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Antecedents and Effects of Information Technology Use in Emergent Knowledge Process

By

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An Abstract of

Antecedents and Effects of Information Technology Use in Emergent Knowledge Processes

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Technology advancement and global competition have driven the pace of the business environment change. Inevitably knowledge workers have to make the business decisions or design products/services under emerging and situated context. Markus et al. (2002) describe Emergent knowledge processes (EKPs) are organizational activities that exhibit three characteristics in combination: (1) deliberations with no best structure or sequence, (2) knowledge requirements include both general and tacit knowledge distributed across experts and non-experts, and (3) highly unpredictable actor set in term of job role or prior knowledge. Unlike in stable business process, knowledge workers in EKPs have to rely on more information technology to collaborate with other actors to solve

problem and make decision for unexpected situations. However, the knowledge work outcomes, such as new idea, new interpretation, new processes, and productivity, can either be enhanced or constrained by how knowledge workers use information technology.

This research proposes a causal model that suggests different factors, such as personal interpretative styles (Thomas and Velthouse, 1990), communities of practice (Brown and Duguid, 1991), and interpretative flexibility (Orlikowski, 1992), will influence user empowerment, which is an integrative motivational concept based on different cognitive task assessments emerging from the interaction of people, process and technology in virtual work (Doll et al. 2004). In turn, user empowerment will affect the enactment of technology use for problem solving, decision support, collaboration, and system reconfiguration. Consequently, the enacted technology use will change the knowledge work outcomes, i.e. the frequency of generating new ideas, new interpretations, new processes, and new artifacts as well as increasing productivity.

Structural equation model based on the sample of 211 knowledge workers support that (1) personal interpretive styles and interpretive flexibility of technology have direct positive effects on user empowerment and have positive indirect effects on enacted system use and knowledge work outcomes; (2) user empowerment has direct positive effect on enacted system use and indirect positive effect on knowledge work outcomes; and (3) enacted system use has positive effects on knowledge work outcomes. However, communities of practice have no significant effect on user empowerment.

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Chapter 1: Introduction

As the business evolution continues, firms are shifting form industrial systems driven by efficiency to post-industrial systems driven by quick response to customer demand for high product variety (Skinner, 1985; Doll and Vonderembse 1991). With the increasing global competition, accelerating technology change, and growing customer expectation, the great challenges any business can face is how to deal with the unexpected. And managing unexpected is about alertness, sense making, updating, and staying in motion (Weick and Sutcliffe, 2001, p. 35). Technology that supports managing the unexpected has to be significantly different from the technology that supports managing the efficiency.

The properties of technology in industrial era are deterministic, mechanized, and physical, whereas in postindustrial era are stochastic, continuous, and abstract (Weick, 1990). In other words, the environment that technology is operated in is shifting from predictable to unpredictable. The emphasis of technology is shifting form efficiency to flexibility. Managers and workers experience more cognitive demands, more problem solving and decision making. The conceptualizations of technology in industrial era are structure, analysis, static, and behavior and output control, while, in postindustrial era are structuration, affect, dynamic interactive complexity, and premise control (delegation). In this notion, human actors are the important part in the use of technology. They determine how technology is used and designed, and further shape the structure of technology.

Inevitably, knowledge workers have to rely on the technology to solve problems, to make decisions, and to collaborate in the emergent and situated context. Emergent knowledge processes (EKPs) have been described by Markus et al. (2002) as organizational activities that exhibit three characteristics in combination: (1) deliberations with no best structure or sequence, (2) knowledge requirements include both general and tacit knowledge distributed across experts and non-experts, and (3) highly unpredictable actor set in term of job role or prior knowledge. To better manage the emergent knowledge process, the study of the interaction of knowledge workers and technology is essential.

1.1. Research Questions

Acknowledging the phenomenon of emergent knowledge process, researchers and business managers may raise the following questions: how do knowledge workers use information technology in the context of emergent knowledge process, what are the benefits of using information technology in the emergent and situated context, and what are the factors that affect knowledge workers using information technology? The current study attempts to answer these questions by conducting a large scale empirical investigation to identify the antecedents and consequences of information technology use by knowledge workers.

The objectives of this research are to identify: (1) how individual interpretive styles, the communities of practice, and interpretative flexibility of technology empower knowledge workers to use information technology, (2) how user empowerment affects enacted information technology use for decision support/problem solving, collaboration, and system reconfiguration, and (3) how the enacted information technology use influences the knowledge work outcomes.

Accomplishing above research objectives will help providing guidelines and frameworks for IS designers to incorporate the attributes that enhance user empowerment into system design, for the manufacturing companies to enhance organizational design to empower IT users for more innovative and productive knowledge work outcomes, and for the research communities to accumulate more knowledge toward the IS success theory.

1.2. Emergent Virtual Work Environment

Diffusion of communication and computing technologies has driven organizations to conduct business in new ways. The e-mail/internet/intranet infrastructure combined with powerful database software and groupware has made it possible to increase the span of communication. Ideas, experiences, and problems can be communicated and shared much more quickly, more widely, and more often less expensively than ever before (Hackett, 2000). Advanced technologies have driven the change of the interaction patterns among the different entities in the value chain constantly, such as relationships with customer and suppliers. Firms have to not only operate as adaptive systems, but also anticipate changes under the new set of market conditions.

New forms of technology certainly change the ways people work as well as the types of skills and behaviors required for improving productivity. People now can communicate any time, almost anywhere, and at relative low cost. With the information communication technology prevailing, the nature of the work has been transformed from physical (traditional) to digital (virtual). Most organizations went through business process reengineering to embed their work processes, organization objectives, and commitments into information technology. The concept of virtual implies permeable interfaces and boundaries of organizations; project teams that rapidly form, reorganize, and dissolve when the needs of a dynamic market change; and individuals with different competencies who are located across time, space, and culture (Mowshowitz, 1997; DeSanctis and Monge, 1999).

Contrast to the traditional work environment which builds on the employee's sensation of the physical artifacts, in the virtual work environment, the work is more abstract (Zuboff, 1982). As work becomes digitized, information technology has enhanced individual worker's capability to access and process information. While individual workers focus on their job in the "virtual" world, they also lose the opportunities to interact with physical world including people and objects. They may feel isolated and impersonal, and further endanger their work identity.

The term "virtual" has been use to described varieties of emergent work forms that are different from traditional work on different dimensions, such as the location of the workers, where and how work is accomplished, and the basis for relationship between workers and organizations (Wstson-Mahheim et al., 2002). To apply concept of "virtual" to a border context, a working setting can be described as virtual when the tasks are mostly performed via computer with simulated images rather than exchange physical materials through physical processes.

The researchers of virtual organization and virtual teams emphasize the characteristics of virtual work environment as work forces are geographically distributed and electronic linked (Majchrzak et al, 2004; Martins et al., 2004; DeSanctis and Monge, 1999; Mowshowitz, 1997; Fulk and DeSanctis, 1995; Davenport and Pearlson, 1998). As the increasing numbers of organizations go through acquisition, merge, and outsourcing, the advance of information technology has made the intra- and inter-collaboration possible. Consequently, the organizational boundary becomes blurred and the task becomes more interdependent. Virtual work environment can also be characterized as "lack of physical proximity" (Alexander, 1997) or a "workplace without wall" (Finholt, 1997).

Among the researches of virtual environment, communication pattern is a main research focus (Martins et al., 2004; Leenders et al., 2003; DeSatnctis and

Monge, 1999; Ahuja and Carley, 1999; Kraut et al., 1999; Fritz et al., 1998; Lea et al., 1995). In the virtual environment, the communication is expected to be fast and customized to respond to the external environment changes. Thus, the communication content and direction tend to be more temporary as the links between individual workers formed and dissolved overtime. To an extent, lateral relationship in the virtual form substitutes for the traditional hierarchical channel to make communication more efficient (DeSatnctis and Monge, 1999).

Current study extends the view of the virtual work environment of previous researches and contends that individual workers are engaging in the virtual works as long as the work processes are embedded in the technologies and they are electronic linked to their coworkers or communities of practice. Whether the individual workers are geographically distributed, they are using the same types of information and communication technology. A team can work "virtually" even when team members work in the same building, one the same floor and in the same room (Arnison and Miller, 2002). From this wider view, the virtual work environment has the following characteristics: work process embedded in technology, more lateral communication, less physical location constraints, increasingly use electronic means as a way of communication, and more coordination.

The transformation from traditional to virtual work environment has two implications. On the positive side, information technologies enhance organization's capability to respond to the dynamic business environment more quickly, to use resource more efficiently, and to reconfigure its workforces more easily. However, new form of organization also has its dark side. Without the proper work design, individual workers may feel low commitment, role overload, and role ambiguity that may lead to identity crisis and lack of trust to their coworkers.

1.3. Challenges of Information Technology Use in Virtual Works

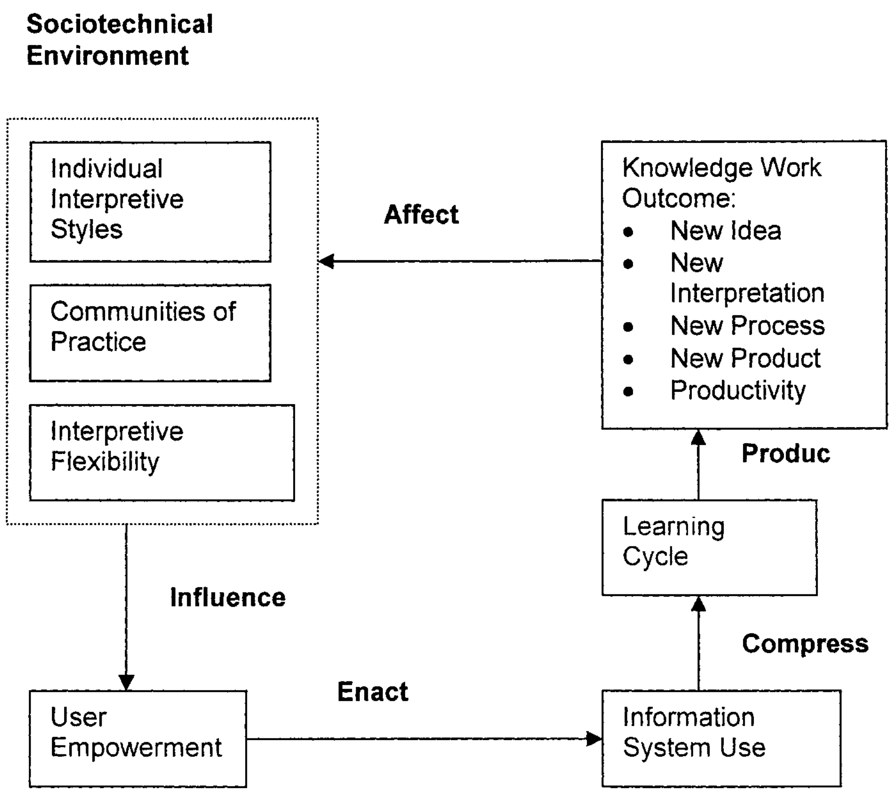
To cope with the challenges of the virtual woks in emergent knowledge process, knowledge workers have to become active learners in their organization. To "learn" means to enhance capacity through experience gained by following a track or discipline. Learning always occurs over time and in "real life" contexts, not in classroom or training sessions (Senge et al., 1999). Knowledge workers have to actively learn how to use information technology in a specific context to solve problems, support decision making, and collaborate with other members in the communities of practice.

Information technology used to be considered as a magic bullet for organizational change. Organizations believe by implementing new information technology, people would just change their old behavior and work productively. In the view of the magic bullet theory, IT designers are the tool builders, who build the guns that fire the magic bullets. And magic bullets always hit the right targets. Markus and Benjamin (1997) point out the fallacy of this magic bullet theory and suggest that IT enables change instead creates change. After all, people, not technologies, initiate organizational change. IT plays a facilitating role to make people empowered to create change by providing the connectivity and valid information. However, empowerment is a state of mind that people must enter on his own.

In the emergent knowledge process, knowledge workers have to engage nonstop learning from the working experience of themselves and others to solve business problems in a context sensitive situation. The higher level of user empowerment will enable knowledge workers to continue using information technology for problem solving, decision making, collaboration, and technology reconfiguration to redesign or improve work process by generating new ideas, new interpretations, new processes, and new artifacts, and increasing productivity.

Current study intends to integrate different theories including technology sturcuration theory, empowerment theory, situated learning theory, and IS success theory, and to view the technology use as an essential part of the learning cycle. When users are empowered to use IT for their work, their learning cycle will be compressed. It will take less time to accomplish the expected and unexpected outcomes such as new ideas, new interpretation, new processes, and new products, and to improve knowledge-work productivity. These knowledge work outcomes are the foundation for organizations to gain competitive advantages in an equivocal business environment. As knowledge workers have satisfied experience in the knowledge work outcomes, the results would affect how individual interprets external events, interacts with others in communities of practice, and further reconfigures information system for more effective use of technology. Figure 1 illustrates process of the preconditions and the consequences of technology use in emergent virtual work.

Figure 1.1: Preconditions and Consequences of Technology Use in the Emergent Virtual Work.



