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A USER COMMITMENT APPROACH TO INFORMATION SYSTEMS INFUSION

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Abstract

Many organizations have huge investments on information systems (IS) but are unable to achieve the maximum benefits expected. The IS infusion stage refers to the state of using IS to its full potential. IS infusion is a form of organizational citizenship behavior because full utilization of IS requires extra-role behaviors (i.e., IS use beyond the mandated usage) beyond intra-role behaviors (i.e., mandated IS usage). As commitment is a key driver of organizational citizenship behavior, IS infusion requires the user's commitment to IS usage. This study investigates the development of user commitment from the socio-technical system design perspective and the effect of user commitment on IS infusion. We identified five constructs from the socio-technical system design (job fit, task competence, technology competence, self-determination with technology, and self-determination with task). A survey of 236 enterprise system users showed that user commitment has a positive effect on IS infusion. User commitment, in turn, is influenced by job fit, technology competence, and self-determination with task. This study contributes to IS infusion research by introducing the development of user commitment from the socio-technical system design perspective. Managers can promote user commitment in order to reach the infusion stage of fully utilizing information systems.

Keywords: IS infusion, user commitment, socio-technical system design, enterprise system

1. INTRODUCTION

Information Systems (IS) including enterprise systems come at a high price as companies invest gigantic amounts of capital to establish them. Enterprise systems refer to software packages (e.g., supply chain management, enterprise resource planning, and customer relationship management) that enable the integration of transaction-oriented data and business processes throughout an organization (Markus and Tanis 2000). The enterprise system market totals US\$200 billion and is expected to reach US\$300 billion by 2013 (Gartner 2009). Even in cases of successful IS implementations, organizations are still unable to extract full value from their systems (Schrage 2006). The underutilization of implemented IS is a major factor underlying the productivity paradox that resulted in lackluster returns on organizational investments in IS (Sundaram et al. 2007; Venkatesh and Davis 2000). For example, up to 80 percent of organizations with enterprise systems have underutilized them (Morphy 2006). According to the six-stage information technology (IT) implementation model (Cooper and Zmud 1990), IS implementation and usage vary over six different stages: initiation, adoption, adaptation, acceptance, routinization, and infusion. Organizations are able to leverage on their IS investments only at IS infusion which refers to *using the system to its full potential* (Saga and Zmud 1994).

Even though the importance of IS infusion has been emphasized in the past several decades, it is still inexplicable and understudied. Previous IS research has focused on IS adoption and post-adoption such as IS continuance. Among the limited number of studies on IS infusion, many of them have examined IS infusion based on the viewpoints of technology acceptance (Jones et al. 2002; Saeed and Abdinnour 2008), IS continuance (Hsieh and Wang 2007; Wang and Hsieh 2006), and the theory of reasoned action (TRA) (Sundaram et al. 2007). IS infusion is a form of organizational citizenship behavior (OCB) because full utilization of IS requires IS use beyond the prescribed or mandated usage. OCB means an employee's willingness to go above and beyond the prescribed roles which the person has been assigned (Organ et al. 2006). In contrast to IS infusion, technology acceptance or IS continuance are not a form of OCB. For this reason, we need a new theoretical viewpoint in examining IS infusion. Previous research (Meyer and Allen 1991; Meyer et al. 2002; Pare and Tremblay 2007) explains that commitment is a key antecedent of OCB. We therefore adopt commitment theory (Allen and Meyer 1990; Meyer and Allen 1991; Meyer and Hercovitch 2001) as the theoretical lens in examining IS infusion at the individual user level.

The purpose of this study is twofold: First, to examine IS infusion from the user commitment perspective; and second, to examine the formation of user commitment in the use of IS. This study proposes various work system design factors as the antecedents of user commitment because job design can affect the development of psychological states (i.e., user commitment) (Hackman and Oldham 1976). In the context of IS use, socio-technical system design can affect the psychological states and work outcomes (Bostrom and Heinen 1977; Hackman and Oldham 1976). For this reason, we examine job design in terms of socio-technical system design. Our theoretical model is tested through a field study that focused on individual's use of an enterprise system.

This work contributes by extending commitment theory and adds to the literature on IS infusion. It also advances the understanding of user commitment, socio-technical system design, and IS infusion behavior. Moreover, this study can inform organizations on how to develop user commitment and attain IS infusion. This paper is organized as follows: the next section reviews the existing literature on IS infusion and discusses commitment and socio-technical system design. This is followed by our explanation of the research model and hypotheses. We then describe the research methodology. After interpreting the empirical results, we discuss the theoretical and practical implications and conclude with a summary of the study.

2. CONCEPTUAL BACKGROUND

2.1 IS Infusion

Cooper and Zmud (1990) introduced the six-stage IT implementation model: initiation, adoption, adaptation, acceptance, routinization, and infusion. The purpose of the six-stage IT implementation model was to facilitate the interpretation of connections between empirical results of different stages. The model begins with initiation, which identifies a match between an innovation and its application in an organization. It is followed by adoption, when a decision is reached to invest resources to accommodate the implementation effort. Adaptation occurs when a better fit is achieved by the modification processes that are directed towards individuals or organizations and the technology. Thereafter is the post-adoption stages which include acceptance, routinization, and infusion. Acceptance refers to the efforts taken to induce organizational members to submit to the use of IT applications (Cooper and Zmud, 1990). Routinization is the routine and regular use of IT applications. When employees are able to utilize the IS in a way that goes beyond routine and standardized usage, they achieve a higher level of usage that allows them to exploit the fullest potential of the system (i.e., IS infusion).

