Information Systems Research

Publication details, including instructions for authors and subscription information:
http://pubsonline.informs.org

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Ritu Agarwal, Jayesh Prasad,

To cite this article:
Ritu Agarwal, Jayesh Prasad, (1998) A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology. Information Systems Research 9(2):204-215. http://dx.doi.org/10.1287/isre.9.2.204

A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology

Ritu Agarwal • Jayesh Prasad
Information and Management Sciences Department, The Florida State University, Tallahassee, Florida 32306-1110
ragarwal@cob.fsu.edu
University of Dayton, Department of MIS and Decision Sciences, Dayton, Ohio 45469-2130
prasad@uhura.mis.udayton.edu

The acceptance of new information technologies by their intended users persists as an important issue for researchers and practitioners of information systems. Several models have been developed in the literature to facilitate understanding of the process by which new information technologies are adopted. This paper proposes a new construct that further illuminates the relationships explicit in the technology acceptance models and describes an operational measure for this construct that possesses desirable psychometric properties. The construct, personal innovativeness in the domain of information technology, is hypothesized to exhibit moderating effects on the antecedents as well as the consequences of individual perceptions about a new information technology. The construct was developed and validated in the context of the innovation represented by the World-Wide Web. Implications for theory and practice are discussed.

(*Instrument Development*; *Innovation*; *IT Adaption*; *World-Wide Web*; *IT Implementation*; *Personal Innovativeness*)

Introduction

Why do some individuals readily adopt new information technologies while others reject them? This problem, variously labeled *information systems implementation*, *technology adoption*, and *technology acceptance*, has persisted in the information systems literature for several decades. As the organizational utilization of information technology proliferates, and as technology becomes more critical for competitive survival, the importance of the technology acceptance problem escalates; systems that are not *accepted* by their intended users will not result in any sought-after benefits. Recognition of the magnitude of this problem is evident in the quantity of recent research focused on examining the determinants of information technology acceptance (Moore and Benbasat 1991, Davis et al. 1989, Taylor and Todd 1995, Szajna 1996). Indeed, significant attention has been focused on developing and validating *theoretical* models that postulate various relationships between constructs recognized as germane to technology acceptance (Davis et al. 1989, Taylor and Todd 1995). The purpose of this paper is to propose a new construct that further illuminates the relationships explicit in the technology acceptance models, and to describe an operational measure for this construct that possesses desirable psychometric properties.

The construct described in this paper, personal innovativeness in the domain of information technology, has implications for both theory and practice. From the perspective of practice, personal innovativeness helps identify individuals who are likely to

1047-7047/98/0902/0204$05.00

adopt information technology innovations earlier than others. Such individuals can then serve as key change agents and opinion leaders to facilitate further diffusion of a new technology (Rogers 1995). Moreover, when implementation resources are limited, the construct helps target scarce resources more fruitfully. From a theoretical perspective, although the dominant technology acceptance models provide insights into *how* adoption intentions are formed, the inclusion of personal innovativeness furthers our understanding of this process by explicating the role of individual traits in technology adoption.

Theoretical Background

Theories of Technology Acceptance

Beginning with Rogers' (1983) theory of the diffusion of innovations, several models have been proposed to conceptualize the complex behavioral and social process by which individuals adopt new information technologies. Rogers' work, which includes a meta-analysis of a variety of innovations studied in diverse contexts such as the adoption of family planning and new agricultural techniques, can be characterized as an information-centric view of the diffusion of innovations. According to Rogers (1995), information about the existence of innovations flows through social systems where potential adopters are situated. This information is processed by adopters to form perceptions about the characteristics of the innovation; such perceptions, among other contextual factors, then serve as the drivers for innovation adoption decisions. Recently, Moore and Benbasat (1991) extended the set of perceptions proposed by Rogers (1983) to include seven perceived characteristics of an innovation as predictors of IT adoption behavior.

Although Rogers' model has been utilized to predict and explain technology diffusion in the contexts of information systems innovations (e.g., Brancheau and Wetherbe 1990), in the domain of information technology specifically, the technology acceptance model (TAM) has garnered significant empirical support (Davis et al. 1989, Taylor and Todd 1995). Drawing upon the theory of reasoned action (Ajzen and Fishbein 1980), TAM posits that technology adoption decisions (i.e., individual intentions to use the technology) are driven by an individual's affective response (attitude) toward the use of the innovation. Attitude, in turn, is premised to be determined by two salient beliefs about the innovation: perceived usefulness, a measure of the individual's subjective assessment of the utility offered by the innovation in a specific work-related context; and perceived ease of use, an indicator of the cognitive effort needed to be expended to utilize the innovation. In TAM, attitude serves as a key mediating construct between beliefs and usage intentions, although perceived usefulness is also hypothesized as exhibiting a direct effect on intentions in addition to its indirect effect through attitude. TAM derives its theoretical roots from a rich literature in social psychology where actual behavior, intentions to perform the behavior, attitude as a determinant of intentions, and the antecedents of attitude, have been examined both theoretically and empirically for several decades (e.g., Fishbein 1967, Ajzen and Fishbein 1980). Other models recently proposed that appear to exhibit reasonable predictive validity in IT contexts include the theory of planned behavior and variants of it (Taylor and Todd 1995).

