Personality and technology acceptance: Personal innovativeness in IT, openness and resistance to change

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Abstract

Individual users are known to differ in their tendency to adopt new technologies. Among the individual differences, Personal Innovativeness in IT (PIIT) has been shown to be a reliable predictor of users' beliefs about the ease of use and usefulness of new technologies. However, it is unclear what are the personality traits that make some users more innovative in IT than others. Personality traits are used in the psychology literature to explain human beliefs and behavior, and recently see a growing interest in the IS literature as an explanatory tool of user behavior. The present research investigates two personality traits established in the psychology literature, Resistance to Change (RTC) and Openness, as determinants of PIIT. A survey of 121 prospective users of a digital library system was conducted to test our hypotheses. The findings suggest that RTC and Openness are determinants of PIIT. Implications for research and practice are discussed.

1. Introduction

Today's business organizations have become increasingly dependent on information technology to carry out their daily operations. As a result, companies big and small have spent heavily in computer systems, software, and services. However, without full cooperation from end users, these investments do not necessarily translate into productivity gains and competitive advantage. When individual users accept and integrate technologies into their daily work, actual usage could link information technologies to their realized benefits (Devaraj and Kohli 2003). On the other hand, when users resist the introduction of technology innovations, the expected benefits will stay on paper and never accrue. Therefore, there have been great interests among scholars and practitioners alike in understanding how individual users come to accept and use technology innovations (e.g., Davis 1989; Venkatesh et al. 2003).

Two user beliefs, perceived ease of use (PEOU), and perceived usefulness (PU), have been identified as key factors that motivate individual users to accept and use a specific technology innovation. Each of these beliefs, however, captures the aggregated effects of a set of upstream factors that represent individual differences, organizational influences, and system characteristics (e.g., Agarwal and Prasad 1999; Lewis et al. 2003). A good understanding of what factors strengthen or weaken individual beliefs about ease of use and usefulness of information systems (IS) not only has significance for theory development in the IS field, but also bears high practical value. With better knowledge of what factors lead users to perceive a system as easy to use, IS managers can take actions to improve systems on these factors, and consequently prevent user rejection and ensure IS success.

Acceptance of new technologies often involves users' resistance to the change (Venkatesh et al, 2000), and therefore, in order to better understand users' PEOU of new technologies it is important to understand users' resistance to change. Resistance to change has been studied in the IS literature (e.g., Jiang et al, 2000), at both the individual and organizational level. However, such studies have focused on users' resistance within certain situations and have not examined resistance to change as a fundamental personality trait.

Research in social psychology has shown that individuals' beliefs and behavior across different aspects of human life are often determined by fundamental personality traits (e.g. Digman, 1990; Klein et al., 2004). Recently, there has also been a growing interest in personality as an explanatory tool in the IS literature (e.g., Li et al., 2006). Advances in psychology research led to the identification of the personality trait of resistance to change (RTC) (Oreg, 2003; 2006) which reflects individuals' disposition to resist changes. Introduction of new technologies

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often involves some form of change to users. The identification of the RTC trait enables us to assess its impact on users' personal innovativeness in IT (PIIT), a construct that influences both PU and PEOU when they face a new IS. This is the subject of the present study.

2. Background and literature review

One of the phenomena that interested IS scholars and practitioners alike is individual user's decision to adopt specific technologies. IS researchers have studied users' technology adoption using frameworks such as theory of reasoned action (TRA) (e.g. Fishbein and Ajzen 1975), theory of planned behavior (TPB) (e.g. Ajzen, 1991), diffusion of innovations theory (Rogers, 1995), and the technology acceptance model (TAM) (Davis 1989). All of these conceptual models build upon a set of user beliefs and attitudes that influence adoption of new technologies.

Among these models, the technology acceptance model is probably the most prevalent in the IS literature. TAM was developed by Davis et al. (1989) as an extension of TRA. There are four variables in TAM: PU, PEOU, behavioral intention, and behavior. According to TAM, both PU and PEOU affect intention to use a technology. Following their conceptualization, reliable and valid scales have been developed for these two key constructs (e.g., Davis 1989; Moore and Benbasat 1991; Venkatesh et al. 2003). Many studies have replicated, validated and extended Davis' work (Lee, et al 2003). Furthermore, in the last two decades IS research have also extended the model to incorporate antecedents of both PU and PEOU.

