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Motivational Differences Across Post-Acceptance IS Usage Behaviors

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Abstract

We identify two post-acceptance information system (IS) usage behaviors related to how employees leverage implemented systems. While routine use (RTN) refers to employees' using IS in a routine and standardized manner to support their work, innovative use (INV) describes employees' discovering new ways to use IS to support their work. We use motivation theory as the overarching perspective to explain RTN and INV and appropriate the rich intrinsic motivation (RIM) concept from social psychology to propose a conceptualization of RIM toward IS use, which includes intrinsic motivation toward accomplishment (IMap), intrinsic motivation to know (IMkw), and intrinsic motivation to experience stimulation (IMst). We also consider the influence of perceived usefulness (PU)—a representative surrogate construct of extrinsic motivation toward IS use—on RTN and INV. We theorize the relative impacts of the RIM constructs and PU on RTN and INV and the role of personal innovativeness with IT (PIIT) in moderating the RIM constructs' influences on INV. Based on data from 193 employees using a business intelligence system (BIS) at one of the largest telecom service companies in China, we found 1) PU had a stronger impact on RTN than the RIM constructs, 2) IMkw and IMst each had a stronger impact on INV than either PU or IMap, and 3) PIIT positively moderated the impact of each RIM construct on INV. Our findings provide insights on managing RTN and INV in the post-acceptance stage.

Keywords: post-acceptance stage, post-acceptance behaviors, routine use, innovative use, motivation theory, intrinsic motivation

1. Introduction

Throughout the last 30 years, organizations have continually invested significant resources in implementing complex information systems (IS) to achieve competitive advantages. In general, IS implementation is conceived as a multi-stage process (Cooper and Zmud 1990, Kwon and Zmud 1987). While the pre-acceptance and acceptance stages establish milestones of initial IS success (Thong 1999), the post-acceptance stage is critical for organizations to realize returns on IS investments (Bhattacherjee 2001, Jasperson et al. 2005, Saga and Zmud 1994). However, in the post-acceptance stage, employees rarely use the implemented IS to its fullest potential, thus preventing organizations from realizing the promised benefits. The extant IS literature has primarily examined IS use at the pre-acceptance and acceptance stages, while IS usage behaviors in the post-acceptance stage have received limited attention (e.g., Hsieh and Wang 2007, Jasperson et al. 2005). In this study, we investigate routine use (RTN) and innovative use (INV)—two distinct usage behaviors that can coexist in the post-acceptance stage and are suggested to be important in leveraging implemented systems and ameliorating low returns on IS investments (Jasperson et al. 2005, Saga and Zmud 1994).

After gaining first-hand usage experience in the acceptance stage, employees develop a certain level of understanding about an implemented IS, which enables them to achieve work objectives in the post-acceptance stage by not only using the system in a standardized way but also using the system in novel ways that they uncover (Saga and Zmud 1994). Two key, yet distinct, post-acceptance IS usage behaviors that employees can engage in to achieve work objectives are (1) routine use (RTN), or using IS in a routine and standardized manner to support their work (Saga and Zmud 1994, Schwarz 2003), and (2) innovative use (INV), or applying IS innovatively to support their work (Ahuja and Thatcher 2005, Jasperson et al. 2005). Routine and innovation behaviors have been shown to create significant advantages when they coexist in various organizational behavior contexts including the following: employees' simultaneous pursuit of standard performance and innovative performance (Janssen 2001, Katz and Kahn 1966), knowledge workers' reuse of existing solutions and exploration of new solutions to solve problems (Durcikova et al. forthcoming), customers' general and innovative product usage behaviors (Hirschman 1980, Ridgway and Price 1994), and organizations' use of both exploitation and exploration learning strategies (e.g., Atuahene-Gima and Murray 2007).

We conceive RTN and INV as two qualitatively different behaviors that can coexist in the post-acceptance stage and need to be managed holistically (Benner and Tushman 2003, Gupta et al. 2006, March 1991). The resident challenge is to promote the coexistence of both RTN and INV, which has motivated us to examine them together in the post-acceptance context. Accordingly, it is important to understand the mechanisms that promote RTN and/or INV, as knowledge in this regard will help organizations achieve the desired balance and synergy between the two usage behaviors and realize the benefits that each behavior provides (Atuahene-Gima and Murray 2007). Toward this end, we draw on motivation theory and propose that RTN and INV are promoted differentially by extrinsic and intrinsic motivations.

Specifically, people engage in activities based on intrinsic motivation and extrinsic motivation (Deci and Ryan 2002). Intrinsic motivation refers to the state in which a person performs an activity for the joy or satisfaction derived from the activity itself, while extrinsic motivation refers to the state in which a person performs an activity to gain external benefits (e.g., rewards, money) rather than simply partaking in the activity (Deci and Ryan 2002). While motivation theory has been applied in previous IS studies to understand general IS use (Venkatesh et al. 2003), our literature review reveals that intrinsic and extrinsic motivations have received unbalanced attention in IS research and that there is a gap in our understanding on their differential roles in predicting different post-acceptance usage behaviors.

Prior IS research has typically viewed perceived usefulness (PU) as the most important extrinsic motivator and perceived enjoyment (PE) as the most representative intrinsic motivator for IS use (Brown and Venkatesh 2005, Davis et al. 1992). Researchers have paid significantly more attention to the role of extrinsic motivation than intrinsic motivation in understanding IS use (e.g., Venkatesh et al. 2003, Legris et al. 2003, Hong et al. 2006, van der Heijden 2004). This biased attention is attributable, in part, to the oversimplified conceptualization of intrinsic motivation toward IS use. As suggested by Thomas and Velthouse (1990), intrinsic motivation in workplaces should be distinguished from intrinsic motivation in hedonic contexts. In organizations, employees are likely to pay more attention to instrumental job-related benefits that could be generated from IS use rather than the hedonic values derived from IS use (Van der Heijden 2004), yet IS use may still be enjoyable due to the meaningfulness, satisfaction, and fulfillment that employees derive from it (Deci and Ryan 2002, Vallerand 1997). However, PE does not capture the richness of these innately rewarding perceptions. In order to develop a more comprehensive and precise conceptualization of intrinsic motivation toward IS use, we appropriate the multidimensional intrinsic motivation conceptualization from social psychology (Vallerand 1997, van Yperen and Hagedoorn 2003) to the post-acceptance IS use context and propose the concept of rich intrinsic motivation

(RIM), which consists of the following three constructs: intrinsic motivation toward accomplishment (IMap), intrinsic motivation to know (IMkw), and intrinsic motivation to experience stimulation (IMst).

Most IS studies in organizational settings have identified extrinsic motivation, specifically PU, as the dominant predictor of IS use (e.g., Davis et al. 1992, Legris et al. 2003). Drawing on this insight from past IS research, we focus on PU as a representative surrogate construct of employees' extrinsic motivation toward a system implemented in their organization. We challenge the predominant role of extrinsic motivation, specifically PU, in explaining IS use and argue that it is inadequate for explaining post-acceptance IS use behaviors. Our position is consistent with creativity research, which reveals that intrinsic motivation has a tremendous impact on innovative behaviors in organizations (Amabile 1996) and that extrinsic motivation, though instrumental in enhancing common work performance, has less influence on creativity than intrinsic motivation (Bass 1998, McGraw 1978). Thus, we elaborate on the conceptualization of post-acceptance IS use behaviors by differentiating between RTN and INV, introduce the RIM concept to capture intrinsic motivation toward IS use, and argue for a nuanced and holistic view that considers the role of both extrinsic and intrinsic motivations in influencing post-acceptance IS usage behaviors.

In addition, to further understand the influence of RIM on INV, we identify employees' personal innovativeness with IT (PIIT) as an important individual characteristic that should moderate this relationship. Uncovering individual characteristics that serve as moderators can reveal important differences in relationships between constructs across individuals and can provide a powerful basis to tailor interventions based on salient individual characteristics (Evans and Lepore 1997, Wohlwill and Heft 1987). Accordingly, we explore the influence of RIM on INV across levels of employees' innovativeness with IT.

To summarize, our research objectives are to 1) conceptualize two important, yet distinct, post-acceptance usage behaviors (i.e., RTN and INV); 2) appropriate the RIM concept to the post-acceptance IS use context to enrich the knowledge on intrinsic motivation toward IS use; 3) examine the relative importance of the three RIM constructs and PU in explaining RTN and INV; and 4) investigate how PIIT moderates RIM's influence on INV.

2. Theoretical Background

To set the theoretical foundations for our work, we define routine use (RTN) and innovative use (INV), introduce the concept of rich intrinsic motivation (RIM) and contextualize it to IS use, and develop the rationale for personal innovativeness with IT (PIIT) as an individual characteristic that moderates RIM's influence on INV.

2.1 Routine Use and Innovative Use

2.1.1 Coexistence of RTN and INV in the Post-Acceptance Stage

IS implementation in an organization typically involves six stages (Cooper and Zmud 1990, Saga and Zmud 1994): initiation, adoption, adaptation, acceptance, routinization, and infusion. While the first three stages primarily concern activities at macro levels (e.g., organizational or departmental levels), the latter three stages are manifested at both macro and micro levels. Specifically, at an individual level, *acceptance* reflects employees' commitment to IS use, *routinization* describes the state in which IS use is integrated as a normal part of the employees' work processes, and *infusion* refers to embedding IS deeply and comprehensively in work processes (Cooper and Zmud 1990, Saga and Zmud 1994). Importantly, routinization and infusion—conceived together as the post-acceptance stage (Hsieh and Wang 2007)—do not necessarily occur in sequence but rather occur in parallel (Cooper and Zmud 1990, Saga and Zmud 1994). Accordingly, while RTN and INV are typically associated with the routinization and infusion stages, respectively, employees can engage in both of them in the post-acceptance stage (Cooper and Zmud 1990, Saga and Zmud 1994).

Moreover, during the post-acceptance stage, employees may display either RTN or INV at a precise point in time during a workday, but they can also display both behaviors within a period of time (e.g., an entire workday). Also, both RTN and INV are expected to vary across employees. RTN, or employees' routine use of IS in their work, may differ as employees exhibit significant variance in the extent to which they standardize and integrate IS use in their work (Brown et al. 2002, Hartwick and Barki 1994). Similarly, INV occurs at employees' discretion and can also vary across employees (Hsieh and Wang 2007, Silver 1991).

2.1.2 Frame of Reference for RTN and INV

Our frame of reference for RTN and INV is the individual employee who uses IS in the post-acceptance stage to support his/her work. Because it is typically difficult for one's IS usage behaviors to be observed by others (Goodhue and Thompson 1995, Rai et al. 2002), the focal individual's cognitive framework is usually the most appropriate frame of reference for his/her own behaviors (Dutton and Penner 1993, Weick et al. 2005). Also, whether a behavior (which is hard to be observed by a third party) is routine or innovative is in the beholder's eyes. Indeed, empirical evidence shows that individuals resort to their own cognitive frameworks as the reference point to make sense of their behaviors (Weick et al. 2005, Dukeich et al. 2002). Owing to the hard-to-observe nature of IS usage behaviors and the importance of individuals' cognitive framework in making sense of their own behavior, we view employees as the frame of reference for their IS usage behaviors (i.e., RTN and INV).

2.1.3 RTN vs. INV: Standardization vs. Innovation Orientation

We propose that RTN and INV can be contrasted based on the distinction between standardization and innovation orientations of employees' IS usage behaviors. Researchers have differentiated between the standardization and innovation of activities at the organizational level (e.g., Benner and Tushman 2002, 2003). While standardization aims to avoid risks, routinize activities, and improve efficiency in work processes, innovation challenges this embedded stability in work processes and generates creative alternatives (Benner and Tushman 2002). Achieving significant performance outcomes is often contingent upon organizations' ability to manage the standardization *and* innovation of activities simultaneously (Benner and Tushman 2003, Teece et al. 1997). In this study, we draw on these two qualitatively different orientations to conceptualize the differences between employees' RTN and INV in the post-acceptance IS implementation context.

Table 1 Similar IS Use Concepts in the IS Literature

IS Use	Similar Concepts and Sources
Routine Use (RTN)	1. Routine use (Schwarz 2003) The extent to which IS use has become a normal part of work routines 2. Routine use (Sundaram et al. 2007) The extent to which IS use has been integrated into users' normal work routine 3. Standardized use (Saga and Zmud 1994) Users' utilization of IS in a way that reduces variations in usage patterns 4. Use perceived as being normal (Saga and Zmud 1994) Users' perception that their IS use is normal
Innovative Use (INV)	1. Emergent use (Saga and Zmud 1994) Users' utilization of IS to accomplish work that was not feasible or recognized prior to the application of the IS to the work system 2. Emergent use (Wang and Hsieh 2006) Users' utilization of IS in an innovative manner to support their work performance 3. Individual feature extension (Jasperson et al. 2005) Users' discovery of ways to apply the IS features that go beyond the ways originally conceived by the designers or implementers of the IS 4. Intention to explore (Nambisan et al. 1999) Users' willingness to and purpose for exploring IS and identifying its potential use 5. Trying to innovate with IT (Ahuja and Thatcher 2005) Users' goals of finding novel uses for IS

Drawing on the standardization versus innovation distinction and synthesizing prior IS literature (Table 1), we first define RTN as employees' using IS in a routine and standardized way to support their work. Routine use (Schwarz 2003, Sundaram et al. 2007), which is likened to standardized use and use perceived as being normal (Saga and Zmud 1994), has two unique characteristics: 1) it is repetitious and perceived as a normal part of employees' work activities and 2) it has been standardized and incorporated into employees' work processes. As we set employees as the frame of reference for evaluating the nature of their own post-acceptance usage behaviors, RTN focuses on the standardization of IS use in individual employees' work processes rather than the standardization of IS use across employees in an organization that implements a system. Such repetitive and standardized use of IS in the post-acceptance stage helps employees develop familiarity with the implemented system, thereby facilitating IS use to be integrated in their individual work processes (Saga and Zmud 1994).

Next, INV, as a form of innovation at the individual level, describes employees' application of IS in novel ways to support their work. In the post-acceptance stage, through accumulated experiences with the implemented IS, employees are able to apply the IS in innovative ways, thereby realizing its further value (Jasperson et al. 2005). Some concepts have been introduced to explain employees' creative application of IS (Table 1), such as 'emergent use' (Saga and Zmud 1994, Wang and Hsieh 2006), 'individual feature extension' (Jasperson et al. 2005), 'intention to explore' (Nambisan et al. 1999), and 'trying to innovate with IT' (Ahuja and Thatcher 2005). Although these concepts concern employees' creative IS use, there is ambiguity as to whether or not the innovative use pertains to supporting their work. In this study, given our emphasis on employees' IS use in organizational contexts, we focus on employees' innovative use of IS to support their work.