Despite some differences in hypothesized relationships, there are a few key similarities between the various technology acceptance models in terms of the constructs they assign salience to. Two recurring constructs in these models are perceptions about the innovation's characteristics (labeled beliefs in TAM and TRA) and individuals' usage intentions regarding the innovation. Intentions are conceptualized as a direct and significant predictor of actual usage behavior. A set of constructs not specifically included in these models are variables related to individual differences; although TRA attempts to capture the effects of individual differences by utilizing an expectancy formulation for beliefs, where beliefs are multiplicatively weighted by individual assessments of the value of the outcome to them personally. We argue here that the inclusion of an important individual difference variable—personal innovativeness with respect to information technology—would help us to further understand both how perceptions are formed and the subsequent role they play in the formation of usage intentions.

Personal Innovativeness and IT Adoption

Whereas several individual difference variables could potentially affect how individuals respond to innovations, personal innovativeness as a construct that is important to the study of individual behavior toward innovations has had a long-standing tradition in innovation diffusion research in general (Rogers 1983, 1995) and the domain of marketing in particular (e.g., Midgley and Dowling 1978, Flynn and Goldsmith 1993). Rogers and Shoemaker (1971) and Rogers (1995) conceptualize this construct in terms of its operational definition, i.e., individuals are characterized as "innovative" if they are early to adopt an innovation. Thus, the construct is used as a basis for segmenting consumer populations into "innovators" and "noninnovators," and consequently, operationalized as the "time of adoption." Recently, however, this particular characterization of personal innovativeness (PI) has been criticized; Midgley and Dowling (1978) and subsequently Flynn and Goldsmith (1993) argue that PI is a hypothetical construct. Its definition as well as its measurement as an observable phenomenon (i.e., time of adoption) obscures the true abstract definition of the concept. Moreover, Flynn and Goldsmith point out that using time of adoption methods also has several adverse methodological consequences, such as the inability to compare findings across studies and lack of metrics to assess the reliability and validity of the measure. A more crucial limitation of this measure, however, is that it does not allow for prediction and subsequent management intervention: innovativeness is measured after the decision to adopt the innovation has already been made. In this context, then, it is little else than an *ex post* descriptor of the behavior. Thus, attempts were made in the literature to explicate the construct of innovativeness more clearly and to begin to develop ways of measuring it directly (Goldsmith and Hofacker 1991).

While innovativeness has received attention as a determinant of innovation adoption behavior, researchers in marketing have noted recently that it is important to conceptually and operationally draw a distinction between *global* innovativeness and *domain specific* innovativeness (Flynn and Goldsmith 1993). Several years ago Kirton (1976, p. 624) noted that "some people characteristically adapt while others characteristically innovate"; this notion of global innovativeness was hypothesized in early work as a personality trait that is possessed by all individuals to a greater or lesser degree. Hurt et al. (1977) described innovativeness as a "willingness to change" and developed a self-report scale that reflected this particular definition of innovativeness. However, global innovativeness exhibits low predictive power when applied to any specific innovation adoption decision (Goldsmith and Hofacker 1991, Leonard-Barton and Deschamps 1988). Domain-specific innovativeness, on the other hand, is posited to exhibit significant influence on behaviors within a narrow domain of activity (Goldsmith and Hofacker 1991), and it has been suggested that this trait also be measured directly via self-report, in a manner similar to the measurement of attitudes and other personality variables (Flynn and Goldsmith 1993).

Consistent with the emphasis in the marketing literature on the construct of PI, we argue that PI is an important concept for examining the acceptance of information technology innovations also. However, as noted above, it has not been included in any of the dominant technology acceptance models, although there is considerable theoretical as well as empirical support from other disciplines for its role as a key variable in innovation adoption. As recommended in prior research, we focus attention on domain-specific as opposed to global innovativeness. We define PI *in the domain of information technology,* henceforth PIIT, as "the willingness of an individual to try out any new information technology." This definition is derived from the work of Midgley and Dowling (1987) and Flynn and Goldsmith (1993). PIIT is conceptualized as a trait, i.e., a relatively stable descriptor of individuals that is invariant across situational considerations.[1] As noted by Webster and Martochhio (1992), traits are generally not influenced by environmental or internal variables, i.e., they are not idiosyncratic to a specific configuration of individual and situational factors.