2.1. Personality and information systems

The psychology literature has long used personality as a predictor of human beliefs and behavior. Research in the field led to the establishment of models such as the five-factor (Big Five) model of personality (e.g. Digman, 1990; Klein, et al., 2004) and the Myers-Briggs Type Indicator (Smither, 1998). Numerous studies have provided substantial evidence for the role of personality traits as predictors of beliefs and behavior, across a variety of contexts (e.g. Mischel, 2004; Pulford and Sohal, 2006). For example, the personality trait of agreeableness was linked with higher levels of organizational citizenship behavior (Ilies et al., 2006), and the personality trait of narcissism was associated with leaders' grandiose belief systems and leadership styles (Rosenthal and Pittinsky, 2006).

More recently, there has been a growing interest in personality as an explanatory tool in the IS literature (e.g. Karahanna et al, 2002; Devito and Greathead, 2007), and evidence from IS studies show that personality traits predispose individuals to behave in certain ways across different situations (Thatcher and Perrewé, 2002), and help us understand people's use of IS (Pratt and Chudoba, 2006). In recent years, personality traits are being used in IS research to explain and predict users' behavior: the personality trait of extraversion was shown to be positively related to users' initial systems acceptance (Pratt and Chudoba, 2006), and CIOs personality traits of extroversion and openness to experience were shown to have a positively impact on their organizations' innovative usage of IT (Li, et al. 2006).

2.2. Personal innovativeness in IT

In an effort to identify upstream antecedents of the technology acceptance beliefs, the concept of personal innovativeness was introduced in an IS context (Agarwal and Prasad 1998). Individuals' personal innovativeness reflects their willingness to change (Hurt et al. 1977). In the context of IT, Personal Innovativeness in IT (PIIT) was defined as "the willingness of an individual to try out any new information technology" (Agarwal and Prasad 1998, p. 206), and a PIIT scale was developed and validated by Agarwal and Prasad (1998).

PIIT was said to contribute to our understanding of perceptions such as PU, compatibility, and PEOU (Agarwal and Prasad 1998). Further empirical research has shown that PIIT is related positively to computer self-efficacy and negatively to computer anxiety (Thatcher and Perrewé, 2002), and that PIIT is negatively related to relative advantage (Karahanna et al., 2002). From a practice perspective, understanding personal innovativeness can help to identify in the organization individuals who are likely to adopt information technology innovations earlier than others and serve as change agents to facilitate diffusion of new technologies (Agarwal and Prasad 1998).

Overall, however, while PIIT has been used in recent years to explain technology acceptance beliefs, there has been no research as to its antecedents, and in particular, what are the personality traits that underlie it. In addition to the potential contribution to theory by exploring what underlies PIIT, IS managers will also benefit from a better understanding of what fundamental personality traits make some users more open to new information technologies than others, and who is expected to exhibit more innovativeness in IT-intensive jobs.

2.3. Resistance to Change and technology acceptance

One aspect of human behavior which seems to be critical for technology acceptance is resistance to change. Resistance has been seen as central to IT-enabled change (Manzoni and Angehrn, 1997), and the relationship between technology adoption and resistance to change has been studied widely: users' resistance was shown to affect IT implementation (e.g. Cooper and Zmud, 1990), and issues such as uncertainty and change in job content have been shown to underpin resistance to adopting new technologies (e.g. Jiang et al., 2000). From an organizational perspective, organizational resistance was found to be negatively related to ERP implementation success (Hong and Kim, 2002).

Thus, while resistance to change received much interest in the IS literature, it has not been studied quantitatively at the individual level, because no suitable conceptualization and measurement was available. Recently, however, advances in social psychology research led to the identification of the personality trait of resistance to change (RTC) (Oreg, 2003; 2006). The resistance to change (RTC) trait, which reflects individuals' dispositional inclination to resist changes (Oreg, 2003), consists of four related, yet distinct, dimensions: routine seeking, emotional reaction to change, short-term focus, and cognitive rigidity, whereby each dimension reflects a different source of resistance. The RTC trait has been linked to people's behavior under conditions of change in a variety of contexts (Oreg, 2003; van Dam, 2005): people differ from each other in their inclination to resist or adopt changes, and the RTC disposition can therefore explain why some people are more inclined than others to try adopt new products, and also explain why some people are less inclined than others to try out new technologies (Oreg et al., 2005).

