ON THE MULTI-DIMENSIONAL NATURE OF COMPATIBILITY BELIEFS IN TECHNOLOGY ACCEPTANCE

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ABSTRACT

Theoretical and empirical research on technology acceptance, while acknowledging the importance of individual beliefs about the compatibility of a technology, has produced equivocal results. This study focuses on further theoretical and empirical development of this important belief in technology acceptance. Specifically, unlike prior research which has examined only one aspect of compatibility, we provide a more comprehensive conceptual definition that views compatibility as a multi-dimensional construct. Based on the conceptual definition of compatibility, we develop operational measures of the multiple dimensions of compatibility. The model is tested using the World Wide Web (WWW) as the target innovation. Scale validation indicates that the operational measures of compatibility developed in this study have acceptable psychometric properties and confirmatory factor analysis supports the multi-dimensional structure of this construct. We then assess the nomological validity of this construct by situating it within the Technology Acceptance Model. In contrast to prior research which has regarded beliefs of compatibility as an independent antecedent of attitude, we posit causal linkages among the three beliefs of compatibility, usefulness, and ease of use. Results largely support the theorized relationships.

ON THE MULTI-DIMENSIONAL NATURE OF COMPATIBILITY BELIEFS IN TECHNOLOGY ACCEPTANCE

Information technology (IT) acceptance and usage represent central concerns in recent information systems research. Although several theoretical models have been proposed to describe the phenomenon of IT acceptance, the Technology Acceptance Model (TAM) is increasingly recognized as a robust yet parsimonious conceptualization. Drawing upon the Theory of Reasoned Action (TRA), TAM argues that IT acceptance behaviors can be explained by individual beliefs about the usefulness and ease of use of the IT. Empirical studies based on TAM have indicated that usefulness and ease of use beliefs do explain significant variance in attitude, intentions, and usage. Other work in technology acceptance, notably innovation diffusion studies, however argue for a more comprehensive set of beliefs. Juxtaposing TAM with other findings (e.g., Moore and Benbasat, 1996; Tornatzky and Klein, 1982), we identify compatibility as an important belief recurrent in innovation adoption studies but missing from TAM. Recent studies have tried to incorporate compatibility, but with limited success because of problems inherent with the measurement this construct.

In this study, we focus on this important belief in technology acceptance. Specifically, unlike prior research which has examined only one aspect of compatibility, we provide a more comprehensive conceptual definition that views compatibility as a multi-dimensional construct. We assess the nomological validity of this construct by situating it within TAM. In contrast to prior research which has regarded beliefs of compatibility as an independent antecedent of attitude, we posit causal linkages among the three beliefs of compatibility, usefulness, and ease of use. Based on the conceptual definition of compatibility, we develop operational measures of the multiple dimensions of compatibility. The model is tested using the World Wide Web as the target innovation. Scale validation indicates that the operational measures of compatibility developed in this study have acceptable psychometric properties and confirmatory factor analysis supports the multi-dimensional structure of this construct. Further, results largely support the theorized relationships.

CONCEPTUAL BACKGROUND

The technology acceptance model proposed by Davis (1989) is based on constructs and relationships in the theory of reasoned action (Fishbein and Ajzen 1975). It posits that usage of

an IT is determined by beliefs a user holds about its perceived usefulness (PU) and its perceived ease-of-use (EOU). *PU* is defined as the degree to which a person believes that use of a system would improve his or her performance (Davis, 1989). *EOU* refers to the degree to which a person believes that using a particular system would be effortless (Davis, 1989). Even though both PU and EOU were significantly correlated with usage, Davis' findings suggest that PU mediates the effect of EOU on usage. The model was shown to have good predictive validity for the use of several information technologies (Adams et al., 1992; Davis, 1989; Davis et al., 1989; Mathieson, 1991; Sjazna, 1996; Thompson et al., 1991).

