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# UNDERSTANDING TECHNOLOGY ADOPTION IN THE HOUSEHOLD CONTEXT: A COMPARISON OF SEVEN THEORETICAL MODELS

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## Abstract

*We first reviewed seven theoretical models that have been used to explain technology adoption and use, primarily in the workplace. Then, we examined the boundary conditions of prior models of technology adoption when applied to the household context using empirical data from 1,247 U.S. households. Those households that had adopted household technologies were surveyed regarding their use behavior. Non-adopters were surveyed regarding their purchase intentions. This allowed us to identify the most influential factors impacting a household's decision to purchase and use technologies. Our results showed that the model of adoption of technology in the household (MATH) provided the richest explanation of technology adoption and use in the household.*

*Keywords: Technology adoption, Household technology purchase decision, Model of adoption of technology in households.*

# 1 Introduction

More and more technologies are developed specifically with the household in mind including televisions, multi-media entertainment centers, game consoles and personal computers. While these technologies were less widespread ten to fifteen years ago, households increasingly adopt and use these technologies (Deutsche Bank Research 2011; Forrester Research 2011). For instance, game consoles have become widely adopted. As a result, vendors have learned to specifically tailor products for households and groups (Sherr and Wingfield 2011). For example, many games developed for Nintendo's Wii are made for families. Wii controllers provide an entirely new gaming experience that has become widely accepted by gamers of all ages. Deutsche Bank reports that the computer gaming industry generates a global turnover of more than 40 billion US dollars (Deutsche Bank Research 2011). The console gaming industry is only one example of the trends taking place in the household appliance, audio-visual, television and computer industries (Gartner Group 2010; Forrester Research 2011; Sherr and Wingfield 2011). For example, Gartner group reports that in 2010 more than one hundred million personal computers were sold to households in developed countries (Gartner Group 2010). Likewise, Forrester Research predicts that more than 800 million households in Brazil, Russia, India, and China will adopt and purchase personal computers by 2015 (Forrester Research 2011). Advances in consumer technologies have resulted in many of them being commonly used and shared by several household members, which has implications for the adoption and purchase decision-making process. If purchasing technologies used exclusively by individuals, the purchase decision is a cognitive process that can be solely decided by individuals without consulting others. Adopting technology in a household context is significantly different from individual-level adoption due to the complex interactions and negotiations among household members (Venkatesh and Brown 2001).

A recent analysis of the adoption and acceptance literature suggests that a significant body of research has examined individual adoption of new technologies (Williams, Dwivedi et al. 2009). These studies have identified a number of factors that differentially influence individual reactions to various information technologies (e.g., mobile devices, internet banking, virtual worlds) in the workplace and non-work related contexts (Bhattacharjee 2001; Hong, Thong et al. 2006; Pavlou and Fyngenson 2006; Brown, Dennis et al. 2010; Venkatesh and Goyal 2010; Cenfetelli and Schwarz 2011). Models including the technology acceptance model (TAM) (Davis 1989), social cognitive theory (Compeau, Higgins et al. 1999), IS continuance theory (Bhattacharjee 2001) as well as the unified theory of acceptance and use of technology (UTAUT) (Venkatesh, Morris et al. 2003) were developed to better understand the most influential factors in these user settings. Some researchers have argued that technology adoption at the individual level is one of the most mature and most studied areas in the IS literature (Venkatesh, Davis et al. 2007). However, our literature review suggested that no prior studies have compared research models that could be used to study technology adoption in a household context (Brown and Venkatesh 2005; Brown, Venkatesh et al. 2006; Williams, Dwivedi et al. 2009).

To better comprehend the household technology adoption process, Venkatesh and Brown developed and tested the model of adoption of technology in households (MATH) (Venkatesh and Brown 2001; Brown and Venkatesh 2005). MATH was among the first theoretical models that explained the adoption decision-making process in a household context (Venkatesh and Brown 2001; Brown and Venkatesh 2005). The current study builds upon MATH and reviews and compares it with alternative models that could be used to explain the adoption decision-making process at the household level. Specifically, the current work seeks to accomplish two major objectives. First, we review major theoretical models explaining technology adoption and use and test the applicability of these models to a household context (Hong, Thong et al. 2006; Johns 2006). Second, the study of individual technology adoption has tended not to focus on purchase decisions because employees typically are not concerned with the cost or purchase processes (Venkatesh and Brown 2001; Van der Heijden 2006; Williams, Dwivedi et al. 2009). However, consumer psychology has found that purchase

decisions and consumption decisions are systematically different (Mittal and Kamakura 2001). Therefore, we investigate both purchase decisions and use decisions as a way of examining the generalizability of the models to more complex decision-making situations than previously investigated (Lee and Baskerville 2003).

