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ABSTRACT

Recent research indicates that Perceived Usefulness of IT (PU) is a significant and stable predictor of long-term IT acceptance when PU is measured at the preprototype stage, i.e. before a working prototype of the IT has been tested or used by prospective users. This finding has important consequences for the development of a Municipal Wireless Network (MWN) because it suggests that the future likelihood of acceptance of an MWN can be estimated early, before too many limited or precious resources have been expended towards building it, and when there may still be considerable flexibility to modify key aspects related to it. Of particular interest then, to both IS (Information Systems) researchers and practitioners is the issue of why different prospective users contemplating the same MWN come to different conclusions regarding PU, even before they have tested or used it. To address this issue, this research develops a model for the determinants of preprototype PU in the context of a proposed Municipal Wireless Network.

Keywords

Preprototype Perceived Usefulness of IT, Municipal Wireless Networks

INTRODUCTION

Recent research indicates Perceived Usefulness of IT (PU) (Davis 1989; Davis et al. 1989) is a significant and stable predictor of long-term IT acceptance even when PU is measured at the preprototype stage (Davis and Venkatesh 2004). From a user point of view, Davis and Venkatesh define a preprototype stage as the stage of the IT development process before a working prototype of the IT has been tested or used by prospective users.

This finding has important consequences for the development of a Municipal Wireless Network (MWN)[1] because it suggests that the future likelihood of acceptance of an MWN can be estimated early, before too many limited or precious resources have been expended towards building it, and when there may still be considerable flexibility to modify key aspects related to it.

Of particular interest then, to both IS (Information Systems) researchers and practitioners is the issue of why different prospective users contemplating the same MWN come to different conclusions regarding PU, even before they have tested or used it. What factors account for the variation in preprototype PU among different individuals? For researchers, this issue is important because it can yield knowledge and understanding about some of the earliest antecedents of individual acceptance of IT. For practitioners the issue is important because such knowledge can facilitate practical interventions intended to improve preprototype PU of an IT, thereby increasing the likelihood that the IT will meet with long-term acceptance.

A limited number of prior IS (Information Systems) research studies have produced distinct models for the determinants of PU. However, these models were developed and tested in postprototype contexts, i.e. after working prototypes of IT were tested and used by prospective users. These models are not completely applicable in the preprototype stage because 1) they contain variables that are not applicable at the preprototype stage, and 2) they neglect variables that may be particularly relevant at the preprototype stage. Additionally, the prior studies used different theories to build their models for

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[1] An MWN is defined as wireless broadband internet access network that is created with active leadership and involvement of a community's local government.

determinants, and there is considerable disparity in the variables they arrived at. That is, they have little overlap. There is thus an opportunity to integrate them to arrive at a more holistic model.

This research study develops and tests a model for the determinants of preprototype PU by incorporating components drawn from the earlier models, and by adding new variables relevant to the preprototype stage.

The rest of this paper is organized as follows. The following section contains a brief review of relevant literature. The section after that develops the hypotheses and research model. This is followed by a section on the research methodology. The last chapter contains concluding remarks including an indication of when results will be available (this is research in progress).

LITERATURE REVIEW

Perceived Usefulness of IT (PU)

PU is an individual's subjective assessment of the extent to which using an IT will enhance the individual's performance in achieving relevant objectives. This construct is usually reflexively associated with the Technology Acceptance Model (TAM) (Davis 1989; Davis et al. 1989), and is also present in several other important models of IT acceptance. Conventionally, PU is employed as a determinant of individual acceptance of a new IT or an IT innovation, and is regarded as one of the most significant determinants/antecedents of individual acceptance of IT in the short-term as well as the long-term. In many studies PU has been found to be the only significant and stable determinant of IT acceptance over the long-term (Venkatesh et al. 2003).

The construct of PU has been employed in hundreds of studies of IT acceptance but only five studies have produced comprehensive models for the determinants of PU. Tables 1 and 2 summarize these five studies.