Chapter 2: Theory and Hypotheses Development

The technology use in emergent knowledge process (EKP) is different from the technology use in the traditional environment. In the knowledge emergent process, information technology needs to provide the fast and efficient communications that bridge time and space; information repository or organizational memory for all members; and mechanism in which members can share and update their solution of problems dynamically (Goodman and Darr, 1998). While in the stable environment, the emphasis of information technology use is to improve efficiency of business operations. In EKPs, the use of information technology has to be able to facilitate individual learning and further support the community of knowing (Orlikowski, 2002). The following sections review the theories that provide the different perspective of information technology use. Next, a research model that grounded on the reviewed theories is proposed and hypotheses are developed.

2.1. Structuration Theory and Technology Use

DeSanctis and Poole (1994) propose adaptive structuration theory (AST) as a framework for studying variations in organization change that occur as advanced information technologies are used. The central concepts of AST, structuration and appropriation, provide a dynamic picture of the process by which people incorporate advanced technologies into their work practices. According to AST, adaptation of technology structures by organizational actors is key factor in organizational change.

AST views advance information technology as a social structure that enable and constrain interaction among organizational actors in their workplace. The social structures provided by advanced information technology can be described in terms of the structural features and spirits of a given technology. Structural features are the specific type of rules and resources, or capabilities offered by the system. The restrictiveness of the feature sets of a technology can limit the possible actions that users can take to apply the structural features. Spirit is the general intent that regards the value and goal underlying a given set of structural features. Typically, spirit provides the normative frame to guide user's behaviors that are appropriate in the context of the technology.

DeSanctics and Poole (1994) describe structuration is the act of bring the rules and resources from an advanced information technology, such as group decision support systems, or other structural source into action. Thus, structuration is the process of use and reuse of technology structures. Over time the act of use and reuse of technologies become institutionalized and lead to organizational change. In AST, they propose that group decision process will vary depending on the nature of advanced information technology appropriation. The nature of appropriation includes appropriation moves, faithfulness of appropriation, instrumental uses, and persistent attitudes toward appropriation.

The dimensions of decision processes consist of idea generation, participation, conflict management, influence behavior, and task management.

Based on Giddens' theory of structuration (1984), Orlikowski (1992) proposed technology structuation model to explain the technology structure as the process of interactions among institutional properties, technology, and human agent. The structuration model of technology consists of three components: (1) human agents including technology designers, users, and decision makers, (2) technology consisting of material artifacts mediating task execution in the workplace, and (3) institutional properties of organization including organizational dimensions such as structural arrangement, business strategy, ideology, culture, control mechanism, standard operating procedures, expertise, communication patterns, environment pressures, professional norms, state of knowledge about technology, and socio-economic condition.

There are two premises of technology structuration theory: duality and interpretative flexibility of technology. Technology is created and modified by human actions, yet it is also used by human to accomplish some action. This recursive notion of technology is the duality of technology. The term interpretive flexibility refers to the degree to which users of a technology are engaged in its constitution (physically and/or socially) during development or use. Interpretive flexibility is an attribute between human and technology and hence it influenced by characteristics of material artifact, human agents, and context.

According to technology structuration theory, interpretive flexibility of technology operates in two modes: designer mode and user mode. In designer mode, human agents design the technology by embedding certain interpretive schemes, resources and norms. In the user mode, human agents appropriate technology by assigning shared meaning to the interpretive schemes, resources and norms that embedded into the technology to perform their tasks. However users can choose not to utilize technology or choose to modify their engagement with technology to fit their local situation.

In most cases, the constitution of technology occurred in the vendor sites that are often separated from the customer sites in which technology was used and appropriated. Recognizing the time-space discontinuity of the design and use of technology, Orlikowski (1992, 2000) suggests that technology structure is repeatedly constructed socially and physically through the interactions between human agent and technology. Being influenced by numbers of individual and social factors, users interpret, appropriate, and manipulate technology in various ways to fit their working environment. Through this interpretive flexibility of technology, the designer mode and user mode are not completely separated; users can shape the technology they use and further modify the effects of existing technology.

2.2. Empowerment Theory

Conger and Kanungo (1988) defined empowerment as a process of enhancing feelings of self-efficacy among organizational members through identification of conditions that foster powerlessness. These conditions can be removed by both formal organizational practices and informal techniques that provide efficiency information. In this definition, individuals feel empowered when their self-efficacy is enhanced. Bandura (1977) identified four sources of efficacy information: performance accomplishments, vicarious experience, verbal persuasion, and emotional arousal. In the organization setting, individuals build their self-efficacy through their job experiences. The successful job experiences make one feel more capable and therefore empowered. The individuals' empowered feeling can also come form the vicarious experiences by observing co-workers successfully perform the similar jobs. Words of encouragement, verbal feedback, and other forms of social persuasion from one's supervisor and co-workers will reduce self-doubts and therefore enhance one's self-efficacy. Individuals' self-efficacy is also affected by their emotional arousal states that result from stress, fear, anxiety, and depression. Formal or informal support systems will assist the empowering process by reducing the negative effects of adverse arousal state and enhance belief of self-efficacy.

Thomas & Velthouse (1990) viewed the empowerment as increased intrinsic task motivation. Intrinsic task motivation involves positively valued experience that individuals derived directly from a task. In their cognitive model of empowerment, task assessments consist of four cognitive components: impact, competence, meaningfulness, and choices. *Impact* refers to the degree to which behavior is seen as "making a difference" in term of accomplishing the purpose of the task. *Competence* refers to the degree to which a person can perform task activities skillfully when he or she tries. *Meaningfulness* concerns the value of the task goal or purpose, judged in relation to the individual's own ideals or standards. *Choice* involves causal responsibilities for a person's actions. Perceived choice produces greater flexibility, creativity, initiative, resiliency, and self-regulation.

Empowerment is a multifaceted construct and its essence can not be captured by a single concept (Thomas & Velthouse, 1990; Spreitzer, 1995). Spreitzer (1995) developed a measurement model and suggested that psychological empowerment is a second order construct that is reflected on the four first order constructs: meaning, competence, self-determination, and impact. The measurement model of psychological empowerment was validated with sufficient convergent and dircirminant validity.

Doll et al. (2004) describe user empowerment as a set of motivating cognitive task assessments that emerge as active human agents engage in virtual work. The difference between the psychological empowerment and user empowerment is that psychological empowerment is based on cognitive task assessment of a work process and user empowerment is based on cognitive task assessment of an enactment. Here, enactment process is the interaction among people, technology, and work process. Doll et al. (2004) apply psychological empowerment in the context of computer mediated work and develop a measurement model of *user empowerment* that comprises four dimensions: user autonomy, self-efficacy, intrinsic motivation, and perceived impact. *User autonomy* is defined as the degree of choice individuals have in enacting how they use the computer in their virtual work (Doll et al. 2004). Derived from the concept of computer self-efficacy which is a belief that one can be successful in performing a specific computer-mediated task (Compeau and Higgins 1995), *self-efficacy* in the user empowerment is defined as a belief that one can be successful in enacting how technology is used in virtual knowledge work. *Intrinsic motivation* is the pleasure or inherent satisfaction derived from using the computer to perform knowledge work (Doll et al. 2004). *Perceived impact* (Torkzadeh and Doll 1999) is defined in terms of the perceived consequences (impacts) of using the computer application.

2.3. Communities of Practice and Situated Learning

The core concept of communities of practice is rooted on the relationship between work practice and learning. Instead of viewing learning as a process of knowledge transfer, Brown and Duguid (1991) suggest that practice is central to understand work. "Learning-in-working" best represent the fluid evolution of learning through practice.

Based on Orr's ethnographic studies, Brown and Duguid (1991) categorize three central features of work practices: narration, collaboration, and social construction. The first feature, *Narration*, refers to the story telling aspect of work practice. Through story telling, workers can exchange stories that help them diagnose their work problems. In addition, stories act as repositories of accumulated wisdom that guides the work practices and as sources for the improvisation to be developed. The second feature, *collaboration*, is built on the base of the feature of narration. The act of story telling is mutual and thereby collaborative. When workers try what they know for their work problems and fail, they know they reach the limit. With the other workers, they can trade stories, develop insights, and construct new options. Thus, individual learning can not be separated from collective learning. The emphasis of this feature is the supports of the communities foster individual learning. The third feature, *social construction*, refers to the construction of shared understanding among the workers. Workers construct shared understanding by sharing their stories and sorting out confused data. This constructed understanding reflects the workers' view of the world. Through the process of constructing shared understanding, workers construct and develop work identity and community in which they work. Because of the nature of work practice, learning can not be isolated from practice. Workers form communities of practice to exchange stories, collaborate, and build shared understanding so that they can learn collectively for their emergent situation or problems.

Situated learning theory (Lave and Wenger, 1991) proposes that learning is located or "situated" within every day practices. The premise of situated learning theory is to focus attention directly upon learning as pervasive, embodied activity involving the acquisition, maintenance, and transformation of knowledge through processes of social interaction. There are several implications of situated learning. First, knowledge is viewed as emergent and distributed, and is residing in people, practices, artifacts, and symbols. Second, learning is viewed as occurring in the context of work practice that requires the interactions among actors. Third, the action of learning involves the combination of resources and knowledge distributed across multiple individuals and roles (Nidumolu et al, 2001).

From the view of situated learning theory, learning occurs as individuals become members of the "communities" in which they are acculturated as they participated actively in the diffusion, reproduction, and transformation of knowledge-in-practice about agents, activities, and artifacts (Contu and Willmott, 2003). Individuals have the chance of becoming part of communities of practice by observing "old-timers" and experts doing their job, and by interacting physically and verbally with them. Being able to participate in the community of practice is important for individuals to learn and build their identity through the interaction with others in the community.

Wenger (1998) proposes there are three sources that keep coherence of communities of practice: mutual engagement, joint enterprise, and shared repertoire. *Mutual engagement* is the first source that maintains the coherence of a community. Although practice may involve different kinds of artifacts, practice doesn't reside in artifacts. Instead, practice exists in the action that people negotiate meaning with one another. Thus, practice resides in a community of people and relations of mutual engagement by which they can do whatever they want. For an individual to enable the mutual engagement, he/she has to be included in the community of practice. Membership is essential for defining the community. The second source that holds a community together is the process of negotiating *joint enterprise.* The enterprise of a community of practice is not fixed or just a statement of purpose. Instead, it is dynamic and complex. Because members produce a practice to deal with what they understand as their enterprise, their practice as it unfolds becomes part of their community. Negotiating a joint enterprise gives rise to relations of accountability among those involved. These relations of accountability foster the shared understanding of what to do and what not to do. The third source that keeps a community coherent is the development of shared repertoire. The repertoire of a community of practice could be routines, words, tools, ways of doing things, stories, symbols, actions, and etc. The shared repertoire, on one hand, reflects a history of mutual engagement, on the other hand, remains inherently ambiguous.

2.4. System Success Theory

Information system success has been a main research area for IS researchers. Many researchers devote their efforts to search measurements for IS success (Doll and Torkzadeh, 1988; Davis, 1989; Straub et al., 1995; Doll and Torkzadeh, 1998 ; Torkzadeh and Doll, 1999). In search of the dependent variables of information system success, DeLone and McLean (1992) identify six major dimensions of IS success: system quality, information quality, system use, user satisfaction, individual impact, and organizational impact. In their information system success model, system quality and information quality affect user satisfaction and system use which in turn influence individual impact and further contribute to organizational impact.

Numerous empirical studies were conducted by different researchers to validate IS success model (DeLone and McLean, 2003). Empirical evidence supports the association between system use and individual impacts. System use was typically voluntary and was measured as frequency of use, time of use, number of access, usage pattern, and dependency. Individual impacts were measured in term of job performance and decision-making performance. Even though evidences from previous researches support the link between system use and individual impacts, one question remain is that “is the meaning of system use universal in different contexts?” For information systems designed for automating work processes, frequency of use and number of access may reflect IS success. However, for information systems designed for the problem solving, decision support, and collaboration, frequency of use and number of access may not capture the essence of IS success. Rather, it is the context that individual use information system for will lead to individual and organizational impacts. Thus, information system use can not be separated from the organizational context (Doll and Torkzadeh, 1998; Sharma and Yetton, 2003).

2.5. Research Model

To better understand information technology use in emergent knowledge process, a research model is developed based on a comprehensive review of literatures. The research model in Figure 2.1 intends to integrate technology structuration theory (Orlikowski, 1992, 2000; DeSanctis and Poole, 1994), empowerment theory (Thomas and Velthouse, 1990; Spreitzer 1995; Doll et al., 2004), theory of communities of practice (Brown and Duguid, 1991; Wenger, 1998), and system success theory (DeLone and McLean, 1992, 2003) to depict the antecedents and effects of information technology use.

The constructs included in the research model include: (1) *interpretive styles* which refers to the different interpretive process in which one interprets external events and forms one's cognition for task assessment; (2) *communities of practice* which refers to the communities that are formed formally or informally by a group of workers with common disciplinary background, similar work activities, and tools, and shared stories, context, and values;(3) *interpretive flexibility* which is the degree to which users believe that they are able to constitute and reconstitute technology (physically and/or socially) during development or use; (4) *user empowerment* which is integrative motivational concept that reflecting an individual's orientation to his/her use of computer application for a specific task; (5) *enacted system use* which refers to user's behavior of the ongoing information system use or modifying existing information system use for his/her work; and (6) *knowledge work outcomes* which refer to the knowledge productions and enhanced productivity result from the information system use.