IS Infusion can occur in different ways, such as extended use, integrative use, and emergent use (Saga and Zmud 1994). Users thus go beyond the prescribed and mandated use of IS at the stage of IS infusion. It is believed that mandatory usage alone is underutilization of the IS technology. With discretionary and voluntary usage, employees are able to further utilise technology, even in ways that may not have been envisaged in the initial technology acceptance. Employees can leverage the technology and maximize the ratio of output to input to improve performance, resulting in more positive organizational consequences, at the infusion stage (Cooper and Zmud 1990; Sundaram et al. 2007; Wang and Hsieh 2006).

There have been some researches on IS infusion. Jones et al. (2002) and Sundaram et al. (2007) examined the antecedents of IS infusion in the context of sales force automation system based on the technology acceptance model (TAM) and theory of reasoned action. Similarly, Saedd and Abdinnour-Helem (2008) examined the antecedents of IS infusion based on the TAM. Wang and Hsieh (2006) and Hsieh and Wang (2007) examined IS infusion based on the IS continuance model and TAM. Previous research on IS infusion thus showed the significant role of perceived usefulness and satisfaction in leading to IS infusion. Some other studies examined IS infusion in terms of work environment. For example, Ahuja and Thatcher (2005) examined the influence of the work environment on trying to innovate with IS, grounded in the theory of trying and the theory of planned behaviour. Similarly, Hsieh et al. (2011) examined the effect of work environment and feedback mechanism on extended use of IS.

While it is meaningful to examine IS infusion based on the theoretical lenses commonly used in technology acceptance and IS continuance, there is a limitation in generating new knowledge. Further, IS infusion requires users to go beyond the mandated use of IS to exploit the fullest potential of the system. The voluntary and discretionary extension or exploitation of IS is a form of OCB (i.e., the employee is willing to go above and beyond his or her prescribed roles) (Organ et al. 2006). Organ (1988, p.4) defined OCB as “individual behavior that is discretionary, not directly or explicitly recognized by the formal reward system, and that in the aggregate promotes the effective functioning of the organization.” There are three key characteristics in the conceptualization of OCB. First, OCBs are discretionary behaviors and are performed by employees as a result of personal choice. Second, OCBs go beyond job requirements. Third, OCBs contribute positively to the performance of target organization. OCB includes not only intra-role but also extra-role behaviors (Organ et al. 2006), that motivated employees perform at their own discretion. While IS infusion requires a form of OCB, normal technology acceptance and IS continuance do not. For this reason, there is a limitation in examining IS infusion based on the theoretical lenses used in examining technology acceptance and IS continuance. IS infusion research thus needs a new theoretical lens that can be used in examining OCB. Previous research has adopted the commitment theory as the theoretical lens in examining OCB (Meyer and Allen 1991; Morrison 1994; Pare and Tremblay 2007). We therefore adopt the commitment theory in examining IS infusion.

2.2 User Commitment

Commitment is “a force that binds an individual to a course of action of relevance to one or more targets” (Meyer and Herscovitch 2001) and is experienced by an individual as a mindset (i.e., a psychological state that compels an individual toward a course of action). There are two targets of commitment: commitment to a course of action and commitment to a relationship (Li et al. 2006). Commitment to a course of action is “a state of being in which an individual becomes bound by his actions and through these actions to beliefs that sustain the activities and his own involvement” (Salancik 1977, p. 62). Commitment to a relationship explains an individual’s attitude toward a social or business relationship and his motivation to remain in the relationship. Commitment to a relationship has been used in examining relationship marketing (e.g., Bansal et al. 2004) and employee management (e.g., Meyer et al. 1993).

Commitment has three sub-types: affective commitment, normative commitment, and continuance commitment (Meyer and Allen 1991). Affective commitment means an emotional attachment or affective orientation toward the target of commitment. Normative commitment means an obligation to maintain the relationship with the target of commitment. Continuance commitment means maintaining relationship with the target of commitment as a result of the perception of discontinuance costs. Among the three sub-types of commitment, however, affective commitment is shown to have the strongest positive relation with desirable work behaviors (e.g., OCB) (Meyer et al. 2002). In contrast, continuance commitment (i.e., discontinuance costs) is expected to be unrelated and normative continuance (i.e., obligation) is expected to have a weak effect on OCB. Morrision (1994) further highlights that a strong affective commitment motivates individuals to view their roles as extending beyond formally prescribed tasks, and this encouraging them to adopt extra-role behaviors.

Previous IS research using commitment theory has examined the effect of commitment on IS continuance intention (Li et al. 2006; Wang and Datta 2010), user satisfaction (Doll and Torkzadeh 1989), and performance (Chang et al. 2010). For example, Malhotra and Galletta (2005) examined the effect of commitment on system adoption and usage behavior as well as perceived beliefs such as usefulness and ease of use. Regarding antecedents of commitment, Shaw and Edwards (2005) explored potential antecedents of user commitment, in the context of knowledge management strategy implementation. Doll and Torkzadeh (1989) proposed trust and sense of control as antecedents of commitment. Chang et al. (2010) proposed ability and extrinsic motivation as antecedents of user commitment. There has been, however, insufficient understanding about the development of commitment and the role of commitment in IS infusion.

The main premise of commitment theory is that employees with commitment will exhibit OCB, such as extra-role behaviors (Meyer and Allen 1991; Meyer et al. 2002; Pare and Tremblay 2007). In the same vein, user commitment is a motivational force for users to assume extra-role behaviors in using IS to its full potential at work (i.e., IS infusion). This study defines user commitment as *an individual user’s psychological attachment to using the system in performing tasks*.

