet is easy for me	4.30	4	0.827	-1.570	1	5
PE2 I find it easy to get what I need from the Internet	3.95	4	0.902	-1.150	1	5
PE3 My interaction with the Internet is clear and understandable	4.03	4	0.869	-0.930	1	5
PE4 I find the Internet to be flexible to interact with	3.90	4	0.935	-0.732	1	5
PE5 It is easy for me to become skillful at using the Internet	4.07	4	0.855	-0.856	1	5
PE6 I find the Internet easy to use	4.24	4	0.841	-1.279	1	5
Attitude Toward Using	**Mean**	**Median**	**Std. Dev.**	**Skewness**	**Minimum**	**Maximum**
AT1 I have fun interacting with the Internet	3.97	4	0.892	-0.924	1	5
AT2 Using the Web provides me with a lot of enjoyment	3.71	4	0.986	-0.413	1	5
AT3 I enjoy using the Web	3.91	4	0.902	-0.645	1	5
AT4 Using the Web bores me	2.07	2	1.056	0.986	1	5
Behavioral Intention to Use	**Mean**	**Median**	**Std. Dev.**	**Skewness**	**Minimum**	**Maximum**
BI1 Use the Internet whenever there is a feature to help	4.04	4	0.873	-1.082	1	5
BI2 Use the Internet in as many cases/occassions as possible	3.66	4	0.975	-0.628	1	5
BI3 Plan to use the Internet in the future	4.57	5	0.618	-1.692	1	5
BI4 Will continue using the Web in the future	4.59	5	0.608	-1.760	1	5
BI5 Expect use of the Web to continue in the future	4.60	5	0.606	-1.814	1	5
Perceived Complexity	**Mean**	**Median**	**Std. Dev.**	**Skewness**	**Minimum**	**Maximum**
PC1 Using the Internet can take up too much of my time	2.80	3	1.141	0.118	1	5
PC2 Difficulty integrating Internet into work tasks	2.34	2	0.969	0.764	1	5
PC3 Exposure to Internet vulnerabilities	3.02	3	1.076	0.035	1	5
Voluntariness	**Mean**	**Median**	**Std. Dev.**	**Skewness**	**Minimum**	**Maximum**
VU1 Using the Internet is voluntary as far as work/school is concerned	3.02	3	1.162	-0.083	1	5
VU2 I am not required to use the Internet for work/school	2.52	2	1.102	0.355	1	5
VU3 It is not required to use the Internet to complete tasks	2.77	3	1.081	0.015	1	5
Actual Usage	**Mean**	**Median**	**Std. Dev.**	**Skewness**	**Minimum**	**Maximum**
AU1 How often do you use the Internet?	4.23	4	0.904	-1.109	1	5
AU2 On average, how frequently do you use the Internet?	3.45	3	0.966	0.281	1	5
AU3 Indicate how frequently you use the Internet	4.23	5	0.999	-1.161	1	5
AU4 How many different Websites do you visit?	3.81	4	0.854	-0.027	1	5
Internet Tasks	**Mean**	**Median**	**Std. Dev.**	**Skewness**	**Minimum**	**Maximum**
e-mail	0.950	1	0.216	-4.217	0	1
Research for papers	0.930	1	0.257	-3.379	0	1
School assignments	0.840	1	0.370	-1.839	0	1
Information gathering	0.830	1	0.380	-1.735	0	1
Searching	0.820	1	0.389	-1.638	0	1
News	0.710	1	0.457	-0.915	0	1
Entertainment	0.600	1	0.491	-0.426	0	1
Work-related	0.480	0	0.501	0.088	0	1
Shopping	0.520	1	0.501	-0.066	0	1
Instant messaging	0.450	0	0.499	0.198	0	1
Auctions	0.220	0	0.417	1.343	0	1
Chat rooms	0.080	0	0.274	3.084	0	1
Tasks TOTAL	7.410	7	2.296	-0.395	1	12

making it easier to do tasks in general (μ=4.34). We also found that the Internet is useful in the workplace to increase respondents' productivity (μ=4.35). We found that the Internet is extremely useful in the job or at school by the respondents in this study (μ=4.54).

Most of the items related to perceived ease of use showed strong means. The respondents found it relatively easy to use the Internet (μ=4.24) and easy to learn to use the Internet (μ=4.30). In the same way that learning to use the Internet was easy for the sample respondents, so was the ease at which they were skillful using the Internet (μ=4.07). Flexibility with Internet interaction (μ=3.90) also led respondents to find it easy to get what they need from the Internet (μ=3.95). The items associated with attitude toward using mean responses were around the 3.7-3.9 range. Most of the respondents reported having fun using the Internet (μ=3.97). With respect to enjoyment, respondents enjoyed using the Internet (μ=3.71, μ=3.91). Asking about the boredom using the Internet yielded a relatively low mean (μ=2.07), as expected.

Most of the scores related to behavioral intention to use came in relatively high. The items related to the behavioral usage in the future elicited fairly high responses, such as planning to use the Internet in the future (μ=4.57), will continue to use the Web in the future (μ=4.59), and expect one's use of the Web to continue in the future (μ=4.60). The items related to using the features of the Internet (μ=4.04) and using the Internet in as many cases as possible (μ=3.66) were significantly lower as individual indicators of a user's behavioral intention to use. The items related to perceived complexity using the Internet were lower than most of the other items in the survey, as expected. All of the items in this category contained questions that were negative in connotation; nevertheless if they are reversed out, the means are still much lower than other items.

The Internet was found not to take up too much of the respondent's time, with a moderate response (μ=2.80). Difficulty integrating the Internet into work tasks was not seen as too significant in this study (μ=2.34) and exposure to Internet vulnerabilities, such as security and virus protection, was not considered significant (μ=3.02). This last finding surprised us given the growth of online viruses and worms. The voluntariness items all appear to contain only a moderate degree of required usage when it came to using the Internet for school or work. Using the Internet is deemed voluntary (μ=3.02), not being required to use the Internet for work/school (μ=2.52), and not being required to use the Internet to complete tasks (μ=2.77). We can only conclude here that a majority of the respondents in this study felt that using the Internet was required in order to complete their work and/or school tasks. This finding is not unusual given that although use of the Internet was not deemed to be explicitly mandatory with most of the respondents, they felt that not using the Internet would not allow them to complete their tasks.

The actual usage variable was measured in terms of frequency of use and amount of use. Both frequency of use (μ=4.23) and amount of Internet usage (μ=4.23) were both relatively high. Respondents in our study reported visiting between 5-10 Web sites per day and using the Internet between two to three hours per day on average. Most of the respondents in the study used the Internet for e-mail (95%) and research (93%), while surprisingly only a small number of respondents reported using the Internet for chatting (8%).

Inter-Correlations

We noticed a significant number of independent two-tailed correlations among the constructs as we initially found in the literature (see Figure 7). This is in keeping with other studies that demonstrated similar correlational patterns (Agarwal & Karahanna, 2000; Agarwal & Prasad, 1999; Igbaria et al., 1996, 1997; Szajna, 1994). We used the correlations to examine the independent relationships between the constructs and to get an initial feeling for how well the hypotheses were supported in the original model.