In short, RTN and INV describe two qualitatively different post-acceptance IS usage behaviors performed by an employee to support his/her work. The agent (i.e., the employee) and the purpose (i.e., to support his/her work) of these two IS usage behaviors are the same. The main difference lies in the nature of these two behaviors—namely, how the employee uses the system. Consider a marketing analyst whose work responsibilities include evaluating the firm's marketing performance, understanding the competitive environment, and suggesting marketing strategies. To fulfill his/her assigned work, the analyst is expected to use a business intelligence system (BIS) equipped with various analytic functions to analyze data that is consolidated in a data warehouse (that includes customer, product, service, and sales data, as well as competitors' activities). In this setting, RTN could refer to the analyst generating standardized reports on a routine basis; by reviewing these reports, the analyst can understand current marketing performance and external conditions and then suggest adjustments in marketing strategies. Additionally, if the analyst believes that he/she can attain further insights that could not be attained via the routine use of the BIS, he/she can engage in INV, such as extracting new variables from the data warehouse, combining variables across several routine reports to generate novel views of customers' purchase patterns, or synthesizing the analysis functions used in various routine reports to analyze the data in very different manners. In effect, INV pertains to the analyst using the BIS in novel non-routine ways to creatively analyze data in the data warehouse and suggest alternatives for marketing strategies. Thus, although RTN and INV represent very different ways of using the BIS, both usage behaviors can enable the analyst to accomplish his/her assigned work.

2.1.4 RTN vs. INV: Employees' Learning Orientation of IS Use

We propose that RTN and INV also differ in their learning orientation such that they bear resemblance to the twin concepts of exploitation and exploration in organizational learning research (March 1991, Im and Rai 2008). We draw on learning as a supplemental theoretical lens because learning influences the utilization of existing knowledge and/or the creation of new knowledge (Gupta et al. 2006), thereby reducing barriers to assimilating IS in work processes (Fichman and Kemerer 1999, Robey et al. 2002). This also responds to scholars' call to apply the learning perspective to understand post-acceptance IS usage behaviors (Cooper and Zmud 1990, Jasperson et al. 2005). In the organizational learning literature, exploitation refers to the utilization of existing resources and competencies, and exploration describes organizations' experimentation with new alternatives (March 1991, Gupta et al. 2006, Im and Rai 2008). Arguably, employees' repetitive use of IS (i.e., RTN) captures the idea behind exploitation because employees' cognition is anchored and refined with respect to standardized ways of using the implemented IS (Starbuck 1982). On the other hand, attempts at novelty (i.e., INV) are similar to exploration, which goes beyond standardized ways of applying the IS to support employees' work (Hsieh and Zmud 2006, Jasperson et al. 2005). Compared to RTN, INV involves more dramatic learning and requires employees' to expand their knowledge about the potential of the implemented IS for their work.

2.1.5 Summary

Our above discussion suggests that viewed from the frame of reference of an employee whose work is supported by a system, RTN and INV are two behaviors that can coexist and support employees' work in the post-acceptance stage. While RTN pertains to employees' engaging in standardized IS use, INV refers to employees' exploring and incorporating novel ways to use the system to support their work. Given the importance of managing standardized and innovative behaviors simultaneously in organizational contexts (Benner and Tushman 2003, Teece et al. 1997), it is not only crucial to focus on employees' routine use of the system, but it is also important to focus on employees' discovery of how the system can be used innovatively to achieve work objectives (Jasperson et al. 2005). Toward this end, motivation theory offers a solid theoretical foundation to explain employees' variations in these two IS usage behaviors.

2.2 Motivation Theory

Individuals engage in activities due to intrinsic motivation and extrinsic motivation (Deci and Ryan 2002, Vallerand 1997). The key difference between intrinsic and extrinsic motivations is that while intrinsically motivated individuals enjoy the process of performing a given activity, extrinsically motivated individuals value the results rather than the process of performance (Deci and Ryan 2002, Vallerand 1997). Moreover, extrinsic motivation is associated with individuals perceiving tension and pressure, while intrinsic motivation is associated with individuals feeling free and relaxed (Vallerand 1997). As a result, intrinsic motivation can induce cognitive flexibility, enjoyment, and satisfaction during an activity, thereby stimulating innovation (Amabile 1988, Shin and Zhou 2003). Nevertheless, studies have seldom theoretically and empirically examined the relative impacts of intrinsic and extrinsic motivations on focal IS behaviors, including the two post-acceptance IS usage behaviors of RTN and INV with which we are concerned.

IS studies have contextualized and applied motivation theory to examine IS use and have shown that both extrinsic (e.g., perceived usefulness (PU)) *and* intrinsic motivations (e.g., perceived enjoyment (PE)) influence IS use (Davis et al. 1992, Venkatesh et al. 2003). However, as we discuss below, intrinsic motivation toward IS has been under-conceptualized; as a result, the importance of intrinsic motivation for IS use is not well understood and has potentially been undervalued relative to extrinsic motivation in promoting post-acceptance IS use.

2.2.1 Perceived Usefulness as Extrinsic Motivation toward IS Use

The utilitarian view of human nature, positing that individuals' behaviors are strengthened by positive consequences, offers a perspective for understanding the effects of extrinsic motivation on focal behaviors (Bentham 1988, Eisenberger and Cameron 1996). Perceived usefulness (PU) is typically viewed as the most important aspect of extrinsic motivation influencing IS use (Davis et al. 1992, Venkatesh et al. 2003). As defined by Davis et al. (1989), PU refers to users' perceptions of whether using IS will effectively enhance their work performance. Over the past two decades, there has been consistent empirical evidence showing that PU is the dominant determinant of IS use (Davis et al. 1989, Legris et al. 2003, Venkatesh et al. 2003). It is understandable that in workplaces, employees would like to use IS if the enhanced performance derived from IS use can help them accrue job-related benefits, including "raises, promotion, bonuses, and other rewards" (Davis et al. 1989, p. 320, Venkatesh and Speier 1999). As such, PU, which focuses on utilitarian considerations, has been recognized as one of the most representative surrogate constructs of extrinsic motivation for IS use. Accordingly, we focus on PU's influence on RTN and INV.

2.2.2 A Rich Conceptualization of Intrinsic Motivation toward IS Use

Perceived enjoyment (PE) has typically been viewed as the representative intrinsic motivator for IS use (van der Heijden 2004). Empirical studies have shown that PE promotes technology acceptance and use across contexts, including in educational settings (Davis et al. 1992), game-based training (Venkatesh 1999), home use (Brown and Venketesh 2005, Hsieh et al. 2008), e-commerce transactions (Kamis et al. 2008), mobile services (Fang et al. 2006), knowledge contribution in e-networks (Wasko and Faraj 2005), knowledge transfer in IS implementation (Ko et al. 2005), and open-source software project development (Shah 2006).

Admittedly, PE is a salient determinant of individuals' use of technologies. The pleasant sensational experiences of use effectively drive users' interest, ease their cognitive burdens, nurture positive attitudes toward use, and boost use intentions, all of which enhance IS use. Particularly in the case of hedonic IS, the amusement perceived by users can be a critical factor promoting use intentions and behaviors (van der Heijden 2004).

However, social psychology research suggests that across education, work, and sports contexts, intrinsic motivation is comprised not only of hedonic physical sensations (i.e., perceived enjoyment, PE) but also of the pleasure and satisfaction from accomplishment and learning when performing such activities (Deci and Ryan 2002, Maslow 1970, Vallerand 1997). Given that the IS literature on intrinsic motivation has focused solely on physical enjoyment and has excluded the joyful feelings that result from accomplishment and learning (e.g., Hsieh et al. 2008, Thong et al. 2006, van der Heijden 2004), we appropriate the rich intrinsic motivation (RIM) concept from social psychology to the IS context and propose a more comprehensive and precise conceptualization of intrinsic motivation to explain IS usage behaviors in the post-acceptance stage.

In offering a more comprehensive conceptualization of intrinsic motivation toward human behaviors in general, Vallerand and his colleagues suggest that intrinsic motivation consists of three core aspects: intrinsic motivation toward accomplishment (IMap), intrinsic motivation to know (IMkw), and intrinsic motivation to experience stimulation (IMst) (Vallerand et al. 1989, Vallerand et al. 1992, 1993, Vallerand et al. 1997). According to Vallerand, most behavioral studies examine only one of the three intrinsic motivations rather than adopting an integrated perspective. Identified through a meta-analysis, the above three constructs incorporate the predominate types of intrinsic motivations in the extant social psychology literature (Vallerand and Briere 1990, Vallerand et al. 1989). Specifically, IMap refers to the pleasure and satisfaction experienced while individuals are trying to solve problems or accomplish something (e.g., Nicholls 1984, White 1959). Note that although IMap is directed by accomplishing some end result, the focus of IMap is still the process of accomplishment and overcoming difficulties (Vallerand 1997). IMkw is the enjoyment individuals experience when learning or exploring things (e.g., Berlyne 1971, Brophy 1987). The last dimension, IMst, pertains to the intensely pleasant feelings associated with performing certain activities (e.g., Csikszentmihalyi 1978, Zuckerman 1979). These definitions and the corresponding measures of the three intrinsic motivations have been applied in a number of hedonic (e.g., sports) and non-hedonic (e.g., work, academic) contexts (Deci and Ryan 2002, Vallerand 1997, van Yperen and Hagendoom 2003), thereby supporting the RIM concept's utility for understanding the focal IS usage behaviors (i.e., RTN and INV) of interest in this study.

IMap, IMkw, and IMst are three different types of intrinsic motivations. They are, to different extents, driven by individuals' innate needs, including competence, relatedness, and autonomy (Deci and Ryan 2002, Vallerand 1997). For instance, IMap is stimulated when individuals want to prove their competence and interact effectively and proficiently with the environment (Kowal and Fortier 1999). IMkw is aroused when individuals feel that learning is associated with interactions and connections with coworkers, providing them with a sense of belongingness and satisfying their need for relatedness (Lee et al. 2005, Wegner et al. 2002). IMst is generated by individuals' need for autonomy, as autonomy allows them to freely search for information and enjoy a variety of choices and experiences (deCharms 1968, Steenkamp and Burgess 2002).

From an alternative view, the three types of intrinsic motivation satisfy different aspects in Maslow's theory of needs (Maslow 1970). First, IMap relates to individuals' desires for esteem and self-actualization. When individuals successfully solve problems, they realize their self-value; when they overcome difficulties, they have a positive evaluation of themselves, as well as their capabilities in performing related activities (Bandura 1997, Gist and Mitchell 1992). Second, IMkw satisfies individuals' needs to reduce uncertainty, which relate to their needs for safety. Individuals tend to explore when they feel unfamiliar with their surrounding environment (White 1959). Hence, it is intuitive for individuals to strive to learn and understand new things when they encounter uncertain situations. Third, IMst is associated with hedonic needs, which belong to the physiological category of Maslow's theory (e.g., Berlyn 1971, Maslow 1970). Overall, this tri-dimensional view of intrinsic motivation renders a holistic conceptualization and captures the richness of intrinsic motivation in regards to complex human behaviors, such as employees' IS usage behaviors to support their work in the post-acceptance stage.

Accordingly, we propose that intrinsic motivation toward IS use manifests in three ways: IMap, IMkw, and IMst. We define a) IMap as the pleasure and satisfaction that users experience when solving problems or overcoming difficulties in using IS, b) IMkw as the pleasure and satisfaction that users experience when learning new things or trying to understand something new in using IS, and c) IMst[1] as the pleasure and satisfaction that users experience when interacting with IS. As a whole, these three types of intrinsic motivations capture the RIM concept for IS use. The RIM concept goes beyond PE, which captures only the hedonic aspects of enjoyment but overlooks individuals' innate needs for realizing self-value, such as challenge, accomplishment, curiosity, and learning (Vallerand 1997, Venkatesh 1999). Toward this end, the RIM concept provides the basis for us to develop a rich conceptualization of intrinsic motivation toward IS use.

2.3 Personal Innovativeness with IT

Incorporating personal factors as moderators not only helps to reconcile inconsistent findings but also increases the explanatory power of individual behavior models, as they can provide a more comprehensive explanation about the behavioral phenomenon of interest (Sun and Zhang 2006, Venkatesh et al. 2003). To attain a more nuanced understanding about the relationship between RIM and INV, we identify employees' personal innovativeness with IT (PIIT), one of the most relevant individual characteristics for understanding IS use (Agarwal 2000, Gallivan et al. 2005), as a plausible moderator. An individual is regarded as being 'innovative' when he/she adopts an innovation early on (Rogers 2003). Defined as the degree to which an individual is willing to try out a new technology, PIIT characterizes individuals' risk-taking propensity and tolerance of uncertainty during technology use processes (Agarwal and Prasad 1998, Rogers 2003, Thatcher and Perrewe 2002) and, for reasons we elaborate on later, can change the influence of each of the three RIM constructs on INV.

3. Research Model and Hypotheses

Our research model is shown in Figure 1. While both extrinsic and intrinsic motivations could be important for IS use (Davis et al. 1992, Venkatesh et al. 2003), social psychology researchers have suggested that as the three intrinsic motivations differ significantly, their effects may also vary significantly depending on the focal

[1] IMst is distinct from several related constructs in prior IS literature, including arousal, computer playfulness, flow, and cognitive absorption. While IMst relates to users' *motivational tendency* toward using IS because of the enjoyment and hedonic fun in the usage process, arousal is an important component of users' *emotions* that possibly drives IS use (Deng and Poole 2010), computer playfulness captures a concrete *psychometric disposition* that is manifested through users' intellectual interaction with computers (Webster and Martocchio 1992), and flow and cognitive absorption describe users' *cognitive status* when interacting with IS (Agarwal and Karahanna 2000, Webster et al. 1993).

behavior and the context (Vallerand 1997, Vallerand and Briere 1990). Accordingly, we examine the impacts of each of the three RIM constructs, theorize the relative impact among the three RIM constructs and PU on RTN and INV, and develop our logic for PIIT moderating the RIM constructs' influence on INV.