Comparing TAM to research grounded in Innovation Diffusion theory, we find that empirical studies in the latter tradition have used a more complex set of beliefs to predict adoption and usage. Based on studies of multiple innovations in various domains, Rogers (1983) proposed that adoption behavior is influenced by beliefs related to relative advantage, compatibility, complexity, trialability, and observability. Perceived usefulness in TAM is equivalent to Rogers' relative advantage while ease of use is equivalent to complexity (EOU is the direct antonym of complexity). Moore and Benbasat (1991) further refined the theoretical and operational definitions of these innovation beliefs into a set of seven conceptually distinct constructs. These were subsequently used by Moore and Benbasat (1996) to predict usage of personal workstations. Only perceptions of usefulness, ease of use, and compatibility were significantly related to usage. The importance of compatibility in predicting technology acceptance outcomes has also been consistently supported in other empirical IS studies (e.g., Agarwal and Prasad, 1997; Brancheau and Wetherbe, 1990; Hoffer and Alexander, 1992; Karahanna et. al, 1998; Taylor and Todd, 1995). Furthermore, Tornatzky and Klein's (1982) meta analysis of over 100 innovation studies showed that of the ten innovation attributes identified, only relative advantage (PU), compatibility, and complexity (EOU) were consistently related to adoption and/or utilization decisions.

Attempts so far to incorporate compatibility in models of technology acceptance have had limited success. Although compatibility and perceived usefulness are conceptually distinct and although compatibility has been shown to have significant effects on attitude and/or usage, empirically most studies have not been able to discriminate between the two constructs. In addition to the empirical confounding of the two constructs, there are two more shortcomings with the treatment of compatibility in prior work. First, the operational definition of compatibility has generally been limited to compatibility with one's preferred work practices, even though compatibility has a much broader connotation. Second, except for TAM, innovation diffusion-based

studies, while acknowledging that these innovation characteristics are correlated, do not explore any causal linkages among them.

Below we address both these limitations of prior work. First, consistent with its conceptual definition, we treat compatibility as a multi-dimensional construct and we develop operational measures to reflect these multiple dimensions. Second, we posit a set of causal linkages among the three most salient technology adoption beliefs of perceived usefulness, ease of use, and compatibility.

DEFINITION OF COMPATIBILITY

One of the earlier conceptualizations of compatibility has been offered by Rogers (1983, 1995) who defines compatibility as the degree to which using an innovation is perceived as consistent with the existing sociocultural values and beliefs, past and present experiences, and needs of potential adopters (Rogers, 1983; p. 223). Tornatzky and Klein (1982) elaborate on this definition to suggest two types of compatibility: normative or cognitive compatibility referring to compatibility with what people feel or think about an innovation, and practical or operational compatibility, referring to compatibility with what people do.

Although Rogers' definition of compatibility is widely accepted and used, the latter part of the definition, which refers to compatibility with the needs of potential adopters, taps an aspect of relative advantage since an innovation cannot be viewed as advantageous if it does not meet users' needs (Moore and Benbasat, 1991). Therefore, because of the potential for confounding between the definitions of compatibility and perceived usefulness, we eliminate compatibility with needs from our conceptualization of this construct.

Based on Rogers' definition, we can isolate two distinct dimensions of compatibility: compatibility with values and compatibility with prior experience. These two dimensions are subsumed in Tornatzky and Klein's normative or cognitive compatibility. However, Rogers' definition does not explicitly include operational compatibility. Following from Tornatzky and Klein's elaboration, two additional dimensions emerge: compatibility with existing work practices and compatibility with preferred work style.

Prior IS work on compatibility has tended to focus exclusively on compatibility with preferred work style. Surprisingly, compatibility was measured as a unidimensional construct, even though the conceptual definition of compatibility employed in these studies was much broader. This may have contributed to the inability of these studies to discriminate between perceived usefulness and compatibility and to the lack of clear insight into the role of compatibility in the technology acceptance process.

In summary, our conceptual definition of compatibility treats it as a construct spanning four dimensions: (1) compatibility with existing work practices, reflecting the extent to which a technology "fits" with a user's current work process; (2) compatibility with preferred work style, capturing the possibility offered by the technology of being consistent with a desired work style; (3) compatibility with prior experience, reflecting a fit between the target technology and a variety of users' past encounters with technology; and (4) compatibility with values, epitomizing the match between the possibilities offered by the technology and the user's dominant value system. A contribution of this study then is the multidimensional conceptualization of compatibility, and its operationalization, as described below.

THEORETICAL MODEL

Figure 1 presents a nomological net which situates the compatibility construct within the Technology Acceptance Model. As discussed above, the relationships between PU, EOU, attitude, and intentions derive directly from TAM. We extend TAM to include compatibility beliefs that are posited to influence usage behavior via their effects on attitude. Furthermore, we posit causal linkages between compatibility and ease of use and usefulness beliefs. The theoretical rationale for these relationships follows.