PIIT and Technology Acceptance Theories

Following from the conceptual definition of PIIT as well as prior theoretical and empirical work in the diffusion of innovations, we argue that the effects of PIIT

[1]The stability of the trait is expected across different types of IT, not all types of innovations.

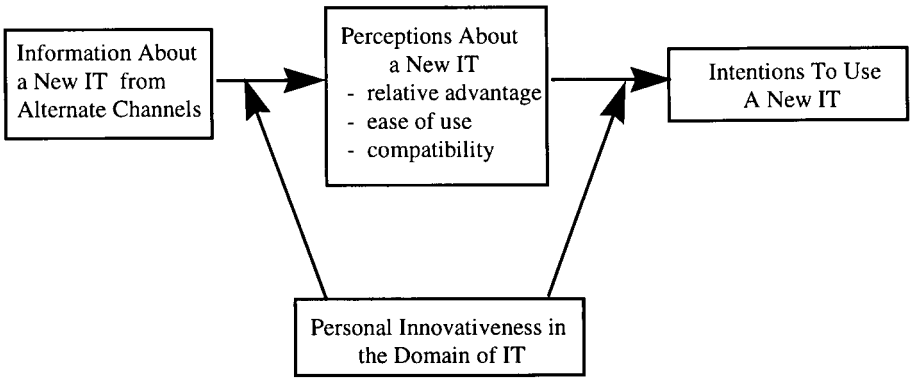
are manifest in technology acceptance behavior through its relationships with beliefs or perceptions. Indeed, Midgley and Dowling (1978) note that the "trait-behavior" model is an inadequate representation of innovation adoption behavior as several variables potentially *intervene* between trait and behavior. We propose that PIIT serves as a key *moderator* for the antecedents as well as the consequences of perceptions. Following from the information processing view of the development of perceptions that pervades the technology acceptance literature (e.g., Rogers 1995), as an antecedent moderator PIIT determines the relative use of alternate channels of information utilized for the development of perceptions. As a consequence moderator it epitomizes the risk-taking propensity that exists in certain individuals and not in others. These hypothesized relationships between PIIT and other technology acceptance constructs are depicted in Figure 1.

The recognition that "innovators" exhibit certain characteristic behaviors is evident in Rogers' (1995) work, where he derives a series of propositions about the behavior of innovators. For example, he notes that innovators are "active information seekers about new ideas" (1995, p. 22) and are more cosmopolite than later adopters. He also suggests, consistent with our conceptualization of PIIT, that innovators have greater mass-media exposure and place less reliance on the subjective evaluation of other members of their social system about the expected consequences of adopting an innovation. Thus, PIIT serves to moderate the relationship between the type of communication channel utilized by an adopter to learn about a specific IT innovation and the development of perceptions about the innovation. Rogers (1995) suggests that channels can be classified as mass-media or interpersonal, and that, in general, interpersonal communication channels are more efficacious for the development of perceptions about the innovation. The expectation of moderation, however, implies that for the same mix of channels, individuals with higher PIIT will develop more positive perceptions about the innovation.[2] Alternatively, in order to develop the same level of perceptions, more innovative individuals can utilize a mix of channels that places *less* reliance on interpersonal sources.

As a moderator of the consequences of perceptions, PIIT epitomizes risk-taking behavior. Kirton (1967) notes that innovation, by its very nature, is associated with greater risk, uncertainty, and imprecision. In his characterization of innovators Rogers (1995) argues that innovators and early adopters are able to cope with higher levels of uncertainty. Insofar as individuals with higher PIIT are more prone to take risks, it is reasonable to expect them to develop more positive

[2]An assumption implicit in this statement, consistent with prior research in innovation adoption (e.g., Kwon and Zmud 1987), is that not only does the innovation possess some intrinsic, positive value for potential adopters, but that this value is acknowledged by the transmitters of information about the innovation (Rogers 1995). Consequently, it is reasonable to assume that any information transmitted would be focused on emphasizing such positive value, and hence would serve to heighten and sharpen positive perceptions.

Figure 1 **Hypothesized Relationships Between PIIT and Other Technology Acceptance Constructs**



intentions toward the use of an innovation, given the same level of perceptions as a less innovative individual. Similarly, for the same level of usage intentions regarding the innovation, the individual with higher PIIT would require fewer positive perceptions than an individual who is less innovative.

In addition to the support for these hypothesized effects of PIIT provided by Rogers (1995), similar arguments can also be found in research specifically in IT adoption as well as in the social psychology literature that forms the reference discipline for several of the major technology acceptance models. Leonard-Barton and Deschamps (1988) argued and empirically demonstrated that personal innovativeness moderates the relationship between management messages, or support, and innovation use in the context of the innovation represented by an expert system for use by sales representatives. Recognition of the contingent nature of certain key relationships in popular theories of behavior such as TRA may be found in the work of Liska (1984), who suggests that other variables such as personality and environmental characteristics may intervene in the hypothesized relationships of TRA.