Figure 2.1 Research Model

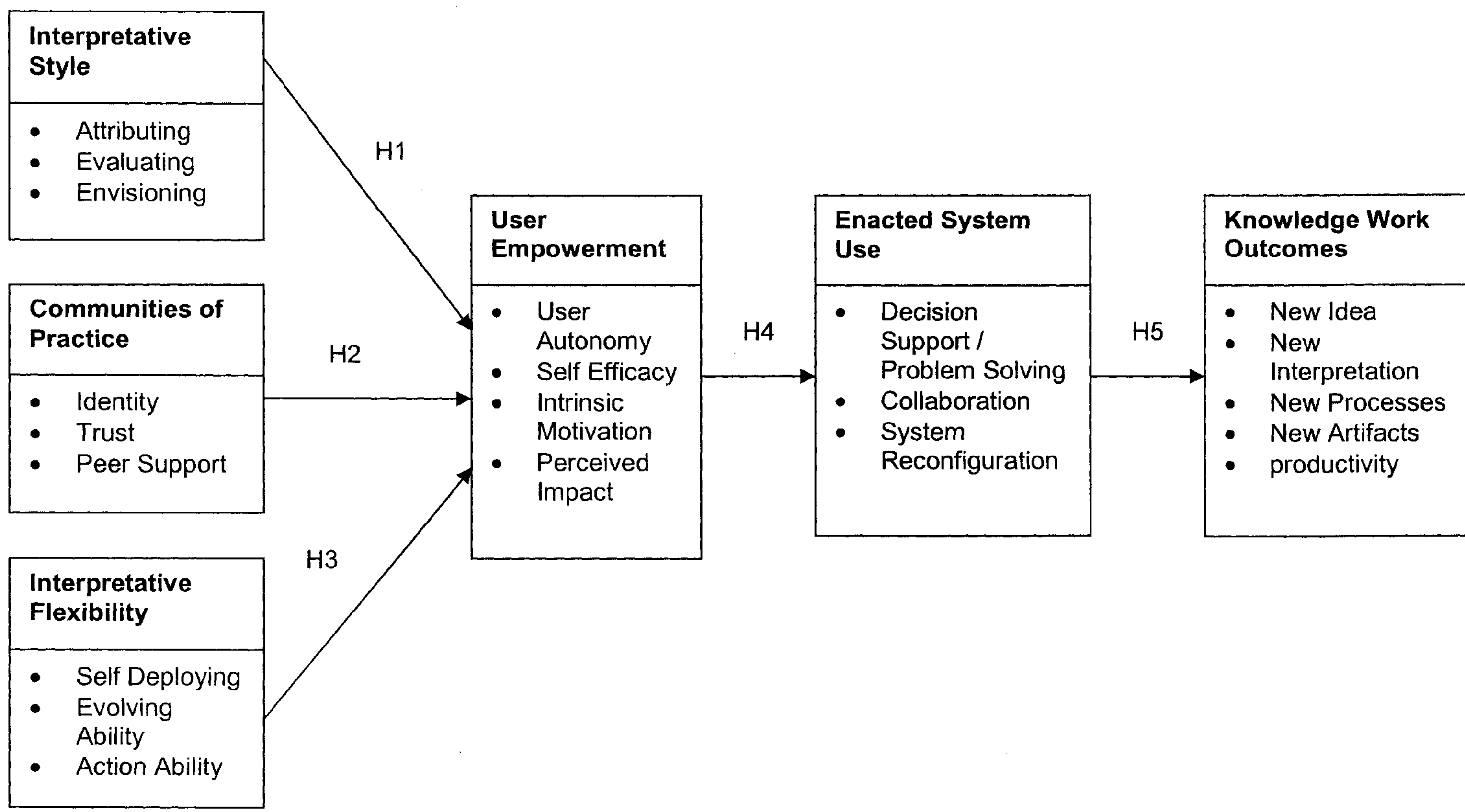


Table 2.1 Construct Definitions and Literature Basis

Construct	Definition	Literature
Interpretive Styles	It refers to the different types of interpretive processes in which one reviews the information from external events and forms one's cognition for task assessments.	Ambramson et al., (1978); Peterson et al.(1982); Harrison, (1983); Dweck, (1986); Thomas and Velthouse, (1990); Bennett et al., (1994)
Communities of practice	It refers to the communities that are formed formally or informally by a group of workers with common disciplinary background, similar work activities and tools, and shared stories, contexts, and values.	Brown and Duguid, (1991); Wenger (1998); Millen et al, (2002); Wenger and Snyder, (2000)
Interpretive Flexibility	The degree to which users believe that they are able to constitute and reconstitute technology (physically and/or socially) during development or use.	Orlikowski, (1992, 1995, 1996, 2000)
User Empowerment	It is an integrative motivational concept based on four cognitive task assessments reflecting an individual's orientation to his/her use of computer applications for a specific task.	Conger and Kanungo, (1988); Thomas and Velthouse, (1990); Spreitzer, (1995); Doll et al., (2004).
Enacted System Use	It refers to user's behavior of the ongoing information system use or modifying existing information system use for his/her work.	DeLone and McLean, (1992; 2003); Doll and Torkzadeh, (1998); Orlikowsi, (2000); Olikowski and Iacono, (2001)
Knowledge Work Outcome	It refers to the knowledge productions result from the information system use.	Cohen and Levinthal (1990); Nonaka (1994); Boland and Tenkasi (1995); Gaimon (1997); Moorman and Miner (1998); Drucker (1999); Miner et al. (2001); Davenport (2004)

The rationale underlying this research model can be described in the following aspects.

1) In knowledge emergent process, information system use would focus on the decision support, problem solving, and collaboration to produce knowledge works.

In the knowledge economy, the job functions of knowledge workers mostly involve knowledge manipulation and knowledge creation. As it described by Markus et al. (2002), emergent knowledge processes (EKPs) demonstrates three characteristics: deliberation with no best structure, knowledge requirements distributed across experts and non-experts, and highly unpredictable actor sets. To make the information use meaningful, information systems use has to tie to the organizational activities (Doll and Torkzadeh, 1998). In the context of EKPs, the major organizational activities to cope with emerging and situated work practices is to engage problems solving, decision making, and collaboration with others in the communities of knowing. Thus, information system use in problem solving, decision making, and collaboration reflects the success of system use in the context of EKPs. Based on the systems success theory (MeLone and McLean, 1992, 2003), successful system use will lead to positive individual impact. As knowledge becomes increasingly important assets of knowledge intensive firms, one major impact of knowledge workers is the knowledge production such as, new idea, new interpretation, new processes, and new artifacts. In addition to enhancing the opportunities of improvisation for knowledge works, another impact of system use is to improve productivity of knowledge workers.

2) Information system use is enacted to fit emergent and situated work practices.

Based on the technology structuration theory (Orlikowski, 1992), Information technology use can not be studied separately from organizational activities. There are two important views derived from the technology structuration theory. First, information technology is not a stabilized entity. During the use of technology, people can redefine and modify the meaning, properties, and application of technology. Reconfigurable and user-reprogrammable software have been developed and used today. Second, information systems do not "embody" social structure. Rather, social structure is emerging as the human repeatedly interact with technology. Here, structures are the set of rules and resources instantiated in recurrent social practice (Orlikowski, 2000).

From structurational perspective, information technology is an external entity in which rules and resources are embedded in it. Without the work practice, information technology is simply a collection of hardware and software. Technology structure emerges through users' on going interaction with technology. Thus, technology use should be view as an enactment structure. To study the information technology use in EKPs context, viewing technology use as an enactment is crucial. Since designer of information systems can not anticipate every instance of system use, build-in flexibility that allows users to reconfigure features of existing systems to fit their emergent work practice also reflects successful system use.

3) User empowerment is an important factor that influence enacted information system use.

Empowerment has been defined in term of motivational processes in workers (Conger and Kanungo, 1988). Management researchers have been studied empowerment construct to understand the role of psychological empowerment in worker's performance (Conger and Kanungo, 1988; Thomas and Velthouse, 1990; Spreitzer, 1996; Spreitzer et al, 1999) and the measurement of psychological empowerment (Spreitzer, 1995). In the virtual work environment, the concept of psychological empowerment can be extended to the concept of user empowerment, which is a motivational construct based on the interaction of people, process, and technology (Doll et al, 2004). Since the business processes and technologies can not be completely separated in the virtual work environment, knowledge workers have to engage technology to use, enhance, and create work process. Thus user empowerment is a critical research subject for information technology use.

As knowledge workers engage in the knowledge creation process, their commitment and intension to manipulate information and to make sense of their environment will motivate them to use information technology for their work practice. Without intention, it would be impossible to judge the value of information or knowledge perceived or created (Nonaka, 1994). In addition, Individual autonomy widens the possibility that individuals will motivate themselves to form new knowledge. When individuals feel competent to use information technology and perceive the impacts of the information technology use for their work, they will more likely be motivated to use information technology as well. Thus, user empowerment is an important factor that influence enacted information system use.

4) The individual interpretive styles, communities of practice and interpretive flexibility of technology can affect the level of user empowerment.

Different conditions in individual's mind state, organizational practice, and technology will affect how individual feel empowered over technology use. Thomas and Velthouse (1990) suggest that personal interpretive styles of external events play a key role in interpreting empowerment, which is defined as increased intrinsic task motivation. Positive personal interpretive styles associate with individual's positive feeling about autonomy, competence, meaningfulness of his/her task, and sense of impact.

Organizational practices can either lead to psychological state of powerlessness (Conger and Kanungo, 1988) or shape the environmental changes to increase self-empowerment (Thomas and Velthouse, 1990). Based on technology structuration theory (Orlikowski, 1992), the institutional properties of a work group which is the immediate working environment of the knowledge workers will shape how they interact with the information technology. As work environment transforms from traditional to virtual, knowledge workers do not need to be or can not possibly be closely supervised due to the nature of works. Knowledge workers are likely to become a member of communities of practice in which they can gain supports and information sources for their knowledge works.

Therefore, the characteristics of the communities of practice play an important role in empowering knowledge workers toward the use of information technology.

Membership of communities of practice provides identity to knowledge workers (Brown and Duguid, 1991) and increase level of trust among members through shared understanding (Millen et al, 2002). The participants in these communities of participants are learning together by focusing problems that are directly related to their works (Wenger and Snyder, 2000). Thus, through the membership of communities of practices, knowledge workers will become more self-empowered to use technology to solve their work related problems. Case studies support that communities of practice has an important influence on the technology implementation through the knowledge sharing among members (Hislop, 2003).

Information technology design is another factor that affects the level of individual workers feel empowered about technology use. Technology is designed by human agents with the aims to embed certain institutional properties in the design. Technology is also used by human agents to reaffirm the institutional properties embedded in technology. This property of technology is what Orlikowski (1992) called "the duality of technology". However, technology designer can not predict how technology users will use technology in every different situation. Thus, the flexibility built in technology will affect how people interact with technology. Orlikowski (1992) termed this property of technology - *interpretive flexibility*, which refers to the degree to which users of a technology are engaged in its constitution (physically and/or socially) during development or use. With the interpretive flexibility of technology, user and designer role are not completely separated. The interpretive flexibility of technology empowers users to reconfigure technology to solve their problems in a situated and emergent context.

2.6. Hypotheses Development

To empirically examine the relationship between each construct in the research model, hypotheses are developed in the following sections.

2.6.1. The Link between Personal Interpretive Style and User Empowerment

Interpretive Style refers to the different types of interpretive processes in which one reviews the information from external events and forms one's cognition for task assessments. Based on the cognitive model of empowerment proposed by Thomas and Velthouse (1990), personal interpretive information can produce additional information for task assessments which consist of sense of impact, competence, meaningfulness, and choice. They suggest three interpretive styles: *attributing*, *evaluating* and *envisioning*, can explain that individuals contribute to their own empowerment and disempowerment. This argument can also extend to the concept of user empowerment which is that task assessments involving information technology use. Thus,

> H1: The individual interpretive styles are associated with the user empowerment of information technology use.

The attribution theory centers on the attribution made to account for "failure" – typically not reaching performance goals (Abramson et al., 1978). Causal attributions are distinguished along three dimensions: internal (self-oriented) vs. external (other person or circumstance-oriented), stable (long-lasting) vs. unstable (short-term), and global (broad applicable) vs. specific (limited applicability) (Peterson et al. 1982; Hull and Mendolia, 1991; Furnham et al, 1992; Higgins et al., 1999; Higgins and Hays, 2003). The tendency to give internal, sable, and global causal explanations for bad events accompanied by external, unstable, and specific explanation for positive event, is referred as a depressive or pessimistic attribution style (Higgins et al., 1999).

Attributing is an individual's causal attributions to his/her performance outcome. In this research the performance outcome refers to the outcome of user-system interaction (Karsten, 2002). When end users attempt to use information system to complete work-related tasks, personal attributing style determine how end users attribute their successful or not so successful user-system interaction. Personal interpretive style that favors internal, stable and global explanation for unsuccessful events is seen as negatively influencing motivation by over generalizing the existence of obstacles. Similarly, any interpretive style that underutilize stable and global to attribute for successful events would make individual less empowered by reducing assessment of competence and/or impact (Thomas and Velthouse 1990). Thus,

H1a: Individual with pessimistic attributing style is less empowered in using information technology.