Hypotheses

Hypothesis 1: *Perceived ease of use of the Internet is positively and significantly correlated to perceived usefulness of the Internet and attitude toward using the Internet.*

We found support for H1 where a strong correlation exists between perceived usefulness and perceived ease of use (r=.523) as purported by Venkatesh and Davis (2000). Szajna (1994) also reported a strong correlation between these variables (r=.48). Van der Heijden, Verhagen, and Creemers (2003) (r=.48) and Gefen (2003) (r=.55) have reported similar correlations.

Hypothesis 2: *Perceived usefulness of the Internet is positively and significantly correlated to attitude toward using the Internet, behavioral intention to use the Internet, and actual usage of the Internet.*

The relationships between perceived usefulness and attitude toward using (r=.467),

Figure 7. Inter-correlations among study variables

		Perceived Usefulness	Perceived Ease of Use	Attitude Toward Using	Behavioral Intention to Use	Perceived Complexity	Voluntariness	Experience	Gender
Percived Ease of Use	Pearson Correlation Sig. (2-tailed) N	.523** 0.000 192							
Attitude Toward Using	Pearson Correlation Sig. (2-tailed) N	.467** 0.000 192	.522** 0.000 192						
Behavioral Intention to Use	Pearson Correlation Sig. (2-tailed) N	.566** 0.000 192	.566** 0.000 192	.497** 0.000 192					
Perceived Complexity	Pearson Correlation Sig. (2-tailed) N	-.368** 0.000 192	-.418** 0.000 192	-.264** 0.000 192	-.245** 0.001 192				
Voluntariness	Pearson Correlation Sig. (2-tailed) N	-.069 0.344 191	.085 0.240 191	-.061 0.405 191	-.101 0.166 191	.123 0.091 191			
Experience	Pearson Correlation Sig. (2-tailed) N	.132 0.068 191	.379** 0.000 191	.235** 0.001 191	.389** 0.000 191	-.183** 0.011 191	-.053 0.462 191		
Gender	Pearson Correlation Sig. (2-tailed) N	-0.112 0.131 184	-0.282** 0.000 184	-0.121 0.131 184	-0.131 0.076 184	0.164 0.026 184	-0.014 0.847 184	-0.168 0.023 184	
Actual Usage	Pearson Correlation Sig. (2-tailed) N	.276** 0.000 191	.473** 0.000 191	.499** 0.000 191	.463** 0.000 191	-.289** 0.000 191	-.149** 0.039 191	.490 0.000 191	-0.227** 0.002 184

** Correlation is significant at the 0.01 level (2-tailed)

behavioral intention to use (r=.566), and actual usage (r=.276) are all statistically significant, supporting H2. Chau (1996) found a strong relationship between perceived near-term usefulness and perceived long-term usefulness and behavioral intention to use. Igbaria et al. (1997) found that perceived usefulness directly impacts system usage. Sun (2003) reported that after looking at 13 studies examining the relationship between perceived usefulness and behavioral intention to use that all of the studies found statistical significance with that relationship. Pikkarainen et al. (2004) found perceived usefulness to be a main factor influencing online banking acceptance. Carey and Day (2005) found a strong relationship between perceived usefulness and attitude.

Hypothesis 3: *Attitude toward using the Internet is positively and significantly correlated to behavior toward using the Internet.*

The relationship between attitude toward using the Internet and behavior toward using is also supporting H3 (r =.497). Taylor and Todd (1995b) did find this relationship as significant in their study where they integrated experience, as we have. Chau and Hu (2001) found the relationship between attitude and behavioral intention to be significant in all three of their models. Wu (2003) found that online shoppers have higher attitude scores, which are directly related to online purchase decisions.

Hypothesis 4: *Behavioral intention toward using the Internet is positively and significantly correlated to actual usage of the Internet.*

We also found a significant relationship between behavior toward using and actual usage of the Internet (r =.463), giving support to H4. Davis et al. (1989) found that behavioral intention to use the Internet strongly affected

actual usage in both models, taking into effect direct belief-intention relationships.

Hypothesis 5: *Gender will significantly influence the perceived use of the Internet, perceived usefulness of the Internet, and actual usage of the Internet.*

We did not find that gender impacts perceived usefulness (r =-0.112) as we initially thought yielding mixed results for H5. However, gender was correlated to actual usage (r=-0.227) and perceived ease of use (r=.-.0282). Venkatesh and Morris (2000) found that ease of use was not a significant determinant for behavioral intent for men, whereas women weighted ease of use more strongly in determining behavioral intent than did men. They also found that men consider perceived usefulness to a greater extent than women in making their decisions regarding the use of a new technology. Gefen and Straub (1997) found that gender impacts perceived usefulness and perceived ease of use in their study of 392 respondents. Surprisingly, they did not find a relationship between gender and actual usage. Sun (2003) found that gender has a mediating effect on perceived usefulness on user acceptance.

Hypothesis 6: *Experience using the Internet will be positively and significantly correlated to perceived usefulness of the Internet and the behavioral intention to use the Internet.*

We did not find a significant relationship between experience and perceived usefulness (r =.132) although Taylor and Todd (1995b) found a strong differentiation between experienced and inexperienced users and their perceived usefulness variable of information technologies. Szajna (994) reported a strong relationship between perceived usefulness and experience using. Igbaria et al. (1995) found a strong relationship between experience and behavioral intent (as measured by variety of use), similar to the study (r =.389). Agarwal and Prasad (1999) found a strong relationship between experience and their behavioral intent to use the technology. Sun (2003) found experience to have mediating effects between the relationships of ease of use and perceived usefulness. The findings supported part of H6, while other portions require further investigation.

Hypothesis 7: *Perceived complexity of using the Internet will be negatively and significantly correlated to perceived usefulness of the Internet and the actual usage of the Internet.*

We found a strong correlation between perceived complexity and perceived usefulness (r=-.368) and with perceived complexity and actual usage (r=-.289). This finding shows support for H7 and corroborates the results from Igbaria et al. (1996) and Davis et al. (1989).

Hypothesis 8: *Voluntariness of using the Internet is positively and significantly related to the behavioral intention to use the Internet.*

In this study, we did not find a strong relationship between voluntariness and behavioral intent to use (r =-.101) and therefore could not support H8. Venkatesh and Davis (2000) found a significant correlation between voluntariness and intention to use in their study looking longitudinally across four organizations (n =156). Sun and Zhang (2003) found that voluntariness moderates behavioral intention to use.