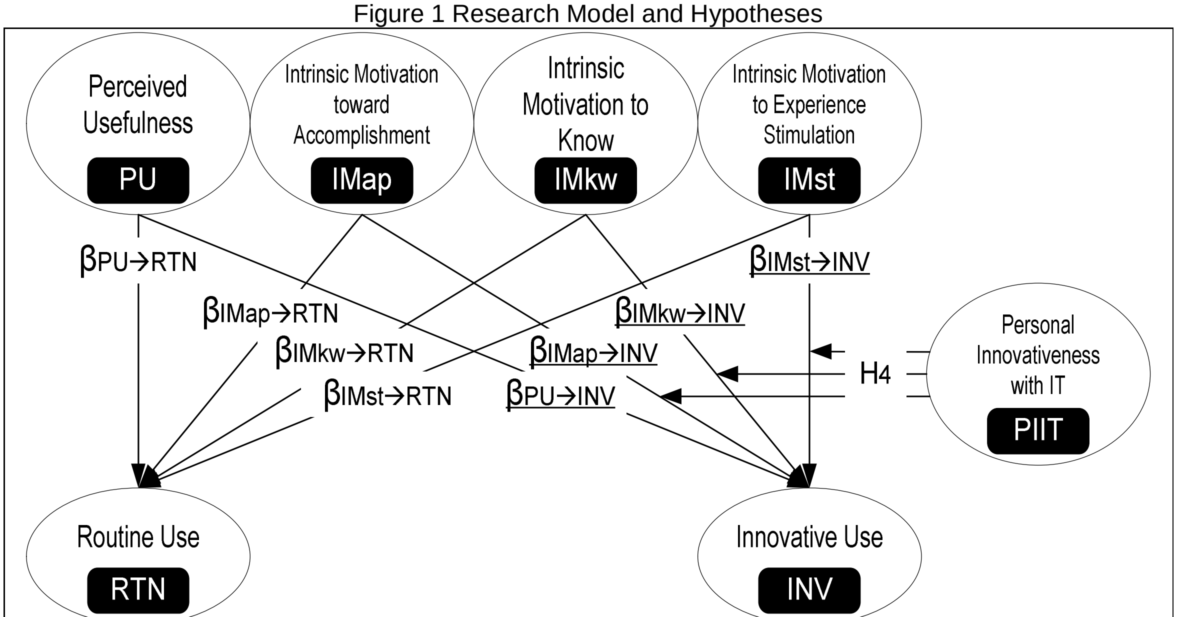
To begin with, PU could positively influence both RTN and INV. PU refers to employees' perceptions that using IS can lead to better performance (Davis et al. 1989). PU is regarded as a representative surrogate construct of extrinsic motivation toward IS use, as enhanced performance ultimately contributes to attaining material rewards like payment, promotion, and bonuses (Davis et al. 1992). Indeed, utilitarian rewards are commonly used to encourage positive performance outcomes in organizational contexts (Scott and Podsakoff 1982, Eisenberg 1992). In the post-acceptance stage, when employees perceive that material rewards are attainable via enhanced performance, they would be willing to engage in IS usage behaviors, routine or innovative, that are conducive for performance outcomes. Toward this end, RTN and INV, both of which may enable employees to attain better performance (Sage and Zmud 1994), can help them to accrue utilitarian rewards. Therefore, when employees perceive that instrumental benefits will result from their IS use, they may partake in RTN and INV to support their work.

Next, Ryan and Deci (2000, p.55) contend that "intrinsic motivation results in high-quality learning and creativity." Learning refers to individuals' attempts to transform prior experience and create new knowledge (Kim 1993, Kolb 1984), and innovation requires individuals to develop promising original ideas and to remain patient during numerous trial-and-error iterations before a new solution emerges (Amabile 1988). Toward this end, intrinsic motivation toward performing a particular behavior induces the spontaneous enthusiasm and interest that enhances individuals' cognitive flexibility and develops their commitment to and perseverance in the performance process (McGraw and McCullers 1979, Shin and Zhou 2003, Vallerand 1997). Specifically, individuals who need to feel a sense of competence are inclined to concentrate on challenging activities and stay perseverant in the face of obstacles as they engage in experimentation for innovative behaviors (Deci and Ryan 2002, Schaefers et al. 1997) (IMap). Additionally, curious individuals are generally excited about devoting effort to learning and exploring, and an extensive knowledge base is one of the critical steps leading to innovation (Greif and Keller 1990, Kurtzberg and Amabile 2001) (IMkw). The heightened interest in an activity itself motivates individuals to surpass formal requirements (Piccolo and Colquitt 2006) and seek creative ways to perform activities that realize their self-value (Amabile 1996) (IMst).

Following the above reasoning, we argue that in the post-acceptance context, the three intrinsic motivations toward IS use can positively contribute to INV. Specifically, the pleasure derived from overcoming difficulties and solving problems when using IS nurtures employees' concentration and perseverance, which are conducive for experimenting with different ways of using IS (IMap). The satisfaction experienced when learning new things in the IS use process encourages employees to devote their time and effort to improving their technical skills and discovering new ways of using IS (IMkw). Finally, the enjoyment experienced when interacting with IS provides employees with cognitive flexibility, which stimulates alternative ideas for how to use IS creatively (IMst).

Intrinsic motivation could also stimulate RTN. Employees' sense of accomplishment could be satisfied when they successfully repeat usage behaviors that were conducted previously and consider such repetition as a mastery of usage skills (IMap) (Bandura 1984). Repeating prior usage practices could also help employees move farther along the learning curve when the repetition accumulates their usage experience and makes their usage skills more proficient (IMkw) (Argote 1999). The enjoyment feelings in interacting with IS could also create favorable user reactions to the IS (Venkatesh 1999), making employees' routine use less tedious and tiring (IMst). Thus, employees who are intrinsically motivated toward accomplishment, to know, and to experience stimulation may possibly engage in RTN.

Figure 1 Research Model and Hypotheses



H_{1a}, H_{1b}, H_{1c}: β_{PU} à RTN > β_{IMap} à RTN, β_{IMkw} à RTN, β_{IMst} à RTN
H_{2a}, H_{2b}, H_{2c}: β_{IMap} à INV, β_{IMkw} à INV, β_{IMst} à INV > β_{PU} à INV
H_{3a}, H_{3b}: β_{IMkw} à INV, β_{IMst} à INV > β_{IMap} à INV
H_{4a}, H_{4b}, H_{4c}: PIIT positively moderates β_{IMap} à INV, β_{IMkw} à INV, and β_{IMst} à INV

While the above discussion suggests that PU, IMap, IMkw, and IMst may all influence both RTN and INV, these motivations may exert differential impacts on these two IS usage behaviors. To develop a richer understanding of how these various motivations influence the two post-acceptance IS usage behaviors, we theorize and propose comparative hypotheses on the differential (and most salient) effects of PU and the three intrinsic motivations on RTN and INV.

We first theorize that PU, relative to the three intrinsic motivations, should have a stronger impact on RTN. As we elaborate below, PU should enable RTN, while the three RIM constructs can either promote or attenuate RTN. In essence, RTN reflects employees' engagement in repetitive use of implemented IS (Cooper and Zmud 1990, Saga and Zmud 1994). Scholars have long argued that external rewards and punishment (the opposite of rewards) are powerful mechanisms to promote the development of routines (Blau 1964, Kelman 1958). Toward this end, organizational studies have revealed corroborative evidence that economic exchange between employees and organizations effectively promotes repetitious routine behaviors among employees (e.g., Luthans and Kreitner 1985, Scott and Podsakoff 1982). Following this logic, when employees perceive that using IS can be instrumental in supporting work and deriving material rewards from the organization, they would be motivated to standardize and incorporate IS use as a normal part of their work. Thus, PU can effectively drive RTN.

In addition, as argued earlier, employees' IMap, IMkw, and IMst can contribute to RTN. However, the literature also suggests a contrary viewpoint that the three intrinsic motivations can direct employees' cognitive resources away from regular tasks, preventing them from optimizing their time and effort in exercising standardized and repetitious behaviors like RTN. According to the resource-matching perspective, when the required resources and the available resources do not match, individuals might not maximize their effort in a given activity (Anand and Sterthal 1990, Meyers-Levy and Peracchio 1995). Following this logic, employees who are motivated to strive for achievement in using IS (IMap) may feel that their cognitive resources do not match and are superior to the cognitive resources required to use the IS in a repetitive manner: they would feel that they are overqualified for RTN, thus preventing them from devoting much effort to this type of IS usage behavior. In addition, the spontaneous interest in exploring and learning when using IS (IMkw) and the enjoyment derived from simply interacting with IS for hedonic fun (IMst) may possibly induce employees' experimentation or even entertainment, thereby distracting them from performing RTN (MacKenzie et al. 2001, Starbuck and Webster 1991). In other words, these three intrinsic motivations can influence RTN both positively and negatively. The above discussions suggest that while external motivations promote RTN in a straight-forward manner, intrinsic motivations can simulate or stifle RTN, rendering intrinsic motivations, a weaker motivational driver for RTN in relation to extrinsic motivation (e.g., PU).

In short, although RTN could be driven by both extrinsic and intrinsic motivations—given its repetitive nature, which should be facilitated by PU—together with the competing (positive and negative) forces of intrinsic motivations on RTN, we argue that RTN will be more effectively enhanced by external outcomes (i.e., PU) than by the internal pleasure and satisfaction employees experience when overcoming difficulties, learning new things, or having hedonic fun in IS use (IMap, IMkw, and IMst). The above theorizing collectively leads to the following:

H_{1a}: Perceived usefulness (PU) has a stronger impact on routine use (RTN) than intrinsic motivation toward accomplishment (IMap).

H_{1b}: Perceived usefulness (PU) has a stronger impact on routine use (RTN) than intrinsic motivation to know (IMkw).

H_{1c}: Perceived usefulness (PU) has a stronger impact on routine use (RTN) than intrinsic motivation to experience stimulation (IMst).

Next, we theorize that the three intrinsic motivations play more important roles than PU in explaining INV. As elaborated earlier, IMap, IMkw, and IMst can positively impact INV. PU may also influence INV in some sense; that is, if employees perceive IS use as being useful for enhancing their performance, they are likely to devote time and effort engaging in INV to advance their work performance (Karahanna and Agarwal 2006).

Extending this logic, we argue that PU has a weaker impact on INV relative to intrinsic motivations. The underlying rationale for this assertion lies in the two contradictory mechanisms associated with how extrinsic motivation influences an individual's behavior: informational and controlling mechanisms (Ryan et al. 1983). While the informational aspect of extrinsic motivation makes individuals aware of their competence and self-determination, which facilitates innovative ideas and learning initiatives, the controlling aspect of extrinsic motivation pressures individuals toward specified outcomes and stifles their creativity and learning interests (Amabile et al. 1986, McGraw 1978, Ryan et al. 1983). In the IS use context, these two mechanisms of PU can generate two forces that simultaneously promote and demote INV. On the one hand, the informational mechanism of PU positively motivates employees to engage in innovative IS use; on the other hand, the control mechanism of PU negatively constrains employees from exploring new ways of using IS. These two competing forces together make PU a less influential driver than intrinsic motivations for INV.

In conclusion, employees who experience joy and satisfaction while overcoming difficulties (IMap), while learning new things (IMkw) during IS use, or while physically interacting with IS (IMst) may display much higher determination, concentration, and flexibility but may feel less pressured when pursuing INV (Deci and Ryan 2002, Vallerand 1997). In relation to the three RIM constructs, PU appears to be less powerful in leading employees to endure the possibly demanding and uncertain process associated with INV. Therefore, we propose the following:

H_{2a}: Intrinsic motivation toward accomplishment (IMap) has a stronger impact on innovative use (INV) than perceived usefulness (PU).

H_{2b}: Intrinsic motivation to know (IMkw) has a stronger impact on innovative use (INV) than perceived usefulness (PU).

H_{2c}: Intrinsic motivation to experience stimulation (IMst) has a stronger impact on innovative use (INV) than perceived usefulness (PU).

While we argue that the three types of intrinsic motivations all stimulate INV, given the distinctive characteristics of the post-acceptance context, we also expect the three types of intrinsic motivations to exert differential influence on INV.

On the one hand, IMap, as noted earlier, concerns the satisfaction and pleasure derived from overcoming difficulties in using IS. In early stages of IS implementation, employees have to overcome technical hurdles. For example, they need to develop the skills to use the IS, familiarize themselves with how to interface the new system with existing systems, and understand data standards and compatibility issues that must be addressed to use the system. In the post-acceptance stage, employees have developed familiarity and experience with the implemented IS (Saga and Zmud 1994) and overcome important difficulties in using the IS to support their work. Such familiarity and experience should also reduce the perceived technological difficulties (Thompson et al. 1994) associated with identifying novel ways of using the system, thereby decreasing the importance of IMap for INV.

On the other hand, employees in the post-acceptance stage are still progressing along the learning curve in discovering potential applications of the implemented IS (Jasperson et al. 2005). As a result, employees' enjoyment in exploration induces them to engage in the learning process and motivates them to identify innovative ways to use IS in the post-acceptance stage (Ahuja and Thatcher 2005, Nambisan et al. 1999) (IMkw). Employees' sensations of pleasure when interacting with IS also allows for cognitive flexibility, which is an important psychological quality for pursuing innovation (Amabile 1988) (IMst). The cognitive flexibility associated with IMst stimulates employees' alternative and creative thinking when they encounter challenges when using IS (Jasperson et al. 2005) (IMst). The above discussion collectively suggests that while all three types of intrinsic motivation can promote INV, the characteristics of the post-acceptance stage create the conditions for IMkw and

IMst to play a more important role than IMap in influencing INV. As such, we propose the following:

H_{3a}: Intrinsic motivation to know (IMkw) has a stronger impact on innovative use (INV) than intrinsic motivation toward accomplishment (IMap).

H_{3b}: Intrinsic motivation to experience stimulation (IMst) has a stronger impact on innovative use (INV) than intrinsic motivation toward accomplishment (IMap).

Finally, we propose PIIT as an important individual characteristic that moderates the relationship between RIM and INV. As previously mentioned, PIIT refers to the degree to which an individual is willing to try out a new technology and characterizes individuals' risk-taking propensity and tolerance of uncertainty during the technology use process (Agarwal and Prasad 1998, Rogers 2003).

As discussed earlier, INV is closely associated with risk and imprecision (Ahuja and Thatcher 2005, Nambisan et al. 1999). When pursuing INV, employees who need to feel a sense of competence tend to be persistent in face of uncertainties and problems (Deci and Ryan 2002, Schaefers et al. 1997). Accordingly, the tolerance for high uncertainty that is associated with high-PIIT employees (Bommer and Jalajas 1999, Thatcher and Perrewe 2002) should enable them to be even more patient and determined during the numerous rounds of trial and error that accompany INV. Therefore, we expect PIIT to positively moderate the effect of IMap on INV. Second, employees who are high in PIIT are "active information seekers about new ideas" (Hirschman 1980, Rogers 2003 p. 22); thus, curious employees who are high in PIIT should be even more excited about learning, exploring, and engaging in INV. Accordingly, we expect PIIT to positively moderate the effect of IMkw on INV. Third, PIIT epitomizes individuals' risk-taking propensity (Agarwal and Prasad 1998, Rogers 2003); thus, such risk-taking propensity of high-PIIT employees will make them better appreciate, or even enjoy, the risk embedded in pursuing creative ways of using IS, thereby stimulating INV (Amabile 1996, Piccolo and Colquitt 2006). For this reason, we expect PIIT to positively moderate the effect of IMst on INV.