The interpretive style of evaluating can be viewed from individual's goal orientation that ties to their tasks. Evaluating interpretive style refers to the goal orientation of individual end user regarding information systems use. Researchers have proposed that goals pursued by individual provide the framework to interpret and to react to the outcome. Two classes or type of goals that are related with adaptive and maladaptive motivational pattern: learning goal and performance goal (Dweck, 1986). When an individual adopt a learning goal orientation toward his/her tasks, he/she will strive to increase their competence by seeking understanding or mastering something new. Alternatively, an individual can adopt a performance goal orientation toward his/her tasks. Individual with performance goal orientation seeks to gain favorable judgment of their competence or to avoid negative judgment of their competence (Elliott and Dweck, 1988; Grant and Dweck, 2003).

The two different goal orientations develop different motivational patterns for information technology use. Performance oriented individuals concerns more about getting their job done as quickly as they can. When facing the failure outcome, they display negative affect, and may give up using information systems for their work completely. Although no one would favor failure outcome, individual with learning goal orientation display different motivational pattern from performance oriented individual. Individual with learning goal orientation is mastery-oriented. They tend to view the unpleasant outcome as an opportunity to receive feedback, so that they can improve their performance in the future (Elliot and Dweck, 1988; Button and Mathieu, 1996).

Performance goal orientation tends to reduce assessments of self-efficacy since the low ability is the attribution for the obstacles. It is more difficult for performance-oriented individual to be persistent in face of obstacle. Lack of persistence will reduce one's intrinsic motivation such as task interest or enjoyment of effort (Dweck, 1986). Thus, individual that is performance-oriented is less empowered. Empirical evidences (Dykman, 1998; Phillips and Gully, 1997) support that performance goal orientation is negatively associated with self-efficacy. Alternatively, individual with learning goal orientation tends to view setback as an opportunity to learn new skills and improve performance. Hence, he/she has high level of persistence in face of obstacles. High persistence translates into high intrinsic motivation. Consequently, the individual with learning goal orientation is more empowered.

In the context of information systems use, performance-oriented individual will be easily frustrated when the information systems do not generate expected outcome. Since they don't have patience to deal with the unfavorable outcome, they may decide more effort is useless and meaningless. Therefore, he/she will have less intrinsic motivation and feel less impact for the system use. Performance-oriented end users think they can not change the strategies of using information system and may decide not to use IT for their tasks entirely. Thus, performance-oriented end user will feel less empowered for system use.

H1b: Individual with performance goal orientation is less empowered in using information technology.

End users with learning goal orientation tend to analyze the causes of the unsuccessful user-system interaction and change their strategies of information systems use. Through the process of problem solving of using information systems, they enhance the task assessment of self-efficacy and intrinsic motivation, and find the impact of IT use. Thus the end users with learning goal orientation will feel empowered to use information technology for their tasks.

H1c: Individual with learning goal orientation is more empowered in using information technology.

Envisioning is the process that involves cognitive imagery of future events (Thomas and Velthouse, 1990). In other words, envisioning requires the ability to visualize and anticipate what can happen. Visualization is mental imaginary capability that facilitate individual to see the alternative future events (Anthony et al., 1993). When people visualize, they tend to able to think in more concrete terms, overcome more personal assumption, evoke much greater memory, and assess possible ramifications more creatively (Bennett et al., 1994). High performing individual usually creates vivid mental image of successes and avoids images of setbacks or failure (Harrison, 1983).

Literatures of human-computer interaction suggest that Individual's cognitive ability, such as visualization ability affect the pattern how users learn to use computer software (Sein, 1993). Visualization ability is the ability to manipulate or transform the image of spatial pattern into other arrangement. Being able to visualize and transform images provides the users additional information source for using the computer software. Different researches have suggested that visualization ability is an important predictors for the outcome of user-system interaction in different domain such as vocational-training program (McGee, 1979), extracting information from map (Thorndyke and Stasz, 1980), using a hierarchical database (Vicente et al., 1987), text editing (Gomez et al., 1986), and Web information search (Zhang and Salvendy, 2001). Results of empirical study (Sein et al., 1993; Zhang and Salvendy, 2001) support that individuals with high visualization ability performs better than those with lower visualization ability across different type of software. Thus, individual with higher visualization ability tends to have higher self-efficacy, more intrinsic motivation, and higher sense of impact of IT use.

H1d: Individual with high visualization ability in envisioning interpretive style is more empowered in using information technology.

2.6.2. The Link between Communities of Practice and User Empowerment

Communities of practice refers to the communities that are formed formally or informally by a group of workers with common disciplinary background, similar work activities and tools, and shared stories, contexts, and values (Brown and Duguid, 1991; Wenger and Snyder, 2000; Millen et al., 2002). Researchers viewed communities of practice as management practices (Wenger and Snyder, 2000) or social capital (Lesser and Storck, 2001) that lead to worker's behavior change. The communities of practice can influence workers' behaviors in different aspects by forming the identity, developing a sense of trust, and building shared understanding and receiving supports through connections with others.

Millen et al. (2002) conducted semi-structured interview to study the benefits of communities of practice in seven firms. They identified several benefits at individual level including improve reputation, a better understanding of what others are doing in the organization, and increase level of trust. Their findings suggested that communities of practices provide a supportive environment that encourages member interaction, ongoing professional development, and learning about new tools. Workers have autonomy to decide to join the community. As they participate, they gain the identity and legitimacy to access the resources and support form the community. Communities of practice provide the needed supports for knowledge workers in using information technology to solve problem and collaborate with others by enhancing the task assessment in autonomy, self-efficacy, intrinsic motivation, and perceived impact. Thus,

> H2: The level of participation of communities of practice is positively associated with the level of user empowerment.

The extent that an individual involves in the communities of practice can be examined by how an individual relates to and interact with his/her workgroups which may reside within the firm or outside the boundary of the firm. To satisfy the properties of communities of practices, first, an individual has to belong to a community to enable mutual engagement (Brown and Duguid, 1991; Wenger, 1998). Secondly, an individual has to establish substantial level of trust by holding each other accountable to define and create the joint enterprise in a communities or practice (Wenger, 1998; Millen et al., 2002). Thirdly, the members have to receive supports from their peers to build the shared context and shared repertoire (Wenger, 1998). Thus, the extent of communities of practice can be examined in there different dimensions: *identity*, *trust*, and *peer support*.

Identity is defined as the extent to which an individual worker feels belonging to his/her immediate work group (Dutton et al., 1994; Mclaughlin and Webster, 1998; Wiesenfeld et al., 1999; Griffith and Neal, 2001; Karreman and Alvesson, 2004). As knowledge works become more complex and interdependent (Wageman, 1995; DeSanctis et al., 1999; Sharma and Yetton, 2003), it often requires individuals to align – at least to certain extent – with a collective, such as their work team or workgroup. Through the interactions with others in the workgroups, individual forms the identity that shapes his/her motivation and behavior at work (Wiesenfeld et al., 2001; Ellemers et al., 2004; Martins et al., 2004; Majchrzak et al., 2004). Through identities, individual share ideal cognitive models of the world based on the similar categories (Kogut and Zander, 1996).

Unlike formal units organized by management, communities of practice are organized by workers. The members of communities of practice set their own agendas and establish their own leadership. The membership of communities of practice is self-selected. Individuals decide when and if they should join. They know if they have something to give and weather they are likely to take something away (Wenger et al., 2000). In other word, individuals have great extent of autonomy to decide to join the communities to collaborate with others. Therefore, individuals as information technology user are empowered by having autonomy to decide how they are going use technology to work with other.

Theory of communities of practice suggests that learning is fostered by the membership of the communities of practice, not by the individual practice (Brown and Duguid, 1991). The membership provides the identity for workers and thus gives workers the legitimacy to access to not only the information but also the periphery of communication, such as e-mail, formal and informal meeting, and stories. Individuals who identify with their groups are likely to experience more cohesion, greater compliance with group imperatives, lower rational conflict, and greater satisfaction with the group (Bartel, 2001; Griffith and Neal, 2001). Thus, identity will enhance workers' empowerment feeling to use information technologies to collaborate through the increasing task assessment of self-efficacy and perceived impact.

H2a: Stronger identity of communities of practice is positively associated with user empowerment.

Working together in the communities of practice involves mutual engagement, and people must therefore depend on others in various ways to accomplish their personal and group goals. During the process of defining the joint enterprise, trust is a lubricant that reduces friction among members. For the trust relationship to be developed, there are two parties involved: trustor and trustee. Trustor is a trusting party and trustee is a party to be trusted. In the extensive review of trust researches, Mayer et al. (1995) propose that three characteristics of trustee explain major portion of trustworthiness. These three characteristics are ability, benevolence, and integrity. Ability is a group of skills and competencies that enable a party to have influence within some specific domain. Benevolence is the extent to which a trustee is believed to intend to do good to the trustor, beyond an egocentric profit motive. Integrity is the trustor's perception that the trustee adheres to a set of principles which are acceptable to the turstor. Thus, *Trust* is defined as the extent to which an individual believes that his/her coworkers have ability, benevolence, and integrity (Mayer et al., 1995; McKnight et al., 1998; Bhattachderjee, 2002; Water 2003).

Zolin et al. (2004) conducted a longitudinal study of interpersonal trust in cross-functional and geographically distributed work. Their findings support that the initial perception of one's coworkers may determine the extent to which one believes these coworkers have followed through the work expectations. When people trust other members in the community, it reduces uncertainties of establishing relationship for joint enterprise. Thus individuals feel empowered for their task assessment.

Jones and George (1998) proposed that the experience of trust is determined by the interplay of people's values, attitudes, and moods and emotions. Trust evolves when the parties to an exchange have strong confidence in each others, have favorable attitudes toward each other, and experience positive affect in the context of the relationship. The effect of trust will lead to high confidence in others, mutual relationship (Kirkman et al., 2002), help-seeking behavior, broader job roles, free exchange of knowledge and information, and high involvement (Jones and George, 1998).

Empirical studies support that trust has the positive effects in the following aspects: individual satisfaction (Martins et al., 2004), task effectiveness (Raghuram et al., 2001), involvement in design activities (Walter, 2003), virtual collaborative relationship (Jarvenpaa and Leidner, 1999; Paul and McDaniel, 2004), and interpersonal cooperation (McAllister, 1995). In the communities of practice, trust is developed through the connections of members, shared stories, and common context. As individuals develop the trust among other members, they will tend to use information technology to communicate and coordinate with other members for their joint enterprise in more effective fashion.

When group members have mutual trust, they would understand their group goals more clearly. Hence they will be more motivated to use information technology to achieve their goal or mission. Mutual trust also means less uncertainty and less fear. Fears and uncertainties are negative information sources for individual's self-efficacy (Bandura 1977). Without fear, individual is not afraid to seek help when they need to. Therefore, trust will enhance the group member's empowerment feeling by removing the negative sources of self-efficacy and seeing the impact of using information technology to accomplish the personal and common goals.

H2b: High level of trust in other members in communities of practice is positively associated with user empowerment.

Peer support is defined as the emotional or physical support to and from other members in the communities of practice. Communities of practice provide the relational ties for its members through the shared practices. These relational ties are channels for the transfers of resources, such as emotional support, knowledge, and expertise (Visser and Mirabile, 2004). Fundamentally, communities of practice provide a social structure for members to gain support from each other for their shared practices (Wenger, 1998).

Based on the observation of six R&D teams of a large Japanese manufacturing firm, Orlikowsk et al. (1995) suggest mediators such as local experts can structure user's use of technology. Mediators can help user understand technology, alter technological features to ease use, and modify institutional policies to promote particular kinds of communicative practices. They further suggest that the effectiveness of the mediator group was facilitated by its member's proximity to the context of use, their understanding of users' practices and norms, their credibility with the users, and their knowledge of user's technical abilities. In CoPs, local experts and proficient users can serve as the mediators of technology use. As the individual knowledge worker trust these mediators and gains support from them, he/she will fell empowered to engage information technology for their tasks.

Helping others may reinforce one's technology competency and, thus, improving one's self-esteem (Goodman and Darr, 1998). Through membership and the generalized norm of reciprocity in CoPs, helping others in technical issues is rewarding to the members. The members in CoPs concern about how they can be useful to others, and how their advice might solve organization problems (Constant and Sproull, 1996). Thus helping others also provide the sense of meaningfulness and impact which are important dimensions of user empowerment. On the other hand, members can also expect to get help from their peers in the community when they need one. As they encounter problems in the technology use for their work, they know they are not alone. The supports from peers reduce the fear of uncertainty; thus individuals are empowered to use information technology when they have higher level of peer support.

H3b: High level of peer support in communities of practice is positively associated with user empowerment.

2.6.3. The Link between Interpretive Flexibility and User Empowerment

Technology affects organizations in its dual and paradoxical nature (Olikowski, 1992). It is both engine and barrier for change. It is also both product and process. Lucas (1994) suggests that information technology can either increase or decrease the ability of an organization to confront with new circumstances. IT can be designed to increase organizational flexibility in the following ways: (1) loosening the constraints that limit where tasks can be accomplished and when tasks can be performed, (2) affecting nature of work by speeding up information processing, and (3) enabling firm to respond quickly to the environment. IT can also be designed in a way that a firm loses its flexibility gradually in the following ways: (1) increasing time, effort, and cost to change systems, and (2) increasing time, effort, and cost to change workflows and organizational structure.