2.3 The Socio-Technical System

Previous research (Hackman and Oldham 1976) explains that job designs, including job characteristics, can affect commitment. In the IS context, the socio-technical system (STS) approach to work design is used to analyse the precedents and their effects on the development of commitment (Hackman and Oldham 1976). The STS is a perspective of an organization’s work system and it comprises two interacting sub-systems – social and technical (Bostrom and Heinen 1977). The social subsystem includes structure and people, whereas the technical subsystem includes technology and task. Leavitt (1989) further explained each of the four elements. Task refers to work or function to be performed. People refer to actors performing task. Technology refers to the body of knowledge and tools that can be applied to the task. Structure includes the systems of communication, systems of authority or other roles, and systems of workflow. The important implication of the STS approach is that the output of this work system results from the joint interaction between the two subsystems (Bostrom and Heinen 1977). A major cause of low work system capability is that the enabling technology is not effectively integrated within the work system (Armstrong and Sambamurthy 1999; Purvis et al. 2001). That is, the four elements of the STS interact with each other and the level of fit between elements can affect the development of commitment and the productivity of the work system.

Figure 1 shows the interactions between elements and the identification of five constructs from the interactions.

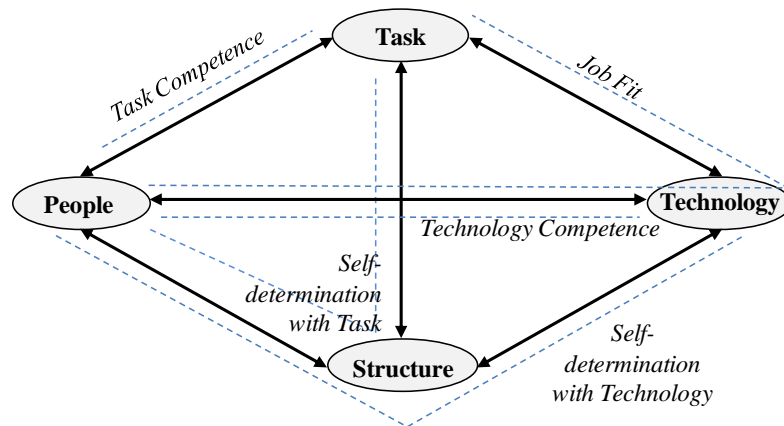


Figure 1: Identification of Job Design Factors based on the STS

2.3.1 People-Task-Technology Interaction: Job Fit

People-Task-Technology interaction means the match between the task to be performed by the person and the technology to be used by the person for the task. The effect of people-task-technology interaction is partially supported by other studies which found that successful innovation and adoption occurs when the task and the technology are compatible (Cooper and Zmud 1990). As a factor corresponding to task-technology interaction of the person, task-technology fit explains the interaction between task requirements and the functionality of target technology (Goodhue and Thompson 1995). At a micro level, the task-technology fit examines how a specific component of a technology helps an individual to perform a specific task or subtask. As the STS highlights the interaction of social and technical subsystems, and the consequence effect on an individual's performance of organizational tasks in general, task-technology fit is not appropriate. We propose job fit as a corresponding factor to people-task-technology interaction from a more general perspective. Job fit means *the degree to which an individual believes that using the target technology can enhance the performance of his or her job* (Thompson et al. 1991).

2.3.2 People-Technology Interaction: Technology Competence

People-Technology interaction refers to a match between an individual and the technology used by the person. To use technology, an individual should have the relevant skills and knowledge. Previous studies have shown the importance of individual-technology interaction in promoting managerial effectiveness and innovative behavior (Blili et al. 1998; Munro et al. 1997; Spreitzer 1995). We propose technology competence as a corresponding factor to people-technology interaction. Technology competence means *the perceived degree to which an individual has relevant knowledge, skills and confidence in his or her ability to use the system* (Munro et al. 1997). Technology competence need not be constrained by usage for the current task. For example, a person can know the technology beyond what he needs for his current task.

2.3.3 People-Task Interaction: Task Competence

People-Task interaction refers to a match between an individual and the task that is performed by the person. To perform the tasks effectively, individuals should have the relevant knowledge, skills and confidence. Perceived self-confidence, knowledge and skills are all necessary abilities for making effective task-related decisions and execution. We propose task competence as a corresponding factor to people-task interaction. Task competence means *the perceived degree to which an individual has relevant knowledge, skills, confidence and ability to perform the tasks* (Ritter and Gemunden 2004).

2.3.4 People-Structure-Task Interaction: Self-determination with Task

Because this study centers on individual level interaction instead of organizational level, we focus on a specific component of structure – the authority system. The authority system reflects how much power and control is delegated to individual employees. The degree of self-determination by the employee may affect his or her attitude in performing tasks. People-Structure-Task refers to a match among individual, structure (i.e., authority), and task. We propose self-determination with task as a corresponding factor to people-structure-task interaction. Self-determination with task means *an individual's sense of having a choice in regulating and performing tasks* (Deci et al. 1989).

2.3.5 People-Structure-Technology Interaction: Self-determination with Technology

Similar to people-structure-task interaction, People-Structure-Technology interaction refers to a match among individual, structure (i.e., authority), and technology. The degree of permissible authority of an individual in using technology may affect the individual's attitude in using the technology at work. We propose self-determination with technology as a corresponding factor to people-structure-technology interaction. Self-determination with technology means *an individual's sense of having a choice in using and regulating the technology (information systems)* (Deci et al. 1989).