Study	IT Context
Karahanna and Straub (1999)	Use of an organizational e-mail system by an organization's employees
Lewis et al. (2003)	Use of Internet Technologies by faculty at a University
Venkatesh and Davis (2000)	Use of four kinds of IT by employees in four different organizations. The IT were: Manufacturing Scheduling System, Windows-based Financial Operations System, Windows-based Customer Account Management System, Investment Banking Stock Management System
Agarwal and Prasad (1999)	Use of a Graphical User Interface (GUI) by an organization's employees
Wixom and Todd (2005)	Use of Data Warehousing Software by employees in multiple organizations

Table 1. The Five Prior Research Studies on the Determinants of PU

Theoretical Underpinnings	Variable	Venkatesh and Davis (2000)	Lewis et al. (2003)	Karahanna and Straub (1999)	Agarwal and Prasad (1999)	Wixom and Todd (2005)
Social Influences and Norms	Subjective Norm	T		T		
	Image	T				
	Temporal Extent of Target System Use	T				
Cognitive Instrumental Processes	Relevance	T				
	Result Demonstrability	T				
	Output Quality	T				
Technology Acceptance Model	Perceived Ease of Use	T		T	T	T
Theory of Reasoned Action	Satisfaction with Output Information					T
Social Presence Theory	Social Presence of Communication Medium			T		
Theory of Planned Behavior	Perceived Accessibility of IT			T		
Institutional Theory	Top Management Commitment		T			
Rogers' Diffusion of Innovations Theory	Personal Innovativeness in IT (PIIT)		T			
Various Theories of Learnings	Training on System				T	
Notes: T = Tested and found to be a significant determinant of PU in this study						

Table 2. Comparison of the Five Prior Studies of Determinants of PU

As is evident in Table 2, the five prior models for the determinants of PU are quite disparate and the determinants identified by them are substantially non-overlapping. A major reason for this is that these studies employed different theoretical perspectives to develop their models.

Municipal Wireless Networks

A confluence of factors has recently made MWNs an increasingly feasible and attractive option for providing large-scale broadband access to the Internet (Gillett et al. 2004).

First, According to economic theory, it is appropriate for government to intervene in the provision of a service if the service utilizes public goods and has the potential to result in significant positive externalities (Cornes and Sandler 1986). Arguably, wireless Internet service fulfills these requirements because it utilizes the publicly owned radio spectrum, and can increase the potential for new innovations and societal benefits as more citizens get connected.

Second, recent developments in broadband wireless standards and technology have made the deployment of broadband wireless networks more convenient and cost-effective than ever before, and a viable alternative to cable, DSL, and other wired technologies for accessing the Internet (Sirbu et al. 2006).

Third, there is an expectancy that municipalities will find it relatively easy to set up wireless networks because they have ready and free access to physically dispersed assets such as lampposts and traffic lights that are ideal for installing geographically dispersed components of MWNs.

Since 2003, more than 300 communities around the world have begun taking steps to build MWNs. The proliferation of MWNs represents a major new trend in information technology and as with any IT trend, this trend too provokes various research questions that need be examined by IS researchers.

Our study is conducted in the context of a proposed MWN for the city of Philadelphia that is being advocated and sponsored by the city government of Philadelphia.

RESEARCH MODEL AND HYPOTHESES

The purpose of this study is to generate and test a set of hypotheses and propose a model for the determinants of preprototype PU of an MWN.

The research model that is developed and tested is depicted in Figure 1. The model is developed by integrating variables from the five previous studies of determinants of PU; and by adding new variables that may be particularly relevant to the preprototype stage and of an MWN. Hypotheses are developed to incorporate three kinds of factors into the model: environmental, technology and individual. Four separate moderation effects are proposed and tested. All hypotheses and measures are at the individual level of analysis.

Environmental Factors

Subjective Norm

Social influence and norms were found to be significant determinants of PU in Karahanna and Straub (1999) and Venkatesh and Davis (2000). To explain the role of social influence and norms on PU, these studies used Social Influence Processing Theory, the Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB) to argue that individual perceptions are shaped by social pressure to conform to norms. Hence, the following hypothesis:

> *H1: Subjective Norm (SN) is positively associated with preprototype PU.*

Perceived Image

Image was found to be a significant determinant of PU in Venkatesh and Davis (2000). Image is defined as "the degree to which use of an innovation is perceived to enhance one's... status in one's social system" (Moore and Benbasat 1991, p. 195; Venkatesh and Davis 2000, p. 189).

To explain the influence of Image on PU, Venkatesh and Davis (2000) used Kelman's concept of identification with social normative influence. If the use of an IT is perceived to enhance an individual's image in the group, the individual will perceive greater usefulness of the IT. Hence, the following hypothesis:

> *H2: Perceived Image (IMG) is positively associated with preprototype PU.*

Social Goods Support

This study was conducted in a context where a city government had advocated an MWN as a development that was intended for the social good.