As the decentralized technologies are widely use to support the virtual environment, both needs for common standards and the needs for situated, tailorable and flexible technologies grow stronger (Star and Ruhleder, 1996). On one hand, the common standards will reduce the complexity of the system design and increase the interoperability among the different components within the systems. On the other hand, the lowest common denominator approach can not satisfied the diversity of user groups in term of skills, experience and situated needs. These paradoxical requirements have created new challenges for the system design. A flexible system has to provide the following characteristics: openness, malleability, structure, and navigability (Star and Ruhleder, 1996). In a sense, an ideal system has to be "organic" enough to adapt to evaluation of the change of business communities.

Interpretive flexibility refers to the degree to which users believe that they are able to constitute and reconstitute technology (physically and/or socially) during development or use (Orlikowski, 1992). Orlikowski (1996, 2000) views the technology as emergent and situated structure that is enacted in the context of work practice. Technology structures do not exist as artifacts alone. Rather they are virtual, emerging from people's repeated and situated interaction with particular technology. When users choose to use a technology, they are also deciding the way to interact with that technology. They may deliberately or unintentionally use technology in ways that are not anticipated by the developers.

To meet the challenge of emergent knowledge process, knowledge workers often need to add or modify the technological properties to execute their tasks. Thus, knowledge workers are actively shaping and crafting the technology to fit their particular requirements and interests to craft their job (Wrzesniewski and Dutton, 2001). The capabilities of crafting technology and work process, reconfiguring computer application, and enacting use of technology give knowledge workers a sense of power to cope with emergent events and situations they confront (Conger and Kanungo, 1988). And thus they feel empowered from their mastery experience (Doll et al., 2004).

In the case study of technology adaptation, Majchrzak et al. (2000) analyzed how an inter-organizational virtual team adapted the use of a collaborative technology to successfully achieve its challenging objectives. By analyzing the technology appropriation of a virtual team for 10 months in the four different areas including access to same communication tool, knowledge capture, knowledge sharing, and decision making, they concluded that the malleability of group and technology structure is the reason for the success of technology adaptation.

The research findings by Marjchrzak et al. (2000) suggest that the misalignment between the technology and user environment not necessarily result from the pre-existing structure, but instead arise from emerging events. As the unpredictable creative process unfold, they need to overcome the barriers to adding knowledge to public repository, sharing information, and using search tools. Since the virtual team members were able to change the technology structure to meet their emergent needs for their task in accessing the communication tool, capturing knowledge, sharing knowledge, and making decision, they feel empowered to use the technology to accomplish their goals.

According to technology structuration theory (Orlikowski, 1992), technology can either facilitate or constrain social practices. When users are aware that they are able to use or change the technology to fit their context of work, they feel more empowered to enact the use of technology, because they can foresee the meaning and impact of the technology use in the specific context. On the contrary, if users perceive that they don't have much control to modify technology use to meet their local condition, they will feel less empowered to use technology for their task execution. Thus,

H3: High interpretive flexibility is positively associated with user empowerment.

Markus et al. (2002) proposed a design theory for systems that support emergent knowledge process. To support the evolving knowledge creation process that has no best structure, complex knowledge requirements, and unpredictable actor sets, information systems have to be interpretively flexible. Derived form design theory of emergent knowledge process, an interpretively flexible system should possess three design properties: self-deploying, evolving ability, and action ability. *Self-deploying* refers the capability that a system can support different system-user interaction and engage users with different skill sets. *Evolving ability* refers to the ability that a system can accommodate complex, distributed, and evolving knowledge-bases. *Action ability* refers the ability that a system support an unstructured, dynamically changing process of deliberation and tradeoffs, so that users can act upon the knowledge that system provides.

Emergent knowledge process often involves different type users including high-level professionals and technical personnel. With the unpredictable actors, information systems have to accommodate the users with different skill levels. Knowledge workers usually have higher degree of autonomy. They may resist using the predefined routines or refuse to use information systems completely, if the information systems impose too many constraints. Thus, a system equipped with self-deploying design will empower users with different skill level to use the system.

> H3a: Information systems with higher self-deploying capability will empower user more.

Information technology is generally described in term of the characteristics of the process. In virtual knowledge work, the characteristics of process are situated and user information requirements are emergent. Knowledge workers usually need to involve in an iterative process of series of trail-and-error between problem finding and solution evaluation. Thus, there is no best structure or sequence to follow in the evolving process of knowledge creation. Information technology with the evolving ability embedded in its design will empower user to cope with their emerging and situated work process.

> H3b: Information systems with higher evolving ability will empower user more.

Emergent knowledge process also involves complex knowledge which is distributed across different people (Markus et al., 2002). Knowledge workers often need to consult domain experts in different areas for their task execution. Information systems having high action ability can capture expert knowledge and translate them into actionable tradeoff for non-expert user. Thus, information systems with high action ability will empower users to enact information system use for their task execution.

H3c: Information systems with higher action ability will empower user more.

2.6.4. The Link between User Empowerment and Enacted System Use

Enacted system use can be defined as user's behavior of the ongoing information system use or modifying existing information system use for his/her work. Users can either use technology the way as it was designed or they can alter technology properties to fit their emergent and situated work practice. If it is necessary they can even invent new ways to use technology that beyond designer's exceptions.

According to AST (DeSanctis and Poole, 1994), user's attitude toward appropriation of advanced information technology is one aspect that shapes enacted technology use. Users' attitude of technology use can be presented as: the extent to which users feel relaxed and confident in their use of technology, the extent to which users perceive the value of technology use to their work, and their willingness to work hard and excel in using technology. These attitudes set the tone for application of technology, and whether the users pursue the applications of technology with vigor and confidence. These attitude sets are similar to the dimensions of self-efficacy and impact in user empowerment construct.

As Knowledge workers use or appropriate complex technologies, they often need to deal with ambiguity and unstructured local situation that deviated from the normal operations (Perrow, 1983; Wynne, 1988). In these situations, users often need to continue negotiate or enact the use the technology that is different form intent of the original technology design. Through the process of interaction between human actors and technology, the more the users have intrinsic motivation, feel competent to "negotiate" with technology, and see the impact and meaning of technology use to their task execution, the more likely they will enact technology for their task execution.

H4: Level of user empowerment is positively associated with the level of enacted system use.

In the context of emergent knowledge process, knowing in practice is constituted by the on going activity of diverse individuals. Knowledge workers have to generate competence form their work practices which are emergent and contextual in nature (Orlikowski, 2002). Information technology can assist knowledge workers to shorten their learning cycle in areas of problem solving, decision making, collaborating with other, and system reconfiguration to cope with their emergent work practice. Thus, *problem solving/decision support*, *collaboration*, and *system reconfiguration*, are three types of enacted system use that are critical for knowledge workers to produce knowledge works in the emerging knowledge process.

As the business environment changing rapidly, decision making and problem solving process become more complicated. There are several factors that affect decision making and problem solving. First, because of the improved technology and communication, the number of available alternatives is much larger than ever before. Second, the cost of making errors could be large because of the complexity and interdependence of operations. Third, task requirements are changing continuously to meet the fluctuating environment. Finally, decision making has to be fast to respond the quickly changing environment (Turban et al., 2005). Information technology such as decision support systems, database management, and data analysis tool can help knowledge workers coping with the emergent process and problem. Information system use for *decision support/problem solving* can be defined as the extent that an individual use computer technologies for decision support and problem solving in his/her virtual work (Doll and Torkzadeh, 1998; Doll et al., 2003; Doll et al. 2004).

The availability of information system alone doesn't ensure the improving performance of individual (Markus and Benjamin, 1997). Rather, individuals have to feel empowered to use IT tools to support their decisions and solve problem in innovative ways. Doll et al. (2004) conducted an empirical research using 192 engineers as a sample to develop and validate a measurement model of user empowerment. Their research findings suggest that user empowerment is highly correlated with enacted use of IT for problem solving/decision support.

H4a: Level of user empowerment is positively associated with system use for decision support/problem solving.

To support the community of knowing, knowledge workers need to broaden their point of views of the framework used, the issues seen as relevant, and the problem-solving options considered (Bush and Frohman, 1991). Collaboration is an important mechanism to enhance individuals' opportunity to learn and to broaden their viewpoints. Schrage (1990) described collaboration as an act that involves two or more individuals with complementary skills to create a shared understanding that none had previously processed or could have come to on their own. It is the space of the shared understanding between the individuals provides the environment for collaboration.

Information technology such as collaboration technology supports the function of coordination and cooperation so that individuals can work together more efficiently. *Information system use for collaboration* can be defined as the extent that an individual use computer technologies to communicate, coordinate, and share knowledge with other member in the communities in his/her virtual work. Collaboration technologies such as instant messaging, data conferencing and videoconferencing allow people to collaborate synchronously. Technologies such as E-mail, workflow management system, calendar and scheduling system, and electronic bulletin boards can assist people to collaborate asynchronously (Munkvold, 2003).

Information system researches present the mix results whether the use information technology will facilitate the collaborative behavior. An emerging body of researches suggests that collaborative systems can facilitate collaboration and support teamwork (Majchrzak et al., 2000; Cohen and Mankin, 1999; DeSanctis and Monge, 1999; Kraut et al., 1999). Alternatively, researches on the implementation of Lotus Note (Vandenbosch, and Ginzberg, 1996; Olesen and Myers, 1999) suggest that implementation of the collaborative technology alone does necessarily increase the level of collaboration in an organization. Unless the use the collaborative technology reaches "critical mass", the availability of collaborative technology can not automatically raise the level of collaboration in an organization or a community.

Individual's cognitive assessment play an important role in using collaborative technologies (Jarvenpaa and Staples, 2000). When individuals have autonomy to make local decision, they enjoy their job more and are willing to put more creativity to their work (Malone, 1997). The sense of autonomy empowers individuals to use collaborative technology to network with others for knowledge creation and to make better decision. IT research also suggest that perceived benefits of information technology in supporting collaboration, such as efficiency and ability to deal with large group, is positively associated with the deployment of the collaborative technologies (Lewis et al., 2004). As knowledge workers perceive the impact of using collaborative technology on their work, they will be more empowered in using information technology for collaboration. The extent of computer self-efficacy also influences how people would use collaborative technologies for their work. Research findings on collaborative technology use (Easley et al., 2003) suggest that computer self-efficacy is positively associated with collaborative technology use. Thus, user empowerment is a critical factor that influences the use of information technology for collaboration.

H4b: Level of user empowerment will positively associated with system use for collaboration.

Technology is interpretatively flexible. During the process of interacting with information technology, individual may need to alter meaning of technology properties to meet their situated work practice. Individuals with higher computer self-efficacy will not be afraid to reconfigure system to get their tasks done. Furthermore, empowered users may think being able to reconfigure system make their job more fun and more enjoyable. Thus, highly empowered users tend to reconfigure system for their work more often than less empowered users.

H4c: Level of user empowerment will positively associated with the frequency of system reconfiguration for the work practice.

2.6.5. The Link between Enacted System Use and Knowledge Work Outcome

As the products and processes become more specialized, knowledge intensive firms have to integrate the specialized knowledge form different communities for the new knowledge production. The need of the integration of the communities of knowing has strengthened the requirement of collaborative works among the knowledge workers. Knowledge production involves the collaboration among the different communities of knowing within the firm and outside the boundary of the firm.

Communication is one of the critical functions for the collaborative works. Boland and Tenkasi (1995) refer to communication that strengthen the unique knowledge of a community as perspective making, and communication that improves its ability to take knowledge of other communities into account as perspective taking. As knowledge workers explore different alternatives to solve their specific problem, they gain the new understanding of the problem. They then form the mental model of the problem solutions and express it in either narration or metaphor. In this problem solving process, knowledge workers make their perspective and communicate their perspective with others in the communities of knowing. However, the new knowledge creation is not isolated individual behavior. It requires the interactions of individuals. Nonaka (1994) argue that social interactions among individual, groups and organizations are fundamental to organizational knowledge creation, because such interaction helps put problem solvers in touch with the actual problems that arise in similar or different contexts. Thus the knowledge production is the result of collaboration in which diverse individuals are able to appreciate and synergistically utilize their distinctive knowledge through a process of perspective taking (Brown, 1991; Henderson, 1994; Nonaka, 1994; Boland and Tenkasi, 1995).

Goodman and Darr (1998) observed the distributed communities which were self-designed group of managers from the same jobs who had come together to exchange job-related information and best practices. These groups used multi media that facilitate synchronous as well as asynchronous communications to exchange knowledge. These communities emerged to exchange job related information and best practices. The use of information technology makes the learning among members more efficient which is important precondition for innovative ideas.

H5: Level of enacted system use is positively associated with knowledge work outcomes.

Enact use of information technology for emerging knowledge process can enhance the knowledge works in two ways. First, it increases the efficiency of information acquisition. Second, it provides individual more opportunities to improvise. Existing knowledge is the base for developing absorptive capability. Cohen and Levinthal (1990) describe absorptive capability as the ability to recognize the value of new, external information, assimilate it, and apply it to increase to the innovative capabilities. With the assistance of information technology individuals can retrieve the codified knowledge more efficiently through various database application and search engine. Furthermore, they can also use collaborative technology to solicit tacit knowledge from other members or experts in the community of knowing. Thus, knowledge worker using information technology for their work greatly enhances efficiency of knowledge acquisition. Research evidence supports that acquisition of innovative information is associated with new product innovativeness (Brockman and Morgan, 2003).