<< Insert Figure 1 About Here >>

TRA, on which TAM is based, asserts that the influence of beliefs on behavior is mediated by attitude towards the behavior. Such mediation by attitude is also present in recent extensions of TRA such as the theory of planned behavior (Taylor and Todd, 1995). Although some recent research questions the full mediation of beliefs by attitude, by and large empirical findings support these mediation effects. Consequently, we posit a direct link between compatibility beliefs and attitude.

The decomposition of compatibility into its constituent dimensions allows us to specify more precisely the paths through which compatibility influences attitude. Technologies perceived to be compatible with various aspects of an individual's experiences (compatibility with prior experience) and work styles (compatibility with existing work practices and compatibility with preferred work style) are likely to induce feelings of familiarity and positive affect. Further, strongly held values about the role of technology in work), even in the presence of apparent instrumental benefits from technology use, may result in less positive attitudes being formed if the technology is counter to these values (compatibility with values). Hence, we posit:

H1: Beliefs about the compatibility of a technology positively influence attitude towards using the technology.

In contrast to TAM, which posits a relationship between beliefs of usefulness and ease of use, the innovation diffusion literature has not proposed any such relationships. Consistent with TAM, we propose causal linkages between compatibility and both usefulness and ease of use.

Ease of use represents the perceived cognitive burden induced by a technology. It follows that the more compatible a technology, the less effort is required to use it. This effect is due to two of the four compatibility dimensions: compatibility with prior experiences and compatibility with existing work practices. Compatibility with prior experience implies that one has the cognitive schemas in place to utilize the technology which in turn results in a lower cognitive burden. Compatibility with existing work practices suggests that use of the new technology does not require substantial change in one's work, again resulting in less effort to utilize the technology. We therefore test the following hypothesis:

H2: Beliefs about the compatibility of a technology positively influence beliefs about its ease of use.

Perceived usefulness refers to the instrumental value derived from use of the technology. Compatibility influences perceived usefulness through two of its dimensions: compatibility with prior experience and compatibility with one's preferred work style. As observed in prior research, the more experience one has in the innovation domain the easier it is to recognize the value of the

innovation[1] (Hirschman 1980, Moore 1989). Further perceptions of usefulness of the innovation are a function of the fit between the innovation and one's preferred work style. These expectations are summarized in the following:

H3: Beliefs about the compatibility of a technology positively influence beliefs about its usefulness.

METHODOLOGY AND RESULTS

Study Context and Sample

The overall approach taken to empirically test the relationships implied by the research model and the research hypotheses was a field study using a survey methodology for data collection. We collected data from student subjects enrolled at a large state University. Given the nature of the sample, we chose the World-Wide Web as the target innovation. Besides being widely in use by students, this technology is appropriate for at least two other reasons: one, it is a volitional technology in the sense that students use it of their accord and not from any mandate, and two, the technology is widely available from a number of locations on campus, thus, access is not an inhibitor to technology usage.

Students enrolled in two classes in the College of Business were surveyed. The two classes are a junior level statistics class and a senior level management information systems class. Students were instructed to respond to the survey as candidly as possible, that there were no right or wrong answers, and that we were interested primarily in their perceptions about the Web. A total of 76 completed surveys were returned, representing all students who were present in both classes on the day data were collected.

Operationalization of Research Variables

All research variables were measured using multi-item scales (see Appendix). Scales for perceived usefulness and ease of use were adapted from those developed and rigorously validated by Davis (1989), while attitude was measured following the recommendations of Ajzen and Fishbein (1980). Usage was operationalized using two indicators: (1) an item for frequency of use, measured using a fully anchored 5-point scale with "Several times a day", "Once a day", "Few times a week", "Few times a month", and "Rarely" as the anchors, and (2) a count of the

[1] An assumption implicit in this statement, consistent with prior research in innovation adoption (e.g., Kwon & Zmud, 1987), is that the innovation possesses some intrinsic, positive value for potential adopters

number of features of the Web that the respondent used on a regular basis. A list of 15 common features of the Web, including search engines, chatrooms/discussion groups, email, and banking was provided. Thus, the usage measure accounted for both frequency as well as depth of usage.