## 2 Technology Adoption and Use

### 2.1 Models of adoption appropriate for the context of this study

Individual adoption and use of a variety of technologies, ranging from PCs in general to specific software packages, have been studied extensively in prior research (Hong, Thong et al. 2006; Thompson, Compeau et al. 2006; Brown, Dennis et al. 2010; Djamasbi, Strong et al. 2010; Cenfetelli and Schwarz 2011). As noted earlier, several theoretical perspectives from MIS, marketing, psychology, and sociology have been used to explain individual adoption and use of technologies. These theories include the theory of reasoned action (TRA) (Fishbein and Ajzen 1975), the theory of planned behavior (TPB) (Ajzen 1991), and the motivational model (MM) (Davis, Bagozzi et al. 1992). Prior research has drawn from this theory base and developed models tailored specifically to study individual adoption and use of technologies. TRA has been tailored to fit individual technology adoption and use in the technology acceptance model (TAM) (Davis 1989; Davis, Bagozzi et al. 1989). Similarly, TPB has been tailored to the technology adoption context by combining it with some TAM constructs in the decomposed theory of planned behavior (DTPB) (Taylor and Todd 1995; Pavlou and Fygenson 2006). While in the case of TRA and TPB, the belief structure will need to be generated from each context of study, in the case of TAM and DTPB, the belief structure suited to individual technology adoption and use was developed via a careful theoretical synthesis of prior research, and is thus purported to hold across different contexts. Venkatesh and Speier (1999) have applied the MM to study technology acceptance in the workplace. Another model, this one with a basis in sociology, that has featured prominently in explaining individual adoption and use decisions is innovation diffusion theory (IDT) (Rogers 1995). IDT emerged in the 1960's to study innovations and has been employed to study the adoption and diffusion of a wide range of technological innovations over the years (Rogers 1995). Moore and Benbasat (1991) identified the core set of characteristics relevant to technology adoption and subsequently there have been applications of IDT to study individual adoption and use decisions (Karahanna, Straub et al. 1999). The last model of interest is one of the few research models that focused on household adoption—MATH (Venkatesh and Brown 2001; Brown and Venkatesh 2005). MATH was derived by integrating TPB and IDT. In keeping with the general conceptual underpinnings of previous technology adoption research, MATH developed the underlying attitudinal, normative, and control beliefs that predict household adoption and use. It is in the underlying belief structure that MATH departs from previous research because MATH provides a belief structure that is tailored to the context of technology adoption in the household.

Although the models have drawn from diverse perspectives, there is some level of overlap across them. The overlap indicates a possible triangulation of results from diverse theoretical perspectives. Furthermore, although there are some shared constructs, the different perspectives are distinct in that they also propose unique constructs. For example, TRA is a subset of TPB (Ajzen 1991). TAM and IDT have overlap, for example in relative advantage and perceived usefulness (Davis 1989; Moore and Benbasat 1991). Finally, MM and TAM have conceptual and empirical similarities (Davis 1989; Davis, Bagozzi et al. 1992). Table 1 summarizes the core constructs identified by each of the models.

<b>Theory/Model and Discussion</b>	<b>Core Constructs</b>
<b>Theory of Reasoned Action</b>	
TRA is one of the fundamental theories in psychology that has been used widely to predict behavior (Fishbein and Ajzen 1975). Sheppard, Hartwick et al. (1988) present a review of TRA research.	<ul style="list-style-type: none"> <li>• Attitude Toward Behavior</li> <li>• Subjective Norm</li> </ul>
<b>Theory of Planned Behavior</b>	

TPB was developed by extending TRA (Fishbein and Ajzen 1975). Ajzen (1991) presented a review of several studies that have successfully used TPB to predict intention and behavior in a wide variety of behaviors. More recently, research has found TPB to be predictive of user acceptance and use (Pavlou and Fygenon 2006).	<ul style="list-style-type: none"> <li>• Attitude</li> <li>• Subjective Norm</li> <li>• Perceived Behavioral Control</li> </ul>
<b>Technology Acceptance Model</b>	
TAM (Davis 1989; Davis, Bagozzi et al. 1989) was adapted from TRA and tailored to the context technology acceptance and use. Since its development in the 1980's, TAM has been applied to a wide range of technologies and through several applications and replications (for a review, see Venkatesh, Davis et al. 2007 for a review).	<ul style="list-style-type: none"> <li>• Perceived Usefulness</li> <li>• Perceived Ease of Use</li> </ul>
<b>Decomposed Theory of Planned Behavior</b>	
DTPB (Taylor and Todd 1995) was derived from TPB, and TAM to a certain extent. DTPB uses attitude toward behavior, subjective norm, and perceived behavioral control from TPB and attempts to decompose the underlying belief structure that determine these constructs. Empirical evidence suggests that DTPB is comparable to TPB and TAM (Taylor and Todd 1995), but possesses the advantage of providing a deeper understanding of acceptance.	<ul style="list-style-type: none"> <li>• Attitude Toward Behavior</li> <li>• Subjective Norm</li> <li>• Perceived Behavioral Control</li> </ul>
<b>Motivational Model</b>	
A significant body of research in psychology has supported a motivational explanation for behavior (Vallerand 1997). Venkatesh and Speier (1999) have applied the MM to study technology acceptance in the workplace.	<ul style="list-style-type: none"> <li>• Extrinsic Motivation</li> <li>• Intrinsic Motivation</li> </ul>
<b>Innovative Diffusion Theory</b>	
IDT (Rogers 1995) has its roots in sociology and has been used since the 1960's to study a variety of innovations, ranging from agricultural tools to organizational innovation. One of the first applications of innovation diffusion theory was by (Moore and Benbasat 1991), who adapted innovation characteristics to technology adoption. Agarwal and Prasad (1998) have studied the role of these characteristics in predicting acceptance and found modest support for the predictive validity of innovation characteristics.	<ul style="list-style-type: none"> <li>• Relative Advantage</li> <li>• Ease of use</li> <li>• Image</li> <li>• Visibility</li> <li>• Compatibility</li> <li>• Results</li> <li>• Demonstrability</li> <li>• Voluntariness of Use</li> </ul>
<b>Model of Adoption of Technology in Households</b>	
MATH includes factors influencing household technology adoption. The model was developed based on the theory of planned behavior (TPB) (Ajzen 1991) and suggests that attitude, subjective norms, and perceived behavioral control predict household technology adoption [for a discussion, see (Brown and Venkatesh 2005)].	<ul style="list-style-type: none"> <li>• Attitudinal Beliefs</li> <li>• Normative Beliefs</li> <li>• Control Beliefs</li> </ul>