Real-time information flow in an organization provides the possibility for individuals to be exposed to unexpected information which invites improvised action. Research evidence (Moorman and Miner, 1998) suggests that greater level of real-time information flow is associated with greater incidence of organizational improvisation in new product actions. However, organizational improvisation should always begin from individual improvisation. As individuals have more opportunity to expose to real-time information flow, they too will have more incidence of improvisation in their work practice.

Miner et al. (2001) describe improvisation as the deliberate and substantive fusion of the design and execution of a novel production. They further identify three different forms of improvisation: behavioral production, artifactual production, and interpretation production. As the knowledge workers use information technologies for problem solving/decision support, collaboration and system reconfiguration, they have more opportunities to be exposed to new knowledge or to see different perspectives from others. Thus, they will have more resources to form novel production for their work. Four types of knowledge production can be facilitated from the information technology use: new idea, new interpretation, new processes and new artifacts. *New idea* refers to the generation of new thinking or new concept. *New interpretation* refers to the new interpretive framework resulted from the information system use. *New processes* refer to the new ways of task execution resulted from the information system use. *New artifacts* refer to the creation of new physical or virtual structure resulted from information system use.

Using information technology not only exposes knowledge workers to different sources of information, but also shortens their experiential learning cycle. Experiential learning cycle can be described as a process that an individual having a concrete experience, making observations and reflection on that experience, forming abstract concepts, generalizing based those reflections, and testing those ideas in a new situation, which lead to another concrete experience (Kim, 1993). Kim (1993) uses the observe-assess-design-implement (OADI) cycle to represent the feature of individual learning. Knowledge workers enact information technology use can increase the efficiency of information acquisition to assess their observation. In the further phases of learning cycle, Information technology can be used as tool to facilitate them to form the abstract concepts and to test the concept in the simulation mode. Because the nature of revocability of information technology use, from concept formation to concept testing (OADI cycle) can iterate many times in a very short period. Shorter learning cycle can lead to higher probabilities of novel production. Thus, enacted information technology use can enhance the knowledge work outcomes in terms of new idea, new interpretation, new processes, and new artifacts.

H5a: Level of enacted system use is positively associated with new idea generation.

H5b: Level of enacted system use is positively associated with formation of new interpretation.

H5c: Level of enacted system use is positively associated with new processes implementation.

H5d: Level of enacted system use is positively associated with new artifact creation.

In addition to improving innovative aspects of knowledge work, use of information technology can also enhance knowledge-work productivity. Knowledge work productivity is different from manual work productivity in the way of how tasks are defined (Drucker, 1999). The tasks of manual works are structured and predefined. Manual workers don't have to define their tasks; instead they perform tasks by following the predefined standard procedures. When the efficiency of operations procedures improves, the manual workers' productivity is also improved. However, the nature of knowledge works is opposite to the nature of manual works. Knowledge work is a matter of process and practice, the way individual workers respond to the real world and accomplished their assigned tasks (Davenport, 2004). Since the business environments continue changing, the process of knowledge works can not be predefined. It usually requires detail observation and collaborates with others to determine the work practice in particular ways. Using information technology can enhance the efficiency of data analysis and communication with others, and shorten the learning cycle (Gaimon, 1997). And thus using information technology will enhance knowledge-work productivity.

H5e: Level of enacted system use is positively associated with knowledge-work productivity.

Chapter 3: Research Method

This study intends to use large scale survey and structural equation modeling as statistical method to validate the proposed research model. The unit of analysis in this study is individual knowledge worker. Based on the widely accepted measurement development framework by Churchill (1979), the model validation will include the following phase: (1) scale development, (2) pilot study, (3) large scale data collection, (4) construct validity assessment, and (5) structural model.

3.1 Scale Development

In the scale development phase, a very important step is to specify domain of the research constructs. Content validity is enhanced when steps are taken to ensure that the domain of the construct is covered (Churchill, 1979).

This study developed the instruments to measure (1) Personal Interpretive Styles, (2) Communities of Practice, (3) Interpretive Flexibility, (4) Enacted System Use, and (5) Knowledge Work Outcomes. Instruments to measure User Empowerment were adopted from previous study (Doll et al., 2004) with minor modifications.

3.1.1. Measures of Interpretive Styles

Personal interpretive style refers to the different types of interpretive processes in which one reviews the information from external events and forms one's cognition for task assessments. It is measured by three different interpretive styles: *Attributing*, *Evaluating*, and *Envisioning*.

Attributing is an individual's causal attributions to his/her successful or not so successful event of user-system interaction. Casual attribution can be distinguished along three dimensions: internal (self-oriented) vs. external (other person or circumstance-oriented), stable (long-lasting) vs. unstable (short-term), and global (broad applicability) vs. specific (limited applicability). Items generated for attributing are based on studies of Abramson et al. (1978), Peterson et al. (1982), Hull and Mendolia (1991), McAuley et al. (1992), Furnham et al. (1992), Higgins et al. (1999), karsten (2002), and Higgins and Hays (2003). The three attributional dimensions rating scale from 1 to 5 associated with one successful user-system interaction and one unsuccessful user-system interaction.

Evaluating refers to the goal orientation of individual end user regarding information systems use. Performance oriented individuals concern more about getting their job done and meeting their due date. While learning oriented individuals concern more about seeking understanding and learning something new. Items for evaluating are generated from the studies of Dweck (1986), Elliot and Dweck (1988), Button and Mathieu (1996), Phillips and Gully (1997), Dykman (1998), and Grant and Dweck (2003).

Envisioning refers the extent to which an end user can visualize and anticipate the future success of user-system interaction. The development of items of envisioning is based on management literatures and human-computer interface literatures. Items for envisioning are generated from the studies of Harrison (1983), Thomas and Velthouse (1990), Anthony et al. (1993), Sein (1993), Bennett et al. (1994), and Zhang and Salvendy (2001).

A five-point Likert type scale is used for measuring evaluating and envisioning dimensions, where 1 = almost never, 2 = sometimes, 3 = about half of the time, 4 = most of the time, and 5 = almost always.

Table 3.1.1 Measurement Items of Personal Interpretive Styles

Label	**Item Description**		
	Attributing Style (18 items)		
	When I think back on a recent unsuccessful experience in using software for my work, the most likely cause could be described as: ______________________________		
	(Internal – External)		
INTATT1	An aspect of myself	1 2 3 4 5	An aspect of the situation
INTATT2	Something inside of me	1 2 3 4 5	Something outside of me
INTATT3	Something about me	1 2 3 4 5	Something about other
	(Stable – Unstable)		
INTATT4	Something permanent	1 2 3 4 5	Something temporary
INTATT5	Something stable over time	1 2 3 4 5	Something unstable over time
INTATT6	Something unchangeable	1 2 3 4 5	Something changeable
	(Global – Specific)		
INTATT7	Something applies to all situation	1 2 3 4 5	Something applies to certain situations only
INTATT8	Something influences all of my tasks	1 2 3 4 5	Something influences some of my tasks

INTATT9	Something affects my life in general	1 2 3 4 5	Something affects certain areas only
	When I think back on a recent successful experience in using software for my work, the most likely cause could be described as: ______________________________		
	(Internal – External)		
INTATT10	An aspect of myself	1 2 3 4 5	An aspect of the situation
INTATT11	Something inside of me	1 2 3 4 5	Something outside of me
INTATT12	Something about me	1 2 3 4 5	Something about other
	(Stable – Unstable)		
INTATT13	Something permanent	1 2 3 4 5	Something temporary
INTATT14	Something stable over time	1 2 3 4 5	Something unstable over time
INTATT15	Something unchangeable	1 2 3 4 5	Something changeable
	(Global – Specific)		
INTATT16	Something applies to all situation	1 2 3 4 5	Something applies to certain situations only
INTATT17	Something influences all of my tasks	1 2 3 4 5	Something influences some of my tasks
INTATT18	Something affects my life in general	1 2 3 4 5	Something affects certain areas only
	Evaluating Style (12 items)		
	My primary goal in using software packages for my work is to:		
INTEVA1	complete my task quickly		
INTEVA2	do my task right		
INTEVA3	follow the standard of operations of my company.		
INTEVA4	meet the due date of my task		
INTEVA5	solve a problem immediately		
INTEVA6	meet my emerging needs		
INTEVA7	have fun		
INTEVA8	learn new computer skills		
INTEVA9	gain new knowledge		
INTEVA10	challenge myself		
INTEVA11	find different ways of using this software.		
INTEVA12	explore how to use this software for different applications		

	Envisioning Style (6 items)
	When I use computer software to do my work:
INTENV1	I see the vivid image of the end result.
INTENV2	I visualize the details of my intellectual end product.
INTENV3	I can visualize what my end product will look like.
INTENV4	I have a vivid image of every work process I need to go through.
INTENV5	I can visualize how to navigate through the different steps of work process.
INTENV6	I can see a vivid image of the map of each work process.

3.1.2. Measures of Communities of Practice

Communities of practice refers to the communities that are formed formally or informally by a group of workers with common disciplinary background, similar work activities and tools, and shared stories, contexts, and values. It is measured by three different dimensions: identity, trust, and peer support.

Identity refers to the extent to which an individual worker feels belonging to his/her immediate work group. The items of identity are adopted from the studies of Male and Ashforth (1992), and Wiesenfeld et al. (2001) with minor modifications. The coefficient alpha for identity was 0.86. *Trust* refers to the extent to which an individual believes that his/her coworkers have ability, benevolence, and integrity. The measures of trust are generated from the studies of Mayer et al. (1995), McKnight et al. (1998), Bhattachderjee (2002), and Water (2003). *Peer support* is defined as the extent to which an individual receives supports from and gives supports to other members in the communities of practice. The items of peer support are developed from the studies of DeSanctis and Poole (1994), Constant et al. (1996), Spreitzer (1996), Goodman and Darr

(1998), and Wenger (1998). A five-point Likert type scale is used for measuring identity, trust, and peer support, where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree.

Table 3.1.2 Measurement Items for Communities of Practice

Label	**Item Description**
	Identity (5 items)
COMIDE1	When I talk about my workgroup, I always say 'we' rather than 'they'.
COMIDE2	I am very interested in what others think about my workgroup.
COMIDE3	My workgroup's success is my success.
COMIDE4	When someone praises my workgroup, it feels like a personal compliment.
COMIDE5	If my workgroup is criticized, I would feel embarrassed.
	Trust (16 items)
	I believe that my coworkers
COMTRU1	have the skills to do their work well.
COMTRU2	have the expertise to do their work well.
COMTRU3	have sufficient knowledge about our business processes.
COMTRU4	have sufficient knowledge about the technology we use.
COMTRU5	have good judgment on problem solving.
COMTRU6	would not lie to me.
COMTRU7	would not do anything to harm our workgroup.
COMTRU8	would not do anything to harm our relationship.
COMTRU9	are not egocentric.
COMTRU10	are loyal to our workgroup.
COMTRU11	are consistent.
COMTRU12	keep their promise.
COMTRU13	do what they say.
COMTRU14	adhere to our workgroup principles.
COMTRU15	have a strong sense of justice.
COMTRU16	are not serf-serving.
	Peer Support (7 items)
COMPSU1	My coworkers value my opinions of job related issues.
COMPSU2	My coworkers listen to me about work related problems.
COMPSU3	I help my coworkers to solve their problems.
COMPSU4	I can get the helps from my coworkers to solve my problems.
COMPSU5	My coworkers provide helpful information for my work.
COMPSU6	With support from my coworkers, I never feel alone.
COMPSU7	I have the support I need from my coworkers to do my job well.

3.1.3. Measures of Interpretive Flexibility

Interpretive flexibility is defined as the degree to which users believe that they are able to constitute and reconstitute technology (physically and/or socially) during development or use. It is measured by three different technology properties: self-deploying, evolving ability, and action ability.

Self-deploying refers to the capability that a system can support different system-user interaction and engage users with different skill sets. *Evolving ability* refers to the ability that a system can accommodate complex, distributed, and evolving knowledge-bases. *Action ability* refers to the ability that a system can support an unstructured, dynamically changing process of deliberation and tradeoffs, so that users can act upon the knowledge that system provides. The measures of interpretive flexibility are generated from the studies of Olikowski (1992), Duncan (1995), Byrd and Turner (2000), and Markus et al. (2002). A five-point Likert type scale is used for measuring self-deploying, evolving ability, and action ability, where 1 = not at all, 2 = to a small extent, 3 = to a moderate extent, 4 = to a great extent, and 5 = to a very great extent.

Table 3.1.3 Measurement Items for Interpretive Flexibility

Label	Item Description
	Self-deploying (6 items)
	The software package at my work:
IFLSDE1	can accommodate my skill level.
IFLSDE2	can guide me for the different applications.
IFLSDE3	can help me with examples.
IFLSDE4	can help me with explanation.
IFLSDE5	can respond my different needs.

IFLSDE6	can accommodate different situations.
	Evolving Ability (7 items)
	The software package at my work:
IFLEVO1	can import information from different sources.
IFLEVO2	can export information to other computer applications.
IFLEVO3	can plug in a new component.
IFLEVO4	can accommodate the growing complexity of my work.
IFLEVO5	can accommodate the growing knowledge base of my work.
IFLEVO6	have add-in features.
IFLEVO7	are configurable to meet my different needs.
	Action Ability (6 items)
	The software package at my work:
IFLACT1	inform me the worst case scenario.
IFLACT2	display the trade-off of my alternative decisions.
IFLACT3	support my changing work process.
IFLACT4	support my decision in different situations.
IFLACT5	support the emergent process of deliberation in my workgroup.
IFLACT6	provide information for offline actions.