Scales for the four compatibility dimensions were constructed following from the conceptual definition of the dimensions and drawing upon the work of Moore (1989). Moore reviewed empirical studies that used the compatibility construct and constructed a comprehensive pool of items. This consisted of items culled from the empirical studies reviewed as well as new ones created by Moore. Prior research items were drawn from Bolton (1981), Hurt and Hubbard (1987), Licker, Newsted, Sheehan (1986), and Ostlund (1969). In this study, items comprising the compatibility with prior experience were "Using the Web is compatible with my past computer experience", "Using the Web is a new experience for me" and "Using the Web is not similar to anything that I've done before." Compatibility with preferred work style was assessed with the items "Using the Web is compatible with most aspects of my work", "Using the Web fits my work style" and "Using the Web fits well with the way I like to work." The items "Using the Web would change my work habits" and "Using the Web requires a change in the way I do my work" were utilized as indicators of compatibility with existing work practices, while "The Web provides capabilities that run counter to my values" and "Use of the Web is not appropriate for a person with my values regarding the role of computers" were the two items comprising the compatibility with values scale. Note the subtle distinction here between preferred work style and existing work practices – while the former captures an individual's self-concept regarding the way they like to work, the latter describes the reality as it is currently experienced. Although the two might be identical in certain situations, that is not always the case. For example, one might like to work in a highly organized fashion using an automated schedule, but available technology might impede the fulfillment of this desire. This subtle nevertheless important distinction has largely been ignored in extant conceptualizations of compatibility.

Results

Sample characteristics are shown in Table 1. On average, the sample includes individuals who have a reasonable level of experience with computing technology, and, are thus, likely to possess well formed beliefs about information technologies in general. Slightly over half the sample is comprised of males, while approximately the same number have management

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(Rogers, 1995).

information systems as their major. The rest of the sample is distributed across a variety of other majors offered in the college of business.

<< Insert Table 1 About Here >>

Descriptive statistics for the research constructs are presented in Table 2. As expected all of TAM's constructs, attitude, perceived usefulness, and ease of use exhibited more than adequate internal consistency as evidenced by Cronbach's alpha. Since a major objective of the study was to develop and validate an operational definition of the multiple dimensions of compatibility, the psychometric properties of these dimensions need to be established. Table 2 shows the reliability coefficients of the four compatibility dimensions. Aside from compatibility with values, which has a Cronbach's alpha of .65, all other dimensions are well above the widely accepted norm of .70 (Nunnaly, 1978). Suggestions for improving the internal consistency of the compatibility with values scale are offered in the Discussion section. In general, however, results are indicative of adequate internal consistency.

<< Insert Table 2 About Here >>

Confirmatory factor analysis was used to assess the convergent and discriminant validity of all belief constructs. A principal component factor analysis of the three beliefs is shown in Table 3. Six factors, which together accounted for 86 percent of explained variance, were extracted. Perceived usefulness, perceived ease of use, and perceived compatibility emerged as distinct factors. This is contrary to many prior studies which were unable to statistically distinguish between compatibility and perceived usefulness. Moreover, the four dimensions of compatibility were also distinct. Together these results point to the convergent and discriminant validity of our conceptualization of compatibility and reinforce the notion that indeed compatibility is a multidimensional construct.

<< Insert Table 3 About Here >>

To assess the nomological validity of compatibility, we used Partial Least Squares (PLS) to test the relationships implied by the research model. PLS, a latent structural equations modeling technique, uses a component-based approach to estimation. Because of this, it places minimal demands on sample size and residual distributions (Lohmoller 1989, Fornell and Bookstein 1982; Chin, 1998). Loadings of measures of each construct can be interpreted as loadings in a principal components factor analysis. Paths can be interpreted as standardized beta weights in a regression analysis. Given sample size constraints relative to number of latent constructs and indicators,

summated scales were used for all constructs except usage (the two items for usage were scaled differently; hence, both items were included in the analysis as reflective indicators of usage). The path coefficients and explained variances for the model are shown in Figure 2.

<< Insert Figure 2 About Here >>

Two of the constructs in the model, namely compatibility and usage, were modeled using multiple indicators rather than summated scales. The loadings for the compatibility construct indicate that three of the four dimensions of compatibility are significant reflective indicators of the latent construct. The less than ideal loading for compatibility with existing values will be addressed subsequently in the discussion section. The two items measuring usage all load highly on the latent construct.

Compatibility and ease of use explain 44 percent of the variance for perceived usefulness, while the three beliefs together account for 20 percent of the variance in attitude. Compatibility alone is instrumental in explaining 36 percent of variance in ease of use. Only a modest four percent of variance in usage is explained by attitude and perceived usefulness.

Examination of the significance of the path coefficients reveals that Hypothesis 1 that posits a positive relationship between compatibility and attitude is not supported. However, as hypothesized in H2 and H3 respectively, compatibility has a significant positive effect on perceived ease of use and perceived usefulness.