Table 1: Contributing Theories and Constructs

## 2.2 Model comparison and boundary conditions

There is an established tradition in information systems research of comparing research models that have been developed and tested in prior research (Taylor and Todd 1995; Venkatesh, Morris et al. 2003; Hong, Thong et al. 2006; Thompson, Compeau et al. 2006). In the current paper, we conduct a comparison of models that can be meaningfully applied to the technology adoption decision-making process in the household context. During the model selection process, we focused on appropriate models for the household technology purchase and adoption processes. For example, UTAUT suggests that age, gender, and experience with technology moderates key causal relationships in the model. These moderators are challenging to test in a household context because they vary across household members. Thus, UTAUT seemed to be less suitable or even inappropriate to study the household decision making process related to technology adoption and use. Apart from MATH, all of the models listed in Table 1 are general behavioral models and none was exclusively developed for technology use in a mandatory use or work setting. Benchmarking these models is an important contribution to research as it examines the generalizability (external validity) of the existing models to a new context (Lee and Baskerville 2003; Johns 2006). Models that generalize better to new settings and contexts are generally considered more scientifically robust. However, lack of support or weaknesses in models will help us understand the boundary conditions of the model(s) that can then serve as important information for scientists to modify and extend the models to the household technology adoption context (Lee and Baskerville 2003; Johns 2006).

## **2.3 Purchase vs. Use**

In choosing a dependent variable for the current research, we examined technology acceptance research and also research in the reference disciplines, particularly psychology. In the current research, we have two major categories of households to be studied: those that currently have adopted household technology (i.e., adopters) and those that currently have not adopted household technology (i.e., non-adopters). For the adopters, the behavior of interest is actually their use of household technologies. Given that the technology adoption decision has already been made in these households, asking adopters about the factors that influenced their original adoption decision would likely result in significant retrospective biases including the inability to report accurately, rendering intention to purchase as an unacceptable dependent variable. Therefore, we employ use as the dependent variable for those who have already adopted household technologies.

For those who have not yet adopted the particular household technology in this study, the appropriate dependent variable was intention to purchase. Given that these households had not yet acquired the technology, we were interested in knowing whether or not the decision to purchase the technology had been made. Psychology theory typically suggests that intention is the appropriate dependent variable to use prior to behavioral performance (Ajzen 1991).

## **3 Research method**

### **3.1 Mail survey**

Despite being originally designed as workstations (e.g., for running office applications), today personal computers are used by households for a variety of tasks. For example, PCs are increasingly in the home to support gaming, viewing television, and digital video recording. Recent market research shows that more than 12 million U.S. households use PCs as a digital hub for digital photos, music, video players, TV receivers and digital video recorders (Leichtman Group 2011). Likewise, Gartner Group (2011) reports that more than 14 million personal computers were sold to households in Western Europe in the third quarter of 2011 alone. These developments are particularly driven by online video and music on demand services, such as Netflix, Apple's iTunes store and Hulu. Likewise, many personal computers are used for gaming and vendors often simultaneously release PC versions for Xbox, Wii and Playstation games. This allows PC users to play and interact with game console owners online. This shows that PC use has diversified significantly over the last few years and market research predicts that households will continue to adopt personal computers (Forrester Research 2011). Thus, it is important for marketers to understand why households purchase and use personal computers.

Our study was designed to gather information regarding PC adoption and use decisions in American households. We conducted a nationwide survey with the assistance of a market research firm. We worked closely with a market research firm to identify 5,200 households to participate in the study via a direct mailing. In total, 1,247 usable responses were received over an eight-week period, resulting in a response rate of just over 24%. In order to assess non-response bias, the responses received in the last two weeks were compared to those received in the first six weeks. Demographics, means, and correlations were compared and no significant systematic differences were found. Consistent with recent estimates regarding the extent of diffusion of PCs to homes (Gartner Group 2010; Forrester Research 2011; Sherr and Wingfield 2011), we found that about 40% of all households (501 out of 1,247) participating in this study possessed a PC.

### **3.2 Measures**

The TRA and TPB constructs (i.e., attitude, subjective norm, perceived behavioral control, intention, and use) were measured with previously used and validated scales (Davis 1989; Davis, Bagozzi et al.