3.1.4. Measures of User Empowerment

User empowerment is an integrative motivational concept based on four cognitive task assessments reflecting an individual's orientation to his/her use of computer applications for a specific task. Four cognitive task assessments are user autonomy, self-efficacy, intrinsic motivation, and perceived impact. *User autonomy* is defined as the degree of choice individuals have in enacting how they use the computer in their virtual work. *Self-efficacy* is defined as a belief that one can be successful in enacting how technology is used in his virtual work. *Intrinsic motivation* is the pleasure or inherent satisfaction derived from using the computer to perform knowledge work. *Perceived impact* is the perception that one can use information technology to enhance the outcome of one's tasks. The measures of user empowerment are adopted from the study of Doll et al. (2004) with minor modifications. The coefficient alphas for user autonomy, self-efficacy, intrinsic motivation, and perceived impact are respectively 0.83, 0.86, 0.90, and 0.91. Doll et al. (2004) find the first order factor has a strong loading (user autonomy = 0.84; self-efficacy = 0.85; intrinsic motivation = 0.79; and perceived impact = 0.75) on the second order user empowerment construct (t-value greater than 9.0).

A five-point Likert type scale is used for measuring user autonomy, self-efficacy, intrinsic motivation, and perceived impact, where 1 = almost never, 2 = sometimes, 3 = about half of the time, 4 = most of the time, and 5 = almost always.

Table 3.1.4 Measurement Items for User Empowerment

Label	**Item Description**
	User Autonomy (3 items)
EMPUAT1	I have considerable opportunity for independence in how I use the software for my work process.
EMPUAT2	I have significant autonomy in determining in how I use software for my work process.
EMPUAT3	I have a say in how I use this software for my work process.
	Self-efficacy (3 items)
EMPSEL1	I am confident about my ability to use the software to complete my work.
EMPSEL2	I believe in my capabilities to using the software for my work.
EMPSEL3	I have mastered the skills necessary for using the software for my work.
	Intrinsic Motivation (3 items)
EMPINT1	Using the software for my work process is enjoyable.
EMPINT2	Using the software for my work process is pleasurable.
EMPINT3	Using the software for my work process foster enjoyment.
	Perceived Impact (3 items)
EMPPER1	Using the software increases my productivity.

EMPPER2	Using the software saves me time
EMPPER3	Using the software allows me to accomplish more work than would otherwise be possible.

3.1.5. Measures of Enacted System Use

Enacted system use refers to user's behavior of the ongoing information system use or modifying existing information system use for his/her work. Three types of information system use are investigated in current study: decision support/problem solving, collaboration, and system reconfiguration.

Decision support/problem solving refers to the extent to which an individual uses computer technologies for decision support and problem solving in his/her virtual work. The measures of decision support/problem solving are adopted from the study of Doll et al. (2004). The coefficient alpha for decision support/problem solving is 0.91. *Collaboration* is the extent to which an individual uses computer technologies to communicate, coordinate, and share knowledge with other member in the communities in his/her virtual work. Items for collaboration are generated from the studies of Schrage (1990), Nonaka (1994), Cohen and Mankin (1999), DeSanctis et al. (1999), Munkvold (2003), and Kang (2003). *System reconfiguration* is the extent to which an individual can modify computer technologies for his/her work. The development of measure for system reconfiguration is based on the literatures of technology structuration theory and emergent knowledge process (e.g., Olikowski, 1992, 1995, 1996, 2000; Markus et al., 2002).

A five-point Likert type scale is used for measuring decision support/problem solving, collaboration, and system reconfiguration, where 1 = almost never, 2 = sometimes, 3 = about half of the time, 4 = most of the time, and 5 = almost always.

Table 3.1.5 Measurement Items for Enacted System Use

Label	Item Description
	Decision Support/Problem Solving (4 items)
ESUDEC1	I use the computer application to improve the efficiency of the decision process
ESUDEC2	I use the computer application to help me make explicit reasons for my decision.
ESUDEC3	I use the computer application to make sense out of data.
ESUDEC4	I use the computer application to analyze why problems occur.
	Collaboration (14 items)
	I use software at my work to:
ESUCOL1	communicate with other members in my workgroup.
ESUCOL2	discuss my interest with other members in my workgroup.
ESUCOL3	discuss issues with other members in my workgroup.
ESUCOL4	understand how my tasks are related with the goals of my workgroup.
ESUCOL5	establish mutual understanding with the members in my workgroups.
ESUCOL6	establish the priority of different tasks in my work group.
ESUCOL7	coordinate with others in my workgroup.
ESUCOL8	understand how the progress of my tasks are related with other's.
ESUCOL9	manage the priorities of my tasks.
ESUCOL10	retrieve the information documented by my workgroup members.
ESUCOL11	share information with my workgroup members.
ESUCOL12	seek help from other workgroup members.
ESUCOL13	exchange information with my workgroup members.
ESUCOL14	share my experience with other workgroup members.
	System Reconfiguration (5 items)
	I modify software to meet the different needs of my works by:
ESUREC1	changing the parameters of the computer application.
ESUREC2	rearranging the user interface of the computer application.
ESUREC3	plugging in different functional component to the computer

ESUREC4	writing the codes to change the computer application.
ESUREC5	using the add-in features of the computer application.

3.1.6 Measures of Knowledge Work Outcomes

Knowledge work outcomes refer to the knowledge productions and knowledge-work productivity result from the information system use. Four types of knowledge production are investigated in this study: new idea, new interpretation, new processes, and new artifacts.

New idea refers to the generation of new thinking or new concept that is resulted from the information system use. *New interpretation* refers to the new interpretive framework that is resulted from the information system use. *New processes* refer to the new ways of task execution that is resulted from the information system use. *New artifacts* refer to creation of new physical or virtual structure that is resulted from information system use. Items generated for four types of knowledge productions are based on literatures in organizational learning, knowledge management, and improvisation (e.g., Cohen and Levinthal, 1990; Kim, 1993; Nonaka, 1994; Boland and Tenkasi, 1995; Moorman and Miner, 1998; Miner et al., 2000).

Knowledge-work productivity refers to the extent to which the efficiency of producing knowledge works. Items are generated from the knowledge-work productivity and knowledge management literatures (e.g., Kraut, 1989; Gaimon, 1997; Drucker, 1999; Davenport, 2004)

A five-point Likert type scale is used for measuring new idea, new interpretation, new processes, new artifacts, and knowledge-work productivity, where 1 = almost never, 2 = sometimes , 3 = about half of the time, 4 = most of the time, 5 = almost always.

Table 3.1.6 Measurement Items for Knowledge Work Outcomes

Label	**Item Description**
	New Idea (6 items)
	Using the computer application for my work enables me to:
KWOIDE1	generate more ideas.
KWOIDE2	come up with different ideas.
KWOIDE3	have more sources to generate new ideas.
KWOIDE4	re-specify new objectives of my tasks.
KWOIDE5	reformulate new objectives of my tasks.
KWOIDE6	discover new pattern in existing data.
	New Interpretation (5 items)
	Using the computer application for my work enables me to:
KWOINT1	see old problems in a new way.
KWOINT2	identify different causes of existing problems.
KWOINT3	discover new explanations of an existing situation.
KWOINT4	find alternative solutions for existing problems.
KWOINT5	try out different solutions for existing problems
	New Processes (4 items)
	Using computer application for my work enables me to:
KWOPRO1	implement new work methods.
KWOPRO2	integrate new ideas into my work processes.
KWOPRO3	implement new processes in my workgroup.
KWOPRO4	modify my existing work process.
	New Artifacts (4 items)
	Using computer application for my work enables me to:
KOWART1	create something new (e.g. document, spreadsheet, drawing, and etc.).
KOWART2	create something different (e.g. codes, template, macro, and etc.).
KOWART3	create new designs
KOWART4	develop new products.
	Productivity (5 items)
	Using computer application for my work enables me to:
KOWPRO1	manage my tasks productively.

KOWPRO2	generate quality task outputs.
KOWPRO3	shorten my learning cycle.
KOWPRO4	make better decision.
KOWPRO5	respond to the problems quickly.

3.2. Data Analysis Method

The goals of data analysis are to purify the observed items and to validate the factorial structure of each construct in the proposed research model. Several steps need to be taken to ensure the reliability and discriminant validity of each scale.

3.2.1. Item Purification

According the sampling domain model, all the items in the same measure are drawn from the domain of a single construct. Thus the responses to those items in the same measure should be highly inter-correlated (Churchill, 1979). The first step of data analysis is purifying items by examining coefficient alpha of a set of items in the scale. High coefficient alpha indicates the items correlated well with the true scores.

Cronbach's alpha (1951) is used to access the reliability of each scale. Alpha value is greater than 0.7 is considered acceptable (Nunnally, 1978). Corrected item-to-total correlation (CITC) can be used to purify scales (Kerlinger, 1978). An item with CITC less than 0.5 should be eliminated from the scale to improve reliability. After eliminate the item with low CITC, alpha coefficient should improve. This process continues until alpha value can not be improved further.

3.2.2. Factorial Structure Examination

The second step of data analysis is to perform factor analysis with SPSS Version 13 on the purified items from the first step. Factor analysis is a procedure that is used to reduce the number of variables by determining which variables "cluster" together. The factors are then formed by the groupings of variables that are measuring some common entity or construct (Mertler and Vannatta, 2002). The purpose of the factor analysis is to investigate the relationship between sets of observed and latent variables.

The criterion to retain the factors in this step of data analysis is based on Kaiser's rule. The rule states that only those factors whose eigenvalues are greater than 1 should be retained. In this research, there is prior belief that underlying factors are correlated (e.g. the belief that new idea and new interpretation are correlated). Thus oblique rotation (Promax) is used for factor analysis.

Factor loading is a frequently used criterion to determine which variables are substantially related to a given factor (Hogarty et al., 2005). The most common used cutoff factor loading value is 0.3. Comrey and Lee (1973) offered the additional suggestion that loading in excess of .71 is excellent, .63 is very good, .55 is good, .45 is fair, and .32 is poor. This research uses 0.4 as cutoff factor loading. The items with factor loading less than 0.4 are the candidate for elimination. In addition, if an item has loaded on more than one factor and its factor loading is grater than 0.4, this item will also be a candidate for removal.

3.2.3. Measurement Model Fitting

The third step of data analysis is to construct measurement models in LISREL based on the factors extracted from the previous step. The purpose of measurement model fitting is to examine the unidimensionality and the correlated error term to further purify the scales.

Measurement model with non-significant chi square value indicates better model fit. Several indexes including Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), and Non-Normed Fit Index (NNFI) are used to assess model fit. The value of CFI and NNFI greater than 0.9 and the value of RMSEA less than 0.1 indicates acceptable model fit (Byrne, 1998). If the measurement model is poorly fitted, correlated error terms will be examined. When correlated error terms exist in a measurement model, one of the items will be removed to improve the model fit. The items with the better theory support will remain in the model.

After the items with correlated error term have been removed, step 1 (calculating alpha and CITC) and step 2 (factor analysis) are repeated to ensure the reliability of each scale are greater than 0.7 and the factorial structure of each construct are supported by theories.

3.2.4. Discrminant Validity

The fourth step of data analysis is to validate the descriminant validity of each scale. Discriminant validity is assessed by estimating an alternative model in which the correlation between a pair of scales is set to 1. The difference of χ^2 values between the restricted model and free model provides the statistical evidence of discriminant validity (Segars, 1997).

Average variance extracted (AVE) indicates the amount of variance that is captured by the scale in relation to the amount of variance due to measurement error (Fornell and Larcker, 1981). If AVE is less than 0.5, the variance due to measurement error is larger than the variance captured by the respective scale. The further evidence of discriminant validity is assessed through comparing AVE and squared correlation between two scales. To fully satisfy the requirement for discriminant validity, AVE for each scale should be greater than the squared correlation between two scales. Such results suggest that items share more common variance with their respective scale than the variance that the scale shares with other scales (Segars, 1997).

3.2.5. Predictive Power

The fifth step of data analysis is to test the predictive power of the scales proposed in the research model. Stepwised linear regression is used to examine the correlation between the constructs. For example, the scales represent individual interpretative styles (i.e. internal/external, stable/unstable, general/specific, performance goal, learning goal, product envisioning and process envisioning) are entered into a regression model as independent variables, and scales represent user empowerment (i.e. self autonomy, self efficacy, intrinsic motivation, and perceived impact) as dependent variables.

Significant standardized beta coefficients of independent variables and R-squared of the model are the evidence of the predictive power.

3.3. Pilot Study

A pilot study is conducted to purify suggested items and validate the factorial structure of the proposed constructs. The result of the pilot study is recommended items for large scale survey.

3.3.1. Data Collection of Pilot Study

Data for the pilot study are collected through the method of web survey (see appendix 1). The criterion to select subjects is that he/she has to use computer software package for his/her knowledge works. The sample of the pilot study is a convenient sample drawn from the knowledge workers in Ann Arbor and Detroit metropolitan area in Michigan, and Toledo, Ohio. Selected knowledge workers are notified the purpose and link of the web survey via e-mail. They then respond to survey from their web browser.

The collection process lasted about four weeks. The responses from a sample of 62 respondents were collected for the initial data analysis. Number of respondents grouped by work process, education, and gender are shown in the Table 3.3.1.1, Table 3.3.1.2, and Table 3.3.1.3.