DISCUSSION

In general, empirical results are encouraging and provide support for the two main objectives of the study. First, based on the theoretical definition of compatibility, we developed four distinct dimensions of compatibility: compatibility with prior experience, compatibility with preferred work style, compatibility with existing work practices, and compatibility with values. Empirical validation of operational measures of this multi-dimensional construct indicated acceptable psychometric properties for the scales. Two issues emerge that indicate directions for further development. First, the reliability of the compatibility with values scale was borderline acceptable. Two-item scales such as the one measuring compatibility with values often exhibit less than desirable reliabilities. Developing more items for this two-item scale seems to be one venue for improving internal consistency. We view compatibility with values as a very important

dimension in contemporary computer environments. Technology today has the potential to radically alter relationships in the workplace as well as the way work is conducted. For example, electronic mail is widely recognized in reducing face-to-face communication. Electronic commerce may alter the way in which employees interact with customers and suppliers. Data warehousing and data mining technologies raise privacy issues. Therefore, compatibility with values is likely to assume primacy in the minds of potential adopters.

Second, the less than ideal loading of compatibility with existing work practices on the compatibility latent construct seems puzzling. A possible explanation might lie in the semantics of the four dimensions. The three other dimensions of compatibility, compatibility with prior experiences, with preferred work style, and with values were phrased focusing on the extent to which various aspects were compatible with usage of the Web. Phrasing for compatibility with existing work practices focused on the extent of change required in one's day to day work processes. These distinct foci may be causing the lesser loading of the latter dimension. It may also be that in a college environment, compatibility with existing work practices is not as salient to respondents as it may be in an organizational context. Nonetheless, despite its loading, we believe that compatibility with existing work practices is an important dimension of compatibility and therefore, recommend that it be retained in the model. Additional validation of these dimensions and of the psychometric properties of their operational definitions across a variety of settings and technologies would provide further evidence of the validity of the scales.

Second, with one exception, the posited theoretical relationships in our model were supported. As postulated by hypotheses 2 and 3, perceptions of compatibility influence one's perceptions of usefulness and ease of use. However, the direct relationship between compatibility and attitude was non-significant in the current study. It appears that the effect of compatibility on attitude may be fully mediated by beliefs of usefulness and ease of use. For example, higher compatibility of an innovation with one's prior experiences and work processes (both preferred work style and existing practices) implies lower cognitive burden and thus higher ease of use. This, in turn, results in more positive affect. A similar argument can be made for the indirect effect of compatibility on attitude via perceptions of usefulness.

According to our hypotheses 2 and 3, these mediating effects occur via three of the four compatibility dimensions: compatibility with prior experiences, preferred work style, and existing work practices. Compatibility with values, however, was hypothesized to only influence attitude

and consequently one would expect a direct significant effect of compatibility on attitude. Absence of this effect may be attributed to three possible explanations. First, given our student sample, it is possible that compatibility with values is not as salient as it can be in organizational settings where IT can potentially influence work practices, work and social relationships, power distribution and influence, and relationships with clients. Second, given the malleable character of the Web, it is possible that it is compatible with a wide range of values and thus it may diminish the effect value compatibility may have on attitude. Indeed, the Web is a prime example of a technology with high interpretive flexibility in that it can be used and appropriate in a myriad of ways. Finally, it may well be that compatibility and attitude are not causally related. Further research with a range of technologies and in a variety of settings may indicate which of the above alternative explanations is more viable.

IMPLICATIONS AND CONCLUSIONS

In this paper we argued for the need to revisit the compatibility construct. Empirical results supported a multi dimensional view of compatibility as well as causal linkages to perceived usefulness and perceived ease of use. Thus, a major contribution of this work is the development of scales to operationalize this multi-dimensional construct. A further contribution is that, unlike prior work which has posited a direct influence of compatibility on attitude (e.g., Moore and Benbasat, 1991; Taylor and Todd, 1995), we demonstrated that the relationship between compatibility and attitude is fully mediated by usefulness and ease of use beliefs.

Several implications for future research and theoretical development emerge from our findings. First, future research should investigate the hierarchical structure of beliefs affecting attitude and subsequently, use. As technology users gather and synthesize information to evaluate technologies, it might be the case that certain beliefs are formed earlier than others and, in essence, become the basis for additional, subsequent beliefs. Second, as argued in our conceptual development, different dimensions of compatibility may be responsible for its effects on other beliefs and attitude. Sample size limitations constrained our analysis to the overall compatibility construct. Others might wish to examine the differential effects of individual dimensions of compatibility on attitude and other beliefs. Finally, this research needs to be replicated to examine the robustness of the postulated relationships across a wide range of technologies and samples.