1989; Taylor and Todd 1995). The additional constructs employed in DTPB were measured consistent with scales used by Taylor and Todd (1995). The measures for the predictors of TAM (i.e., perceived usefulness and perceived ease of use) were adapted from Davis (1989) and Davis et al. (1989). The predictors in the motivation model (i.e., extrinsic motivation and intrinsic motivation) were measured consistent with the scales used in Venkatesh and Speier (1999). The measures for the constructs of IDT were adapted from Moore and Benbasat (1991). MATH measures were adapted from Venkatesh and Brown (2005). Table 2 lists the scales used to collect data for our study.

Construct	Item
<b>Attitude Toward Using a Computer</b>	<ul style="list-style-type: none"> <li>Using a computer at home is a _____ idea. (Bad...Good)</li> <li>Using a computer at home is a _____ idea. (Foolish...Wise)</li> <li>I _____ the idea of using a computer at home. (Dislike...Like)</li> <li>Using a computer at home is _____. (Unpleasant...Pleasant)</li> </ul>
<b>Subjective Norm</b>	<ul style="list-style-type: none"> <li>People who influence my behavior think that I should use a computer at home.</li> <li>People who are important to me think that I should use a computer at home.</li> </ul>
<b>Perceived Behavioral Control</b>	<ul style="list-style-type: none"> <li>I have control over using a computer at home.</li> <li>I have the resources necessary to use a computer at home.</li> <li>I have the knowledge necessary to use a computer at home.</li> <li>Given the resources, opportunities and knowledge it takes to use a computer at home, it would be easy for me to use a computer.</li> <li>A computer is not compatible with other technologies I use at home and work.</li> </ul>
<b>Perceived Usefulness</b>	<ul style="list-style-type: none"> <li>Using a computer improves my performance at home.</li> <li>Using a computer at home increases my productivity.</li> <li>Using a computer enhances my effectiveness at home.</li> <li>I find a computer to be useful at home.</li> </ul>
<b>Perceived Ease of Use</b>	<ul style="list-style-type: none"> <li>My interaction with a computer is clear and understandable.</li> <li>Interacting with a computer does not require a lot of my mental effort.</li> <li>I find a computer to be easy to use.</li> <li>I find it easy to get a computer to do what I want it to do.</li> </ul>
<b>Compatibility</b>	<ul style="list-style-type: none"> <li>Using a computer is compatible with many aspects of my home.</li> <li>I think that using a computer system fits well with the way I do things at home.</li> <li>Using a computer fits into style of activities at home.</li> </ul>
<b>Peer Influence</b>	<ul style="list-style-type: none"> <li>My co-workers think I should use a computer at home.</li> <li>My friends think I should use a PC at home.</li> </ul>
<b>Superior Influence</b>	<ul style="list-style-type: none"> <li>My superiors think I should use a computer at home.</li> <li>My boss thinks I should use a PC at home.</li> </ul>
<b>Efficacy</b>	<ul style="list-style-type: none"> <li>I feel comfortable using a computer on my own.</li> <li>If I wanted to, I could easily operate a computer on my own.</li> <li>I can use a computer even if no one is around to help me.</li> </ul>
<b>Resource Facilitating Conditions</b>	<ul style="list-style-type: none"> <li>I won't be able to use the computer at home when I need it.</li> <li>The cost of maintaining a computer (e.g., utility cost, additional phone line, repair, internet service) at home is high.</li> </ul>
<b>Technology Facilitating Conditions</b>	<ul style="list-style-type: none"> <li>Other equipment and technologies I have at home are not compatible with a computer.</li> <li>The software I use at other places (e.g., work) is not compatible with my computer at home and/or other software I have at home.</li> <li>I have trouble reading my disks on my computer at home.</li> </ul>
<b>Extrinsic Motivation</b>	<ul style="list-style-type: none"> <li>Operationalized same as perceived usefulness.</li> </ul>
<b>Intrinsic Motivation</b>	<ul style="list-style-type: none"> <li>I find using a computer to be enjoyable.</li> <li>The actual process of using a computer is pleasant.</li> <li>I have fun using a computer.</li> </ul>
<b>Relative Advantage</b>	<ul style="list-style-type: none"> <li>Using a computer enables me to accomplish tasks more quickly.</li> <li>Using a computer improves the quality of work I do at home.</li> <li>Using a computer makes it easier to do perform some activities at home.</li> <li>Using a computer enhances my effectiveness in activities at home.</li> <li>Using a computer gives me greater control over different activities at home.</li> </ul>
<b>Ease of use</b>	<ul style="list-style-type: none"> <li>Operationalized same as perceived ease of use.</li> </ul>
<b>Image</b>	<ul style="list-style-type: none"> <li>People who use a computer at home have more prestige than those who do not.</li> <li>People who use a computer at home have a high profile.</li> <li>Using a computer is a status symbol.</li> </ul>
<b>Visibility</b>	<ul style="list-style-type: none"> <li>I have seen what others do using a computer at home.</li> <li>I see a computer at many homes.</li> <li>A computer is not very visible in homes.</li> </ul>
<b>Result Demonstrability</b>	<ul style="list-style-type: none"> <li>I have no difficulty telling others about the results of using a computer at home.</li> <li>I believe I could communicate to others the consequences of using a computer at home.</li> <li>The results of using a computer at home are apparent to me.</li> </ul>