For low-PIIT employees, even if they experience pleasure and satisfaction while overcoming challenges in IS use (IMap), while learning new things during IS use (IMkw), or while physically interacting with IS (IMst), their conservativeness and risk-avoidance characteristics may render the constructive effects derived from the three types of intrinsic motivations less stimulating for them (in relation to high-PIIT employees) in terms of pursuing INV. The above discussion leads us to posit the following:

H_{4a}: Personal innovativeness with IT (PIIT) positively moderates the impact of intrinsic motivation toward accomplishment (IMap) on innovative use (INV).

H_{4b}: Personal innovativeness with IT (PIIT) positively moderates the impact of intrinsic motivation to

know (IMkw) on innovative use (INV).

H_{4c}: Personal innovativeness with IT (PIIT) positively moderates the impact of intrinsic motivation to experience stimulation (IMst) on innovative use (INV).

4. Model and Hypothesis Tests

Because we are appropriating the RIM concept to the IS use context, we conducted two preliminary studies to develop and validate the measures of the three RIM constructs. In these two measurement validation studies—which included 165 employees using business intelligence systems (BIS) and 244 employees using customer support systems (CSS), respectively—we established the sound psychometric properties of the three RIM constructs. (See the detailed analysis in Appendix A, Online Supplement.)[2] We then proceeded to test the research model and hypotheses in our main empirical study.

4.1 Site and Sample

In the main empirical study, we chose BIS as the target system to test the model and the hypotheses. BIS are representative complex IS and are rated among the top 10 strategic technologies (Gartner 2009). BIS are data-driven decision-support systems that integrate data gathering, data storage, and knowledge management with complex analytical functions for decision making and strategic planning (Negash and Gray 2008). Organizations devote considerable resources and effort to implementing BIS to leverage their business value and enhance competitive advantage (Davenport et al. 2010, Negash and Gray 2008). BIS allow employees to apply a variety of analytical functions to analyze large volumes of data, which are typically drawn on or refined from data warehouses of internal and external data, and the results from these analyses are used for organizations' strategic planning and decision making (Negash and Gray 2008).

The official study was conducted at one of the largest Chinese telecommunication service organizations. (This site is different from the two sites used in the two preliminary measurement validation studies.) At the time of data collection, the organization had implemented their BIS for about 18 months, well beyond the typical 8-12 month acceptance timeframe for major IS implementation initiatives (Gattiker and Goodhue 2005, Morris and Venkatesh 2010). As further confirmed by the top management, the BIS is a key system for the organization; the use of the system had been well integrated as a normal part of employees' work routine, though its use had not attained its fullest potential. This is consistent with empirical evidence that in the post-acceptance stage, complex organizational IS can be used on a regular basis but may not be utilized to its fullest potential (Boudreau 2003,

[2] An electronic companion to this paper is available as part of the online version that can be found at http://isr.journal.informs.org/.

Hsieh and Wang 2007). Moreover, the facts that the mean value of employees' prior use time (PRI) (mean=17.4 months) was similar to the time of implementation (eighteen months) and that employees reported relatively high mean values of perceived ease of use (PEOU) (mean=5.05, reported later in Table 2) and computer self-efficacy (CSE) (mean=5.11, Table 2) suggest that employees had accumulated significant usage experience and developed familiarity with the BIS.[3]

Our subjects were marketing analysts who used the implemented BIS to analyze customer, product, service, and sales data; monitor competitors' activities; and observe market conditions and trends in the industry to fulfill their work responsibilities, which included assessing the firm's performance, understanding competitive environments, and suggesting ensuing marketing strategies. Corresponding to our theorizing that employees can engage in both RTN and INV in the post-acceptance stage, our in-depth interviews with the organization's senior managers revealed that analysts had significant discretion in the extent to which they a) standardized and integrated BIS use as a normal part of their work (RTN) and b) discovered innovative ways to use the BIS to support their work. Our follow-up interviews with 15 analysts further confirmed that, indeed, they had control over, as well as varied significantly in, the extent to which they pursued RTN and INV to support their work. During the interviews, we observed that there was considerable variance in the extent to which employees' used the BIS to generate standardized reports on a routine basis. The analysts also indicated that the complex functions embedded in the BIS together with the large volumes of data permitted them to apply the BIS innovatively to support their work to varying degrees. Further, we also expected the analysts in our empirical context to display sufficient variance in the four types of motivations toward using the BIS. The huge data source together with the wide variety of the analytical functions in the BIS could have stimulated and satisfied the analysts' need for a sense of accomplishment (IMap), interest in learning (IMkw), and feelings of enjoyment when interacting with the BIS (IMst). At the same time, the functional potential of the BIS would provide the analysts with opportunities to enhance their work performance, thereby attaining external benefits (PU).[4]

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[3] Our analysis results, as delineated later, also reveal that PEOU had no significant impact on either RTN or INV (Table 4). Prior studies have indicated that PEOU's impact on IS usage behaviors is non-significant when users have gained sufficient usage experience and are familiar with the system (e.g., Venkatesh et al. 2003, Venkatesh and Bala 2008). In this study, the insignificant influence of PEOU on RTN and INV suggests that employees have gained significant experience and developed familiarity with the implemented BIS.

[4] Our interview with the analysts and their managers also confirmed that there were no explicit rewards for either RTN or INV. Further, when employees' behaviors are difficult to be observed (Ouchi 1979), organizations usually evaluate and reward employees based on their outcomes (Davenport 2005). Similarly, in our investigative context, the organization rewarded employees based on their work *performance*, rather than their BIS usage *behaviors* (e.g., RTN and INV).

In addition, our interviews with the analysts and their managers confirmed that the analysts' assigned work remained stable within the period of investigation. A survey instrument was developed for data collection. Questionnaire translation and back-translation between English and Chinese were carried out independently by two certified professional translators (Brislin et al. 1973). We first invited 35 employees to complete the questionnaire, and minor modifications were made according to their comments. Then, we administered the questionnaires to 217 randomly sampled subjects and received 193 responses. (See the sample demographics in Appendix B, Online Supplement.)

4.2 Measures

As reported in Appendices A and C (Online Supplement), we adapted the RIM measures from prior literature and first validated them in the two preliminary studies. With this backdrop, for the main study, we assessed IMap (three items) and IMkw (three items) by adapting items from Vallerand (Vallerand 1997, Vallerand et al. 1997, van Yperen and Hagedoorn 2003), and we evaluated IMst (three items) by using Davis et al.'s (1992) measures for PE. (We elaborate in Appendix A1, Online Supplement, on our specification of the RIM constructs' measurement items.) We measured PU (four items) with items adapted from Davis (1989) and Davis et al. (1989), as well as PIIT (three items) with items adapted from Agarwal and Prasad (1998).

Measures for RTN (three items) were adapted from Saga and Zmud (1994), Schwarz (2003), and Sundaram et al. (2007). For INV (three items), we adapted the measures for trying to innovate with IT by Ahuja and Thatcher (2005) and intention to explore by Karahanna and Agarwal (2006). While the measures for trying to innovate with IT and intention to explore describe users' discovery of novel ways to use IS, these measures primarily focus on 'trying' and 'intentions,' respectively, instead of actual usage behavior. Accordingly, we adapted these measures to focus on the actual usage behavior. To ensure RTN and INV were both evaluated with respect to the employees' work, we explicitly assessed employees' IS use to support their work.

To account for alternative explanations, we also controlled for important factors that may affect IS use, including age (AGE), education (EDU), gender (GEN), prior use time (PRI), tenure (TEN) (Agarwal and Prasad 1999), perceived ease of use (PEOU) (three items) (Davis et al. 1989, Venkatesh et al. 2003), and computer self-efficacy (CSE) (three items) (Compeau and Higgins 1995, Venkatesh et al. 2003).

4.3 Results of Hypothesis Tests

We used partial least squares (PLS), a component-based structural equation modeling technique, for data analysis. PLS is especially suitable for theoretical development purposes for which the objective is to maximize the explained variance in the outcome variables (Chin 1998b, Gefen and Straub 2005). We chose SmartPLS 2.0 as the analytical software (Ringle et al. 2005) to evaluate the research model and then tested the hypotheses.

4.3.1 PLS Results for the Research Model

Table 2 shows the descriptive statistics, composite reliability, Cronbach's alpha, and average variance extracted (AVE) for all constructs in the research model. The values of Cronbach's alpha and composite reliabilities were all higher than the recommended 0.707 (Nunnally 1994), and the values of AVE were all above 0.50 (Fornell and Larcker 1981), supporting internal consistency and convergent validity. Discriminant validity was also supported because 1) the AVE value of each construct was higher than its squared correlations with any other construct (Table 2) and 2) item loadings on their own construct were significantly higher than the cross-loadings on any other construct (Table 3) (Chin 1998a, Gefen and Straub 2005).[5,6] The above evidence suggests acceptable psychometric properties for all constructs in our research model. Table 4 reports the results of the PLS analysis.

Table 2 Descriptive Statistics and Psychometric Properties

	Mean	Standard Deviation	RTN	INV	IMap	IMkw	IMst	PU	PEOU	PIIT	CSE
RTN	5.15	1.12	***0.95***								
INV	4.73	1.05	0.25	***0.75***							
IMap	5.06	0.99	0.22	0.14	***0.83***						
IMkw	4.63	1.08	0.23	0.23	0.58	***0.86***					
IMst	4.87	1.12	0.23	0.22	0.25	0.28	***0.90***				
PU	5.39	0.88	0.39	0.14	0.32	0.28	0.33	***0.84***			
PEOU	5.05	0.88	0.22	0.09	0.32	0.28	0.23	0.38	***0.76***		
PIIT	5.41	0.89	0.11	0.08	0.17	0.14	0.14	0.12	0.14	***0.78***	
CSE	5.11	1.04	0.20	0.08	0.22	0.13	0.19	0.33	0.43	0.17	***0.80***
Composite Reliability			0.98	0.90	0.94	0.95	0.97	0.95	0.91	0.92	0.92
Cronbach's Alpha			0.97	0.83	0.90	0.91	0.95	0.94	0.85	0.86	0.88

RTN: routine use
INV: innovative use
IMap: intrinsic motivation toward accomplishment
IMkw: intrinsic motivation to know
IMst: intrinsic motivation to experience stimulation
PU: perceived usefulness
PEOU: perceived ease of use
PIIT: personal innovativeness with IT
CSE: computer self-efficacy

Note: The diagonal elements are AVEs; the off-diagonal elements are the squared correlations among factors.
For discriminant validity, the diagonal elements should be larger than off-diagonal elements.

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5 The first item of IMap was dropped because of high cross-loadings.

6 We also performed covariance-based confirmatory factor analysis (CFA) using AMOS 17 for the three RIM constructs. Discriminant validity is supported when the original measurement model displays significantly better model fit than any other possible model where the correlation between any pair of constructs is constrained to 1 (Segars 1997, Gefen et al. 2003). In our study, the measurement model of the three RIM constructs displayed good model fit (χ^2 = 27.355, *df* = 24, CFI = 0.998, RMSEA = 0.027, SRMR = 0.0334), while the model fit decreased significantly when constraining the correlation between any two RIM constructs to 1. The χ^2 change ranged from 6.480 to 17.222 ($p < 0.01$ for a change with one degree of freedom), suggesting that the three-factor RIM model outperformed all other models. Further, the variance inflation factor (VIF) values of the three RIM constructs ranged from 1.432 to 2.579, indicating no harmful muticollinearity (Diamantopoulos and Siguaw 2006, Petter et al. 2007). The conditional number equaled 12.799, well below the rule of thumb of 30 (Belsley et al. 1980, Grewal et al. 2004).

Table 3 Item Loadings and Cross-Loadings

		RTN	INV	IMap	IMkw	IMst	PU	PEOU	PIIT	CSE
Routine Use	RTN1	0.969	0.491	0.464	0.470	0.465	0.647	0.498	0.336	0.470
	RTN2	0.979	0.514	0.442	0.468	0.458	0.605	0.468	0.329	0.424
	RTN3	0.971	0.519	0.460	0.458	0.479	0.567	0.425	0.308	0.431
Innovative Use	INV1	0.520	0.903	0.417	0.482	0.503	0.452	0.312	0.277	0.316
	INV2	0.479	0.930	0.368	0.455	0.458	0.379	0.338	0.300	0.320
	INV3	0.319	0.752	0.221	0.337	0.281	0.192	0.156	0.159	0.139
Intrinsic Motivation toward Accomplishment	IMap2	0.426	0.327	0.911	0.698	0.433	0.505	0.515	0.368	0.410
	IMap3	0.426	0.355	0.905	0.665	0.416	0.512	0.490	0.342	0.439
	IMap4	0.426	0.411	0.917	0.718	0.508	0.520	0.555	0.417	0.436
Intrinsic Motivation to Know	IMkw1	0.471	0.469	0.641	0.891	0.518	0.490	0.468	0.349	0.327
	IMkw2	0.411	0.449	0.702	0.944	0.464	0.468	0.484	0.353	0.338
	IMkw3	0.441	0.464	0.704	0.937	0.481	0.497	0.518	0.343	0.355
Intrinsic Motivation to Experience Stimulation	IMst1	0.499	0.460	0.473	0.496	0.957	0.594	0.480	0.391	0.434
	IMst2	0.427	0.475	0.486	0.498	0.949	0.550	0.457	0.369	0.425
	IMst3	0.441	0.477	0.463	0.516	0.947	0.508	0.447	0.330	0.388
Perceived Usefulness	PU1	0.582	0.389	0.524	0.491	0.530	0.928	0.570	0.361	0.526
	PU2	0.552	0.402	0.466	0.483	0.519	0.909	0.549	0.259	0.539
	PU3	0.592	0.374	0.499	0.458	0.545	0.909	0.559	0.324	0.511
	PU4	0.557	0.351	0.574	0.492	0.529	0.911	0.579	0.313	0.552
Perceived Ease of Use	PEOU1	0.479	0.319	0.553	0.491	0.475	0.566	0.920	0.371	0.639
	PEOU2	0.376	0.302	0.480	0.502	0.411	0.523	0.875	0.265	0.489
	PEOU3	0.388	0.223	0.460	0.394	0.379	0.530	0.826	0.371	0.608
Personal Innovativeness with IT	PIIT1	0.321	0.250	0.403	0.314	0.351	0.354	0.382	0.886	0.423
	PIIT2	0.265	0.286	0.352	0.355	0.342	0.270	0.312	0.889	0.348
	PIIT3	0.297	0.244	0.339	0.333	0.322	0.285	0.322	0.877	0.332
Computer Self-Efficacy	CSE1	0.456	0.337	0.429	0.357	0.411	0.568	0.626	0.377	0.916
	CSE2	0.366	0.291	0.452	0.331	0.406	0.522	0.628	0.319	0.932
	CSE3	0.390	0.203	0.382	0.297	0.355	0.462	0.519	0.430	0.837

Note: While the cross-loadings for IMap and IMkw are relatively high, the differences between loadings on principal factors and on other constructs are all higher than the threshold (i.e., 0.1) suggested by Gefen and Straub (2005) for how to evaluate item cross-loadings in PLS results. In fact, only two out of the 224 cross-loading differences were between 0.1 and 0.2; all other cross-loading differences were higher than 0.2. We also performed exploratory factor analysis (EFA) and found a similar factor structure with eigenvalues ranging from 1.245 to 12.647 for the constructs. To be conservative, we further conducted confirmatory factor analysis (CFA) using AMOS 17. Because the sample size (N=193) is below the required 250 for CFA (Hair et al. 1998), following Bollen and Stine (1992), we performed a bootstrapping simulation by randomly generating 2,000 sets of samples and then testing them against the measurement model. The resulting Bollen-Stine P-value (p=0.130) was higher than the required 0.05, suggesting acceptable measurement model fit.