3. RESEARCH MODEL AND HYPOTHESES

The commitment of employees that must be present for internally motivated work behavior can be created through the design of job (i.e., job characteristics) (Hackman and Oldham 1976), which forms the theoretical framework used in developing our research model (See Figure 2). As for psychological state representing a user's voluntary and active motivational orientation toward target behavior (i.e., IS infusion), we propose user commitment. We select the STS design approach for job design, and propose five constructs representing different interactions in the social and technical subsystems within the STS. The internally motivated work behavior that is the focus of our research is IS infusion as a form of OCB.

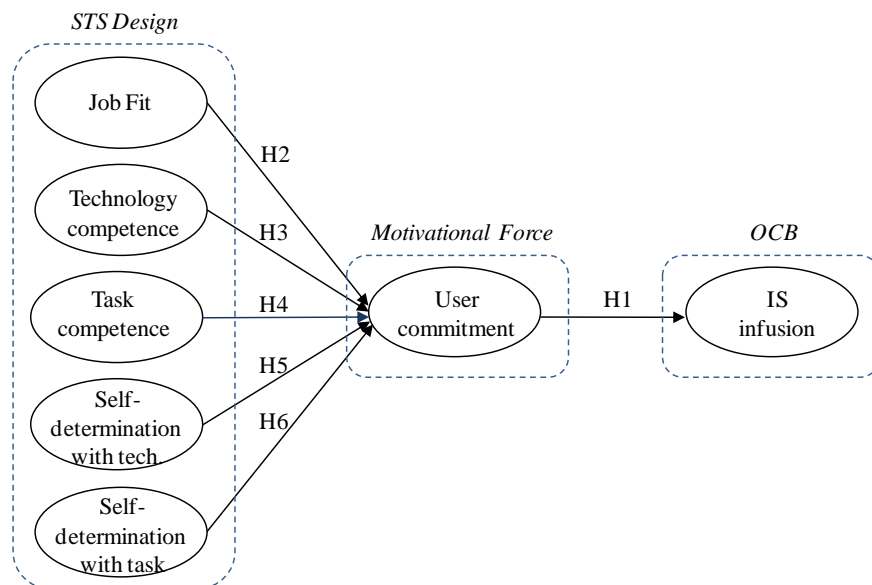


Figure 2: Reserach Modedel

3.1 Consequence of User Commitment

Previous research (Meyer and Allen 1991; Meyer et al. 2002; Pare and Tremblay 2007) has explained that commitment has a strong relationship with OCB. Especially, affective commitment has been proposed as a key antecedent of OCB, in comparison with normative commitment and continuance commitment (Meyer et al. 2002). A strong affective commitment motivates employees to consider their work role as extending beyond tasks formally prescribed, which in turn encourages them to adopt extra-role behaviors (Morrison 1994). Users are typically mandated to adopt and use

information systems in organizational settings, especially in the use of enterprise systems. Because most enterprise systems (e.g., enterprise resource planning and customer relationship management systems) are tightly integrated with tasks over workflows, employees have to use the systems in performing their tasks (e.g., monitoring, analysis, decision making, reporting, and communicating). If employees are not highly motivated, however, they may not try to use the system beyond the prescribed way. In contrast, the strong motivational force (i.e., user commitment) may inspire users to use the system beyond the prescribed ways. IS infusion is essentially voluntary on the user's behavior even in the context of enterprise systems (Hsieh et al. 2007; Hsieh et al. 2011). User commitment should therefore motivate the user to use the system to its full potential by exploring more features of the technology and discovering innovative ways of system usage in performing tasks.

H1: User commitment has a positive impact on IS infusion

3.2 Antecedents of User Competence

Job fit refers to how well the technology of interest supports the user in performing his target tasks and enhance job performance (Speier and Venkatesh 2002; Thompson et al. 1991). Job fit as performance expectancy can directly affect target behavior in the use of IS (Venkatesh et al. 2003). Performance expectancy, the expectation of high work performance and outcomes, can also influence an employee's psychological state at work (Chang et al. 2010). Bandura (1989) also explained that outcome expectation influences an individual's affective reaction to the target technology. With higher expectation of achieving their goals, people will be more committed (Bandura 1989). As the level of job fit increases, and users are able produce better outcomes, they may develop stronger psychological attachment to the use of technology in performing tasks (Speier and Venkatesh 2002). Similarly, previous research (Malhotra and Galletta 2005) examined the relationship between performance expectancy (i.e., perceived usefulness) and commitment to system use. Therefore, job fit should increase user commitment as well.

H2: Job fit has a positive impact on user commitment

Competence beliefs operate on behavior and actions through motivation and affective process. High technology competence first motivates an individual's interest and involvement in the use of technology (Deci and Ryan 1987). Competence is thus related to intrinsic motivation. Bandura (1989) also explained that self-efficacy influences an individual's affective reactions to the target technology. The stronger people believe in their capabilities, the greater and more persistent are their efforts (i.e., motivation force) (Bandura 1989). As an individual's technology competence increases, the person may develop stronger psychological attachment to the use of technology. Similarly, previous research (Chang et al. 2010; Malhotra and Galletta 2005) examined the relationship between effort expectancy (i.e., ability and perceived ease of use) and user commitment. Therefore, technology competence of a user should increase his or her commitment toward the use of IS in performing tasks.

H3: Technology competence has a positive impact on user commitment

Similar to technology competence, task competence refers to how well an individual has relevant knowledge, skills, confidence and ability in performing the tasks. High task competence may motivate an individual's interest and involvement in the target tasks (Deci and Ryan 1987). Bandura (1989) also explains that self-efficacy influences an individual's affective reactions to the target tasks. According to the social cognitive theory (Bandura 1989), competency experience will increase a person's self-efficacy, where he believes that he can do the task well. This increased self-efficacy in turn will make the person more committed and willing to spend time and effort on the task. Thus, task competence may develop a stronger motivational force toward the task, i.e., performing task. In the enterprise system usage context of our study, performing tasks requires employees to use IS. Task competence of an individual, therefore, should increase his psychological attachment, i.e., user commitment, to the use of IS in performing tasks.