The testing of the hypotheses in this section is intended to demonstrate further validation of the instrument, as discussed earlier. If the constructs perform as predicted by theory, then we can infer that the measurement of the constructs is nomologically valid. In testing the model, we wanted to see the difference in explanatory power between the part of the model that considers the perceived usefulness and perceived ease of use and that which considers interaction with actual use of the Internet. Figure 8 shows the linear regression models for dependent variables. While not originally hypothesized, three external variables explain a large percentage of variance ($R^2 = 0.371$). The coefficients

Figure 8. Linear regression model for the dependent variables

Dependent Variable	R Square	F-value (sig)	Independent Variable	B	Std. Error	Stand Beta	t	Signif
Perceived Ease of Use	37.1%	35.406	Gender	-0.241	0.088	-0.165	-2.723	0.007
		0.000	Perceived Complexity	-0.377	0.054	-0.427	-7.025	0.000
			Experience	0.263	0.057	0.280	4.609	0.000
			Constant	4.730	0.283		16.715	
Dependent Variable	R Square	F-value (sig)	Independent Variable	B	Std. Error	Stand Beta	t	Signif
Perceived Usefulness	31.5%	20.539	Perceived Complexity	-0.148	0.054	-0.196	-2.730	0.007
		0.000	Perceived Ease of Use	0.403	0.067	0.473	6.056	0.000
			Gender	0.049	0.080	0.039	0.606	0.545
			Experience	-0.069	0.054	-0.087	-1.287	0.200
			Constant	3.227	0.404		7.997	
Dependent Variable	R Square	F-value (sig)	Independent Variable	B	Std. Error	Stand Beta	t	Signif
Attitude Toward Using	32.4%	45.312	Perceived Ease of Use	0.281	0.052	0.383	5.450	0.000
		0.000	Perceived Usefulness	0.238	0.063	0.267	3.797	0.000
			Constant	1.235	0.244		5.072	
Dependent Variable	R Square	F-value (sig)	Independent Variable	B	Std. Error	Stand Beta	t	Signif
Attitude Toward Using	39.5%	40.746	Perceived Ease of Use	0.175	0.053	0.239	3.286	0.001
		0.000	Perceived Usefulness	0.220	0.059	0.246	3.702	0.000
			Actual Usage	0.231	0.047	0.319	4.931	0.000
			Constant	0.841	0.244		5.072	
Dependent Variable	R Square	F-value (sig)	Independent Variable	B	Std. Error	Stand Beta	t	Signif
Behavioral Intention to Use	47.4%	41.830	Perceived Usefulness	0.412	0.058	0.423	7.054	0.000
		0.000	Attitude Toward Using	0.262	0.067	0.241	3.938	0.000
			Experience	0.204	0.041	0.275	5.010	0.000
			Voluntariness	-0.026	0.033	-0.042	-0.791	0.430
			Constant	1.245	0.283		4.402	
Dependent Variable	R Square	F-value (sig)	Independent Variable	B	Std. Error	Stand Beta	t	Signif
Actual Usage	31.7%	12.366	Perceived Usefulness	-0.040	0.100	-0.034	-0.403	0.688
		0.000	Behavioral Intention to Use	0.357	0.113	0.262	3.146	0.002
			Perceived Complexity	-0.232	0.065	-0.263	-3.558	0.000
			Gender	-0.223	0.098	-0.153	-2.278	0.024
			Constant	3.519	0.587		5.990	
Dependent Variable	R Square	F-value (sig)	Independent Variable	B	Std. Error	Stand Beta	t	Signif
Actual Usage	41.3%	15.395	Gender	-0.125	0.088	-0.086	-1.423	0.157
		0.000	Attitude Toward Using	0.358	0.096	0.259	3.726	0.000
			Perceived Usefulness	-0.080	0.092	-0.069	-0.873	0.384
			Perceived Ease of Use	0.145	0.085	0.146	1.699	0.091
			Behavioral Intention to Use	0.317	0.110	0.313	4.156	0.000
			Perceived Complexity	-0.123	0.061	-0.140	-2.021	0.045
			Experience	0.297	0.061	0.318	4.857	0.000
			Voluntariness	-0.098	0.044	-0.132	-2.219	0.028
			Constant	2.337	0.585		3.996	
Dependent Variable	R Square	F-value (sig)	Independent Variable	B	Std. Error	Stand Beta	t	Signif
Actual Usage	44.0%	24.072	Attitude Toward Using	0.393	0.093	0.285	4.210	0.000
		0.000	Perceived Ease of Use	0.137	0.079	0.136	1.735	0.084
			Behavioral Intention to Use	0.355	0.092	0.292	3.861	0.000
			Perceived Complexity	-0.059	0.056	-0.065	-1.053	0.294
			Experience	0.299	0.058	0.318	5.177	0.000
			Voluntariness	-0.084	0.044	-0.109	-1.906	0.048
			Constant	1.037	0.442		2.347	

for gender (p =.007), perceived complexity (p =.000) and experience (p =.000) are all statistically significant. We only hypothesized the relationship of gender to impact perceived ease of use (H5a). We analyzed the relationships for perceived usefulness (see Figure 13). The linear regression model showed a relatively strong percentage of variance explained (R^2 = 0.315). Only the coefficients related to perceived complexity (p =.007) and perceived ease of use (p =.000) are statistically significant supporting H1a and H7a. We did not find experience or gender to be significant; therefore hypotheses H5b and H6a are not supported.

The variance explained is relatively strong (R^2 = 0.324) with both coefficients found to be statistically significant at p =.000 for perceived usefulness and perceived ease of use. Therefore, the findings support hypotheses H1b and H2a. Venkatesh et al. (2003) (47) discussed the underlying theory and resulting constructs of user acceptance models, purporting that the actual use of information technologies could affect individual reactions and attitudes toward using those technologies. We tested that relationship finding an increase in variance explained (R^2 = 0.395) where the coefficient for actual usage (p =.000) was found to be significant. This could explain why a user's attitude toward using Internet technologies is partially influenced by his or her current utilization of that technology. The linear regression model showed a stronger amount of variance explained (R^2 = 0.474). The coefficients for attitude toward using (p =.000), perceived usefulness (p =.000), and experience (p =.000) were all statistically significant supporting hypotheses H3, H2b, and H6b. However the coefficient from voluntariness (p =.430) was

not significant, removing support for hypothesis H8. The amount of variance explained (R^2 = 0.317) by this model is significantly lower than expected. The coefficients that were found to be statistically significant include behavioral intention to use (p =.002) and perceived complexity (p =.000) supporting hypotheses H4 and H7b. Gender is also significant at the $p < 0.05$ level, supporting H5c. Surprisingly, we did not find perceived usefulness to be significant (p=.688). The summary of our hypotheses, showing both the correlational analysis and regression analysis, is displayed in Figure 9.

DISCUSSION

The technology acceptance model (TAM) serves as one of the most accepted theories for explaining the assimilation of technologies, where we defined assimilation in this study as the extent to which the use of technology diffuses in an organization and within a society. The technology acceptance model is an adaptation of the theory of reasoned action model specifically tailored for modeling user acceptance of information systems. This study analyzed existing research using the TAM in order to develop a reasonably grounded modified model for testing the acceptance of Internet technology by consumers. We analyzed studies using the TAM for model definitions, constructs, and scales in order to assess the construct validity of scale items. The technologies for which the TAM was used in previous studies were examined and the statistically significant correlations analyzed. Analyses of TAM studies by Legris et al. (2002), Sun (2003), and Venkatesh et al. (2003) showed significant relationships between each of the constructs. Based upon existing theory and the findings from those studies, we developed a modified technology acceptance model for Internet-based applications. In this model, we analyzed the constructs and their underlying theory including relevant findings as well as relationships between these constructs as related to the Internet-based applications. We retained the basic constructs of perceived ease of use, perceived usefulness, attitudes toward using, behavioral intention to use, and actual use in this study. We included external variables in the survey instrument based upon the relevance of the construct and the impact of the variables on the Internet technology, to include complexity using the Internet, gender, experience using the Internet, and voluntariness using the Internet. This research purported a set of hypotheses resulting from established theory.