Table 4 PLS Results

		Routine Use (RTN)	Innovative Use (INV)
Intrinsic Motivation toward Accomplishment	(IMap)	- 0.026	0.046
Intrinsic Motivation to Know	(IMkw)	0.158*	0.351**
Intrinsic Motivation to Experience Stimulation	(IMst)	0.084	0.315**
Perceived Usefulness	(PU)	0.419**	0.073
Control Variables			
Perceived Ease of Use	(PEOU)	0.032	- 0.113
Personal Innovativeness with IT	(PIIT)	0.065	0.043
Computer Self-Efficacy	(CSE)	0.090	0.045
Age	(AGE)	- 0.095*	- 0.045
Education	(EDU)	- 0.079	0.110*
Gender	(GEN)	- 0.006	0.041
Prior Use Time	(PRI)	- 0.031	0.022
Tenure	(TEN)	0.051	- 0.006
R^2		45.0%	36.7%

Note: **: p < 0.01, *: p < 0.05, +: p < 0.1, one-tailed test. Standardized path coefficients are reported here.

4.3.2 Results of Path Comparison Tests

We adopted the path comparison method proposed by Cohen et al. (2003) to test H_{1a}, H_{1b}, H_{1c}, H_{2a}, H_{2b}, H_{2c}, H_{3a}, and H_{3b} (Table 5). (See the detailed procedures in Appendix E, Online Supplement.) We found the following: 1) PU had a stronger impact than any of the three RIM constructs on RTN and 2) IMkw and IMap each had a stronger impact than either PU or IMap on INV. Therefore, H_{1a}, H_{1b}, H_{1c}, H_{2b}, H_{2c}, H_{3a}, and H_{3b} were all supported. For H_{2a}, however, we did not find a significant difference between the impacts of IMap and PU on INV.

Table 5 Results of Hypothesis Tests

	Path Coefficient		Results	Conclusion
RTN				
H_{1a}	βIMap à RTN vs. βPU à RTN	= - 0.026 vs. 0.419**	p < 0.01**	(ü) βIMap à RTN < βPU à RTN
H_{1b}	βIMkw à RTN vs. βPU à RTN	= 0.158* vs. 0.419**	p < 0.01**	(ü) βIMkw à RTN < βPU à RTN
H_{1c}	βIMst à RTN vs. βPU à RTN	= 0.084 vs. 0.419**	p < 0.01**	(ü) βIMst à RTN < βPU à RTN
INV				
H_{2a}	βIMap à INV vs. βPU à INV	= 0.046 vs. 0.073	n.s.	(û) No differences detected
H_{2b}	βIMkw à INV vs. βPU à INV	= 0.351** vs. 0.073	p < 0.01**	(ü) βIMkw à INV > βPU à INV
H_{2c}	βIMst à INV vs. βPU à INV	= 0.315** vs. 0.073	p < 0.05*	(ü) βIMst à INV > βPU à INV
H_{3a}	βIMap à INV vs. βIMkw à INV	= 0.046 vs. 0.351**	p < 0.01**	(ü) βIMap à INV < βIMkw à INV
H_{3b}	βIMap à INV vs. βIMst à INV	= 0.046 vs. 0.315**	p < 0.01**	(ü) βIMap à INV < βIMst à INV

Note: **: p < 0.01, *: p < 0.05, +: p < 0.1, n.s.: non-significant One-tailed tests were performed as the directional differences were hypothesized.

4.3.3 Results of Moderation Tests

To examine the moderation hypotheses (i.e., H_{4a}, H_{4b}, and H_{4c}), we first multiplied construct scores to create interaction terms and then added the interaction terms to the model (Goodhue et al. 2007, Tanriverdi 2006). To minimize potential multicollinearity, we mean-centered the construct scores prior to creating the interaction terms (Aiken and West 1991). We also checked the variance inflation factor (VIF) values for each item entered for analysis; all VIF values were lower than the threshold of 3.3, suggesting no harmful multicollinearity (Diamantopoulos and Siguaw 2006, Petter et al. 2007). Table 6 reports the moderation test results (main effects and interaction effects). (See the detailed stepwise test in Appendix F, Online Supplement.) Consistent with Aiken and West's (1991) recommendations to interpret interaction effects, we plotted the interaction diagrams at different levels of the moderator variable, PIIT. (The path coefficient and significance level for the effect of each RIM constructs on INV at different levels of PIIT are also reported below in Figures 2, 3, and 4.) We found that PIIT positively moderated the positive effects of all three RIM constructs on INV, thus supporting H_{4a}, H_{4b}, and H_{4c}.

Table 6 Moderation Results and Interaction Diagrams

Main Effects and Moderation Effects

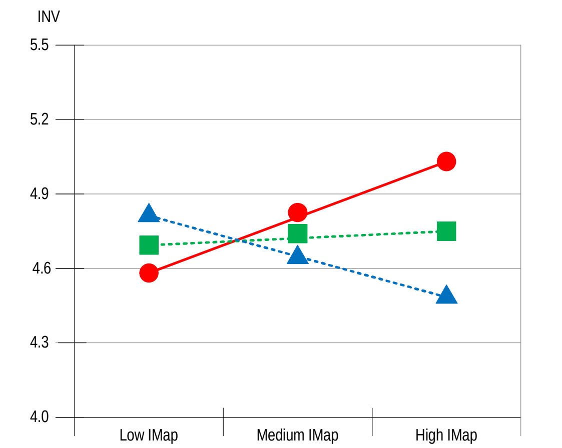
Main Effects	IMap	0.046
	IMkw	0.328**
	IMst	0.265**
	PIIT	0.089
Moderation Effects	IMap*PIIT	0.159*
	IMkw*PIIT	0.255**
	IMst*PIIT	0.250**

Note: **: $p < 0.01$, *: $p < 0.05$, +: $p < 0.1$, one-tailed test.
Standardized path coefficients are reported here.

● High IM
■ Medium IM
▲ Low IM

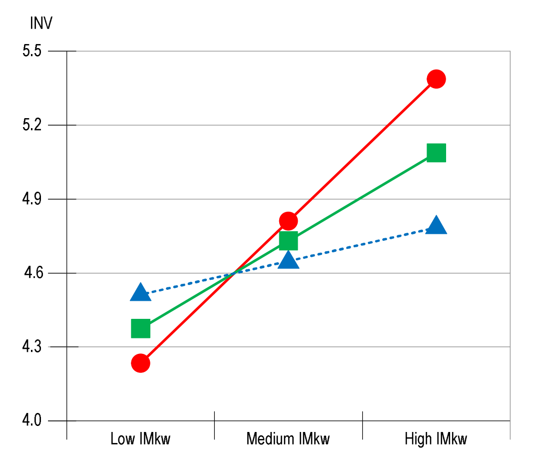
——— Significant
-------- Non-significant

Figure 2 PIIT moderates IMap à INV



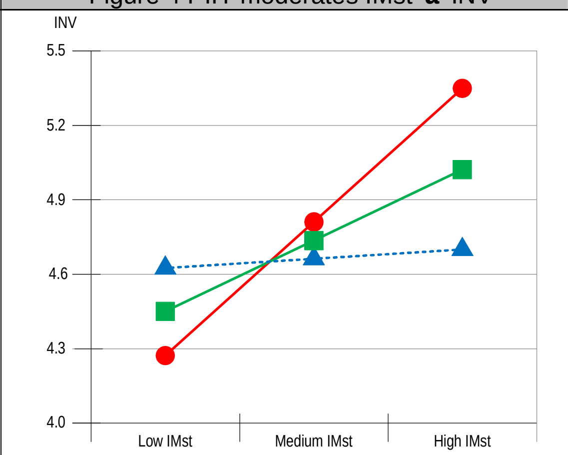
High PIIT: β =0.209*; Medium PIIT: β =0.050; Low PIIT: β =- 0.109

Figure 3 PIIT moderates IMkw à INV



High PIIT: β =0.561**; Medium PIIT: β =0.342**; Low PIIT: β =0.123

Figure 4 PIIT moderates IMst à INV



High PIIT: β =0.484**; Medium PIIT: β =0.251**; Low PIIT: β =0.018

4.4 Post-Hoc Analysis Results

We further examined the differential impact of each motivational factor (i.e., the three RIM constructs and PU) on RTN and INV. (See the detailed procedures in Appendix G, Online Supplement.) The results in Table 7 suggest that 1) IMap had no differential impact on RTN and INV, 2) IMkw and IMst both exerted a stronger influence on INV than on RTN, and 3) PU's impact on RTN was stronger than its impact on INV. We interpret these differential effects in the discussion section.

Table 7 Post-Hoc Analysis Results

IV	Path Coefficient	Results	Conclusion
IMap	βIMap à RTN vs. βIMap à INV = - 0.026 vs. 0.046	n.s.	No differences detected
IMkw	βIMkw à RTN vs. βIMkw à INV = 0.158* vs. 0.351**	$p < 0.05$*	βIMkw à RTN < βIMkw à INV
IMst	βIMst à RTN vs. βIMst à INV = 0.084 vs. 0.315**	$p < 0.01$**	βIMst à RTN < βIMst à INV
PU	βPU à RTN vs. βPU à INV = 0.419** vs. 0.073	$p < 0.01$**	βPU à RTN > βPU à INV

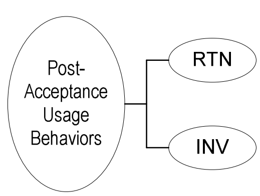
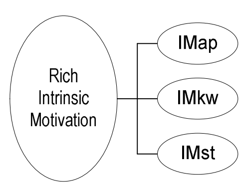
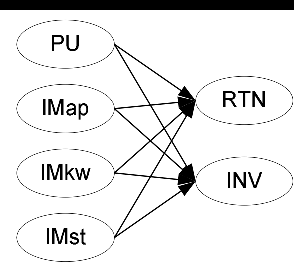
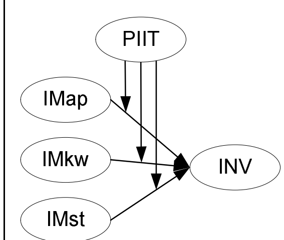
Note: **: $p < 0.01$, *: $p < 0.05$, +: $p < 0.1$, n.s.: non-significant. One-tailed tests were performed as the directional differences were hypothesized.
IV: independent variable

Moreover, since all of the data were obtained from employees through a survey method, we assessed common method bias (CMB) by using the Harman's single factor test (Podsakoff and Organ 1986) and the common method variance factor test (Podsakoff et al. 2003). First, in Harman's single factor test, six factors with eigenvalues greater than 1 were generated with no single factor accounting for the majority of the variance in the items. Second, in the common method variance factor test, the factor loadings remained stable across the original measurement model and the measurement model with a common method variance factor (Appendix H, Online Supplement). In addition, the path coefficients together with the corresponding significance levels remained almost unchanged between the original structural model and the structural model with the common method variable factor added; the maximum change in standardized path coefficients between the two models was only 0.009. The results of the hypothesis test also remained qualitatively the same. The evidence collectively suggests that CMB was not a serious validity threat.

5. Discussion

Our findings reveal important insights for conceptualizing both post-acceptance IS usage behaviors and intrinsic motivation toward IS use, as well as for understanding the relative importance of intrinsic motivation and extrinsic motivation for routine use and innovative use (Table 8).

Table 8 Theoretical Implications

Two Important Post-Acceptance Behaviors	Enriched Conceptualization of Intrinsic Motivation toward IS Use	Differential Influence of IS Motivations on Post-Acceptance Behaviors	Moderation Effects of PIIT
			
• Conceptualized post-acceptance usage behaviors (RTN and INV) that differ in standardization versus innovation orientation, as well as in learning orientation, in the IS use context • Extended measurement validity of the two post-acceptance usage behaviors from the Western context to the Eastern context	• Contextualized the RIM concept from social psychology to the IS use context • Adapted and validated measures for the three RIM constructs using three empirical studies	• Identified the relative importance of the three RIM constructs and PU on RTN and INV • Discovered PU had a stronger positive impact than the three RIM constructs on RTN; IMkw and IMst had a stronger positive impact than PU and IMap on INV • Discovered PU's effect on RTN was stronger than on INV; the effects of IMkw and IMst on INV were stronger than on RTN • Discovered IMap had no significant impact on RTN and INV	• Discovered that PIIT positively moderated the impact of each of the three RIM constructs on INV • Revealed that when PIIT is low, *none* of the three RIM constructs significantly influences INV, suggesting that PIIT and IS motivations need to be managed together

5.1 Implications for Theory

5.1.1 Conceptualization of Post-Acceptance IS Use Behaviors

Our study suggests that employees engage in *diverse IS usage behaviors in the post-acceptance stage* and that routine use and innovative use, two important post-acceptance behaviors, require understanding with regard to their distinctions and motivational drivers (Column 1, Table 8). IS use is one of the most critical elements in the causal chain from IS implementation to individual performance and organizational success (DeLone and McLean 1992, Seddon 1997). Prior IS literature has commonly treated IS use as a broad behavioral category and has examined it in the forms of duration or frequency (e.g., van der Heijden 2004, Venkatesh et al. 2003). Though these assessment approaches capture the quantity of a user's engagement with IS, they overlook the pluralistic nature of IS use in the post-acceptance phase and do not make important qualitative distinctions between IS behaviors. We are among the first to juxtapose routine and innovation behaviors in the IS use context, which enables us to make important conceptual distinctions between routine use and innovative use in terms of their standardization or innovation orientation. The twin learning concepts of exploration and exploitation, typically studied at the organizational level, are also useful to enrich our understanding of individual-level post-acceptance usage behaviors in that routine use and innovative use, respectively, utilize existing and create new knowledge regarding how an implemented system can be used by employees to support their work (Cohen and Levinthal 1990, Gupta et al. 2006). Finally, at the measurement level, we extend the validity of measures of routine use and innovative use from the Western (Ahuja and Thatcher 2005, Schwarz 2003, Sundaram et al 2007) to the Eastern context.