Given that the city government was promoting the usefulness of the IT (i.e., the MWN) and justifying its intervention into the matter by emphasizing its Social Goods aspects. And given the importance of the institutional effect in influencing beliefs about usefulness of IT (Lewis et al. 2003), it can be expected that citizens who agree more strongly with the government about the Social Goods aspects of the IT are likely to develop more positive perceptions about the usefulness of the IT. This leads to the following hypothesis:

> *H3: Social Goods Support (SG) of the IT is positively associated with preprototype PU.*

Technology Factors

Perceived Ease of Use (EOU)

Perceived Ease of Use of IT was found to be a significant determinant of PU in Agarwal and Prasad (1999), Karahanna and Straub (1999), Venkatesh and Davis (2000), and Wixom and Todd (2005). Perceived Ease of Use is the extent to which a prospective user believes that using an IT will be free of effort.

To explain the influence of Perceived Ease of Use on PU, these studies used theoretical arguments from TAM (Davis 1989, Davis et al. 1989) which argues that all else being equal, the less effort required to use an IT, the more useful it seems. The prior findings lead to the following hypothesis:

> *H4: Perceived Ease of Use of IT (EOU) is positively associated with preprototype PU.*

Perceived Relevance

Relevance was found to be a significant determinant of PU in Venkatesh and Davis (2000). Relevance is defined as an individual's perception regarding the degree to which a particular IT is applicable to the tasks he or she needs to accomplish (Venkatesh and Davis 2000). Hence, the following hypothesis:

> *H5: Perceived Relevance (REL) is positively associated with preprototype PU.*

Perceived Result Demonstrability

Result Demonstrability was found to be a significant determinant of PU in Venkatesh and Davis (2000). Result Demonstrability is defined as the "tangibility of the results of using the innovation" (Moore and Benbasat 1991, p. 203; Venkatesh and Davis 2000, p. 192) and it measures individual's perception regarding the degree to which positive results from using an IT are readily discernible. Hence, the following hypothesis:

> *H6: Perceived Result Demonstrability (RD) is positively associated with preprototype PU.*

Current Dissatisfaction (CDS)

According to the innovation diffusion literature, dissatisfaction is a principal reason for discontinuing an innovation in favor of a new innovation (Rogers 1995, Parthasarathy and Bhattacherjee 1998).

Hence, if two individuals have the same level of Perceived Relevance regarding a new IT, the individual with higher Current Dissatisfaction is likely to have more positive perceptions regarding the usefulness of the new IT. Similarly if two individuals have the same level of Perceived Result Demonstrability regarding an IT, the individual with higher Current Dissatisfaction is likely to have more positive perceptions regarding the usefulness of the new IT.

Therefore, Current Dissatisfaction moderates the influence of Perceived Relevance and Perceived Result Demonstrability on PU. This leads to the following hypotheses:

> *H7a: Current Dissatisfaction (CDS) positively influences the relationship between Perceived Relevance (REL) and preprototype PU.*
>
> *H7b: Current Dissatisfaction positively influences the relationship between Perceived Result Demonstrability (RD) and preprototype PU.*

Individual Factors

Personal Innovativeness in the Domain of IT (PIIT)

Personal Innovativeness in the Domain of IT (PIIT) was found to be a significant determinant of PU in Lewis et al. (2003).

PIIT is "the willingness of an individual to try out any new information technology" (Agarwal and Prasad 1998, p. 206), and is a measure of an individual's risk propensity and innovativeness with regard to IT.

To explain the influence of PIIT on PU, Lewis et al. (2003) use Rogers' theory of diffusion (1983, 1995) and findings from prior research (Agarwal and Prasad 1998, 1999) to argue that *ceteris paribus*, individuals with higher PIIT are expected to develop more positive beliefs about an IT. Hence the following hypothesis:

H8: Personal Innovativeness in the domain of IT (PIIT) is positively associated with preprototype PU.

IT Opinion Leadership (ITOL)

Prior research into IT acceptance has found that among individuals, opinion leadership about IT is significantly associated with earlier adoption of IT (Brancheau and Wetherbe 1990, Chau and Hui 1998). There is now a measure of opinion leadership specific to the IT domain, termed IT Opinion Leadership (ITOL) (Chau and Hui 1998) defined as the degree to which an individual influences other peoples' attitudes about IT.

According to Rogers (1973, 1983, 1995) individuals with higher levels of opinion leadership are more likely to conform to social norms.

Earlier, two hypotheses were developed (H1 and H2) on the role of two social normative influences - Subjective Norm and Image - as positive determinants of preprototype PU. IT Opinion Leadership should moderate the relationship between these social normative influences and preprototype PU such that for individuals with higher levels of IT Opinion Leadership the relationship should be stronger. Hence, the following hypotheses:

H9a: IT Opinion Leadership (ITOL) positively influences the relationship between Subjective Norm (SN) and preprototype PU.