	<ul style="list-style-type: none"> <li>I would have difficulty explaining why using a computer at home may or may not be beneficial.</li> </ul>
<b>Voluntariness of Use</b>	<ul style="list-style-type: none"> <li>My use of a computer at home is voluntary.</li> <li>No one who holds power over me requires me to use a computer at home.</li> <li>Although it might be helpful, using a computer at home is certainly not compulsory.</li> </ul>
<b>Applications for Personal Use</b>	<ul style="list-style-type: none"> <li>I find that the computer has tools for personal productivity.</li> <li>I find that the computer has tools to support household activities.</li> <li>The computer has software that helps with activities in the house.</li> </ul>
<b>Utility for Children</b>	<ul style="list-style-type: none"> <li>The computer provides applications that my kid(s) can use.</li> <li>The computer has useful software for my child (or children).</li> <li>I find the computer to be a useful tool for my child (or children).</li> </ul>
<b>Utility for Work-Related Use</b>	<ul style="list-style-type: none"> <li>The computer is useful for me to work-at-home.</li> <li>The computer provides applications related to my job.</li> <li>I am able to work at home more effectively because of software on my computer.</li> </ul>
<b>Applications for Fun</b>	<ul style="list-style-type: none"> <li>The computer provides many applications that are enjoyable.</li> <li>I enjoy playing computer games.</li> <li>My computer has applications that are fun.</li> <li>I am able to use my computer to have fun.</li> </ul>
<b>Status Gains</b>	<ul style="list-style-type: none"> <li>Operationalized same as image from IDT .</li> </ul>
<b>Influence from Friends and Family</b>	<ul style="list-style-type: none"> <li>My friends think I should use a computer at home.</li> <li>Those in my social circle think I should use a PC at home.</li> <li>My family members think I should use a computer at home.</li> <li>My relatives think I should use a computer at home.</li> </ul>
<b>Information from Secondary Sources</b>	<ul style="list-style-type: none"> <li>Information from newspapers suggest that I should use a computer at home.</li> <li>Information that I gather by watching TV encourages me to use a computer at home.</li> <li>Based on what I have heard on the radio, I am encouraged to use a computer at home.</li> </ul>
<b>Rapid Change in Technology (Fear of Obsolescence)</b>	<ul style="list-style-type: none"> <li>The trends in technological advancement are worrisome to me.</li> <li>I fear that today's best home PC will be obsolete fairly soon.</li> <li>I am worried about the rapid advances in computer technology.</li> </ul>
<b>Declining Cost</b>	<ul style="list-style-type: none"> <li>The cost of PCs are constantly declining.</li> <li>I believe the cost of computers will continue to decline in the future.</li> <li>I think we will see better computers for a lower price in the near future.</li> </ul>
<b>High Cost</b>	<ul style="list-style-type: none"> <li>Computers that are available today are too expensive.</li> <li>I think computers are quite pricey.</li> <li>I consider a computer to be big-ticket item.</li> </ul>
<b>Perceived Ease of Use</b>	<ul style="list-style-type: none"> <li>Operationalized same as perceived ease of use from TAM.</li> </ul>
<b>Requisite Knowledge for PC Use</b>	<ul style="list-style-type: none"> <li>Same as efficacy from DTPB.</li> </ul>
<b>Intention to Purchase</b> (applicable only to current non-adopters)	<ul style="list-style-type: none"> <li>I intend to adopt a computer at home.</li> <li>I predict that I would adopt a computer at home.</li> <li>I expect to adopt a computer at home in the near future</li> </ul>
<b>Use</b> (applicable only to current users)	<ul style="list-style-type: none"> <li>On average, how often do you use a computer at home? (Not at all, less than once a week, about once a week, 2 or 3 times a week, 4 to 6 times a week, about once a day)</li> </ul>

*Table 2. Items Used for the Study*

## 4 Findings

We first examined how well the sample represented the population of American households. In order to do this, we compared the characteristics of the sample with the characteristics of the population based on the Bureau of Census for the same time period corresponding to our data collection. The results confirmed that the sample was representative of the population in terms of family status, gender, racial background, age, nativity, region, residence, and household income, thus suggesting that the findings of the current research were likely to generalize to the target population (i.e., American households). Psychometric properties of the different scales were assessed. All scales exhibited reliability as evidenced by Cronbach alpha values of .75 or greater. We proceeded to examine convergent and discriminant validity using factor analysis with direct oblimin rotation. In assessing the validity, we stayed faithful to the theoretical perspectives by examining convergent and discriminant validity for one model at a time. The factor analyses supported convergent validity within constructs and discriminant validity across constructs, with cross-loadings being less than .40 in all models. Given the extensive detail associated with these results, the results are not reported in here.



Interitem correlations also supported this pattern with correlations of items within constructs being significantly higher than correlations of items across constructs in all models. The data were analyzed using regression analysis to test the various models presented earlier among current users and non-adopters. A considerable amount of literature suggests that regression techniques are appropriate for assessing the structural paths in theoretical research models (Hair et al. 1998, Gefen et al. 2000).