The RTC scale, developed to measure the RTC trait, consists of 17 items, and a number of studies (e.g. Oreg, 2003; 2006) have established its convergent, discriminant, and predictive validities, as well as its internal-consistency and its test – retest reliabilities. The seventeen items reflect the four dimensions of the RTC construct. These include, for example, "I generally consider changes to be a negative thing" (routine seeking), "When things don't go according to plans, it stresses me out" (emotional reaction to change), "Changing plans seems like a real hassle to me" (short-term focus), and "I don't change my mind easily" (cognitive rigidity). Measured with the full RTC scale, the RTC trait has been shown to predict specific change related behaviors above and beyond other related personality characteristics, such as tolerance for ambiguity or risk-aversion (Oreg, 2006), and has been recently used to analyze people's behavior in the context of change and innovation (e.g. Moldovan and Goldenberg, 2004).

Furthermore, drawing on behavioral research, according to which when trying to predict behavior in a particular context, narrow and specific traits may yield stronger relationships than those found with more general traits (Jones, et al., 2003; Schneider, et al., 1996), Oreg et al. (2005) introduced the concept of domain-specific resistance to change, and developed the measurement scale which consists of one item from each of the general RTC dimensions, tailored to the specific domain investigated (e.g. trying out new products).

2.4. Openness

Openness is one of the Big Five personality traits (e.g. Digman, 1990; Klein et al., 2004), and together with extraversion, neuroticism, conscientiousness and agreeableness, it is seen as a trait of one's personality (Pratt and Chudoba, 2006; Zweig and Webster, 2003). Openness represents a person's receptivity to new ideas and experiences (Korukonda, 2007) and has been associated with inquiring intellect, intelligence and intellectual interests (John and Srivastava, 1999). It was also used to describe people who are creative, original, curious, sensitive, non-conformist, unconventional, flexible, broad-minded, and adventurous (Costa and McCrae, 1992; Klein et al., 2004; Li et al., 2006). In addition, individuals who score high on openness tend to be inventive and to change their ideas and beliefs as a result of new experiences and information (Korukonda, 2007). In recent years, the effect of openness on people's interaction with technology is increasingly studied (e.g. Ashkanasy, et al., 2007), with a variety of findings, such as negative association between openness and technophobia (Anthony, 2000), and positive association between openness and job satisfaction in a context of ongoing technological change (Gallivan, 2004).

3. Research model

Motivated by the need to explore the effects of personality traits on PIIT, in the present research we aim to understand the effect of domain-specific RTC and openness on PIIT. Our research model is illustrated in Figure 1.

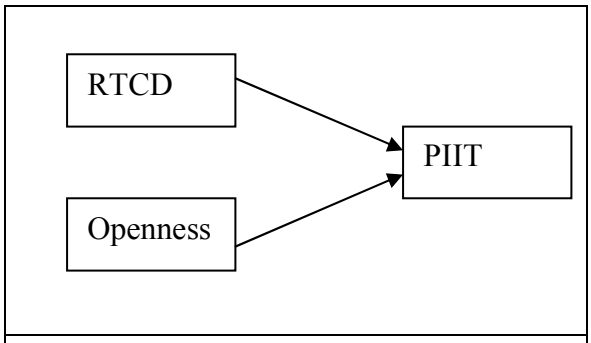

Figure 1. Research Model

3.1. Hypotheses

While the domain-specific RTC construct bears some resemblance to PIIT, on a conceptual level they are different: domain-specific RTC tries to explain *why* people resist trying out new information technologies, and not only *whether* they will try out these technologies. Thus, the domain-specific RTC scale includes one item on behavior, one on cognition and two that are affect-related, while the PIIT scale includes no specific attention to affect and cognitions.

Innovativeness reflects individuals' willingness to change (e.g. Leonard-Barton and Deschamps, 1988; Karahana, et al., 2002). Indeed, prior research indicates that highly innovative individuals tend to seek new experiences (Venkatramen 1991; Thatcher and Perrewé, 2002). Moreover, people who scored high on RTC were found in previous research to be less inclined than others to try out innovative products (Oreg et al., 2005), and more inclined to use innovative IT-based products (Oreg, 2003). Thus, we hypothesize the following:

Hypotheses 1: RTC domain will be negatively related to PIIT.