In summary, there is a significant body of theoretical as well as empirical research in support of the inclusion of PIIT as a central construct to our understanding of innovation adoption. This research also argues that in order to use the construct to predict individual behavior toward the innovation, it is important to focus attention on domain specific as opposed to global innovativeness. We have provided a conceptual definition of such a domain specific measure and presented evidence for postulated relationships between PIIT and other constructs in information technology adoption. However, there is no existing scale for the measurement of such a construct that allows us to test these predictions; below we describe a scale for the measurement of PIIT that exhibits desirable psychometric properties.

Operationalizing PIIT

Study Context and Sample

The measure for PIIT was developed in the context of the innovation represented by the World-Wide Web information service on the Internet. Originally utilized primarily by researchers and scientists, in recent times the growth of new users of the Internet includes commercial as well as home markets, where the growing popularity has often been attributed to the increasing number of graphical tools and browsers that allow quick and easy access to the vast information resources available on the computers that comprise the Internet (Berghel 1996, Delmonico 1996). The popularity of the Net is so immense that it is virtually impossible to open a newspaper or periodical without some reference to its services or activities.

The World-Wide Web epitomizes one such value-added service that facilitates access to the Internet (Kroll 1992). Based on the technology of hypertext, key features of the World-Wide Web include a common "look and feel," consistent interface and a complete shielding of the user from the complexity underlying the storage and retrieval of information on the Net. On the commercial side, the World-Wide Web has witnessed an unprecedented growth in use as firms vie with each other to set up "home pages" and offer a wide range of products and services on-line. Furthermore, by virtue of the vast library of information resources now available on the Web, the service has also started to be utilized extensively for research purposes in educational environments (Wexler 1993).

The choice of the Web as the innovation to be studied is appropriate precisely because of the *emergent* nature of the technology. The 175 subjects in this study were business professionals enrolled in a part-time MBA program at a comprehensive university. These students are employed in the work-force full-time and take classes in the evenings; thus, they are in the unique position of being able to evaluate the technology in the context of both the commercial arena (i.e., in their work-place) as well as the educational arena (i.e., for their graduate program). All subjects had access to the technology in at least one location (the Web is available at public computing labs in the university) and could use it if they chose to do so. However, given the relative infancy of the technology, it is reasonable to assume that the use of the World-Wide Web has not been *institutionalized* for work as well as educational purposes at the time of data collection.[3] Thus, the

[3]In the MBA program, students are exposed to the Internet in general

technology as well as the sample exhibits the desired characteristics for this research: information about the technology is pervasive, potential adopters have knowledge about the technology, and they have the opportunity to use it of their own volition (i.e., technology use is not mandated).

In order to establish alternate forms of construct validity for the measure, it is necessary to identify an existing measure for a related yet distinct construct that exhibits desirable psychometric properties. A choice was made to utilize the Computer Playfulness Scale (CPS) rigorously developed and validated by Webster and Martochhio (1992) as the alternate measure. This choice was motivated by the fact that both scales are similar in that they assess personality traits relevant to information technology usage. However, there is also a crucial conceptual distinction between them: whereas CPS measures how an individual will behave when interacting with a particular kind of IT (e.g., microcomputers), PIIT provides insights into the likelihood of an individual choosing to interact with any IT or not. Because theoretical considerations would lead us to expect differences between the two measures, the choice of CPS as the alternate scale to assess convergent and discriminant validity is appropriate.

Data on PIIT and CPS were collected as part of a larger instrument that measured several other constructs. The items for these two measures were distributed randomly throughout the instrument.

Content Validity: Item Construction

The development of the scale for PIIT was initiated by examining prior work that had developed scales to measure similar constructs. As noted earlier, several measures for global innovativeness have been developed and validated in prior research, including the Open Processing Scale (Leavitt and Walton 1975, 1981, 1983), the innovativeness scale (Hurt et al. 1977), the innovation subscale of the Jackson Personality Inventory (Jackson 1976), and the Kirton Adaption-Innovation Inventory (Kirton 1976). These scales are all self-reports; each attempts to measure a generalized personality trait, conceptualized as "willingness to change," with the assumption that this particular trait exhibits significant influence on the adoption or rejection of innovations. In a comparative study of these four scales, however, Goldsmith (1986) notes that the scales exhibit poor convergent validity; in fact, his results indicate that the scales measure constructs that are related but not identical.