H4: Task competence has a positive impact on user commitment

Self-determination reflects autonomy in the initiation and continuance of work behaviors and processes. As a specific type of self-determination, self-determination with technology refers to

whether an individual has authority and autonomy in deciding how to use technology of interest. In addition to competence, autonomy in the use of technology can motivate an individual's interest and involvement in the use of technology (Deci and Ryan 1987). Autonomy in the use of technology contributes to a higher level of technological determination. Self-determination with technology may thus develop a motivational force toward the use of technology by resulting in learning, interest in the target activities, and resilience even in the face of adversity. Previous research (Doll and Torkzadeh 1989) also suggested the relationship between sense of control and commitment. Spreitzer (1995) also explained that self-determination has an effect on commitment. Therefore, an individual's self-determination with technology should increase his commitment to the use of IS in performing tasks.

H5: Self-determination with technology has a positive impact on user commitment

As another specific type of self-determination, self-determination with task refers to whether an individual has authority and autonomy in deciding how to perform tasks. Self-determination in performing task can motivate an individual's interest and involvement in performing the target task (Deci and Ryan 1987). Similar to the effect of self-determination with technology, autonomy in performing task contributes to a higher level of task determination. Performing tasks, however, requires employees to use IS. Self-determination with task may thus develop motivational force regarding performing tasks with the use of IS. Self-determination with task of an individual, therefore, should increase his or her commitment to the use of IS in performing tasks.

H6: Self-determination with task has a positive impact on user commitment

4. RESEARCH METHODOLOGY

Data to empirically validate the hypotheses were collected through a field survey of users of an enterprise system at a service company. Existing validated scales were adopted where possible and new scales were developed based on previous literature. To measure IS infusion, four items were adopted from Jones et al. (2002). To measure user commitment, we adapted three items ("happy," "personal meaning," and "emotionally attached") of affective commitment from Allen and Meyer (1990) and one more item ("enthusiastic") from Meyer et al. (1993) by considering the context of IS use in performing tasks. We adopted five items for measuring job fit from Thompson et al. (1991). To measure task competence and technology competence, we adapted three items ("mastered," "confident," and "self-assured") from Spreitzer (1995) and one item ("capable") from Stone and Stone (1984) by considering the context of performing task and using technology. Similarly, to measure self-determination with task and self-determination with technology, we adapted three items ("autonomy," "decide on my own," and "opportunity for independence") from Spreitzer (1995). All items used a 7-point Likert scale (1= strongly disagree, 7= strongly agree).

Two IS scholars reviewed the instrument for face validity. Four graduate students were invited to participate in the sorting exercise. Overall, the four sorters correctly placed the items onto the intended constructs. Next, the measurement instrument was reviewed in a focus group of 15 employees working in the target company to check for any ambiguity of wording or format. The measurement instrument is presented in the Appendix.

To test our hypotheses, we targeted employees of an organization that is currently using an enterprise system. To be eligible for the study, an organization needs to have at least two years of experience in using their system so as to ensure sufficient time for IS infusion to take place. The target organization is a service company with more than 1,200 employees. The company has been using the system to assist their operations in customer management, sales channel management, marketing, human resource management, and finance and accounting management since 2007. The organization has been using the system for more than four years, making it a suitable for examining IS infusion. In the target organization, all employees use the system in their works. Although it is mandatory for employees to use the basic functions of the system for their tasks (e.g., reporting), it is voluntary for them to use the advanced functions for their tasks (e.g., business intelligence).

Some users, however, do not have to use the system beyond the mandated way. Other users cannot use the system in any extended way because of the authority control depending on their organization

units and positions. We excluded those users from the survey data collection. With help from the company, we distributed the survey questionnaire to 500 randomly selected employees across different business units and different organizational positions. A total of 236 complete and valid responses (47.2 percent response rate) were collected over two weeks. The descriptive statistics of the respondents indicate that the majority of them are male (75.8%), the average age is 32.7 years (s.d. = 5.4) and the average tenure is 4.6 years (s.d. = 3.8) at the company.

5. DATA ANALYSIS AND RESULTS

5.1 Instrument Validation

We first conducted an exploratory factor analysis involving all measures using principal component analysis (PCA) with varimax rotation using SPSS. We identified seven factors with eigenvalues greater than 1.0. All of the items were loaded into distinct factors. When compared across factors, all of the items were loaded highest into their own factor. Together, all seven factors explained 82.3 percent of the total variance.

Data analysis was conducted using the partial least squares (PLS) technique with SmartPLS. PLS was chosen because it analyzes measurement and structural models with multi-item constructs that include direct and indirect effects. Also, PLS is not as restrictive on the sample as covariance-based structural equation modeling methods that require relatively large sample sizes and multivariate normal data distributions (Jöreskog and Sörbom 1989). We first assessed the validity of the measurement instrument and then tested the hypotheses. We conducted a confirmatory factor analysis to assess the convergent and discriminant validities of the survey instrument using PLS. As shown in Table 1 the standardized path loadings were all significant (t -value > 1.96) and greater than 0.7. The CR and the Cronbach's α or all constructs exceeded 0.7. The AVE for each construct was greater than 0.5. The convergent validity for the constructs was supported.