5.1.2 A Multidimensional Perspective of Intrinsic Motivation toward IS Use

We advance the IS motivation literature by introducing *a multidimensional conceptualization of rich intrinsic motivation (RIM) toward IS use* (Column 2, Table 8). Intrinsic motivation toward IS use has mostly been conceptualized as perceived enjoyment, leading to the unbalanced attention between intrinsic and extrinsic motivations in prior IS studies (van der Heijden 2004). We are among the earliest studies to identify intrinsic motivation as a key predictor of post-acceptance behaviors and, more importantly, to appropriate the RIM concept to the IS use context. Drawing on the intrinsic motivation literature in social psychology (Vallerand 1997, Vallerand et al. 1997), we argue that intrinsic motivation toward IS use is comprised of enjoyment not only from the activity of using IS but also from the satisfaction and fulfillment that users experience when overcoming difficulties or learning new things in using IS. By validating the RIM concept across two types of IS (i.e., business intelligence system—BIS and customer support system—CSS) and across employees at three telecom service organizations, we extend the generalizability of the RIM concept beyond past studies in social psychology, which were conducted in other contexts, such as education (Vallerand et al. 1993), sports (Pelletier et al. 1995), and general workplaces (van Yperen and Hagedoorn 2003), and were not focused on IS behaviors and motivations.

5.1.3 Elaborating the Relative Influence of Intrinsic Motivation and Extrinsic Motivation

We also contribute to our understanding of the relationships between IS use motivations and IS usage behaviors in the post-acceptance stage. With the enriched conceptualization of routine use and innovative use and intrinsic motivation toward IS use, we identify *the differential influence of IS motivations on post-acceptance behaviors* (Column 3, Table 8). We found that PU had a stronger impact than any of the three RIM constructs on RTN (H_{1a}, H_{1b}, H_{1c}) and that IMkw and IMst each had a stronger impact than PU on INV (H_{2b}, H_{2c}). Perceived usefulness, thereby capturing the utilitarian aspect of extrinsic motivation, which has been regarded as the most important determinant for general IS use (Davis et al. 1989, 1992, Legris et al. 2003, Venkatesh et al. 2003). While it is true that IS use in workplaces is influenced by utilitarian considerations (van der Heijden 2004), our study identifies the critical roles of intrinsic motivation in continuous learning and hedonism (IMkw and IMst) in stimulating innovative use when employees engage in IS use above and beyond the minimal requirements. More broadly, we advance our knowledge of the relative importance of intrinsic and extrinsic motivations toward IS use for post-acceptance usage behaviors. Several organizational studies suggest that compared to extrinsic motivation, intrinsic motivation promotes more constructive performance within organizations (e.g., Amabile 1985, Vallerand 1997). However, our findings suggest that the importance of intrinsic motivation relative to extrinsic motivation is a function of employees' focal behaviors (Bandura 1997). In particular, while intrinsic motivation (in terms of RIM) is more influential in stimulating innovative use in relation to extrinsic motivation (in terms of PU), it is less influential for routine use.

In addition, our findings have implications for our *theoretical understanding regarding the relationship between rich intrinsic motivation and innovative use.* First, IMkw and IMst had a stronger impact than IMap on INV in the post-acceptance stage (H_{3a}, H_{3b}). We suggest that the stage of IS implementation is an important contextual consideration, as it can change the relationships among substantive constructs. In general, while contextual factors are important for understanding behavioral phenomena, they have received limited attention in organizational research (Johns 2006). By the post-acceptance stage, employees should have overcome important technical hurdles and developed familiarity in using the implemented IS to support their daily work (Jasperson et al. 2005, Saga and Zmud 1994). Such familiarity should also reduce difficulties in employees' ability to pursue innovative IS use, making IMap less influential for INV than either IMkw or IMst in the post-acceptance stage. As such, we are among the first to extend prior intrinsic motivation literature to IS settings and to show that the impacts of different types of intrinsic motivations on individuals' IS behaviors may be a function of the IS implementation stage (Vallerand et al. 1993, Vallerand 1997). Second, PIIT—an important individual characteristic—moderated the influence of the three RIM constructs on INV (H_{4a}, H_{4b}, H_{4c}) (Column 4, Table 8). For employees with high PIIT, their high propensity toward IT innovation amplifies the influence of all three types of intrinsic motivations on innovative use. However, even when employees are intrinsically motivated, their innovative usage behaviors are suppressed by their low propensity toward IT innovations (PIIT) to a point that none of the three intrinsic motivations influenced innovative use when employees' PIIT was low. While the literature has examined the impacts of both PIIT and intrinsic motivation on IS use (Agarwal and Prasad 1998, Davis 1989), our results suggest that PIIT enhances the positive influence of intrinsic motivation on innovative use. The influence of the motivations from accomplishment, knowing, and stimulation on innovative use are *all* reinforced when the individual takes risks and is more likely to explore ingenious but uncertain ways to use IS.

Our post-hoc analysis provides further insights into the relative effects of each of the four motivation factors (i.e., the three types of intrinsic motivations and PU) on routine use and innovative use. Specifically, we found that 1) PU had a stronger impact on RTN than on INV, 2) IMkw and IMst both had a weaker impact on RTN than on INV, and 3) IMap had non-significant impacts on both RTN and INV. Findings 1 and 2 offer corroborative evidence supporting the theorization that routine use and innovative use, respectively, differ in standardization or innovation orientation, as well as in learning orientation, and, therefore, are distinct behaviors that coexist in the post-acceptance IS use context. This explains why we found the relative influence of PU (i.e., $\beta_{PU \rightarrow RTN} > \beta_{PU \rightarrow INV}$) on RTN and INV to be *opposite* of the relative influence of IMkw (i.e., $\beta_{IMkw \rightarrow RTN} < \beta_{IMkw \rightarrow INV}$) and of IMst (i.e., $\beta_{IMst \rightarrow RTN} < \beta_{IMst \rightarrow INV}$) on them. Finally, the post-acceptance stage may have rendered IMap a less powerful predictor for post-acceptance behaviors in relation to other motivators. This points to the critical role of the IS implementation stage in understanding the effects of IS motivations in general, and intrinsic motivation toward accomplishment in specific, on IS usage behaviors.

5.2 Implications for Practice

Managers should recognize that employees can use implemented systems in the post-acceptance stage in diverse ways: 1) employees may use IS in a repetitive and standardized manner, or 2) employees may take initiatives to apply IS in a novel fashion and engage in innovative use. As these IS usage behaviors differ in the employees' orientation in how the implemented system is to be used to achieve work objectives, managers should pay attention to the quality of IS use above and beyond the quantity of IS use (e.g., time and frequency) (Boudreau and Seligman 2005, Hsieh and Wang 2007). They should recognize that in the post-acceptance stage, employees are more likely to engage in standardized IS usage behavior when they are extrinsically motivated and that they are more likely to explore innovative ways to use the system when they are intrinsically motivated. This requires managers to go beyond motivating employees by making the case that incorporating the use of implemented systems into work processes is useful to support their work.

Given the critical role of intrinsic motivation, managers should recognize that after systems have transitioned to the post-acceptance stage, there are ***three different types of intrinsic motivation toward IS use***. Managers can cultivate employees' intrinsic motivation toward IS use by taking several actions. To stimulate employees' intrinsic motivation toward accomplishment, managers should make the needed resources available to assist employees when they encounter difficulties in using IS. Managers can also help employees set up meaningful performance objectives that could be accomplished through employees' effective IS use (Malone 1981). To enhance employees' intrinsic motivation to know, managers should foster a learning environment in which co-workers are ready to learn and share knowledge with each other to satisfy their curiosity. Constructive feedback from managers on employees' performance related to IS use can also nurture employees' intrinsic motivation to know (Malone 1981). Finally, to increase employees' intrinsic motivation to experience stimulation, managers can focus on offering more entertaining user interfaces or fantasy training programs (Venkatesh 1999).

Managers may also tactically emphasize certain types of motivations among employees to achieve the desired usage behaviors. Specifically, our findings suggest that in the post-acceptance stage, routine use is primarily driven by utilitarian outcomes, and innovative use is mainly determined by the satisfaction of learning and pure hedonic fun when interacting with IS. Thus, when the situation requires employees to display routine use, managers can focus on enhancing employees' extrinsic motivation by emphasizing material outcomes that the employees can obtain by applying the implemented IS in a routine and standardized manner. While there were no explicit reward policies to directly promote post-acceptance usage behaviors at the organizations where we conducted our three empirical studies, extrinsic rewards (e.g., monetary award) for IS use could be effective in nurturing standardized and repetitive behaviors, or routine use.

Moreover, the positive moderating effects of PIIT on the relationships between the three types of intrinsic motivations and innovative use also shed light for managers. Since PIIT is a rather stable individual characteristic (Agarwal and Prasad 1998), managers who want their employees to leverage advanced systems through innovative use to support their work should focus on employees' intrinsic motivations and should *also* identify, select, and recruit employees who are innovative with IT and are willing to take risks and engage in exploration.

5.3 Limitations and Future Research

Despite its contributions to theory and practice, our study has limitations and also opens opportunities for future research. To begin with, we validated the RIM measures in the contexts of business intelligence system (BIS) and customer support system (CSS) in two preliminary studies. Future research can examine the generalizability of these measures to other systems, e.g., enterprise resource planning (ERP). Next, although the correlation between IMap and IMkw is relatively high in our investigative context, it is comparable to results in other empirical contexts like education (Vallerand et al. 1993) and sports (Pelletier et al. 1995). Moreover, given the richness and comprehensiveness of the RIM concept, we recommend future studies appropriate and validate RIM to other IS-related contexts, especially where intrinsic motivation plays an important role, e.g., IS project development (Shah 2006) and knowledge management (Ko et al. 2005). Future studies can also identify the antecedents, moderators, and consequences of RIM in these contexts (Vallerand and Fortier 1998, Vallerand 1997), as well as the possible boundary conditions (i.e., moderators) other than PIIT, e.g., organizational rank.

Our conclusions regarding the relative impacts of intrinsic motivation and extrinsic motivation (i.e., PU) on post-acceptance IS use are limited to one specific IS in a single telecom service organization. Although confounding effects were controlled by collecting data from a single site, including eight control variables, and performing common method bias tests, caution should still be exercised when generalizing the findings to other user, technological, organizational, industrial, and cultural contexts. For example, future research may investigate the validity of our research model across different user groups, e.g., digital natives and digital immigrants (Vodanovich et al. 2010). Also, the cultural differences between Eastern and Western countries could be another concern with regard to generalizing our results. As such, we encourage future studies to examine the proposed research model and hypotheses in different settings.

While we limit focus on extrinsic motivation to utilitarian outcomes, specifically perceived usefulness, and while there were no rewards directly promoting routine use or innovative use in the organizations where we conducted our empirical studies, the influence of other forms of extrinsic motivation (e.g., cash, bonuses, promotions, praise from supervisors, and recognition) on IS usage behaviors are considerations for future studies. Scholars can also draw on the literature in social psychology to further conceptualize extrinsic motivation toward IS use. For example, Deci and Ryan (2002) suggest differentiating among four types of extrinsic motivations (i.e., external regulation, introjected regulation, integrated regulation, and identified regulation). While our focus on perceived usefulness is similar to introjected regulation and external regulation (Vallerand and Fortier 1998), the influence of more constructive forms of extrinsic motivation like integrated and identified regulation, on IS usage behaviors should also be examined in future research. Future studies can also investigate how characteristics of reward mechanisms (e.g., monetary vs. praise from supervisors vs. recognition) moderate the relationships between user motivations and post-acceptance behaviors and whether certain types of rewards can increase or decrease the influence of specific intrinsic and extrinsic motivations.

Furthermore, we theorize that routine use and innovative use can coexist in the post-acceptance context, differ in their standardization or innovation orientation, and resemble the twin learning concepts of exploitation and exploration respectively, although we did not explicitly incorporate the learning elements at the measurement level. Future research could evaluate how routine use and innovative use can be described and measured more richly through further elaboration of learning orientation. Additionally, while we examine the two usage behaviors on a cross-sectional basis, future research can investigate the dynamics and synergies between routine use and innovative use over time. For example, researchers may employ a longitudinal research design to examine the process through which and the reasons why employees choose to routinize a certain type of innovative IS use but not to incorporate others as part of their normal work. Researchers may also investigate the organizational conditions in which routine use facilitates or hinders employees' further innovation.

Routine use and innovative use could, in theory, enhance individual and organizational performance. On the one hand, routine use, which signifies employees' use of IS in standardized ways, can facilitate the integration of IS and work processes (Saga and Zmud 1994). On the other hand, innovative use allows employees to capitalize on the value potential of the implemented IS by exploring ingenious ways to utilize IS (Jasperson et al. 2005, Kwon and Zmud 1987). To advance our theoretical understanding on the performance implications of post-acceptance usage behaviors, future research should investigate both the independent and joint impacts of routine use and innovative use on performance at the individual, process, and organizational levels. In addition, given that we theorize and measure employees' innovative use with the objective to support their work, we focus on its positive, rather than negative, consequences. The potential negative consequences of innovative use, if there are any, regarding cyber loafing, security, and privacy are beyond the scope of this study; whether the overall consequences of innovative use are positive or negative remain to be studied in future research.

While we focus on routine use and innovative use, there could be other types of post-acceptance usage behaviors that deserve further attention. For example, adaptive use (Sun and Zhang 2008) is a higher-order construct consisting of four ways of applying IS features: trying new features, feature substitution, feature combination, and feature repurposing. These four adaptive use dimensions are interesting and worth investigation. Integrative use, another post-acceptance usage behavior, is defined as employees' application of IS to establish or enhance workflow linkages among a set of tasks (Saga and Zmud 1994). Nevertheless, some employees, such as frontline operators, usually do not have the authority to modify workflow linkages between tasks. As such, we suggest that researchers carefully select contextual characteristics, including specific types of IS and user groups, to conceptualize the pertinent post-acceptance usage behaviors.