Based on the theoretical and methodological concerns articulated with these scales in prior research, we searched for scales that had been developed explicitly to measure domain-specific PI. Two such scales were identified in the literature: the six-item Goldsmith and Hofacker (1991) scale, and the three-item PI scale developed by Leonard-Barton and Deschamps (1988). The former measure consists of a series of statements that capture consumer innovativeness in the form of behaviors and states. The scale exhibited high reliability and validity in that study, and subsequently was further validated in another study (Flynn and Goldsmith 1991). It is not clear, however, how the latter measure was developed as, unlike the work of Goldsmith and Hofacker (1991), the purpose of the research where the scale is reported (Leonard-Barton and Deschamps 1988) was not specifically instrument development. Moreover, the scale reported by Leonard-Barton and Deschamps (1988) exhibited less than ideal internal consistency (scale reliability as measured by Cronbach's alpha was 0.66). Therefore, the first scale was deemed a satisfactory source for item construction for the PIIT. In keeping with the suggestions made in prior studies of innovativeness, a choice to utilize a Likert-scaled self-report measure was made.

Utilizing the conceptual definition of PIIT as well as the recommendations made by Goldsmith and Hofacker (1991), four statements that describe prototypical behaviors in the context of IT innovativeness were constructed. The statements were: "If I heard about a new information technology, I would look for

and the Web in particular in one class session in one specific course. The focus of the discussion is on the history and evolution of the Internet, and on technical issues related to data communication and domain names. This presentation is followed by a demonstration where the instructor shows the students how to use the Web, and the students subsequently explore it on their own in the university lab. This is the only class in the program that has a formal Web component; no other class mandates the use of the Web as a class requirement.

ways to experiment with it"; "Among my peers, I am usually the first to try out new information technologies"; "In general, I am hesitant to try out new information technologies"; and "I like to experiment with new information technologies." To alleviate problems arising from potential acquiescence bias, one of the statements was worded negatively. All items were scored on a 1–7 Likert-scale with "Strongly Disagree" and "Strongly Agree" as the two anchors for the endpoints of the scale, and "Neutral" as the anchor for the mid-point of the scale. A score on PIIT for an individual respondent is computed by taking the average across all four statements, thus, the potential range for the scale is 1 to 7. The range of responses obtained for this sample was 1.75 to 7, indicating that scale coverage had been obtained. The items comprising the PIIT scale as well as the CPS scale used for construct validation are shown in Table 1.

Table 1 Constructs and Items

Construct	Items
Personal Innovativeness in the Domain of Information Technology	If I heard about a new information technology, I would look for ways to experiment with it. (PIIT1)
	Among my peers, I am usually the first to try out new information technologies. (PIIT2)
	In general, I am hesitant to try out new information technologies. (PIIT3)*
	I like to experiment with new information technologies. (PIIT4)
Computer Playfulness	I am spontaneous when I interact with the WWW. (CPS1)
	I am unimaginative when I interact with the WWW. (CPS2)*
	I am playful when I interact with the WWW. (CPS3)
	I am flexible when I interact with the WWW. (CPS4)
	I am uninventive when I interact with the WWW. (CPS5)*
	I am creative when I interact with the WWW. (CPS6)
	I am unoriginal when I interact with the WWW. (CPS7)*

Notes: *Reverse Scaled Item
WWW: World-Wide Web

Table 2 Scale Statistics

Item	Mean	Standard Deviation	Item-to-Total Correlation
PIIT1	5.46	1.18	0.666
PIIT2	4.68	1.53	0.652
PIIT3	5.62	1.38	0.591
PIIT4	5.58	1.27	0.794

Reliability and Other Scale Properties

Reliability assesses the internal consistency of scale items (Nunnally 1978). Although several measures of reliability have been proposed and utilized in prior research, the ones with greatest support are Cronbach's alpha and Guttman's lower bound (GLB). Item means, standard deviations, and item-to-total correlations are reported in Table 2; the lowest item-to-total correlation is 0.59. Cronbach's (standardized) alpha for the scale was 0.84, a level generally deemed highly satisfactory for multi-item scales (Nunnally 1978). GLB was also at an acceptable level (0.84). The overall mean for the scale was 5.33, with a median of 5.3. Scale standard deviation was 1.1, while skewness and kurtosis were -0.05 and 0.07, respectively—levels considered more than adequate for good distributional properties (Ghiselli et al. 1981). Thus, the scale exhibits acceptable internal consistency as well as distributional properties.