For this analysis, the dependent variable was use for current users and intentions to purchase for non-adopters. All models provided reasonable explanatory power in understanding current use behavior, with the variance explained ranging from 22% to 37%, with TPB, DTPB and MATH providing the richest explanation. The strongest predictors included attitude, perceived usefulness, extrinsic motivation, subjective norms and perceived behavioral control. These variables were all significant ( $p < .001$ ) and the beta coefficients consistently ranged from .18 to .40. Table 3 shows the results.

Theory/Model	D.V.	I.V.	Current Users		Current Non-Adopters	
			R <sup>2</sup>	β	R <sup>2</sup>	β
TRA	Intention/Use	Attitude	.22	.23***	.28	.28***
		Subjective norm		.17*		.24***
TPB	Intention/Use	Attitude	.37	.25***	.44	.28***
		Subjective norm		.21***		.20**
		Perceived behavioral control		.18**		.25***
DTPB	Intention/Use	Attitude	.37	.25***	.44	.28***
		Subjective norm		.21***		.20**
		Perceived behavioral control		.18**		.25***
	Attitude	Perceived usefulness	.19	.20**	.16	.19**
		Perceived ease of use		.19*		.22**
	Subjective Norm	Compatibility		.08		.07
		Peer influence	.10	.20***	.07	.27***
		Superior's influence		.15*		.13
		Percd. Behl. Cntrl.	.21	.25***	.20	.24**
		Resource facilitating conditions		.19*		.20*
TAM	Intention/Use	Tech. facilitating conditions		.08		.17*
		Perceived ease of use		.19*		.17**
MM	Intention/Use	Perceived usefulness	.27	.28***	.30	.40***
		Extrinsic motivation		.17*		.20**
IDT	Intention/Use	Intrinsic motivation	.25	.27***	.30	.37***
		Relative advantage	.28	.20***	.27	.19*
		Ease of use		.17*		.24**
		Image		.15*		.15*
		Visibility		.08		.07
		Compatibility		.20**		.02
		Result demonstrability		.13*		.07
MATH	Intention/Use	Voluntariness of use		.09		.09
		Attitude	.37	.25***	.44	.28***
		Subjective norm		.21***		.20**
	Attitude	Perceived behavioral control		.18**		.25***
		Applications for personal use	.49	.25***	.48	.18*
	Subjective Norm	Utility for children		.20**		.20*
		Utility for work-related use		.18*		.22*
	Perceived Behavioral Control	Applications for fun		.18*		.17*
		Status gains		.07		.20**
	Perceived Behavioral Control	Friends and family	.12	.16*	.25	.16*
		Secondary sources		.16*		.22**
		Fear of obsolescence	.07	.08	.55	-.28***
		Declining cost		.04		.17*
		High cost		.02		-.16*
Requisite knowledge for PC use	Perceived ease of use		.17*		.19**	
	Requisite knowledge for PC use		.12		.20**	

Note: The dependent variable in the case of current users is use. In the case current non-adopters, the dependent variable is intention to adopt.

Table 3. Model Testing Study

## 5 Discussion

Based on a nationwide sample of 1,247 U.S. households that were representative of the population of U.S. households, the different existing models examined were found to perform relatively well in terms of explaining household technology purchase and use decisions. This research presents an important step in examining the generalizability and thus, the boundary conditions of existing theoretical models of the technology purchase decision and use in the context of households. TPB, DTPB and MATH performed similarly well in explaining variance in both dependent variables (e.g., all the models explained .37 in intention to use and .44 in the intention to purchase). This was not unexpected given that TPB, DTPB and MATH are all based on attitudinal-, normative and control belief structures. While all three models have a similar explanatory power in predicting use and purchase intentions in context of household technologies, we note that these models differ in terms of their ability to provide comprehensive explanations on why household technology adoption takes place. DTPB provides a more fine-grained view than TPB whereas MATH is the richest among the three models.

TPB is the most general model and it appeals due to its parsimony, the robustness of its scales, and the strong generalizability of the model. The predictive validity of TPB has been assessed in empirical studies published in a wide variety of journals (Venkatesh, Davis et al. 2007). Our empirical study confirmed the external validity of the model and TPB also performs well in predicting adoption and purchase behavior of household technologies. In contrast to the original TPB, DTPB is a more comprehensive model and it provides specific information on normative and control beliefs in the household technology use context. For example, as part of the control belief structure, DTPB explains how important self-efficacy beliefs are and examines the influential role of facilitating conditions in context of household technologies. This information could be leveraged in future studies on household technology adoption. For instance, studies could investigate the antecedent constructs influencing household members' self-efficacy beliefs with regard to household technologies.