The development process also helped to clarify and refine some of the definitions used by a variety of researchers using the technology acceptance model. During the development of the instrument, the pre-test data showed the importance of experience using the Internet as a variable affecting both the perceived usefulness of the Internet and the behavioral intention to use the Internet. We found correlation between voluntariness and behavioral intention to use the Internet. Perceived complexity using the

Figure 9. Summary of support for hypotheses

Hypothesis	Variable 1 (independent)	Variable 2 (dependent)	Correlational Analysis	Significance	Support (sig <=0.01)	Regression Analysis	Significance	Support (sig <=0.01)
1a	Perceived ease of use	Perceived usefulness	r = -0.523	p = 0.000	yes	β = 0.403	p = 0.000	yes
1b	Perceived ease of use	Attitude toward using	r = 0.522	p = 0.000	yes	β = 0.281	p = 0.000	yes
2a	Perceived usefulness	Attitude toward using	r = 0.467	p = 0.000	yes	β = 0.238	p = 0.000	yes
2b	Perceived usefulness	Behavioral intention to use	r = 0.566	p = 0.000	yes	β = 0.412	p = 0.000	yes
2c	Perceived usefulness	Actual usage	r = 0.276	p = 0.000	yes	β = -0.040	p = 0.688	no
3	Attitude toward using	Behavioral intention to use	r = 0.497	p = 0.000	yes	β = 0.262	p = 0.000	yes
4	Behavioral intention to use	Actual usage	r = 0.463	p = 0.000	yes	β = 0.357	p = 0.000	yes
5a	Gender	Perceived ease of use	r = -0.282	p = 0.000	yes	β = -0.241	p = 0.007	yes
5b	Gender	Perceived usefulness	r = -0.112	p = 0.131	no	β = 0.049	p = 0.545	no
5c	Gender	Actual usage	r = -0.227	p = 0.002	yes	β = -0.223	p = 0.024	no
6a	Experience using the Internet	Perceived usefulness	r = 0.132	p = 0.068	no	β = -0.069	p = 0.200	no
6b	Experience using the Internet	Behavioral intention to use	r = 0.389	p = 0.000	yes	β = 0.204	p = 0.000	yes
7a	Perceived complexity of using	Perceived usefulness	r = -0.368	p = 0.000	yes	β = -0.148	p = 0.007	yes
7b	Perceived complexity of using	Actual usage	r = - 0.289	p = 0.000	yes	β = -0.232	p = 0.000	yes
8	Voluntariness of using	Behavioral intention to use	r = -0.101	p = 0.166	no	β = -0.026	p = 0.430	no

Internet may be significantly related to the perceived usefulness (as is the perceived ease of use) and directly impact perceived use. Finally, we concluded during development that gender may play an important role in the both of the "belief" variables as well as directly on perceived use of the Internet.

The results showed very strong relationships between the main constructs of the TAM. We found the relationship between attitude toward using and behavioral intention to be surprising. Sun (2003) found, in a comparative analysis of TAM study results, that this relationship was only statistically significant 43% of the times it had been studied. We measured attitude toward using in this study by assessing the enjoyment, fun, and boredom using the Internet, as suggested by Agarwal and Karahanna (2000). This corroborates the finding by Koufaris (2002) where he found a predictive relationship between enjoyment and intent to return to a specific Web site. Wu (2003) also found that consumers who shop online possess higher attitude scores, which are directly related to online purchase decisions. We also found a relationship between complexity using the Internet and the perceived ease of use construct. Although not hypothesized, this finding appears to indicate that Internet users in our study found complexity, measured in loss of time, vulnerability, and difficulty integrating results, as suggested by Igbaria et al. (1996), affected their perception of ease of use. We feel that complexity could exist as a sub-component of the ease of use perceptual construct.

We were surprised by the extent to which experience using the Internet tended to affect not only perceived ease of use and behavioral intent, but also directly with actual usage. While the relationship of experience with ease of use perceptions seems logical and intuitive, the link to actual usage suggests that enhanced education and hands-on exposure to Internet tools can potentially increase an individual's usage of the Internet. This corroborates Holland and Baker's (2001) model that suggests that creating site loyalty leads repeat visits and more positive attitudes toward the site. This also validates the prior research on experience and its impact on TAM variables (Legris et al., 2002).

Voluntariness is not significantly related to behavioral intent as was originally proposed in H8. While the theory tends to show strong support for voluntariness and its moderating effect on intention to use by Venkatesh and Davis (2000), we only a significant relationship to actual usage. This could account for the indirect effect on intention to use that Venkatesh and Davis reported. We also discovered by examining the qualitative data that Internet users in the study did not possess a clear understanding of mandatory use of the Internet, rather more of a perception, as suggested by Moore and Benbasat (1991). Some of the respondents said that mandatory use of the Internet was not "explicitly" stated; however the fact that Internet research, for example, was conducted more efficiently on the Internet created an implied mandatory usage that, in turn, impacted actual usage.

Although previous studies reported gender differences impact the assimilation of technologies (Gefen and Straub, 1997; Venkatesh & Morris, 2000), we did not find significant statistical relationships with either perceived usefulness or actual usage. This finding is similar to what Stafford et al. (2004) discovered in their study of men's and women's involvement in online shopping across the United States, Finland, and Turkey. We can report, and did expect, a strong relationship to exist between gender and perceived ease of use, confirming prior research. We ran another model where all of the variables were added in order to assess changes in the amount of variance explained and to potentially uncover relationships that may have missed. We created a multiple linear regression model for actual usage with all of the coefficients entering the model. We found a substantial increase in the amount of variance explained (R^2 = 0.413). However, only attitude toward using (p =.000), behavioral intention (p = .000), and experience (p = .000) emerged as significant coefficients. It is interesting to note that these coefficients are different than the earlier model and that two of these variables had not been theoretically hypothesized. Voluntariness (p =

.028) and perceived complexity (p = .045) were also significant at the $p < 0.05$. Continuing to search for the best linear regression model, we produced a set of regression models and generated a final model to predict actual usage. The coefficients statistically significant at $p < 0.05$ include attitude toward using (p = .000), experience (p = .000), and voluntariness (p = .048). Using this final model, we have generated two additional relationships, between experience and actual usage and between attitude toward using and actual usage.

CONCLUSION

Many individual and environmental factors exist that can determine a consumer's emotional and cognitive responses to using the Internet. We did not consider physical stimuli variables such as colors and personality traits in this research data (Koufaris, 2002). In fact, we did not include individual differences in the acceptance of Internet-based technologies, investigated by several studies examining the implications of users in specific Web site applications (Gefen, 2003; Van der Heijden, 2000). This study examined the technology users' perceptions of Internet-based technologies to help them accomplish activities and tasks, rather than rating an individual Web site or measuring individuals' perceptions of a specific Web site.