Construct	Item Loadings	AVE	CR	Cronbach's α
Job Fit (JFT)	0.90, 0.86, 0.92, 0.90, 0.88	0.80	0.95	0.93
Technology Competence (TEC)	0.91, 0.90, 0.90, 0.92, 0.94	0.84	0.96	0.95
Task Competence (TAC)	0.82, 0.85, 0.78, 0.86, 0.88	0.70	0.92	0.89
Self-determination with Task (STA)	0.94, 0.84, 0.80	0.74	0.90	0.89
Self-determination with Technology (STE)	0.91, 0.93, 0.88	0.82	0.93	0.93
User Commitment (COM)	0.89, 0.89, 0.88, 0.91	0.80	0.94	0.92
IS infusion (INF)	0.88, 0.85, 0.87, 0.85	0.92	0.74	0.89

Table 1. Results of Convergent Validity Testing

Next we assessed the discriminant validity of the measurement model. As shown in Table 2, the square root of AVE for each construct exceeded the correlations between the construct and other constructs (off-diagonal terms). Hence, discriminant validity of the instrument was established. We further tested our data for common method variance using the Harman's single-factor test (Harman 1960), where the threat of common method bias is high if a single factor accounts for more than 50 percent of the variance. The test showed that common method bias is unlikely.

	Mean	S.D.	JFT	TEC	TAC	STA	STE	COM	INF
JFT	4.88	1.25	0.89						
TEC	4.97	0.98	0.36	0.92					
TAC	4.82	0.99	0.33	0.42	0.84				
STA	4.37	1.23	0.09	0.43	0.53	0.86			
STE	4.39	1.25	0.31	0.66	0.30	0.45	0.91		

COM	4.70	1.27	0.71	0.56	0.38	0.23	0.42	0.89	
INF	4.40	1.14	0.57	0.65	0.33	0.28	0.55	0.70	0.86

Table 2 Correlations between Latent Variables

Note: Leading diagonal in bold font shows the squared root of AVE of each construct

5. 2 Hypothesis Testing

We tested the hypotheses by applying the bootstrapping re-sampling technique. Figure 2 shows the results of the structural model. User commitment has a significant effect on IS infusion (H1), explaining 52 percent of its variance. Job fit (H2), technology competence (H3), and self-determination with task (H6) have significant effects on user commitment, explaining 65 percent of its variance. However, we could not find significant effects of task competence (H4) and self-determination with technology (H5) on user commitment. We further tested for multicollinearity among constructs. In all cases, the variance inflation factor was below 10 and condition index was less than 30, indicating that multicollinearity is not likely to distort testing results in our study (Hair et al. 1998).

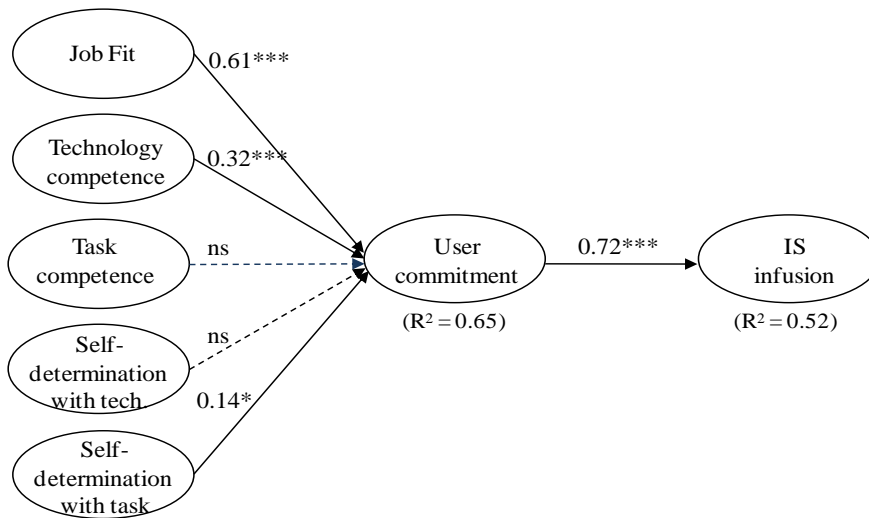


Figure 2. Structural Model Testing Results (*: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$, ns: insignificant at the 0.05 level)

We further conducted a post-hoc analysis to check the mediating effect of user commitment on the relationships between the STS design factors and IS infusion. We tested the main effects of the five STS design factors on IS infusion in Model 1. We then tested the main effects of the job design factors and the mediator, user commitment, on IS infusion in Model 2. After adding the mediator, the path coefficients of job fit and technology competence were still significant. The path coefficients of them, however, were reduced after adding the mediator, which explains the partial mediation effect of user commitment for job fit and technology competence. We further conducted Sobel tests to examine the significant level of mediation effects (Sobel 1982). Regarding job fit, its decrease in path coefficient from Model 1 (0.37) to Model 2 (0.13) was significant at the 0.001 level ($z = 4.94$). Regarding technology competence, its decrease in path coefficient from Model 1 (0.42) to Model 2 (0.29) was significant at the 0.001 level ($z = 3.58$). This study, however, did not find any directly significant effect of the other two STS design factors, task competence and self-determination with task, on IS infusion. Although we could not find a significant relationship between self-determination with technology and user commitment, the post-hoc analysis shows the direct significant effect of self-determination with technology on IS infusion.