MATH is more comprehensive than TPB and DTPB and one of its strengths lies in identifying and developing the role of hedonism (i.e., applications for fun, social outcomes (i.e., status gains) and fear of obsolescence in household technology adoption. Thus, MATH departs from a more utilitarian perspective that has characterized the results from the significant body of prior technology acceptance research in workplace settings (Venkatesh, Morris et al. 2003). For example, the findings for MATH confirmed that fear of obsolescence is one of the important factors constraining household technology adoption. This is a finding subject to volatility due to the declining cost of household technologies. Consumer purchase of big-ticket items is typically influenced by cost, both directly and also by changing the role and importance of other factors. Thus, the high cost of household technologies coupled with rapid changes in the industry could be resulting in a cost-to-useful life ratio that is unacceptable to many consumers. However, with the declining costs of household technologies or increasing perceptions of useful life (perhaps via increased backward compatibility), this dynamic may change in the future. Thus, future research should examine the point at which consumers perceive that the utility of household technologies is in proper proportion to their costs and useful life. We conclude that MATH is the most appropriate model for our context of investigation. Some could argue that such a finding is not particularly surprising given that the model was developed to be tailored to the specific context, but there is a key broader implication. Our findings suggest that context-specific models indeed offer richer insights compared to more general models, which calls into question the conventional wisdom about generalizability being the most critical criterion for theory development; rather, it suggests that, consistent with more recent views, a focus on the context can be more fruitful (see Johns 2006).

Although this research focuses on household technologies, its findings have relevance to organizational adoption and management of IT. We propose that an organization faces many of the same issues faced by a household. While individual theories of adoption might not be immediately applicable to the organization (Rogers 1995), some theoretical components presented here are. For

instance, while the individual adopter in an organization may not be immediately concerned with cost, the organization is. Likewise, obsolescence may not be a factor for the individual adopter in the organization, but it is very likely a concern at the organizational level. Thus, we propose that the factors presented here that do not map directly onto existing workplace technology acceptance models, possibly represent the difference between the factors considered by individuals and those considered by organizations. Future research should examine the degree to which household concerns are useful in examining organizational-level adoption.

From a practical perspective, the findings of this research reveal the most essential factors influencing households to use and purchase technologies. By benchmarking seven general models, we examined the predictive validity of each model and associated survey instruments. These findings should be of value for companies manufacturing and/or distributing household technologies. For example, the findings related to MATH suggest that current household technology users and non-adopters emphasize personal use and the utility for children. Both variables significantly contributed to consumers' attitudes towards household technologies. Companies marketing household technologies in commercials (e.g., TV commercials) should emphasize the technology's usefulness for the entire household, including children and adults. An example of translating our findings into marketing strategies could be commercials of gaming consoles including children gaming with their parents (e.g., playing sport games on Wii). Marketers could also make use of these findings and emphasize the personal use of specific household technologies. For example, recent television models allow users to browse the Internet and even log onto their Facebook and Skype accounts. While televisions are normally shared across several household members, TV advertisements could emphasize that newest models are also useful for personal social networking.

Our findings related to DTPB confirmed that peer influence was highly significant for current and non-adopters of household technologies. Marketers could use this information and emphasize the usefulness of specific household technologies for connecting with friends and peers. For example, game console providers could point out the fact that games can be played online and peers and friends can meet online (e.g., in Sony's PSN network). As discussed earlier, our findings also confirmed that self-efficacy is an important factor for the household use and purchase decision making process. Advertisements and commercials could try to positively influence household members' self-efficacy beliefs by emphasizing how approachable and easy to use the focal household technologies are.

We collected data from U.S. households and tested the generalizability of seven research models to the context of household adoption. A replication of the study drawing from European households would be interesting in order to discover the influential role of national culture on household technology adoption. Hofstede's (2012) culture scores suggest that national cultures differ significantly across European countries and it would be interesting to compare these models with data obtained in various European countries.

## **6 Conclusion**

We examined the generalizability of seven existing models of technology adoption to the context of household technology and found that although all were acceptable, TPB, DTPB and MATH outperformed the remaining models. The present work is expected to serve as a critical starting point for future scientific investigation of technologies in homes as the electronic commerce and mobile commerce revolutions continue to grow. From a practical perspective, organizations, particularly in the household technology industry, stand to benefit from this new knowledge as they plan their marketing their products to current users and non-adopters.