We administered the survey instrument in both paper and electronic formats (Excel via e-mail) to respondents in this study. Unfortunately, we did not prepare the Web survey in a browser-based technology, which may be more relevant to the sample under study. In the future, we might want to analyze the bias toward "older-generation" assessment instruments versus Web-enabled surveys.

This study investigated experienced consumers who were working on undergraduate or MBA degrees at a major university in the United States. To the extent that these consumers are typical of online consumers, the results will hold across more general populations (Gefen, 2002). Gefen et al. (2003) found that, although Remus used business students as good surrogates for managers, students were good subjects for studying Internet-based shopping behaviors and that their status as "student" did not impact the validity of their study.

One of the variables missing from the research framework in this study includes planned purchases of first-time online consumers. Rather than study a consumer's propensity to either visit or return to a specific Web site for purposes of shopping, we focused on the acceptance of consumers to use the Internet generally for a variety of purposes, including shopping. However, Koufaris (2002) stated the importance of capturing data on consumers' planned purchases to shop comparing both their purchase pattern as first-time consumers and returning customers. Another variable that might be influential in adopting a wide variety of technologies is the trust construct. Gefen et al. (2003) suggests that there might be different conceptualizations of trust and those may be useful in defining the model of acceptance for Internet-based technologies. The applicability of the TAM to specific technologies is an important consideration as a potential limitation to this study. While we tried to specifically capture the variables that might impact actual usage of Internet-based technologies, we realize that the behavior of users toward different technologies may ultimately create models that have different nomological structures.

Research Contribution

An important contribution of our study includes the testing and validation of metrics for understanding consumer behavior on the Internet. In addition to high scale reliability, the main constructs of the technology acceptance model also demonstrated high nomological validity, demonstrating behavior as expected in past studies. Therefore, we believe that future research measuring the acceptance of Internet technology by consumers can use these metrics with some assertion. Related is the creation of an overall instrument to measure the various perceptions in the adoption of Internet-based technologies.

The creation process included surveying known existing instruments, choosing appropriate items, revising items as necessary, and then undertaking an extensive scale development process. It is believed that the method of developing the scales will result in a high degree of confidence in their content and construct validity for measuring the acceptance of Internet technology by consumers. This instrument, comprising all of the original TAM constructs (including attitude toward using) and additional external variables, antecedents, and moderators related to the technology in study can now be used to investigate how consumers adopt and accept Internet-based applications.

In recommending this instrument to researchers investigating the acceptance of Internet-based technologies, we caution that its use is tailored for Web-enabled applications. Therefore the wording of the scales reflects our specificity toward this type of technology. As the business world continues to change, it is necessary for companies to adapt to the new environment. With more and more businesses going online, e-business is an appropriate area to focus the attention. For centuries, businesses have attempted to sell their products or services by providing what the customers want or need. Businesses still do this today, but their efforts have moved online. By examining TAM and supported results, we can better understand how to meet the needs of the e-business customer.

Implications

It is believed that results from this study also provide managers with a framework for which areas they need to focus when launching new online products, such as shaping and/or changing their consumers' attitude toward using the Internet, making their Web site easier to use, and enhancing the perceived usefulness of the technologies that enable consumers to get at their products online. The framework we tested and refined in this paper also serves as an important first step toward subsequent predictive modeling with critical marketing variables.

Future Research

Future research includes validation of the modified TAM for Internet technologies by testing the model relationships with organizational samples. While many of the studies we investigated had small sample sizes, in future research we plan to test and validate the model using the instrument in this research with organizations that are developing Internet-based solutions for their customers. Future research also includes testing this modified model with the instrument created to ascertain how consumers can more effectively assimilate Web-base technologies in a global setting. We feel that this research could enhance an organization's ability to determine how well its consumer base will accept their Internet initiatives. Additional variables could be considered in future research to enhance the overall predictability of the TAM in Internet-based situations, such as performance expectancy and effort expectancy. These variables could provide further explanatory power of the TAM to better understand how online consumers use Internet technology to facilitate a number of activities.

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APPENDIX A. SUMMARY OF PREVIOUS STUDIES CONCERNING ONLINE CONSUMER BEHAVIOR

Author(s) / Year	Summary
Anderson and Srinivasan, 2003	Studied the influence of e-satisfaction on e-loyalty. They found that two business level factors (trust and perceived value) and three individual level factors (purchase size, inertia, and convenience motivation) moderate the relationship between e-satisfaction and e-loyalty.
Athiyaman, 2002	Found that consumers may avoid online purchasing of airline tickets because of their attitudes and beliefs about the security of the Internet.
Bauer, Grether, and Leach, 2002	Discovered that customers who trust a Web-based company feel more committed to it. They also found that customer satisfaction has the strongest influence on commitment.
Bhatnagar, Misra, and Rao, 2000	Suggested that, for consumers purchasing online, the perceived risks of Internet shopping outweigh the convenience that it offers.
Burke, 2002	Conducted a national survey (n = 2,120) of online shoppers. He found that consumers are more satisfied with the quality, convenience, selection and value offered by retailers, but are less satisfied with the availability of product information, the level of service provided, and the speed of the shopping process.
Cenfetelli, 2004	Examined factors that inhibit technology usage. He found that these inhibitors act uniquely to bias users' beliefs.
Dennis, Harris, and Sandhu, 2002	Found that online shoppers are concerned about the security and payment aspects of online purchases.
Gammack and Hodkinson, 2003	Found that an online shopper's involvement and willingness to purchase are increased by an enhanced interactive virtual environment. They discovered that shoppers were more likely to purchase when they could design and visualize a product online (a surfboard) as opposed to using a traditional Web site.
Gefen and Straub, 1997	Found that the perceived ease of use seems to vary depending on the type of task the consumer is undertaking. Its effect becomes more pronounced when the consumer is purchasing a product online rather than just gathering information about a product.
Gefen, 2002	Found that customer loyalty to a vendor's Web site increased with perceived better service quality both directly and through increased trust
Girard, Korgaonkar, and Silverblatt, 2003	Found that shopping orientations (such as recreational shopper and convenience) and demographic variables (including education, gender, and income) were significantly related to online consumers' purchase preferences.
Hampton-Sosa and Koufaris, 2005	Examined the impact of Web site appeal and usability on the initial trust beliefs of new customers visiting a company's Web site for the first time. They found that Web site appeal is a significant predictor of initial trust, which significantly affects a user's intention to use the Web site in the future. However, their results did not support a relationship between initial trust and Web site usability.
Heijden, Verhagan, and Creemers, 2001	Found that the perceived risk of online shopping (for example, credit card fraud) and the perceived ease of use of the Web site influence attitude towards online purchasing
Holland and Baker, 2001	Created a model that explains how customers' goals (task or experiential) in visiting a Web site affect their loyalty to the site. The model also illustrates how characteristics of a Web site, such as personalization and community, are related to brand loyalty. Their model suggests that creating site loyalty leads to predictable affective, cognitive, and behavioral outcomes from customers, including repeat visits and more positive attitudes toward the site
Hwang, 2005	Tested the relationships between multiple dimensions of online trust (integrity, benevolence, and ability) and purchase intention. He found that integrity and ability of online trust, as well as ease of use, positively influence purchase intention. Benevolence showed no direct relationship to purchase intention.