H9b: IT Opinion Leadership (ITOL) positively influences the relationship between Perceived Image (IMG) and preprototype PU.

Table 3 contains a list of all the hypotheses. Figure 1 contains the research model with hypotheses indicated.

Hypothesis #	Path (Direction)
H1	SN → PPU (+)
H2	IMG → PPU (+)
H3	SG → PPU (+)
H4	EOU → PPU (+)
H5	REL → PPU (+)
H6	RD → PPU (+)
H7a	ITOL*SN → PPU (+)
H7b	ITOL*IMG → PPU (+)
H8	PIIT → PPU (+)
H9a	CDS*REL → PPU (+)
H9b	CDS*RD → PPU (+)
Note: PPU = preprototype PU	

**Table 3. Research Hypotheses**

RESEARCH METHODOLOGY

This research study is being conducted in the IT context of an MWN for the city of Philadelphia. The research is currently underway and the model developed earlier is being tested via a survey of prospective users of the MWN in the city. A sample size of approximately 120 prospective users is being targeted. The city government is helping to arrange the sample group.

All scales in the measurement instrument have been sourced from scales developed in prior research. Due to paper length limitations, the details have not been provided here.

CONCLUDING REMARKS

This research is currently in progress. Results and conclusions, to the extent available, will be presented as the research develops. Due to paper length limitations, further details are not being provided here.
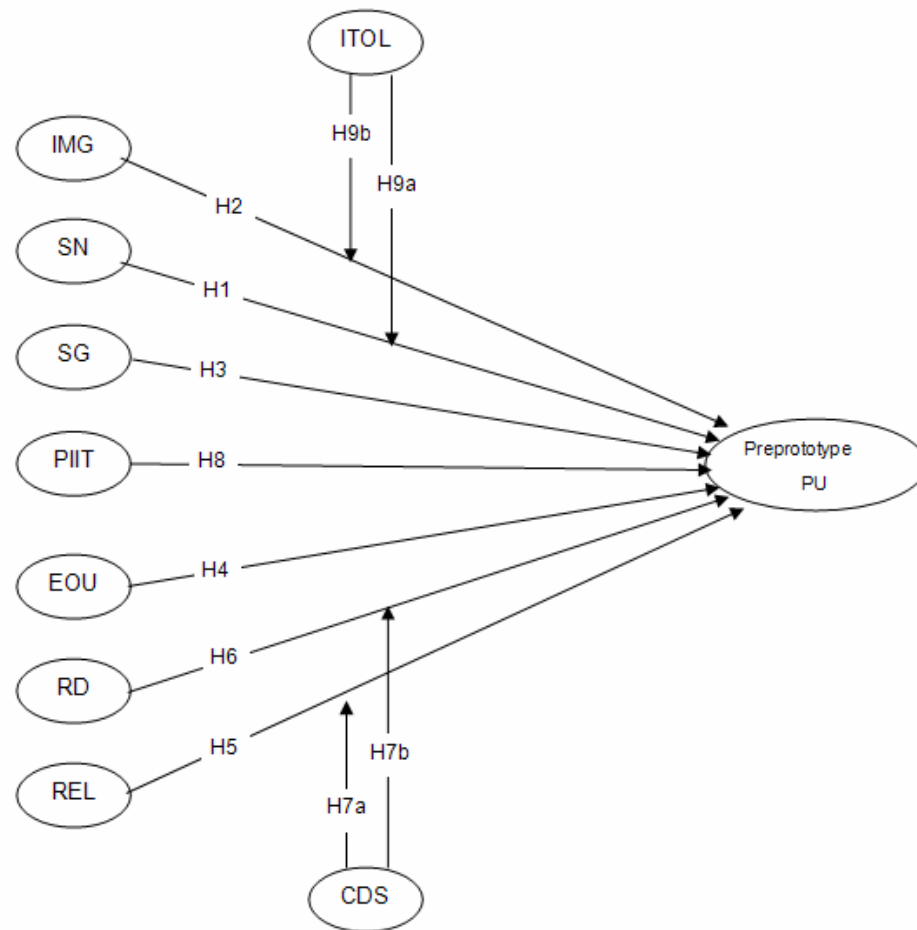
Notes:
PU = Perceived Usefulness of IT
ITOL = IT Opinion Leadership
IMG = Perceived Image
SN = Subjective Norm
EOU = Perceived Ease of Use
SG = Social Goods Support
PIIT = Personal Innovativeness in the domain of IT
RD = Perceived Result Demonstrability
REL = Perceived Relevance
CDS = Current Dissatisfaction

Figure 1. Research Model with hypotheses indicated

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