From the perspective of practice, since compatibility beliefs are instrumental in shaping beliefs about usefulness and ease of use, managers responsible for implementing new technologies need to pay careful attention to their formation. Positive beliefs about the compatibility of a new technology can be developed in many ways: by highlighting the similarities between workflow enabled by the technology and the individual's current and preferred work practices, by underscoring how the technology embodies prevalent values, and by emphasizing the fit between the technology and the mental models created through prior experiences.

BIBLIOGRAPHY

Adams, D., Nelson R.R. and Todd, P., "Perceived Usefulness, Ease of Use, and Usage of Information Technology: A Replication," *MIS Quarterly*, Volume 16, Number 2, 1992, pp. 227-248.

Agarwal, R., and Prasad, J., "The Role of Innovation Characteristics and Perceived Voluntariness in the Acceptance of Information Technologies," *Decision Sciences*, Volume 28, Number 3, Summer 1997, pp. 557-582.

Ajzen, I., and Fishbein, M. *Understanding Attitudes and Predicting Social Behavior*, Prentice-Hall Inc., Englewood Cliffs, N.J., 1980.

Bolton, W.T. "The Perception and Potential Adoption of Channel 2000: Implications for Diffusion Theory and Videotext Technology," Unpublished Doctoral Dissertation, Ohio State University, 1981.

Brancheau, J.C., and Wetherbe, J.C., "The Adoption of Spreadsheet Software: Testing Innovation Diffusion Theory in the Context of End-User Computing," *Information Systems Research*, Vol. 1, No. 2, 1990, pp. 115-143.

Chin, W. and Gopal, A., "Adoption Intention in GSS: Relative Importance of Beliefs," *Data Base*, Volume 26, Numbers 2 and 3, May/August 1995, pp. 42-63.

Chin, W., "Issues and Opinion on Structural Equation Modeling," *MIS Quarterly*, Volume 22, Number 1, March 1998, pp. vii-xvi.

Davis, F.D., "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly*, Volume 13, Number 3, December 1989, pp. 319-340.

Davis, F.D., Richard Bagozzi, and Paul R. Warshaw, "User Acceptance of Computer Technology," *Management Science*, Volume 35, Number 8, August 1989, pp. 982-1003.

Fishbein, M. and Ajzen, I., *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*, Addison-Wesley, Reading, 1975.

Fornell, C. and Bookstein, F., "Two Structural Equation Models: LISREL and PLS Applied to Consumer Exit-Voice Theory," *Journal of Marketing Research*,Volume 19, 1982, pp. 440-452.

Hirschman, Elizabeth C., "Innovativeness, Novelty Seeking, and Consumer Creativity," *The Journal of Consumer Research*, Volume 7, December 1980, pp. 283-295.

Hoffer, J.A. and Alexander, M.B., "The Diffusion of Database Machines," *Data Base*, Vol. 23, No. 2, 1992, 13-19.

Hurt, H.T. and Hubbard, R., "The Systematic Measurement of the Perceived Characteristics of Information Technologies 1: Microcomputers as Innovations, " presented at the ICA Annual Conference, Montreal, May 1987.

Karahanna, E., Straub, D.W., and Chervany. N.L, "Information Technology Adoption Across Time: A Cross-Sectional Comparison of Pre-Adoption and Post-Adoption Beliefs," forthcoming in *MIS Quarterly*, 1998.

Kwon, T. H., and Zmud, R. W., "Unifying the Fragmented Models of Information Systems Implementation" in Boland, R. and Hirscheim, (eds.) *Critical Issues in Information Systems Research*, Chichester: Wiley, 1987, pp. 88-97.

Licker, P.S., Newsted, P.R., and Sheehan, B.S., "A Value-Added Model of Electronic Mail Utilization," Working Paper, #07-86, Faculty of Management, University of Calgary, 1986.

Lohmoller, J., *Latent Variable Path Modelling with Partial Least Squares*, Heidelberg:Physica-Verlag, 1989.

Mathieson, K., "Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior," *Information Systems Research*, Volume 2, Number 3, September 1991, pp. 173-191.