Javenpaa and Todd, 1997	Certain Web site features such as the availability of a frequently asked question area or promotions on the online store Web site can influence traffic and overall e-commerce sales. They found that shopping enjoyment can significantly impact attitude and intention towards online shopping. Shopping environment serves as a major determinant of online customer loyalty.
Kau, Tang, and Ghose, 2003	Examined the online buying behavior of over 3,700 Internet users. They suggest that online shoppers can be classified into one of six categories such as surfers and bargain shoppers.
Kim and Xu, 2004	Examined the effects of trust and perceived price for Internet shoppers, looking at both potential and repeat customers. They found that trust has a stronger effect for potential customers than for repeat customers, while perceived price has a stronger effect for repeat customers than for potential customers. Trust has a stronger effect on purchase intention than perceived price.
Kim, Nam, and Stimpert, 2004	Applied Porter's generic strategy framework to e-business by studying Korean cybermalls. He found that Porter's strategies explain performance differences across companies. Firms using the cost leadership strategy exhibited the lowest performance, while firms using a cost leadership / differentiation strategy exhibited the highest performance.
Koufaris, 2002	Online consumers perform all of the functions of a traditional consumer while interacting with a system. Therefore we can view the online consumer as a computer user displaying all of the characteristics as one using a computer-based information system in a traditional organization. Likewise, an online store uses information technology to operate, where the technology enables the Web site to exhibit a virtual store or online shopping venue. He examined the factors that influence a customer's intention to return to a Web site and to become a return customer. He found that the online consumer possesses a double identity as a shopper and a computer user. To study the online consumer, one must understand not only the customer relationship management function, but also the acceptance of Internet technologies by the user.
Krishnamurthy, 2002	Researched the causal antecedents of customer confidence in e-tailers. He discovered that a site's ease of use, the level of online shopping resources, and existence of a trusted third party seal positively influence the level of customer confidence. Online relationship services had no impact on customer confidence, however.
Lohse and Spiller, 1998	Suggested that the design of the user interface for online shopping plays a key role on the site's traffic and sales, as customers prefer sites that are easy to navigate.
Long, 2004	Adapted Maslow's "hierarchy of needs" to deal with customer experiences on the Web. The four layers from bottom to top are trust, competence, autonomy, and creativity / relatedness. Loyalty increases as we move from the lower to the higher layers of his model.
Mathwick, 2002	Found that the presence of Web-based community-building infrastructure, such as chat rooms, bulletin boards, and interactive events, positively affects customers' future loyalty intentions.
Methlie and Nysveen, 1999	Studied the loyalty of online banking customers and found that customer satisfaction, followed by brand reputation, had the most significant impact on loyalty.
Miyazaki and Fernadez, 2001	Provided evidence that higher levels of Internet experience may lead to lower risk perceptions regarding online shopping. They found that perceived risk partially mediates the impact of Internet experience on online purchasing behavior.
Morrisette, McQuivey, Maraganore, and Lampher, 1999	Found that online consumer loyalty is low overall compared with traditional customers.
Novak, Hoffman, and Yung, 2000	Found that a consumer's involvement with the product(s) sold by a Web-based company can have an effect on the consumer's experience and behavior. They found factors such as ease of ordering, ease of paying, ease of returns, and promptness in shipping to have a strong impact on the online consumer's perception of "ease of use."
Park and Kim, 2003	Found that the quality of the user interface, as well as information quality and security perceptions are significantly related to an online user's actual purchase behavior.
Parsons, 2002	Suggested that online retailers can build interest and loyalty, similar to what physical retailers have done, by actively promoting online communities and offering ways for consumers to easily escape from daily reality.

Reichheld and Schefter, 2000	Noted that some companies spend too much time trying to attract customers instead of retaining them. They discussed the concept of e-loyalty: Earning the trust of Web-based customers. Consumers trusting an online vendor are more likely to share their personal information, thus enabling the vendor to personalize products and services for the customer. This personalization increases trust and strengthens customer loyalty.
Stafford et al., 2004	Examined the role of gender on online shopping in the United States (developed nation), Finland (emerging technological niche), and Turkey (emerging market in the secular East). Across these three nations, they found no differences between men and women for involvement with online shopping. They expected to find that more masculine cultures such as the United States were less likely than less masculine cultures to regard online shopping as an important Internet activity. However, they found the opposite to hold true.
Thorbjornsen and Supphellen, 2004	Found that brand loyalty is a stronger determinant of Web site usage than Internet experience and type of motivation (information or entertainment purposes) for the visit.
Torkzadeh and Dhillon, 2002	Developed two instruments that measure the factors that influence the success of Internet commerce. The first instrument measures the fundamental objectives that consumers perceive to influence online purchases, such as Internet vendor trust. The second instrument measures the fundamental objectives that consumers perceive to be important for Internet commerce, such as Internet product value.
Vijayasarathy, 2003	Examined the relationship between shopping orientations, product types, and consumer intentions to use the Internet for shopping. He found that product types, based on tangibility and cost, do not moderate the relationship between shopping orientations and intentions to shop using the Internet. However, he found that product types have a direct effect on intentions to shop using the Internet.
Wolfinbarger and Gilly, 2001	Found that both online and offline consumers shop differently depending on whether their shopping motivations are goal directed (for efficiency) or primarily experiential (for fun). Goal-oriented consumers are interested in online shopping because of availability of information, selection, convenience, accessibility, and lack of sociality. Experiential shoppers often enjoy online auctions and bargain hunting.
Wu, 2003	Examined the relationship between consumer characteristics and attitude toward online shopping. He found that consumers who shop online have higher attitude scores, which are directly related to online purchase decisions.
Xia and Sudharshan, 2000	Found that interruptions that limit online consumers' concentration reduce Web users' satisfaction with online shopping.
Yoon, 2002	Examined the antecedents and consequences of trust in online purchase decisions. He found that prior satisfaction and familiarity with e-commerce were strongly correlated with Web site satisfaction and trust. He also found that Web site awareness, trust, and satisfaction influenced the intention to purchase online.

APPENDIX B. SUMMARY OF PREVIOUS STUDIES EXTENDING THE TECHNOLOGY ACCEPTANCE MODEL

Author(s) / Year	**Summary**
Agarwal and Karahanna, 2000	Further developed the concept of self-efficacy to analyze the relationship between self-efficacy, perceived usefulness and perceived ease of use. Adding the cognitive absorption construct, they further modified the TAM model from a previous study (Agarwal and Prasad, 1999). The three aspects of cognitive absorption research are the personality trait dimension of absorption, the state of flow, and the notion of cognitive engagement. They conducted the study using the World Wide Web and university students and used PLS to establish the nomological validity of cognitive absorption. The results supported the hypotheses that cognitive absorption is a significant predictor of perceived usefulness and perceived ease of use. They also found that playfulness and personal innovativeness exert strong significant effects on cognitive absorption.