Discriminant and Convergent Validity

Discriminant validity of a measure assesses if the measure is adequately distinguishable from related constructs, while convergent validity assesses the extent to which different indicators for the measure refer to the same conceptual construct. Two popular approaches to establishing both types of validity are what Bagozzi et al. (1991) term "classical approaches," which include multitrait, multimethod (MTMM) validation (Campbell and Fiske 1959) and exploratory factor analysis, and "contemporary approaches" such as confirmatory factor analysis using structural equation modeling and maximum likelihood estimation procedures. Bagozzi et al. (1991) argue that the use of MTMM suffers from certain drawbacks such as obfuscation of the difference in the validity of a concept and

its operational measure and a lack of criteria that conclusively establish construct validity. Based on these concerns, MTMM was not utilized to validate the PIIT scale. However, to increase confidence in scale validity, recommended methods from both validation approaches were utilized: exploratory factor analysis (Bollen 1989) from the classical approaches, and confirmatory factor analysis (Joreskog and Sorbom 1993) from the contemporary approaches.

The results for exploratory factor analysis using principal components extraction with varimax rotation on the items comprising the CPS and PIIT scales are shown in Table 3. The analysis identified two factors with an eigenvalue greater than one, which collectively explained 61.3 percent of the variance. As expected, all indicators loaded on the latent variables they measured, with no cross-loading of items. These results suggest that when compared with a related, yet different construct, the measure for PIIT exhibits high convergent and discriminant validity.

Confirmatory factor analysis (CFA) was performed utilizing Lisrel8 (Joreskog and Sorbom 1993). As argued by Bollen (1989), CFA represents a significant advancement over EFA as it allows for the specification of a precise model that is driven by theoretical considerations. As before, all seven CPS indicators and the four PIIT indicators were included in the analysis, with two latent variables. Based on modifications suggested by the analysis procedures, eight pairs of error terms were allowed to correlate. The χ^2 for overall model fit with 35 degrees of freedom was significant ($\chi^2 = 51.97$, $p = 0.032$). However, Pedhazur (1982) notes that for large samples, the χ^2 statistic frequently indicates poor model fit even though the model fits the data well. As recommended (Bollen 1989), several other fit indicators were utilized. The Root Mean Square Error of Approximation (RMSEA) was 0.053, where values below 0.8 are considered acceptable (Brown and Cudek 1993). The Root Mean Square Residual (RMR) for the model was 0.043, where values below 1.0 are deemed satisfactory (Bollen 1989, Joreskog and Sorbom 1993). GFI and AGFI were 0.91 and 0.85, respectively. Finally, all indicators exhibited a significant relationship with the associated latent variables (the smallest lambda coefficient was 0.63, while the smallest squared multiple correlation was 0.41). Collectively these data suggest that the indicators account for a large portion of variance in the hypothesized latent construct and provide strong support for the validity of the measure. Results for the CFA are summarized in Figure 2.

Table 3 Factor Analysis of CPS and PIIT Scale Items

Item	Factor 1	Factor 2
CPS1	**0.791**	0.110
CPS2	**0.650**	0.157
CPS3	**0.728**	0.183
CPS4	**0.739**	0.313
CPS5	**0.654**	0.307
CPS6	**0.805**	0.234
CPS7	**0.627**	0.344
PIIT1	0.254	**0.761**
PIIT2	0.160	**0.805**
PIIT3	0.198	**0.750**
PIIT4	0.342	**0.826**
Eigen Value	5.34	1.41
Percent of Variance	48.60	12.80

Notes: CPS = Computer Playfulness Scale.

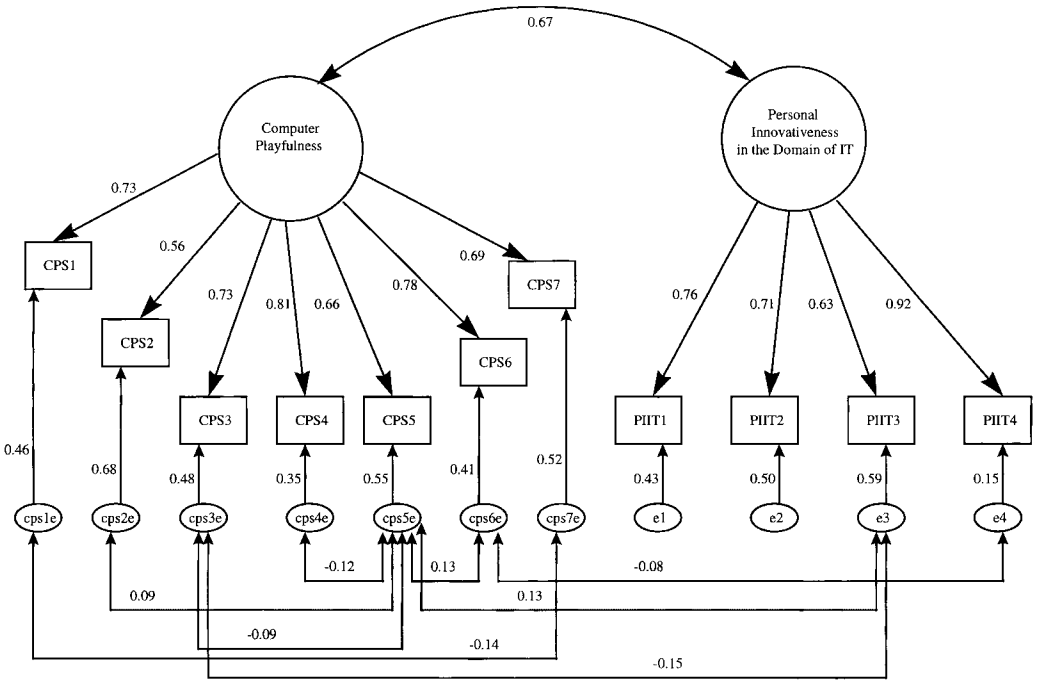
PIIT = Personal Innovativeness in the Domain of information Technology Scale.