Moore, G.C., "An Examination of the Implementation of Information Technology by End-Users: A Diffusion of Innovations Perspective," Unpublished Doctoral Dissertation, University of British Columbia, 1989.

Moore, G.C., and Benbasat, I., "Integrating Diffusion of Innovations and Theory of Reasoned Action Models to Predict Utilization of Information Technology by End-Users," in K. Kautz and J. Pries-Heje (Eds.) *Diffusion and Adoption of Information Technology*, Chapman and Hall, London, pp.132-146, 1996.

Moore, G.C., and Benbasat, I., "Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation," *Information Systems Research*, Volume 2, Number 3, September 1991, pp. 192-222.

Nunnaly, J.C., *Psychometric Theory*, 2nd Edition, New York, McGraw Hill, 1978.

Ostlund, L.E., "Product Perceptions and Predispositional Factors as Determinants of Innovative Behavior," Unpublished Doctoral Dissertation, Harvard University, 1969.

Rogers, E.M., *The Diffusion of Innovations*, 3rd Edition, Free Press, New York, NY, 1983.

Rogers, E.M., *The Diffusion of Innovations*, 4th Edition, Free Press, New York, NY, 1995.

Szajna, B., "Empirical Evaluation of the Revised Technology Acceptance Model," *Management Science*, Vol. 42, No. 1, January 1996, pp. 85-92.

Taylor, S. and Todd, P., "Understanding Information Technology Usage: A Test of Competing Models," *Information Systems Research*, Volume 6, Number 2, 1995, pp.144-176.

Thompson, R.L., Higgins, C. and Howell, J.M., "Personal Computing: Towards a Conceptual Model of Utilization," *MIS Quarterly*, Volume 15, Number 1, 1991, pp. 125-143.

Thompson, R.L., Higgins, C. and Howell, J.M., "Influence of Experience on Personal Computer Utilization: Testing a Conceptual Model," *Journal of Management Information Systems*,Volume 11, Number 1, Summer 1994, pp. 167-187.

Tornatzky, L.G., and Klein, K.J., "Innovation Characteristics and Innovation Adoption-Implementation: A Meta-Analysis of Findings," *IEEE Transactions on Engineering Management*, Volume 29, Number 1, February 1982.

Table 1.

Sample Characteristics

	Mean	Standard Deviation	Missing
Age	23.42	3.63	4
PC Experience	7.48	4.02	4
Work Experience	3.13	1.55	4
Gender	Male	40	7
	Female	29	
Major	Graduate	1	4
	MIS	44	
	Marketing	11	
	Accounting	2	
	Finance	10	
	Management	2	
	Real Estate	1	
	Hotel Management	1	

Notes: Age, PC Experience, and Work Experience are number of years.

Table 2.

Descriptive Statistics

Construct	**Mean**	**S.D.**	**Reliability* (Number of items)**
Usage – Frequency	4.00	1.02	~
Usage – Number of Features	0.39	0.17	~
Attitude	4.50	0.61	0.89 (3)
Perceived Usefulness	5.71	1.26	0.95 (4)
Ease of Use	5.57	1.38	0.96 (3)
Compatibility – Prior Experience	4.64	1.34	0.78 (3)
Compatibility – Existing Work Practice	4.03	1.45	0.86 (2)
Compatibility – Preferred Work Style	4.76	1.34	0.91 (3)
Compatibility -- Values	5.60	1.27	0.65 (2)

Notes: All constructs except Usage are 7-point scales
Usage Frequency is a 5-point scale
~ Single item measures
* Cronbach's alpha

Table 3.

Factor Analysis of Belief Items

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
PU1	.898	.171	.172	.145	.006	.098
PU2	.896	.201	.135	-.021	.048	.212
PU3	.859	.362	.161	-.057	-.005	.064
PU4	.858	.329	.134	-.041	.122	.168
EOU1	.358	.854	.178	.221	-.006	.133
EOU2	.396	.842	.128	.172	-.050	.070
EOU3	.322	.779	.300	.253	.057	.135
COMPref1	.225	.135	.906	.140	.107	.090
COMPref2	.142	.161	.897	.292	-.003	.019
COMPref3	.190	.326	.684	.145	.025	.409
COMExp1	-.040	.140	.139	.837	.162	.096
COMExp2	-.003	.279	.160	.809	.058	.153
COMExp3	.359	.079	.374	.625	-.015	.183
COMExist1	.110	-.031	-.085	.107	.927	.095
COMExist2	-.015	.027	.175	.072	.925	-.024
COMValue1	.164	.112	.105	.172	.073	.899
COMValue2	.437	.130	.202	.236	-.005	.569
Percent of Variance	44.52	13.40	10.10	7.26	6.32	4.37

Notes: PU = perceived usefulness, EOU = ease of use, COMPref = compatibility with preferred work style, COMExp = compatibility with prior experience, COMExist = compatibility with existing work practices, COMVal = compatibility with values.