6. Conclusion

Our study theorizes two important post-acceptance usage behaviors: routine use and innovative use. Routine use and innovative use differ in their standardization or innovation orientation, and resemble the twin learning concepts of exploitation and exploration. Drawing on motivation theory, we appropriate the tri-dimensional rich intrinsic motivation (RIM) concept to the IS use context and assess the relative impacts of three types of intrinsic motivations—intrinsic motivation toward accomplishment (IMap), intrinsic motivation to know (IMkw), and intrinsic motivation to experience stimulation (IMst)—and perceived usefulness (a key extrinsic motivator for IS use) on routine use and innovative use. We conducted three empirical studies with the two preliminary studies validating the measures for the three RIM constructs and the main study testing the research model and hypotheses. We found that for routine use, perceived usefulness had a stronger positive impact than the three types of intrinsic motivations; for innovative use, IMkw and IMst exerted a stronger positive influence than either IMap or perceived usefulness. Personal innovativeness with IT (PIIT) positively moderated the impact of each of the three RIM constructs on innovative use with low PIIT suppressing the positive effects of the RIM constructs. This study represents a significant advance in our theoretical understanding of post-acceptance usage behaviors, IS use motivations, the relationship between IS use motivations and post-acceptance behaviors, and the interaction effect between intrinsic motivation and personal innovativeness for innovative use. The results provide instrumental insights for managers to motivate employees to leverage implemented systems to extract their value potential more effectively.

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<u>Online Supplement</u>

Motivational Differences across Post-Acceptance IS Usage Behaviors

Appendix A: Measurement Validation for RIM

A.1 Measures for the Rich Intrinsic Motivation (RIM) Constructs

We assessed intrinsic motivation toward accomplishment (IMap) (three items) and intrinsic motivation to know (IMkw) (three items) by adapting items from Vallerand (Vallerand 1997, Vallerand et al. 1997, van Yperen and Hagedoorn 2003), and we evaluated intrinsic motivation to experience stimulation (IMst) (three items) using Davis et al.'s (1992) measures for perceived enjoyment (PE) (Appendix C1). We adapted the PE measures instead of Vallerand's measures of IMst for two reasons. First, enjoyment in workplaces is not the same as the *intense* enjoyment one experiences in hedonic behaviors like participating in sports activities; thus, Davis et al.'s PE measures capture users' joyful sensations regarding IS use in workplaces more precisely than Vallerand's IMst items. This point was also confirmed by the participants in the pilot test, as we presented them with the measures adapted from both Vallerand and Davis. Second, many information system (IS) studies have validated the PE items and rendered reliable results (e.g., Davis et al. 1992, Thong et al. 2006). As such, using PE measures permits cross-study comparisons in future research.

A.2 Sites and Samples for Measurement Validation

Since the RIM concept is newly appropriated into the IS use context, we conducted two preliminary studies to develop and validate the measures of the three RIM constructs. We selected business intelligence systems (BIS) and customer support systems (CSS), respectively, as the target systems for preliminary study 1 and study 2. In the following, we provide detailed information on the two data sites and samples, the measurement items of the three RIM constructs, the results of the measurement validation, and the results of measurement invariance analysis between the two preliminary studies.

<u>Preliminary Study 1</u>

BIS are data-driven decision-support systems that synthesize data gathering, data storage, and knowledge management with complex analytical functions and have been gaining popularity in large enterprises for decision making and strategic planning (Negash and Gray 2008). We surveyed employees who use BIS at a large telecommunication service organization in China. At the time of data collection, the organization had implemented their BIS for about 19 months, well beyond the typical 8-12 month acceptance timeframe for major IS implementation initiatives (Gattiker and Goodhue 2005, Morris and Venkatesh 2010). The BIS had also been effectively functioning after the initial year of the implementation. As further confirmed by the top management, the use of the BIS had been well integrated in the management and operational processes in the organization, though its use had not attained its fullest potential. This is consistent with empirical evidence that in the post-acceptance stage, a complex organizational IS can be used on a routine basis but may not be utilized to its fullest potential (Boudreau 2003, Hsieh and Wang 2007). Therefore, we believed the selected organization had progressed into the post-acceptance stage. The subjects were knowledge workers who possessed rich market knowledge and sufficient BIS usage experience. Their job duties were to perform marketing analysis using BIS and, based on this analysis, to propose strategies for market penetration.

A survey instrument was developed for data collection. Questionnaire translation and back-translation between English and Chinese were carried out independently by two certified professional translators (Brislin et al. 1973). In the pilot test, 35 employees completed the questionnaire. Some minor modifications were made to the item wordings and instructions based on participant feedback. We then administered the instrument to 200 employees in the organization, out of which 165 responded. Sample demographics are reported in Table A1.

Preliminary Study 2

Customer support systems (CSS) are designed to facilitate the management of long-term customer relationships by developing and managing huge customer databases (Kim et al. 2004), which mainly contain contact and background information, customer preferences, and service record histories. Like BIS, CSS are also popular among large enterprises for business operation and management (Bolton and Tarasi 2006, Rigby and Ledingham 2004). We conducted the second preliminary study at another large telecommunication service company in China. At the time of data collection, the organization had been using the CSS for about 21 months, which again exceeds the 8-12 month time horizon for IS implementation to move past the acceptance stage (Gattiker and Goodhue 2005, Morris and Venkatesh 2010). Our respondents were frontline service employees who directly serve customers, sell products, and maintain and update the customer database using the CSS.

We also conducted a pilot test by inviting 20 employees to complete the questionnaire and made minor modifications based on their feedback. We then administered questionnaires to 346 employees who used the CSS to support their service activities, and 244 of them responded. Table A1 reports sample demographics.

Table A1 Sample Demographics (Preliminary Studies 1 and 2)

Category		Preliminary Study 1		Preliminary Study 2	
		Frequency	Percentage (%)	Frequency	Percentage (%)
Age	25 or below	18	10.9	195	79.9
	26–30	39	23.6	36	14.8
	31–35	50	30.3	12	4.9
	36–40	33	20.0	0	0.0
	41 or above	25	15.2	1	0.3
Education	Senior High School	7	4.2	43	17.6
	College	55	33.3	163	66.8
	Bachelor's Degree	102	61.8	38	15.6
	Master's Degree	1	0.6	0	0.0
	Doctorate Degree	0	0.0	0	0.0
Gender	Female	102	61.8	184	75.4
	Male	63	38.2	60	24.6

A.3 Results of Measurement Validation

Preliminary Study 1

Table A2 shows the descriptive statistics, composite reliability, Cronbach's alpha, and average variance extracted (AVE) for the three RIM constructs. The fact that the values of Cronbach's alpha and composite reliabilities are all higher than the recommended 0.707 (Nunnally 1994) and that the values of AVE are all above 0.50 (Fornell and Larcker 1981) indicate the three RIM constructs' high internal consistency and convergent validity. The discriminant validity of the three RIM constructs is also supported because 1) the AVE value of each construct is higher than its squared correlations with any other construct (Table A2) and 2) item loadings on their own construct are significantly higher than their cross-loadings on any other construct (Table A3) (Chin 1998, Gefen and Straub 2005). The above evidence suggests acceptable psychometric properties for the three RIM constructs.

Table A2 Descriptive Statistics and Psychometric Properties (Study 1)

	Mean	Standard Deviation	IMap	IMkw	IMst
IMap	5.46	0.94	***0.84***		
IMkw	4.96	1.07	0.30	***0.69***	
IMst	4.33	1.16	0.17	0.34	***0.88***
Composite Reliability			0.94	0.87	0.95
Cronbach's Alpha			0.90	0.78	0.93

IMap: intrinsic motivation toward accomplishment IMkw: intrinsic motivation to know
IMst: intrinsic motivation to experience stimulation
Note: The diagonal elements are AVEs; the off-diagonal elements are the squared correlations among factors.
For discriminant validity, the diagonal elements should be larger than off-diagonal elements.

Table A3 Item Loadings and Cross-Loadings (Study 1)

		IMap	IMkw	IMst
Intrinsic Motivation toward Accomplishment	IMap2	0.909	0.540	0.436
	IMap3	0.919	0.514	0.328
	IMap4	0.916	0.477	0.381
Intrinsic Motivation to Know	IMkw1	0.378	0.742	0.377
	IMkw2	0.504	0.870	0.524
	IMkw3	0.507	0.882	0.549
Intrinsic Motivation to Experience Stimulation	IMst1	0.435	0.567	0.938
	IMst2	0.386	0.565	0.956
	IMst3	0.352	0.505	0.912

Note: PLS item cross-loadings were calculated according to the procedure suggested by Gefen and Straub (2005). The differences between loadings on principal factors and on other constructs are all higher than the threshold (i.e., 0.1) suggested by Gefen and Straub.

Preliminary Study 2

Following the procedures in Study 1, we confirmed appropriate psychometric properties for the three RIM constructs in preliminary study 2 (Tables A4 and A5).

Table A4 Descriptive Statistics and Psychometric Properties (Study 2)

	Mean	Standard Deviation	IMap	IMkw	IMst
IMap	4.59	1.13	***0.82***		
IMkw	4.20	1.13	0.46	***0.84***	
IMst	3.77	1.21	0.31	0.37	***0.93***
Composite Reliability			0.93	0.94	0.97
Cronbach's Alpha			0.87	0.90	0.96

IMap: intrinsic motivation toward accomplishment IMkw: intrinsic motivation to know
IMst: intrinsic motivation to experience stimulation
Note: The diagonal elements are AVEs; the off-diagonal elements are the squared correlations among factors. For discriminant validity, the diagonal elements should be larger than off-diagonal elements.

Table A5 Item Loadings and Cross-Loadings (Study 2)

		IMap	IMkw	IMst
Intrinsic Motivation toward Accomplishment	IMap2	0.896	0.684	0.511
	IMap3	0.906	0.597	0.491
	IMap4	0.912	0.544	0.494
Intrinsic Motivation to Know	IMkw1	0.564	0.875	0.556
	IMkw2	0.637	0.930	0.558
	IMkw3	0.654	0.935	0.548
Intrinsic Motivation to Experience Stimulation	IMst1	0.543	0.577	0.954
	IMst2	0.534	0.581	0.967
	IMst3	0.535	0.589	0.967

Note: PLS item cross-loadings were calculated according to the procedure suggested by Gefen and Straub (2005). The differences between loadings on principal factors and on other constructs are all higher than the threshold (i.e., 0.1) suggested by Gefen and Straub.

A.4 Results of Measurement Invariance Analyses

To evaluate whether the developed measures of IMap, IMkw, and IMst are generalizable and comparable across the BIS and CSS settings, we further performed multi-group measurement invariance analyses for the two preliminary studies with AMOS 17.0 (Steenkamp and Baumgartner 1998, Vandenberg and Lance 2000). We evaluated both configural invariance and metric invariance. Configural invariance refers to congeneric item loading patterns across groups (Vandenberg 2002, Vandenberg and Lance 2000). When modeling configural invariance, no restrictions are imposed on the measurement models across groups (Doll et al. 1998, Steenkamp and Baumgartner 1998). Metric invariance refers to similar loading patterns for measurement items across groups (Vandenberg 2002, Vandenberg and Lance 2000). Item loadings in the measurement models are constrained to be the same across groups when modeling metric invariance (Doll et al. 1998, Steenkamp and Baumgartner 1998).

Table A6 displays the results of the measurement invariance analyses. First, we obtained good model fit when posing no restrictions on the measurement model across preliminary studies 1 and 2, thereby supporting configural invariance (Vandenberg and Lance 2000). Second, as we found no significant change in model fit ($\Delta\chi^2$ = 8.710, Δdf = 6, ΔCFI = 0.001) when constraining item loadings to be equal across the two studies, metric invariance was also supported (Chan 1998, Cheung and Rensvold 2002, Vandenberg and Lance 2000). These results suggest the measures of the three RIM constructs are congeneric and metric invariant across the BIS and CSS settings (Vandenberg 2002, Vandenberg and Lance 2000).

Table A6 Results of the Measurement Invariance Analysis

Goodness of Fit Indices	Configural Invariance	Metric Invariance	Desired Level
χ^2 / df	**(96.947 / 48) = 2.02**	**(105.657 / 54) = 1.96**	< 5
CFI	**0.984**	**0.983**	> 0.9
NNFI	0.975	0.977	> 0.9
RMSEA	0.050	0.048	< 0.08
SRMR	0.0346	0.0380	< 0.08

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Appendix B: Sample Demographics (Main Study)

Category		Frequency	Percentage (%)
Age	25 or below	24	12.4
	26–30	81	42.0
	31–35	50	25.9
	36–40	25	13.0
	41 or above	13	6.7
Education	Senior High School	5	2.6
	College	34	17.6
	Bachelor's Degree	131	67.9
	Master’s Degree	21	10.9
	Doctorate Degree	2	1.0
Gender	Female	72	37.3
	Male	121	62.7

Appendix C1: Measurement Items (Two Preliminary Studies)

Variable	Sources	Measures
Intrinsic Motivation toward Accomplishment	Van Yperen & Hagedoorn 2003, Vallerand 1997	"Why do you use the business intelligence system (BIS)/customer support system (CSS)?" IMap1. Because I feel a lot of personal satisfaction while mastering certain difficult skills in using the BIS/CSS. (dropped)[7] IMap2. For the pleasure I feel while improving some of my weakness in using the BIS/CSS. IMap3. For the satisfaction I experience while I am perfecting my use of the BIS/CSS. IMap4. For the satisfaction I feel while overcoming certain difficulties in using the BIS/CSS.
Intrinsic Motivation to Know	Van Yperen & Hagedoorn 2003, Vallerand 1997	"Why do you use the BIS?" IMkw1. For the pleasure it gives me to know more about the BIS/CSS. IMkw2. For the pleasure I feel while learning new things in using the BIS/CSS. IMkw3. For the pleasure of developing new skills in using the BIS/CSS.
Intrinsic Motivation to Experience Stimulation (Perceived Enjoyment)	Davis et al. 1992	"Why do you use the BIS/CSS?" IMst1. I find using the BIS/CSS to be enjoyable. IMst2. The actual process of using the BIS/CSS is pleasant. IMst3. I have fun using the BIS/CSS.

All measures used a seven-point Likert scale with anchors ranging from strongly disagree (1) to strongly agree (7).

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[7] We dropped IMap1 because of high cross-loadings.