Agarwal and Prasad, 1999	Developed a modified TAM model that focused on the perceptions of technology usefulness and ease of use based on the idea that personal innovativeness positively moderates the relationship between the perceptions of relative advantage, ease of use, and compatibility and the decision to adopt an innovation. They found moderating influences on the perceptions to intentions link which is absent in much technology acceptance research and that communications channels play a significant role in innovation adoption.
Carey and Day, 2005	Examined the role of cultural aspects in the acceptance of technology. They found a strong relationship between perceived usefulness and attitude of satisfaction.
Chakraborty, Hu, and Cui, 2005	Examined the effects of an individual's cognitive style on technology acceptance decisions. In their study of 428 undergraduate students, cognitive style significantly affected a person's technology acceptance decision-making.
Chau, 1996	Modified TAM to differentiate between perceived near-term usefulness and long-term usefulness, simplifying the model by taking out the "attitudes" construct of the original TAM (a trend that followed in many of the TAM studies subsequent to this study). Contrary to previous studies, ease of use produced no statistically significant influence on intention to use. However, ease of use significantly affected perceived near-term usefulness. This finding supports the original TAM in that an individual's intention to use depends on perceived usefulness, not on ease of use.
Chin and Todd, 1995	Applied structural equation modeling (SEM) to TAM, analyzing just the usefulness construct as one-factor or two-factor explanatory interactions. The results of the cross validation analyses also suggest that the one-factor model fits the "true population" model better than the two-factor model.
Compeau, Higgins, and Huff, 1999	Developed a model based on Bandura's Social Cognitive Theory to study the influences of self-efficacy, performance and personal outcome expectations, affect, and anxiety on computer usage. The study did not support a relationship between personal outcome expectations and affect; rather, it found a negative relationship between personal outcome expectations and use. They found that self-efficacy explains 18% of the variance in an individual's usage. The implications of this study reveal the importance of managing self-efficacy and computer usage through training programs and other support mechanisms.
Dasgupta, Granger, and McGarry, 2002	Extended TAM to test its applicability in the user acceptance of e-collaboration technology They included an additional variable, level, to test for significant differences between novice and advanced users. This study found that neither perceived ease of use nor perceived usefulness significant affected usage. User level, as opposed to usefulness significantly determined system usage. They found a negative relationship between perceived usefulness and use of the system.
Dutt and Srite, 2005	Looked at cultural perspective on technology acceptance. They surveyed individuals from 34 countries and found statistically significant main effects for national origin and masculinity/feminity, suggesting that both impact a person's intention to adopt a technology.
Gefen and Straub, 1997	Examined gender differences in regards to the IT diffusion model and the technology acceptance model (TAM), extending the TAM by also studying the constructs of perceived social presence and information richness (SPIR) addendum. They found that women tend to be more cooperative in their conversation and men tend to be more competitive and that women view e-mail as being higher in social presence than men. They also found that women purport a higher value for perceived use than men. In looking at gender in regards to perceived ease of use, they found the opposite result of what they hypothesized. However, this result is supported by other research which indicates that men are more at ease in using computers than women. They did not confirm that women perceive a higher social presence and usefulness of e-mail.
Gefen, 2003	Examined the degree and relative importance of customer trust of an e-vendor's Web site using TAM constructs and comparing the perceptions of new customers with the perceptions of experienced customers. He found that experienced customers trusted the e-vendor's Web site more than new customers. Repeat customers also perceived the Web site to be more useful and were more inclined to purchase from it. While both the perception of Web site usefulness and trust in the e-vendor affect previous customers' intentions to purchase, only trust in the e-vendors influences new customers' intentions to purchase.

Gefen et al., 2003	Examined adoption of an online shopping environment, with repeat visits, by integrating the trust construct with perceived ease of use and perceived usefulness. They found that the core variables explained a large amount of variance in intended behavior of experienced repeat online shoppers. They also found, in a study of 213 student responses, that online trust is built through (1) a belief that the vendor has nothing to gain by cheating, (2) a belief that there are safety mechanisms built into the Web site, (3) having a typical Web-based interface, and (4) having an interface that is easy to use. The authors recommend that e-vendors attempt to understand the sequence of activities, functionality, and types of information that match consumer mental models of "typical Web sites." Overall, the constructs employed in their TAM yielded fairly high reliabilities ($r >= 0.76$), strong squared multiple correlations ($R^2 >= 0.41$), and all of the paths except one (between familiarity in the e-vendor and trust) yielded statistically significant paths.
Gribbins, Shaw, and Gebauer, 2003	Investigated employees' acceptance of integrating mobile commerce into organizational processes. Their study did not find several expected relationships between the traditional TAM constructs. They did not find significant relationships between perceived ease of use and perceived usefulness, between perceived ease of use and attitude, and between perceived usefulness and behavioral intention.
Igbaria et al., 1996	Examined the influence of three motivators on an individual's choice to use a computer: (1) perceived usefulness, (2) perceived enjoyment/fun, and (3) social pressure. They used two indicators of microcomputer usage: (1) self-reported daily use of microcomputers, and (2) self-reported frequency of microcomputers. The results also show the importance of perceived usefulness, perceived enjoyment, and social pressure in mediating the relationships of antecedent variables and perceived complexity on microcomputer usage. The results support the threefold motivational model and help in explaining the relationships between perceived usefulness, perceived enjoyment, social pressure, and microcomputer usage. The study also shows that perceived complexity is an important variable in linking skills, organizational support, and organizational usage with perceived usefulness, perceived enjoyment, and social pressure. They recognized the importance of organizational support in promoting wider usage of microcomputers.
Koufaris, 2002	Stated that by treating a Web store as a technology system and the Web consumer as a computer user, we can apply TAM and test how well it predicts user intention to use the technology or Internet-based system. Therefore when online consumers expect that their shopping productivity (perceived usefulness) will be enhanced, they will more likely return.
Legris et al., 2002	Examined IS implementation through an analysis of the TAM studies. They consulted 80 articles for analysis of the TAM and found a high proportion of positive results for all relations of the TAM components with some inconsistencies. Most TAM studies employ a regression model for predicting use. In many of the studies, researchers measured usage through self-reporting. They found no clear pattern for external variables. Their marginal influence helps in understanding the variance in system use. They used meta-analysis to show heterogeneous research findings except in one grouping - by type of software and only for students. The limitations of the TAM research include the involvement of students, the type of applications, and self-reported use. They conclude that TAM's predictive capacity may increase if organizational and social factors were included in the model.
Liaw and Huang, 2003	Examined individual's attitudes toward online search engines by integrating several perception theories including TAM and motivation. They found that individuals' computer experience, perceptions of technology acceptance, quality of search systems, and motivation are the key factors affecting individuals' feelings to use search engines.
Ma and Liu, 2003	Included Internet self-efficacy (ISE) as an antecedent to the traditional TAM constructs. They found that ISE explained 48% of the variation in perceived ease of use. ISE and perceived ease of use explained 50% of the variation in perceived usefulness. Their full model explained 80% of the variance in behavioral intention.
Mahinda and Whitworth, 2005	Extended TAM with the Web of System Performance (WOSP) model, which consists of eight factors including privacy, security, flexibility, and connectivity. Security and privacy emerged as more important than the traditional TAM constructs, usability and functionality.
Muthitacharoen and Palvia, 2003	Proposed a new intention model based upon TAM, named the Theory of Preferred Technology (TPT), to explain alternative behaviors of online consumers. Their model integrates preferential decision knowledge to TAM. In their study, TPT is used to explain why consumers choose to purchase at Internet or conventional stores.
Noor, Hashim, Haron, and Sriffin, 2005	Applied an extension of TAM to examine community acceptance of a knowledge sharing system for a tourism Web site. They found that perception of trust and perceived sharing resulted in positive behavioral intention of sharing. Evidence was also presented that perceived risk resulted in a negative behavioral intention of sharing.