6. DISCUSSION AND IMPLICATIONS

6.1 Discussion of Findings

This research has several salient findings. One key finding in this study is the significant role and effect of user commitment in explaining IS infusion. User commitment as a psychological attachment to the use of IS in performing tasks had a positive effect on IS infusion, using the system to its full potential beyond the mandated usage, as a type of OCB. This finding is in line with previous research explaining commitment as a key antecedent of OCB (Meyer and Allen 1991; Morrison 1994; Pare and Tremblay 2007). User commitment as a heightened motivation state inspires employees to go beyond the mandated use of IS to further exploit the full potential of the system, i.e., using more of the system features and using the system more innovatively. Motivated employees with user commitment thus perform not only intra-role behaviors (i.e., customary use of IS) but also extra-role behaviors volitionally in the use of IS.

The other key finding is the identification of antecedents of user commitment. In particular, this study found the antecedents of user commitment from the STS design perspective. The survey results explain that three STS design factors (job fit, technology competence, and self-determination with task) have significant effects on user commitment. This finding is in line with the theoretical argument of previous research (Hackman and Oldham 1976). The effect of job fit on user commitment in this study is similar to the effect of job fit on organizational commitment (Speier and Venkatesh 2002) and the relationship between perceived usefulness and commitment to system use (Malhotra and Galletta 2005). The effect of technology competence on commitment in this study is similar to the effect of ability on user commitment (Chang et al. 2010). The effect of self-determination with task on user commitment is in line with the theoretical argument of Deci and Ryan (1987); self-determination in performing task motivates an individual's interest and involvement in performing the target task. Because IS usage is essential for performing tasks, self-determination with task motivates an individual's interest and involvement in using the target system.

However, this study did not find a significant effect of self-determination with technology on user commitment. A post-hoc analysis showed a significant direct effect of self-determination with technology on IS infusion, but did not find a significant direct relationship between self-determination with task and IS infusion. This explains the importance of task-related authority in developing user commitment and the importance of technology-related authority in enhancing IS infusion. This study did not find a significant relationship between task competence and user commitment. In the context of enterprise system where tasks and the system are integrated, an individual with high level of task competence is more likely to have high level of technology competence. Task competence could thus increase technology competence. Therefore, there may be a mediating effect of technology competence on the relationship between task competence and user commitment. A post-hoc analysis showed a significant effect of task competence on technology competence (path coefficient = 0.44, $p < 0.001$). The findings thus explain that the importance of task authority and technology competence as well as job fit in directly and indirectly promoting user commitment.

6.2 Limitation and Future Research

The results of this study should be interpreted in the context of its limitations. First, the data for this study was collected from a single organization with a particular enterprise system. It would be useful to replicate this study across other enterprise systems in organizations in different sectors to establish the robustness of the results. Second, this study adopted a cross-sectional approach in data collection and analysis. Future research could adopt a longitudinal approach to investigate the development of user commitment and its effect on IS infusion. Third, this study adopted IS infusion as a single dimensional construct. Saga and Zmud (1994) explained there are three subtypes of IS infusion: extended use, emergent use, and integrative use. No research, however, has tested the validity of the concept concerning the true nature of IS infusion. Future research needs to examine the nature of IS infusion, i.e., its subtypes. This study also conceptualized user commitment as an affective commitment. There are three subtypes of commitment: affective commitment, normative commitment, and continuance commitment (Meyer and Allen 1991). Future studies could conceptualize IS infusion and commitment as multidimensional constructs and examine in-depth effects of multiple dimensions of commitment on subtypes of IS infusion. Finally, future studies could examine the effects of job design factors on the subtypes of user commitment. Future studies also could identify other

antecedents of user commitment although the current study considered only job design factors based on the STS design.

6.3 Implications for Research

This study offers several implications for research. First, it has a key theoretical implication in terms of the application of commitment theory in examining IS infusion. Previous research examined IS infusion based on the background theories used for explaining technology adoption (Jones et al. 2002; Saeed and Abdinnour-Helm 2008) or IS continuance (Hsieh and Wang 2007; Wang and Hsieh 2006) and found several significant antecedents such as satisfaction (Wang and Hsieh 2006), perceived usefulness (Hsieh and Wang 2007; Saeed and Abdinnour-Helm 2008; Wang and Hsieh 2006), personal innovativeness (Jones et al. 2002), attitude (Jones et al. 2002), and facilitating condition (Jones et al. 2002). Using the system to its full potential (i.e., IS infusion) requires IS use beyond the prescribed or mandated usage. Because OCB requires extra-role behaviors as well as intra-role behaviors, IS infusion is a type of OCB. In contrast, IS adoption and continuance do not necessarily require extra-role behaviors. Because they do not require IS usage beyond the mandated usage, IS adoption and continuance are not a type of OCB. For this reason, there is a limitation in explaining IS infusion based on the theoretical lenses used for technology adoption and IS continuance.

OCB can be caused by commitment (Meyer and Allen 1991; Morrison 1994; Pare and Tremblay 2007). The main contribution of this study is thus the application of commitment theory in examining IS infusion as a type of OCB. We have further proposed user commitment (i.e., affective commitment) as a main antecedent of IS infusion because continuance commitment and normative commitment have weak or insignificant effects on OCB (Meyer et al. 2002; Morrison 1994). Our findings explain that user commitment as a psychological attachment to the use of IS in performing tasks increases IS infusion. While previous research on IS infusion found some antecedents of IS infusion including attitude, no research has considered psychological attachment or commitment to the use of IS.

This study has another contribution in examining user commitment from the STS design perspective. Job design has been a key approach used in promoting employees' psychological state (Hackman and Oldham 1976). Because of user commitment regarding the use of IS in performing tasks, job design should consider not only task but also technology elements. We have thus adopted the STS for job design and then examined the effect of the STS design on user commitment. We have identified five constructs representing the STS design and examined their effects on user commitment. While there has been little research on examining the antecedents of user commitment, we have found three significant antecedents (job fit, technology competence, and self-determination with task) in the context of enterprise system usage.