Significant factor loadings are highlighted.

Nomological Validity—Expected Relationships

Recall that personal innovativeness was expected to exhibit moderating influences on the antecedents and consequences of perceptions about a new information technology. The search for nomological validity for the measure is an attempt to confirm such theory-based predictions; if the measure is an adequate metric for the conceptual construct, such predictions should be empirically derivable (Bollen 1989). In the context of the specific innovation examined here, it is extremely difficult to distinguish between specific sources utilized to obtain information about the World-Wide Web, such information is ubiquitous and subject response to questions relating to channel use has the potential to be unreliable. This is in contrast to, for example, a system that is developed specifically for an organization or a target group of users, as it is likely that information about such a new technology emanates from a limited and controlled set of sources. Because of such operational difficulties in assessing the relative use of

Figure 2 **Results of Confirmatory Factor Analysis**



alternate channels to develop perceptions about the Web, nomological validity was assessed by examining the contingent effects of PIIT on the relationship between perceptions about the innovation and usage intention regarding the innovation. In addition, following from the theoretical definition of PIIT (i.e., "... more willing to try ..."), the expectation of a positive correlation between PIIT and the criterion variable of usage intentions was also checked.

Perceptions Salient to Acceptance Behavior. Through a synthesis of several previous studies examining adoption behaviors, Rogers (1983, 1995) identified several attributes of an innovation that determine user acceptance. Moore and Benbasat (1991) refined this work and showed that perceptions of relative advantage, compatibility, complexity, result demonstrability, visibility, and trialability in addition to voluntariness predicted technology acceptance. However, in a meta-analysis of the work on innovation characteristics, Tornatzky and Klein (1982) found that only three innovation characteristics—relative advantage (subsequently labeled perceived usefulness in TAM), complexity (labeled ease of use in TAM), and compatibility—have been related *consistently* to adoption. Hence, nomological validity was assessed by examining the moderating influence of PIIT on the relationship between these three perceptions and usage intentions.

Data on perceptions and usage intentions toward the World-Wide Web were collected contemporaneously with the PIIT and CPS measures. The standard scales rigorously developed by Moore and Benbasat (1991) were utilized for the three perceptions, while the scale for usage intentions was based on the recommendations made by Ajzen and Fishbein (1980) and Davis et al. (1989).[4] (See the appendix for all scales and items.)

A multiple regression procedure was utilized to test for the presence of the hypothesized moderating effect of PIIT on the relationships between perceptions and

[4]Reliabilities for the scales in this sample were 0.88 for the five-item relative advantage scale, 0.81 for the four-item ease of use scale, 0.81 for the three-item compatibility scale, and 0.71 for the two-item usage intentions scale.

usage intentions.[5] The regression included all four main effects (PIIT and three perceptions), a product term for PIIT and each perception as the independent variables, and usage intentions as the dependent variable. A significant coefficient for any product term was interpreted as indicative of interaction effects (Baron and Kenny 1985). An analysis of residuals was also performed to verify that the assumptions underlying regression analysis—independence, homoscedasticity, and normal distribution of the error terms—were not violated. All assumptions were confirmed. Results of the regression analysis are shown in Table 4. One of the interaction terms was significant, providing some evidence for the hypothesized moderating effect. Finally, the correlation between PIIT and usage intentions was 0.47, significant at $p < 0.01$.

We had theorized that PIIT would exhibit a moderating influence on the relationship between all three salient perceptions and usage intentions. For this sample and technology, significant moderation was observed for only one of the perceptions—that of compatibility. While it might appear that this provides only weak evidence of moderation, there is a plausible explanation for why PIIT did not moderate the relationships between ease of use, usefulness, and usage intentions for the Web in particular. Of the three perceptions, compatibility is the only one that necessitates a significant change in the work behavior of a potential adopter. In the context of the Web, the considerable attention paid to the technology in the media and the widely available information about its "usefulness" and "ease of use" may tend to level the playing field for all types of adopters and hence, render the moderating effects of PIIT as nonsignificant. Nonetheless, the extent to which potential adopters are willing to accept changes in the way they are accustomed to work in order to use the Web (as measured by compatibility) is significantly influenced by their innate risk taking propensity with regard to technology.