The openness trait characterizes people who are creative, original, adventurous (Costa and McCrae, 1992), inventive (Korukonda, 2007) and non-conformist (Klein, et al., 2004). Therefore, we expect that this personality trait, more than others, would most relevant to innovativeness in IT. Furthermore, we would expect that people who are high in openness will also be creative and inventive in an IT context. Moreover, previous research on the relationship between openness and technology usage has shown a positive association between organizational innovative usage of IT and the openness of the organization's CIO (Li et al., 2006), a negative association between users' openness and computer self-efficacy (Korukonda, 2007) and a negative association between openness and technophobia (Anthony, 2000).

In addition, Colquitt et al (2002) found that access to computer-assisted communication improved the decision-making performance of teams - but only when the teams consisted of people who were high in openness. This would also lead us to expect that people who are high in openness would be more comfortable with using IT.

Overall, drawing on previous research, which shows a positive relationship between openness and creativity and inventiveness, as well as a positive relationship between openness and the use of IT, we hypothesize the following:

Hypotheses 2: openness to experience is positively related to PIIT.

4. Methodology

4.1. Participants and settings

The setting of the present research is the library of a university in northeastern US. Among the services the library provides is a web-based system which enables users to locate books and periodicals, and in addition, access to numerous web-based databases of scientific periodicals such as EBSCO, Proquest and Science Direct. Like other types of systems, a concern associated with digital libraries is that in order to avoid under-utilization of their resources, digital libraries need to be easy to use (Hong et al., 2002). Thus, new students in the university, who are the potential users of the library system, take part in a one hour in-class instruction session to the library web-based system as part of their first year curriculum. Since these potential users are all new students, the instruction is a useful context on which to look at users' perceptions toward an information system that is new to them. Reflecting this, a survey was administered to 165 students immediately at the end of a library system introduction session. Of these, 143 students returned the questionnaire. Participation was voluntary and no incentive was provided. After dropping responses from incomplete questionnaires, and those with excessive missing data (for example, more than 1 missing items in any multi-item measurement), we have 121 usable responses. This yields a response rate of 73%.

One of limitations of previous technology acceptance studies was the reliance on retrospective surveys conducted long after the systems were introduced,

and long after the users' acceptance decision was made (Venkatesh, et al., 2003). This limitation is overcome in the present research, as data is collected immediately after the introduction of the new system and before the users get to use it on a regular basis.

4.2. Measures and procedure

We used Oreg et al.'s (2005) domain-specific RTC scale, adjusted to the context of computer software usage. Items in this scale included "I often feel a bit uncomfortable to try out new computer software, even though it may be beneficial to me" and "I find it exciting to try out new computer software" (reverse coded).

For PIIT, we used Agarwal and Prasad's (1998) scale. Items in this scale included "Among my peers, I am usually the first to try out new information technologies." and "In general, I am hesitant to try out new information technologies" (reverse coded).

For Openness, we used the short, four-item scale used in Li et al (2006). Items in this scale included "I like to challenge the norms" and "I love to read challenging material".

5. Results

5.1. Instrument Validation

The first step in validating our instrument is to ensure the discriminant and convergent validity of our measurement scales. We conducted a principle component analysis (PCA) with varimax rotation using SPSS. A three-factor solution emerged as expected. All items loaded on their expected factors with a minimum loading of 0.556, higher than the 0.4 cutoff commonly use in social science and IS studies (Straub, et al, 2004). Most of the items also had less than 0.4 cross-loadings onto other factors. RTCD2 has a slightly higher than 0.4 cross-loading onto personal innovativeness. However, it has a much higher loading on resistance to change. The three-factor solution explained 62% total variance in the PCA. Table 1 presents the mean, standard deviation, and factor loadings of each measurement items.

To further assess factor validity, we also calculated the Average Variance Extracted (AVE) for each measure (Fornell and Larcker 1981). To demonstrate discriminant and convergent validity, each factor is expected to have an AVE above .5, and the square root of AVE is expected to be higher than the correlations with other factors (Chin 1998; Straub et al. 2004). As illustrated in table 2, all measures showed satisfactory AVEs.

We verified the internal consistency and reliability of each measurement scales by calculating the Cronbach's alphas. As illustrated in Table 2, all constructs have an alpha value that satisfy the generally agreed upon lower limit of 0.70 for confirmatory research (Straub et al. 2004), indicating that all constructs are reliable. Table 2 also lists the mean, standard deviation of all three variables in this study.