Appendix C2: Measurement Items (Main Study)

Variable	Sources	Measures
Intrinsic Motivation toward Accomplishment	Van Yperen & Hagedoorn 2003, Vallerand 1997	"Why do you use the business intelligence system (BIS)?" IMap1. Because I feel a lot of personal satisfaction while mastering certain difficult skills when using the BIS. (dropped)[8] IMap2. For the pleasure I feel while improving some of my weakness when using the BIS. IMap3. For the satisfaction I experience while I am perfecting my use of the BIS. IMap4. For the satisfaction I feel while overcoming certain difficulties when using the BIS.
Intrinsic Motivation to Know	Van Yperen & Hagedoorn 2003, Vallerand 1997	"Why do you use the BIS?" IMkw1. For the pleasure it gives me to know more about the BIS. IMkw2. For the pleasure I feel while learning new things when using the BIS. IMkw3. For the pleasure of developing new skills when using the BIS.
Intrinsic Motivation to Experience Stimulation (Perceived Enjoyment)	Davis et al. 1992	"Why do you use the BIS?" IMst1. I find using the BIS to be enjoyable. IMst2. The actual process of using the BIS is pleasant. IMst3. I have fun using the BIS.
Extrinsic Motivation (Perceived Usefulness)	Davis 1989, Davis et al. 1989	PU1. Using the BIS in my job enables me to accomplish tasks more quickly. PU2. Using the BIS improves my job performance. PU3. Using the BIS in my job increases my productivity. PU4. Using the BIS enhances my effectiveness in my job.
Perceived Ease of Use	Davis 1989, Davis et al. 1989	PEOU1. It is easy to get the BIS to do what I want it to do. PEOU2. My interaction with the BIS is clear and understandable. PEOU3. I find the BIS flexible to interact with.
Routine Use	Saga and Zmud 1994, Schwarz 2003, Sundaram et al. 2007	RTN1. My use of the BIS has been incorporated into my regular work practices. RTN2. My use of the BIS is pretty much integrated as part of my normal work routine. RTN3. My use of the BIS is now a normal part of my work.
Innovative Use	Ahuja and Thatcher 2005, Karahanna and Agarwal 2006	INV1. I have discovered new uses of the BIS to enhance my work performance. INV2. I have used the BIS in novel ways to support my work. INV3. I have developed new applications based on the BIS to support my work.
Personal Innovativeness with IT	Agarwal and Prasad 1998	PIIT1. If I heard about a new information technology, I would look for ways to experiment with it. PIIT2. Among my peers, I am usually the first to try out new information technologies. PIIT3. I like to experiment with new information technologies.
Computer Self-Efficacy	Compeau and Higgins 1995	CSE1. I feel comfortable using the BIS on my own. CSE2. I can easily operate the BIS on my own. CSE3. I feel comfortable using the BIS even if there is no one around me to tell me how to use it.

All measures used a 7-point Likert scale with anchors ranging from strongly disagree (1) to strongly agree (7).

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[8] We dropped IMap1 because of high cross-loadings.

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Appendix D: Unstandardized Path Coefficients

As partial least square (PLS) only computes standardized path coefficients, we followed recommended procedures to compute unstandardized path coefficients—namely, we used PLS to first compute the unstandardized latent variable scores for all the constructs and then calculated the unstandardized path coefficients using multiple regression analysis. The unstandardized coefficients (Table D1) and the standardized coefficients (Table 4 in the manuscript) are qualitatively consistent.[9]

Table D1 Unstandardized Path Coefficients

		RTN	INV
IMap		- 0.02	0.06
IMkw		0.16*	0.34**
IMst		0.09	0.31**
PU		0.54**	0.08
Control Variables	PEOU	0.04	- 0.13
	PIIT	0.09	0.05
	CSE	0.09	0.04
	AGE	- 0.02$^+$	- 0.01
	EDU	- 0.14	0.16$^+$
	GEN	- 0.01	0.10
	PRI	- 0.03	0.03
	TEN	0.02	- 0.00
R^2		44.7%	35.9%

IMap: intrinsic motivation toward accomplishment
IMkw: intrinsic motivation to know
IMst: intrinsic motivation to experience stimulation
INV: innovative use
PEOU: perceived ease of use
PU: perceived usefulness
PIIT: personal innovativeness with IT
RTN: routine use
CSE: computer self-efficacy
Note: **: $p < 0.01$, *: $p < 0.05$, +: $p < 0.1$, one-tailed test. Unstandardized path coefficients are reported.

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[9] While standardized coefficients can simplify the interpretation of the effects, they can also mask effects as they increase or decrease the effects (expressed in standard deviation terms) based on the standard deviation of the independent variable relative to the standard deviation of the dependent variable (Cohen et al. 2003).

Appendix E:

Procedures and Results of Hypothesis Tests

We adopted the test described in Cohen et al. (2003) to compare the differential effects between the three rich intrinsic motivation (RIM) constructs and perceived usefulness (PU) on routine use (RTN) and innovative use (INV).

$$t = \frac{\beta_i - \beta_j}{\sqrt{\frac{1-R_Y^2}{n-k-1} * \left(\frac{sd_y^2}{sd_i^2} * r^{ii} + \frac{sd_y^2}{sd_j^2} * r^{jj} - 2\frac{sd_y^2}{sd_i * sd_j} * \frac{r^{ij}}{\sqrt{r^{ii} * r^{jj}}}\right)}}$$

where β_i is the unstandardized path coefficient of the independent variable I (see the unstandardized path coefficients in Appendix D.), sd_i is the standard deviation of I, r^{ij} are the elements of the inverted correlation metrics, R_Y^2 is the explained variance of the dependent variable Y, n is sample size, and k is the number of total independent variables.

Table E1 reports the results of the hypothesis tests. One-tailed tests were performed as the hypotheses specified directional differences. As indicated in Table E1, 1) the three RIM constructs each had a weaker impact on RTN than PU (IMap vs. PU: $p < 0.01$; IMkw vs. PU: $p < 0.01$; IMst vs. PU: $p < 0.01$); 2) IMkw and IMst each had a stronger impact on INV than PU (IMkw vs. PU: $p < 0.01$; IMst vs. PU: $p < 0.05$), while the impact of IMap on INV was similar to the impact of PU (IMap vs. PU: n.s.); and 3) among the three RIM constructs, IMkw and IMst each had a stronger impact on INV than IMap (IMap vs. IMkw: $p < 0.01$; IMap vs. IMst: $p < 0.01$).

Table E1 Results of Hypothesis Tests

	Path Coefficient		Results	Conclusion
RTN				
H_{1a}	β_{IMap} à RTN vs. β_{PU} à RTN	= - 0.026** vs. 0.419**	p < 0.01**	(ü) β_{IMap} à RTN < β_{PU} à RTN
H_{1b}	β_{IMkw} à RTN vs. β_{PU} à RTN	= 0.158** vs. 0.419**	p < 0.01**	(ü) β_{IMkw} à RTN < β_{PU} à RTN
H_{1c}	β_{IMst} à RTN vs. β_{PU} à RTN	= 0.084** vs. 0.419**	p < 0.01**	(ü) β_{IMst} à RTN < β_{PU} à RTN
INV				
H_{2a}	β_{IMap} à INV vs. β_{PU} à INV	= 0.046** vs. 0.073	n.s.	(û) No differences detected
H_{2b}	β_{IMkw} à INV vs. β_{PU} à INV	= 0.351** vs. 0.073	p < 0.01**	(ü) β_{IMkw} à INV > β_{PU} à INV
H_{2c}	β_{IMst} à INV vs. β_{PU} à INV	= 0.315** vs. 0.073	p < 0.05*	(ü) β_{IMst} à INV > β_{PU} à INV
H_{3a}	β_{IMap} à INV vs. β_{IMkw} à INV	= 0.046** vs. 0.351**	p < 0.01**	(ü) β_{IMap} à INV < β_{IMkw} à INV
H_{3b}	β_{IMap} à INV vs. β_{IMst} à INV	= 0.046** vs. 0.315**	p < 0.01**	(ü) β_{IMap} à INV < β_{IMst} à INV

Note: **: p < 0.01, *: p < 0.05, +: p < 0.1, n.s.: non-significant   One-tailed tests were performed as the directional differences were hypothesized.

References

Cohen, J., P. Cohen, S.G. West, L.S. Aiken. 2003. *Applied Multiple Regression/ Correlation Analysis for the Behavioral Sciences*. Lawrence Erlbaum Associates, London.

Appendix F: Moderation Test Results

To investigate the moderation effects of PIIT on the relationship between the three RIM constructs and INV, we adopted a stepwise procedure: Model F1 included the control variables (AGE, EDU, GEN, PRI, TEN, PU, PEOU, and CSE), Model F2 included the control variables and main factors (IMap, IMkw, IMst, and PIIT), Model F3 incorporated the factors in Model F2 and the interaction terms (IMap*PIIT, IMkw*PIIT, and IMst*PIIT). We found that PIIT moderated the effects of all three intrinsic motivation variables on INV (IMap*PIIT à INV: β = 0.159*, $p < 0.05$; IMkw*PIIT à INV: β = 0.255**, $p < 0.01$; IMst*PIIT à INV: β = 0.250**, $p < 0.01$).

	Model F1	Model F2	Model F3
Control Variables			
AGE	- 0.071	- 0.045	- 0.041
EDU	0.024	0.109^{+}	0.095
GEN	0.049	0.040	0.033
PRI	0.075	0.022	0.017
TEN	- 0.035	- 0.006	0.005
PU	0.327**	0.094	0.092
PEOU	0.064	- 0.113	- 0.064
CSE	0.056	0.051	0.073
Main Effects			
IMap		0.046	0.046
IMkw		0.351**	0.328**
IMst		0.315**	0.265**
PIIT		0.043	0.089
Interaction Effects			
IMap*PIIT			0.159*
IMkw*PIIT			0.255**
IMst*PIIT			0.250**
R^2	20.1%	36.8%	42.4%

IMap: intrinsic motivation toward accomplishment
IMkw: intrinsic motivation to know
IMst: intrinsic motivation to experience stimulation
INV: innovative use
PEOU: perceived ease of use
PU: perceived usefulness
PIIT: personal innovativeness with IT
RTN: routine use
CSE: computer self-efficacy
Note: **: $p < 0.01$, *: $p < 0.05$, +: $p < 0.1$, one-tailed test Standardized path coefficients are reported here.

Appendix G: Post-Hoc Analysis Results

We adopted the statistical method suggested by Cohen and his colleagues (Cohen et al. 1990, Cohen et al. 2003) to compare a certain independent variable's impacts on two different dependent variables within the same sample. First, we obtained unstandardized path coefficients (Appendix D). Next, we generated the estimated value of one dependent variable, say $\widehat{RTN}$. We subtracted $\widehat{RTN}$ from INV (i.e., $INV - \widehat{RTN}$) and then regressed this new variable, $INV - \widehat{RTN}$, on the original set of independent variables. The resulting path coefficient of a particular independent variable and its significance level, respectively, indicate the magnitude and significance of the difference in the independent variable's impacts on INV and RTN.

Table G1 reports the results of this post-hoc analysis. As shown in Table G1, IMap's impacts on RTN and INV were not differentiable (n.s.). IMkw and IMst each had a stronger impact on INV than on RTN (IMkw: $p < 0.05$; IMst: $p < 0.01$). On the other hand, PU had a stronger impact on RTN than on INV ($p < 0.01$). As these are all directional comparisons, we interpreted the significance levels based on one-tailed tests.

Table G1 Post-Hoc Analysis Results

IV	Path Coefficient	Results	Conclusion
IMap	$\beta_{IMap \to RTN}$ vs. $\beta_{IMap \to INV}$ = - 0.026** vs. 0.046	n.s.	No differences detected
IMkw	$\beta_{IMkw \to RTN}$ vs. $\beta_{IMkw \to INV}$ = 0.158** vs. 0.351**	$p < 0.05$*	$\beta_{IMkw \to RTN} < \beta_{IMkw \to INV}$
IMst	$\beta_{IMst \to RTN}$ vs. $\beta_{IMst \to INV}$ = 0.084** vs. 0.315**	$p < 0.01$**	$\beta_{IMst \to RTN} < \beta_{IMst \to INV}$
PU	$\beta_{PU \to RTN}$ vs. $\beta_{PU \to INV}$ = 0.419** vs. 0.073	$p < 0.01$**	$\beta_{PU \to RTN} > \beta_{PU \to INV}$

Note: **: $p < 0.01$, *: $p < 0.05$, +: $p < 0.1$, n.s.: non-significant. One-tailed tests were performed as the directional differences were hypothesized.
IV: independent variable

References

Cohen, J., P. Cohen, S.G. West, L.S. Aiken. 2003. *Applied Multiple Regression/ Correlation Analysis for the Behavioral Sciences*. Lawrence Erlbaum Associates, London.

Cohen, P., J.S. Brook, J. Cohen, C.N. Velez, M. Garcia. 1990. Common and Uncommon Pathways to Adolescent Psychopathology and Problem Behavior. L.N. Robins, M. Rutter Eds. *Straight and Devious Pathways from Childhood to Adulthood*, Cambridge University Press, Cambridge, 242-258.

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Appendix H: Common Method Variance Factor Test Results

The common method variance factor test assesses common method bias for single-source data (Podsakoff et al. 2003). Table H1 summarizes the factor loadings of all variables in the original measurement model and the factor loadings in the measurement model with a common method variance factor. As shown in Table H1, factor loadings remained stable across the two measurement models.

Table H1 Common Method Variance Factor Test Results

Variable	Indicator	Factor Loading	
		Measurement Model	Measurement Model with CMV
Routine Use	RTN1	0.969	0.934
	RTN2	0.979	0.994
	RTN3	0.971	0.992
Innovative Use	INV1	0.903	0.815
	INV2	0.930	0.908
	INV3	0.752	0.893
Intrinsic Motivation toward Accomplishment	IMap2	0.911	0.946
	IMap3	0.905	0.935
	IMap4	0.917	0.851
Intrinsic Motivation to Know	IMkw1	0.891	0.845
	IMkw2	0.944	0.995
	IMkw3	0.937	0.929
Intrinsic Motivation to Experience Stimulation	IMst1	0.957	0.924
	IMst2	0.949	0.954
	IMst3	0.947	0.975
Perceived Usefulness	PU1	0.928	0.927
	PU2	0.909	0.947
	PU3	0.909	0.904
	PU4	0.911	0.880
Perceived Ease of Use	PEOU1	0.920	0.852
	PEOU2	0.875	0.931
	PEOU3	0.826	0.844
Personal Innovativeness with IT	PIIT1	0.886	0.854
	PIIT2	0.889	0.905
	PIIT3	0.877	0.893
Computer Self-Efficacy	CSE1	0.916	0.854
	CSE2	0.932	0.965
	CSE3	0.837	0.870

CMV: common method variance factor

Reference

Podsakoff, P., S. MacKenzie, J. Lee, N. Podsakoff, 2003. Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies. *Journal of Applied Psychology* 88(5) 879-903.