Figure 1
Theoretical Model

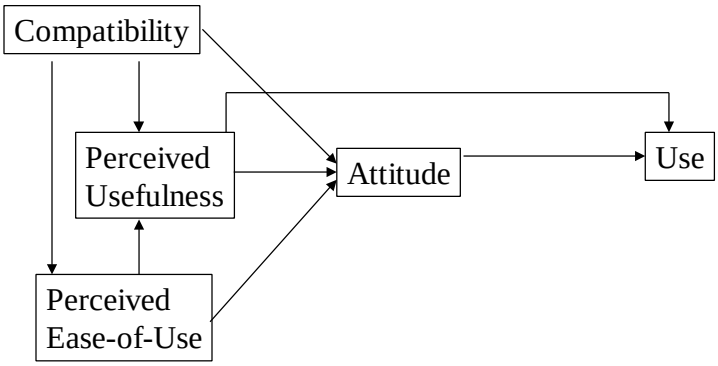
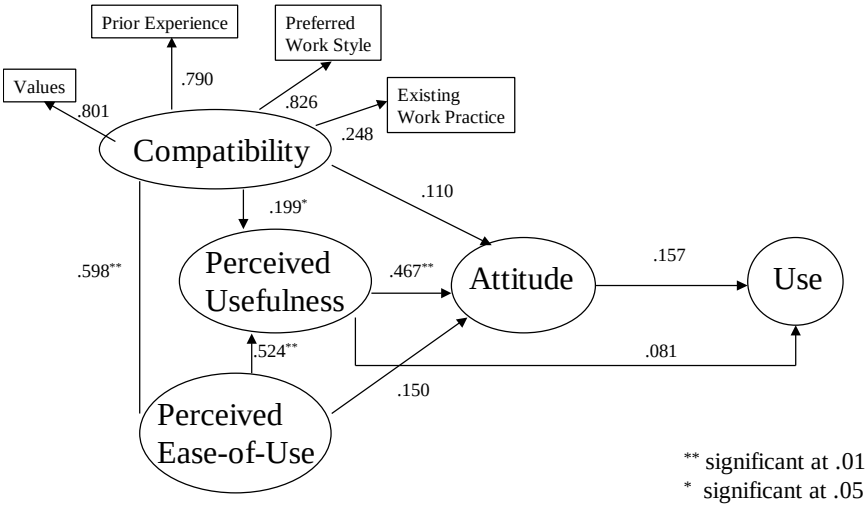


Figure 2
PLS Results



APPENDIX
Scales and Items

Perceived Usefulness
Using the Web enhances my effectiveness in college.
Using the Web enhances my productivity.
I find the Web useful in my college activities.
Using the Web improves my performance in college.

Ease of Use
I find it easy to get the Web to do what I want it to do.
It is easy for me to become skillful at using the Web.
I find the Web easy to use.

Compatibility with Preferred Work Style
Using the Web is compatible with most aspects of my work.
Using the Web fits my work style.
Using the Web fits well with the way I like to work.

Compatibility with Experience
Using the Web is compatible with my past computer experience.
Using the Web is a new experience for me.
Using the Web is not similar to anything that I've done before.

Compatibility with Existing Work Practices
Using the Web would change my work habits.
Using the Web requires a change in the way I do my work.

Compatibility with Values
The Web provides capabilities that run counter to my values.
Use of the Web is not appropriate for a person with my values regarding the role of computers.

Attitude
All things considered, using the Web within the next six months would be

extremely negative						extremely positive
extremely good						extremely bad
extremely harmful						extremely beneficial

Usage
Please indicate how often you use the Web

___ Several times a day ___ Once a day ___ Few times a week ___ Few times a month ___ Rarely

Which of the following Web features do you regularly use (check all that apply)?

Search engines	___	Email	___
Chatrooms/discussion groups	___	Creating your own web page	___
Searching for information	___	Downloading software	___
Requesting information	___	Purchasing products	___
Taking courses	___	Selling products	___
Playing games	___	Listening to music	___
Applying for jobs	___	Banking	___
Checking the weather	___		