Table 1. Item Means, Standard Deviations, and Factor Loadings

		Mean	SD	1	2	3
1	RTCD1	4.40	1.47	.663		
	RTCD2	2.98	1.34	.667		-.445
	RTCD3	2.83	1.51	.682		
	RTCD4	3.83	1.61	.828		
2	OPEN1	4.51	1.23		.830	
	OPEN2	5.40	1.18		.589	
	OPEN3	3.88	1.64		.648	
	OPEN4	4.93	1.21		.751	
3	PIIT1	5.05	1.30			.888
	PIIT2	4.09	1.30			.559
	PIIT3	5.00	1.40			.556
	PIIT4	4.79	1.31			.790

Note: factor loadings below .400 are suppressed.

Table 2. Construct Means, Standard Deviations, Reliability, Intercorrelations,						
Construct	Mean	SD	α	1	2	3
1. Resistance to Change	3.51	1.13	.76	.713		
2. Openness	4.68	0.98	.72	-.407**	.710	
3. PIIT	4.73	1.04	.79	-.551**	.525**	.713

Note: The diagonals are the square root of the AVE of each factor

** Significant at the 0.01 level, one-tailed test

5.2. Testing of Hypotheses

Table 3 lists the results from linear regression analysis using SPSS. The model is significant overall ($F = 41.322$, $df = 2$, $p < 0.001$). The adjusted R^2 of our regression model is 0.402, and both regression coefficients for resistance to change and openness are significant at the .001 level. Therefore, our hypotheses were supported.

Table 3. Linear Regression Results				
	Independent Variables	β	t	*p*
Results of individual predictors	Constant		7.809	.000
	Resistance to Change	-.404	-5.224	.000
	Openness	.361	4.671	.000
Results of the overall model	R^2	.412		
	Adjusted R^2	.402		
	F	41.322 (df = 2, $p < .001$)		

6. Discussion and conclusion

Drawing on existing IS literature, as well as social psychology literature, the findings from the present research suggest that openness and resistance to change are significant determinants of PIIT. Addressing the relationship between resistance to change and technology acceptance (Venkatesh, et al, 2000), the present research introduces to the IS research the personality trait of resistance to change, which has been well established in the social psychology and the innovation literatures (e.g. Oreg, 2003; Oreg et al., 2005; Moldovan and Goldenberg, 2004). As the findings suggest, domain-specific resistance to change is a determinant of individuals' PIIT. This contribution to the research on technology acceptance broadens our understating of the determinants of PIIT, which has not been studied so far, by taking into account two fundamental personality traits, one of which (RTC) has not been considered so far in the IS literature. The findings also support our hypothesis of a positive relationship between PIIT and another personality trait – openness – which, given its emphasis on creativity and non-conventional thinking (Klein, et al., 2004), is most relevant to PIIT among the big five personality traits. Our findings add to the increasing evidence that technology related individual beliefs and behavior are at least partially a consequence of more fundamental personality traits, and therefore further signify the need for researchers to take these individual differences into consideration in studies of not only IT acceptance, but also other areas of technology user behavior.

Moreover, the present research overcomes one of the common limitations of previous technology acceptance studies, namely the reliance on retrospective surveys conducted long after the users were introduced to the systems (Venkatesh, et al., 2003). Therefore, the findings represent users' personality and beliefs, at a time that is critical to users' adoption decisions.

There are several limitations in our study. First, we tested our research model on a student population. Although the technology innovation chosen is highly relevant to our respondents, future research can verify if the same results can be generalized to a business organization setting. Second, in this study we aimed for a parsimonious explanation of PIIT and

only selected two personal traits that are most likely to be close and direct antecedents of PIIT. Our research model predicts PIIT with a satisfactory R^2. Future research may further improve the predicting power on PIIT by incorporating other possible antecedents of PIIT, or, if more data is available, use an SEM approach to look at the relationships between RTC, PIIT and user beliefs and behavior such as PEOU and intended system adoption and actual adoption.

Understanding what underlies PIIT can help organizations that struggle with the introduction of new technologies: matching people to tasks according to their personality types can help organizations improve productivity and quality (Devito and Greathead, 2007). Hence, since organizations often administer personality tests to their employees (Eunjung-Cha, 2005; Srite and Karahanna, 2006), they may want to include measures of RTC and openness in such tests. This can help with the assessment of employees' suitability for certain IT-related jobs and their expected innovativeness in such jobs, and therefore help create better alignment of employees, organizational roles and systems.

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