Pikkarainen et al., 2004	Investigated the acceptance of online banking in Finland (n=268) by developing a model using traditional TAM constructs. Perceived usefulness and information on online banking on the company's Web site emerged as the main factors influencing the acceptance of online banking.
Sánchez-Franco and Roldán, 2005	Compared Web acceptance of experiential and goal-directed Web users. They found that goal-directed and experiential users weigh intrinsic and extrinsic motives differently when on the Web. Process provides more motivation for experiential users while instrumental factors drive goal-directed users. The authors suggest further extension of TAM to deal with the usage of the Web.
Speier and Poston, 2001	Proposed ITAM, an extension to the traditional TAM, to examine Web site acceptance. Their model integrates affective and cognitive involvement and task type, which is the specific task an individual has in mind when using the Web. They found that the primary driver of intention to return to a Web site varies based upon the type of task performed.
Szajna, 1994	Found that the perceived usefulness/ease-of-use (U/EOU) instrument demonstrates reasonably good predictive validity. The U/EOU instrument has been shown to be reliable and valid for (1) intentions to use, (2) self-report usage, (3) self-predicted usage, (4) attitudes toward use, and (5) choice. Here the construct for self-report and self-predicted usage is introduced. In the pre-implementation version, intentions predict self-report usage but do not predict actual usage; whereas in the post-implementation version, perceived usefulness directly affects self-report usage.
Taylor and Todd, 1995a, 1995b	Developed a modified TAM focusing on assessing the efficacy of the augmented TAM in helping, a priori, to understand the behavior of experienced/inexperienced users. The results from the studies reveal that there are significant differences in the relative influence of the determinants of usage depending on experience. It is also showed that the augmented TAM can be used to predict subsequent usage behavior for inexperienced users. The studies found perceived usefulness to be the strongest predictor of intention for the inexperienced users and perceived behavioral control for the experienced users. They also found a strong link between behavioral intention and behavior for experienced users.
Van der Heijden, 2000	Examined the individual acceptance and usage of a Web site adding two new constructs: perceived entertainment value and perceived presentation attractiveness. He found significant relationships between perceived usefulness, perceived entertainment value and Web site revisit. Conversely, he did not find significant relationships between ease of use, perceived attractiveness, and Web site usage. Perceived usefulness and perceived entertainment value emerged as significant factors in determining Web site usage. Perceived entertainment value contributes to the length of visit more than perceived usefulness. The findings also reveal that ease of use only indirectly influences Web site usage through usefulness and that attractiveness indirectly impacts Web site usage through entertainment value.
Van der Heijden, 2004	Examined the differences between pleasure-oriented (hedonic) and productivity-oriented (utilitarian) Web sites by using TAM. Perceived enjoyment and perceived ease of use emerged as stronger determinants of intention than perceived usefulness to use a pleasure-oriented Web site. His study suggests that the perceived usefulness construct from TAM loses its predictive power for hedonic Web sites.
Venkatesh and Davis, 2000	Extended the original TAM to include social influence and cognitive instrumental processes. TAM2 hypothesizes that three social influences will affect an individual's decision to accept or reject an IS: subjective norm, voluntariness, and image. In four longitudinal field studies, TAM2 received strong support. It explained up to 60% of the variance in perceived usefulness as a determinant of user intentions. Interestingly, they found an interactive effect between job relevance and output quality. The effects of social influence processes and cognitive instrumental processes are consistent with TAM2.
Wang and Benbasat, 2004	Noted that online product recommendation agents are becoming more popular on Web sites. They examine the role of trust in these agents as it relates to a Trust-TAM integrated model. The results suggested that consumers' initial trust directly influences their intention to adopt the recommendation agents, and has an indirect effect through perceived usefulness of the agents.
Wilson, Mao, and Lankton, 2005	Tested a new model of IT acceptance, derived from TAM, for conditions of sporadic use. They also included habit and perceived regularity of use as constructs in their model. They found that their model predicts more variance in continuing acceptance of IT than alternative models.
Wu and Wang, 2005	Integrated innovation diffusion theory, perceived risk, and cost into the technology acceptance model to examine what determines the acceptance of mobile commerce. All of the variables, with the exception of perceived ease of use, significantly affected behavioral intention. Compatibility emerged as the most important determinant for intention to use. Cost exhibited a significant negative direct effect on behavioral intention, but showed less influence on intention than perceived risk, perceived usefulness, and compatibility.

Yu, Liu, and Yao, 2003	Developed a technology acceptance model for wireless Internet via mobile devices (WIMD). The model breaks usefulness into two subconstructs: Near-term and long-term usefulness. They included additional constructs such as technology complexity, individual differences, facilitating conditions, social influences, and wireless trust environment. The authors provided this framework for future testing, as they provided no data in this study.

APPENDIX C. SCALES DERIVED FOR THE INTERNET

Figure 10.

Perceived Usefulness of the Internet

PU1	Using the Internet can enable to accomplish tasks more quickly
PU2	Using the Internet can improve my performance
PU3	Using the Internet can make it easier to do my tasks
PU4	Using the Internet in my job/school can increase my productivity
PU5	Using the Internet can enhance my effectiveness
PU6	I find the Internet useful in my job/school

Perceived Ease of Use

PE1	Learning to use the Internet is easy for me
PE2	I find it easy to get what I need from the Internet
PE3	My interaction with the Internet is clear and understandable
PE4	I find the Internet to be flexible to interact with
PE5	It is easy for me to become skillful at using the Internet
PE6	I find the Internet easy to use

Attitude Toward Using the Internet

AT1	I have fun interacting with the Internet
AT2	Using the Web provides me with a lot of enjoyment
AT3	I enjoy using the Web
AT4	Using the Web bores me

Behavioral Intention to Use the Internet

BI1	I always try to use the Internet to do a task whenever it has a feature to help me perform it
BI2	I alwys try to use the Internet in as many cases/occassions as possible
BI3	I plan to use the Internet in the future
BI4	I intend to continue using the Web in the future
BI5	I expect my use of the Web to continue in the future

Perceived Complexity Using the Internet

PC1	Using the Internet can take up too much of my time when performing many tasks
PC2	When I use the Internet, I find it difficult to integrate the results into my existing work
PC3	Using the Internet exposes me to the vulnerability of computer breakdowns and loss of data

Experience

EX1	I have a great deal of experience using the Internet
EX2	Number of years using the Internet

Voluntariness Using the Internet

VU1	Using the Internet is voluntary as far as work/school is concerned
VU2	I am not required to use the Internet for work/school
VU3	While the Internet enhances effectiveness in completing tasks, it is not required that I use it

Gender

	Male or Female

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