This study has another theoretical implication in terms of the application of STS. The STS is based on Levitt's organization model (Levitt 1968) which explains that an organization consists of four main elements: task, people, structure, and technology. By separating the organization model (Levitt 1968) into two subsystems (i.e., a social subsystem with people and structure and a technical subsystem with technology and tasks), Bostrom and Heinen (1977) highlighted the importance of joint interaction between the two subsystems in producing better results of the work system, especially in the context of IS. The key implication of the STS is thus the management of joint interactions among elements. However there has been little research on the use of STS in job design and testing the effects of interactions on user behavior in the IS literature. This study thus has a contribution in the application of the STS, especially the interactions among elements, in examining user behavior. In summary, this study proposes and validates a new model for commitment and IS infusion based on the application of commitment theory and the STS.

6.4 Implications for Practice

The results of this study offer suggestions to management about how to improve IS infusion in terms of user commitment and consequently about how to develop user commitment based on the STS design. First, management should be aware of the critical effect of user commitment on IS infusion. Many IS development projects tend to focus on finishing the project by developing easy to use and

useful system. Development of such a system, however, does not guarantee the full utilization of the system by users (Malhotra and Galletta 2004). Using the system to its full potential requires employees to use the system beyond the prescribed and regular use of the system. This study explains that user commitment is essential for IS infusion. Management therefore should put efforts on developing user commitment.

Second, management should be aware of the effect of the STS design on user commitment. This study explains that the three STS design factors (job fit, technical competence, and self-determination with task) are essential for the development of user commitment. Job fit represents the joint interaction between task and technology. Management should therefore enhance the fit between organizational tasks, people and IS during the IS development project or even after the development. The project team also needs to collect and analyze user requirements and preference for task specifications and reflect them correctly in the system design.

Technical competence represents the interaction between people and technology. Management should enhance the fit between them, i.e., users' technical skills in using the system. Ways to improve employees' knowledge, skills and confidence include training, participation in system acquisition, and increased exposure (Saga and Zmud 1994). Educational efforts can also inform employees throughout the organization about the potential applications of technology to achieve better performance and consequence. Many IS development project teams tend to provide system very specific training to users when the new system was put into operation. However, to encourage fuller utilization of technology, more general and advanced training should be provided.

Self-determination with task represents the interaction among people, structure, and task. Management should provide authority for users in regulating and performing tasks. Many IS development projects do not consider such task authority issues. This study, however, explains that task authority design is important for enhancing user commitment and then IS infusion. The development project team should therefore collaborate with the management team for the task authority design during the system development project.

The post-hoc analysis further shows the critical impact of self-determination with technology on IS infusion. An individual user's authority in using and regulating the system is essential for IS infusion. The project development team should therefore design technology authority for each user during the project. To reduce ambiguity and increase self-determination at work including both task and technology, organizations should have clear yet slightly flexible structure that informs employees of their authority. A clear organization structure in terms of authority reduces role ambiguity and increase employees' senses of responsibility and confidence in their work whereas some flexibility allows employees the freedom to utilize their creativity in work enhancement. It clearly empowers employees and contributes to enhanced use of IS.

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Appendix. Measurement Instrument

Construct	Item	Wording	Reference
Job Fit (JFT)	JFT1	Use of the system can decrease the time needed for my important job responsibilities	Thompson et al. (1991)
	JFT2	Use of the system can significantly increase the quality of output of my job	
	JFT3	Use of the system can increase the effectiveness of performing my job tasks	
	JFT4	Use of the system can increase the productivity in my job for the same amount of effort	
	JFT5	Considering all tasks, the general extent to which use of the system could assist on my job is very high.	
Technology Competence (TEC)	TEC1	I have complete knowledge for using the system	Spreitzer (1995), Stone and Stone (1984)
	TEC2	I am very capable in using the system	
	TEC3	I have mastered the skills necessary for using the system	
	TEC4	I am confident about my ability to use the system	
	TEC5	I am self-assured about my capabilities to use the system	
Task Competence (TAC)	TAC1	I have complete knowledge for performing my tasks	Spreitzer (1995), Stone and Stone (1984)
	TAC2	I am very capable in performing my tasks	
	TAC3	I have mastered the skills necessary for performing my tasks	
	TAC4	I am confident about my ability to perform tasks	
	TAC5	I am self-assured about my capabilities to perform tasks	
Self-determination with Task (STA)	STA1	I can decide on my own how to go about doing my tasks	Spreitzer (1995)
	STA2	I have significant autonomy in determining how to perform my tasks	
	STA3	I have considerable opportunity for independence in how I perform my tasks	
Self-determination with Technology (STE)	STE1	I can decide on my own how to use the system	Spreitzer (1995)
	STE2	I have significant autonomy in determining how to use the system	
	STE3	I have considerable opportunity for independence in how I use the system	
User Commitment (COM)	COM1	I am enthusiastic about using the system in my tasks	Allen and Meyer (1990), Meyer et al. (1993)
	COM2	I am very happy to use the system in my tasks	
	COM3	I feel emotionally attached to the system usage in performing tasks	
	COM4	System usage in performing my tasks has a great deal of personal meaning for me	
IS Infusion (INF)	INF1	I make the best use of the system to support my tasks	Jones et al. (2002)
	INF2	I use the system to its fullest potential in performing my tasks	
	INF3	I use all capabilities of the system in best fashion to complete my tasks	
	INF4	I doubt that there are any better ways for me to use the system in performing my tasks	