In sum, the above analyses indicate that the scale developed for PIIT does measure the conceptual construct it purports to measure. While there is clearly a need for additional studies that examine the measure further with different samples and different IT innovations; the work presented here can provide the stimulus for such studies. We believe that PIIT potentially represents a construct that might be highly salient for studies examining innovative behaviors with respect to computing technology in that it may account for a significant proportion of the variance in innovation related dependent variables. If further studies substantiate this relationship, our recommendation is that PIIT be used as a control variable in individual level studies, where it could serve in a role equivalent to that played by "organization size" at the organizational level of analysis.[6]

Before discussing ways in which this work might be extended, it is important to acknowledge one limitation of the study. Two of the items used for the PIIT scale use the same phrase: ". . to try out a new information technology." Although one of the items was reverse scored, in general, utilizing identical phraseology for multiple items in a scale is not recommended. While the factor structure of the data indicates that this has not caused a problem with the current study, others might wish to modify one item with alternate phraseology. Any such change, however, must be consistent with the conceptual definition of the construct and warrants further empirical validation prior to use. One

[5]Lisrel was not utilized to assess nomological validity because the model includes interaction effects involving latent variables.

Table 4 Regression Analysis Results

Relationship	Adjusted R^2	Beta	t-value
Intentions =			
U+		.253	2.933**
EOU+		ns	
COM+		ns	
PIIT+	0.46	ns	
U*PIIT		ns	
EOU*PIIT		ns	
COM*PIIT		.468	5.433**

Notes: U = Usefulness
EOU = Ease of Use
COM = Compatibility
PIIT = Personal Innovativeness in the Domain of Information Technology
ns = nonsignificant; only significant betas are shown.
**Significant at $p < 0.01$.

[6]We thank an anonymous reviewer for pointing this out.

possible rewording might be to substitute the item "Among my peers, I am usually the first to explore new information technologies" for the current item two (as listed in table 1).

Several avenues for future work remain. As alluded to above, from a measurement perspective, the scale for PIIT is in need of additional refinement and validation. In addition, interesting questions related to the role of the innovativeness construct in technology adoption behavior in general can be asked. The only prior study in information systems that has utilized innovativeness as an important individual difference variable (Leonard-Barton and Deschamps 1988) found that it exhibited a negative moderating effect on the relationship between management urging to use an innovation and an individual's actual use of the innovation. In our conceptualization of the construct we hypothesize a moderating effect on the use of communication channels and perception formation. Such a moderating effect needs to be empirically confirmed in more controlled laboratory or field settings where the researcher is able to precisely isolate the various information channels available to a potential adopter.

Conclusions

The purpose of this paper was to provide a conceptual and operational definition of a construct that can shed further light on how individuals adopt new information technologies. As noted earlier, the construct can be used to identify early adopters who can either serve as change agents or else be targeted specifically for adoption when resources are limited. Moreover, the proposed moderating influence of the construct on key relationships in technology acceptance further enhances understanding of this complex behavioral process that can also have practical implications. For example, knowledge about the relative efficacy of alternate channels for individuals with differing levels of PIIT can be used by implementors of new information technologies to more effectively guide the availability of information channels. Finally, personal innovativeness in the domain of information technology can potentially be utilized to enrich more broadly focused models of IT implementation that include constructs other than individual beliefs or perceptions as drivers of technology adoption decisions.

Appendix Items and Scales

Perceive Usefulness

U1. Using the WWW would make it easier to do my work.

U2. Using the WWW would help me to accomplish tasks more quickly.

U3. Using the WWW would improve the quality of the work I do.

U4. Using the WWW would give me greater control over my work.

U5. Using the WWW would enhance my effectiveness in the MBA program and/or my job.

Ease of Use

EU1. My interaction with the WWW is clear and understandable.

EU2. I believe it would be easy to get the WWW to do what I want it to do.

EU3. Overall, I believe the WWW would be easy to use.

EU4. Learning to use the WWW would be easy for me.

Compatibility

C1. Using the WWW would be compatible with all aspects of my work.

C2. I think that using the WWW would fit well with the way I like to work.

C3. Using the WWW would fit into my workstyle.

Usage Intentions

UI1. I intend to increase my use of the WWW for work in the future.

UI2. For future work I would use the WWW.

Notes:

All items are measured on a seven-point scale, with the end points being "Strongly disagree" and "Strongly agree."

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John Leslie King, Associate Editor. This paper was received on July 24, 1996, *and has been with the author* 3 *months for* 2 *revisions.*