## 7 References

- Agarwal, R. and J. Prasad (1998). A conceptual and operational definition of personal innovativeness in the domain of information technology. *Information Systems Research*, 9(2), 204-215.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, 50, 179-211.
- Bhattacharjee, A. (2001). Understanding information systems continuance: an expectation-confirmation model. *MIS Quarterly*, 25(3), 351-370.
- Brown, S. A., A. R. Dennis, et al. (2010). Predicting collaboration technology use: integrating technology adoption and collaboration research. *Journal of Management Information Systems*, 27, 9-54.
- Brown, S. A. and V. Venkatesh (2005). Model of adoption of technology in households: a baseline model test and extension incorporating household life cycle. *MIS Quarterly*, 29(3), 399-426.
- Brown, S. A., V. Venkatesh et al. (2006). Household technology use: integrating household life cycle and the model of adoption of technology in households. *The Information Society*, 22(4), 205-218.
- Cenfetelli, R. T. and A. Schwarz (2011). Identifying and testing the inhibitors of technology usage intentions. *Information Systems Research*, 4(12), 1-19.
- Compeau, D. R., C. A. Higgins, et al. (1999). Social cognitive theory and individual reactions to computing technology: a longitudinal study. *MIS Quarterly*, 23(2), 145-158.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-339.
- Davis, F. D., R. P. Bagozzi, et al. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management Science*, 35(8), 982-1002.
- Davis, F. D., R. P. Bagozzi, et al. (1992). Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Social Psychology*, 22(14), 1111-1132.
- Deutsche Bank Research (2011). A serious business with plenty to play for.
- Djamasbi, S., D. M. Strong, et al. (2010). Affect and acceptance: examining the effects of positive mood on the technology acceptance model. *Decision Support Systems*, 48(2), 383-394.
- Fishbein, M. and I. Ajzen (1975). *Belief, attitude, intention and behavior: an introduction to theory and research*. Addison-Wesley, Reading, MA.
- Forrester Research (2011). *Worldwide PC adoption forecast, 2007 To 2015*. Forrester Research.
- Gartner Group. (2010). Gartner says worldwide pc shipments grew 7.6 percent in third quarter of 2010. Retrieved 21.06., 2011, from <http://www.gartner.com/it/page.jsp?id=1451742>.
- Gartner Group. (2011). Western europe: pc vendor unit shipment estimates for third quarter 2011. Retrieved 27.03., 2012, from <http://www.gartner.com/it/page.jsp?id=1847115>.
- Gefen, D., D. Straub, et al. (2000). Structural equation modeling techniques and regression: guidelines for research practice. *Communications of AIS*, 7(7), 1-78.
- Hair, J.F., R.E. Anderson, et al. (1998). *Multivariate Data Analysis with Readings*, (Fifth ed.) Prentice Hall, Englewood Cliffs, NJ.
- Hong, S., J. Thong, et al. (2006). Understanding continued information technology usage behavior: A comparison of three models in the context of mobile internet. *Decision Support Systems*, 42, 1819-1834.
- Hofstede, G. (2012). Geert hofstede national culture - countries cultural values. Retrieved 27.03., 2012, from <http://geert-hofstede.com/>.
- Johns, G. (2006). The essential impact of context on organizational behavior. *The Academy of Management Review*, 31(2), 386-408.
- Karahanna, E., D. Straub, et al. (1999). Information technology adoption across time: a cross-sectional comparison of pre-adoption and post-adoption beliefs. *MIS Quarterly*, 23(2), 183-213.
- Lee, A. S. and R. L. Baskerville (2003). Generalizing generalizability in information systems research. *Information Systems Research*, 14(3), 221-243.
- Leichtman Group (2011). Nearly 1.3 million add broadband in the first quarter of 2011.

- Mittal, V. and W. A. Kamakura (2001). Satisfaction, repurchase intent, and repurchase behavior: investigating the moderating effect of customer characteristics. *Journal of Marketing Research*, 38, 131-142.
- Moore, G. C. and I. Benbasat (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research*, 2(3), 192-222.
- Pavlou, P. A. and M. Fygenson (2006). Understanding and predicting electronic commerce adoption: an extension of the theory of planned behavior. *MIS Quarterly*, 30(1), 115-144.
- Rogers, E. (1995). *Diffusion of Innovations*. New York.
- Sheppard, B. H., J. Hartwick, et al. (1988). The theory of reasoned action: a meta-analysis of past research with recommendations for modifications and future research. *Journal of Consumer Research*, 15(3), 325-343.
- Sherr, I. and N. Wingfield. (2011). Play by play: sony's struggles on breach. Retrieved May 10th, 2011, from <http://online.wsj.com/article/SB10001424052748704810504576307322759299038.html>.
- Taylor, S. and P. A. Todd (1995). Understanding information technology usage: a test of computing models. *Information Systems Research*, 6(4), 144-176.
- Thompson, R., D. Compeau, et al. (2006). Intentions to use information technologies: an integrative model. *Journal of Organizational and End User Computing*, 18(3), 25-48.
- Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. In M.P. Zanna (Ed.), *Advances in experimental social psychology* New York: Academic Press. M. P. Zanna, New York: Academic Press, 271-360.
- Van der Heijden, H. (2006). Mobile decision support for in-store purchase decisions. *Decision Support Systems*, 42(2), 656-663.
- Venkatesh, V. and S. A. Brown (2001). A longitudinal investigation of personal computers in homes: adoption determinants and emerging challenges. *MIS Quarterly*, 25(1), 71-102.
- Venkatesh, V., F. D. Davis, et al. (2007). Dead or alive? the development, trajectory and future of technology adoption research. *Journal of the Association for Information Systems*, 8(4), 267-286.
- Venkatesh, V. and S. Goyal (2010). Expectation disconfirmation and technology adoption: polynomial modeling and response surface analysis. *MIS Quarterly*, 34(2), 281-303.
- Venkatesh, V., M. G. Morris, et al. (2003). User acceptance of information technology: toward a unified view. *MIS Quarterly*, 27(3), 425-478.
- Venkatesh, V. and Speier, C. (1999). Computer technology training in the workplace: a longitudinal investigation of the effect of mood. *Organizational Behavior and Human Decision Processes*, 79(1), 1-28.
- Williams, M. D., Y. K. Dwivedi, et al. (2009). Contemporary trends and issues in IT adoption and diffusion research. *Journal of Information Technology*, 24 (March), 1-10.