Table 3.3.1.1 Number of Respondents Grouped by Work Process (Pilot Study)

Work Process	# of Respondent	Percent
Administration	9	14.5
Customer Support	2	3.2
Management	8	12.9
Product Design	4	6.5
Manufacturing Engineering	4	6.5
Research	10	16.1
Strategy Formulation	1	1.6
Other	24	38.7
Total	62	100.0

Table 3.3.1.2 Number of Respondents Group by Education (Pilot Study)

Highest Degree	# of Respondent	Percent
High School	4	6.5
Associate	5	8.1
Bachelor	26	41.9
Master	15	24.2
Doctorate	12	19.4
Total	62	100.0

Table 3.3.1.3 Number of Respondents Group by Gender (Pilot Study)

Gender	# of Respondents	Percent
Male	44	71.0
Female	18	29.0
Total	62	100.0

3.3.2 Pilot Study Result

The proposed scales in each construct are purified by examining their alpha coefficient and corrected-item-total-correlation (CITC) using SPSS. The item that does not contribute to alpha value or its CITC is less than 0.5 is removed from the respective scale. Exploratory factor analysis is then performed for the remained items in each construct to investigate its factorial structure. Eigen value greater than 1 is used as the criterion to extract factors. Factor number is used to extract factors, if the number of factors extracted is not consistent with what theories suggest. The correlation matrixes show that scales within the construct are correlated, Promax rotation (an oblique rotation, which allows factors to be correlated) is applied to the procedure of factor analysis. The items that have cross-loading greater than 0.4 on different factors will be removed for further analysis.

The items in each factor are then examined in a measurement model in LISREL. If the items do not fit the measurement model well (i.e. Chi square value is significant and RMSEA is greater than 0.1), modified indexes are used to examine correlated error terms. In the case of correlated error term, one of the items has to be removed. The item that is supported by the theories most will stay in the scale. After the measurement model fitting process, Cronbach alpha and CITC are recalculated for each scale. The results of the purified scale are displayed in Table 3.3.2.1 through Table 3.3.2.12.

In the construct of personal Interpretative style, originally there are same 9 items placed into two groups to measure attribution style of IT use. One group of items reflects on the unsuccessful IT use experience and the other reflects on the successful IT use experience. The results of pilot study show that scales measure attribution style on the unsuccessful IT use experience do not have sufficient alpha value. This is probably because knowledge workers don't like to be reminded their unsuccessful IT experiences. The same 9 items measure on the successful IT experience have sufficient alpha value and form 3 factors as attribution theory suggested. Thus the group that measures attribution style based on the unsuccessful IT experience will be removed from further analysis and large scale study. Evaluating style has two factors respectively performance goal and learning goal as expected. Envisioning style splits into two factors namely product envisioning and process envisioning. Both factors have alpha greater than 0.7 and all items in both factors has CITC greater than 0.5. Two factor model of envisioning style provide better predictive power than single factor model. The purified items of *Personal Interpretative styles* and its factorial structure are displayed in Table 3.3.2.1 and Table 3.3.2.2.

In the construct of communities of practice, 2 items labeled as COMIDE2 and COMIDE5 do not contribute to alpha value and thus be removed from *Group Identity*. Three factors namely ability, benevolence, and integrity have been extracted from the items that measure *Trust* as Mayer's theory (1995) suggested. Items COMPSU1 and COMPSU3 have CITC less than 0.5 and thus removed from *Peer Support*. The purified item of Communities of Practice and its factorial structure are displayed in Table 3.3.2.3 and Table 3.3.2.4.

In the construct of interpretative flexibility, IFLACT6 (Q99) is removed since it does not contribute to alpha value of *Action Ability*. Three factors namely *Self Deploying*, *Evolving Ability*, and *Action Ability* are extracted from the remained items through factor analysis. The resulted items are then fit into a measurement model for each factor. IFLSDE3 (Q83), IFLSDE4 (Q84), IFLSDE5

(Q85), IFLEVO2 (Q88), IFLEVO3 (Q89), IFLACT2 (Q95), IFLACT3 (Q96), and IFLACT4 (Q97) are removed in the measurement model fitting process due to correlated error terms. The purified items and factorial structure in Interpretative Flexibility are displayed in Table 3.3.2.5 and Table 3.3.2.6.

In the construct of *User Empowerment*, four dimensions respectively *User Autonomy*, *Self Efficacy*, *Intrinsic Motivation*, and *Perceived Impact* all have alpha greater than 0.8 and CITC of each items are all above 0.7. Factor analysis confirms that four factors are extracted from the suggested measurement items. The results of pilot study consist with the study by Doll et al. (2004). The results are displayed in Table 3.3.2.7 and Table 3.3.2.8.

In the analysis of the construct of *Enacted System Use,* item ESUDEC4 (Q103) does not contribute the value of alpha and is removed for the further analysis. The rest of items form 5 factors through factor analysis. These 5 factors are namely *Decision Support*, *Communication*, *Coordination*, *Knowledge Sharing*, and *System Reconfiguration*. They all have alpha value grater than 0.8 and range of CITC from 0.637 to 0.886. Within the five extracted factors, communication, coordination, and knowledge sharing represent the dimension of collaboration. The results are displayed in Table 3.3.2.9 and Table 3.3.2.10.

In the analysis of the construct of *Knowledge Work Outcomes*, initially KWOIDE6 (Q128) is removed from the scale of New Idea since it does not contribute to alpha value. In the process of factor analysis, several items cross loaded on more than one component. Item KWOIDE3 (Q125), KWOINT1 (Q129),

KWOINT2 (Q130), KWOART1(Q138), KWOART2(Q139) cross loaded on more than one component and with factor loading greater than 0.4. KOWPRO3 (Q144) has factor loading less than 0.4. These items are removed for further analysis to gain clean factorial structure. After fitting the measurement model, KWOIDE4 (Q127) is removed due to correlated error term. Purified items and factorial structure are displayed in Table 3.3.2.11 and Table 3.3.2.12.

Purified scales are further analyzed for the discriminant validity. Pairwised Chi-square difference test is performed for every pair of scales in each construct. For each pair of scale to be significantly different at $p < 0.01$, the difference of χ^2 value between the free model and constrained model has to be greater than χ^2 value at level p = 0.01/(number of comparison). For example, for 21 comparisons in the construct of personal interpretative style, the critical χ^2 value at p=0.00048.

Table 3.3.2.13 through Table 3.3.2.18 reports the reliability, correlation, and discriminant validity for each scale. Within 29 scales, 13 scales have reliability greater than 0.9, 15 scales have reliability between 0.8 and 0.9 and 1 scale has reliability 0.79. Although alpha value of product envision is 0.79 which is considered acceptable. All 60 pairs of Chi-square difference test show significant difference. The results provide the evidence of the discriminant validity for the proposed scales.

Table 3.3.2.19 through Table 3.3.2.23 displays the predictive power of each scale on each criterion. Number in each cell is standard beta coefficient of the independent variables that enter into the regression model. Empty cell means that relation between the independent variable and criterion is not significant. At the aggregate level, Personal Interpretative Style explains 35.9% variance of User Empowerment and 24.3% variance of Enacted System Use. Communities of Practice is lacking of predictive power on both Empowerment and Enacted System Use at the aggregate level. However, some individual scales have significant relation with individual criterion (see Table 3.3.2.20). Interpretative Flexibility explains 35.9% variance of User Empowerment and 24.3% variance of Enacted System Use at aggregate level. User Empowerment explains 19% variance of Enacted System Use. Enacted system Use explains 67.7% variance of Knowledge Work Outcome.

Table 3.3.2.1 Measurement Items of Personal Interpretive Styles (pilot Study)

Label	Q #	CITC	Item Description
			Attributing Style (9 items)
			The items below describe the attribution of the successful IT use experience.
			(Internal – External) Alpha = .910
INTATT10	Q14	.793	An aspect of myself / An aspect of the situation
INTATT11	Q15	.807	Something inside of me / Something outside of me
INTATT12	Q16	.872	Something about me / Something about other
			(Stable – Unstable) Alpha = .850
INTATT13	Q17	.754	Something permanent / Something temporary
INTATT14	Q18	.723	Something stable over time / Something unstable over time
INTATT15	Q19	.686	Something unchangeable / Something changeable
			(Global – Specific) Alpha = .827
INTATT16	Q20	.645	Something applies to all situation / Something applies to certain situations only
INTATT17	Q21	.777	Something influences all of my tasks / Something influences some of my tasks
INTATT18	Q22	.641	Something affects my life in general / Something affects my certain areas only
			Evaluating Style
			My primary goal in using software package for my work is to:
			Performance Goal (4 items) Alpha = .817
INTEVA1	Q23	.625	complete my task quickly.
INTEVA4	Q26	.656	meet the due date of my task.
INTEVA5	Q27	.674	solve a problem immediately.
INTEVA6	Q28	.620	meet my emerging needs.
			Learning Goal (4 Items) Alpha = .909
INTEVA8	Q30	.824	learn new computer skills.
INTEVA9	Q31	.835	gain new knowledge.
INTEVA10	Q32	.789	challenge myself.
INTEVA11	Q33	.734	find different ways of using this software.
			Envisioning Style
			When I use software package to do my work:
			Product Envisioning (3 items) Alpha = .790
INTENV1	Q35	.634	I have a vivid image of the end result.
INTENV2	Q36	.611	I can visualize the details of my intellectual end product.
INTENV3	Q37	.651	I can visualize what my end product will look like.

			Process Envisioning (3 items) Alpha= .853
INTENV4	Q38	.777	I have a vivid image of every work process I need to go through.
INTENV5	Q39	.713	I can visualize how to navigate through the different steps of work process.
INTENV6	Q40	.710	I can see a vivid image of the map of each work process.

Table 3.3.2.2 Factor Analysis – Personal Interpretative Style (Pilot Study)

Pattern Matrix(a)

	Component						
	Learning Goal	Performance Goal	Process Envision	Internal/ External	Global/ Specific	Stable/ Unstable	Product Envision
q31	.900						
q30	.898						
q33	.877						
q32	.861						
q26		.848					
q27		.800					
q23		.788					
q28		.752					
q38			.944				
q39			.823				
q40			.769				
q14				.914			
q16				.905			
q15				.726			
q20					.904		
q21					.844		
q22					.730		
q17						.923	
q18						.896	
q19						.783	
q37							.934
q35							.743
q36							.544

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
Rotation converged in 7 iterations.

Table 3.3.2.3 Measurement Items for Communities of Practice (Pilot Study)

Label	Q #	CITC	Item Description
			Group Identity (3 items) Alpha = .855
COMIDE1	Q53	.639	When I talk about my workgroup, I always say 'we' rather than 'they'.
COMIDE3	Q55	.795	My workgroup's success is my success.
COMIDE4	Q56	.765	When someone praises my workgroup, it feels like a personal compliment.
			Trust
			I believe that my coworkers:
			Ability (4 items) Alpha =.837
COMTRU1	Q58	.769	have the skills to do their work well.
COMTRU2	Q59	.779	have the expertise to do their work well.
COMTRU4	Q61	.578	have sufficient knowledge about the technology we use.
COMTRU5	Q62	.581	have good judgment on problem solving.
			Benevolence (5 items) Alpha = .879
COMTRU6	Q63	.701	would not lie to me.
COMTRU7	Q64	.760	would not do anything to harm our workgroup.
COMTRU8	Q65	.863	would not do anything to harm our relationship.
COMTRU9	Q66	.604	are not egocentric.
COMTRU10	Q67	.647	are loyal to our workgroup.
			Integrity (5 items) Alpha =.877
COMTRU12	Q68	.603	are consistent.
COMTRU12	Q69	.836	keep their promise.
COMTRU13	Q70	.831	do what they said
COMTRU14	Q71	.628	adhere to our workgroup principles.
COMTRU15	Q72	.665	have a strong sense of justice.
			Peer Support (5 items) Alpha = .854
COMPSU2	Q75	.578	My coworkers listen to me about work related problems.
COMPSU4	Q77	.760	I can get the helps from my coworkers to solve my problems.
COMPSU5	Q78	.690	My coworkers provide helpful information for my work.
COMPSU6	Q79	.662	With support from my coworkers, I never feel alone.
COMPSU7	Q80	.677	I have the support I need from my coworkers to do my job well.

Table 3.3.2.4 Factor Analysis – Communities of Practice (Pilot Study)

Pattern Matrix(a)

	Component				
	Benevolence	Peer Support	Integrity	Ability	Group Identity
q65	.947				
q64	.847				
q63	.841				
q66	.641				
q67	.499				
q77		.887			
q80		.865			
q78		.781			
q79		.665			
q75		.595			
q70			.878		
q68			.826		
q69			.757		
q71			.685		
q72			.477		
q58				.925	
q59				.893	
q62				.611	
q61				.534	
q53					.871
q56					.869
q55					.867

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
Rotation converged in 7 iterations.

Table 3.3.2.5 Measurement Items for Interpretive Flexibility (Pilot Study)

Label	Q#	CITC	Item Description
			Self-deploying (2 items) Alpha = .898
			The software packages at my work:
IFLSDE1	Q81	.815	can accommodates my skill level.
IFLSDE2	Q82	.815	can guide me for the different applications.
			Evolving Ability (4 items) Alpha = .901
			The software packages at my work:
IFLSDE6	Q86	.694	can accommodate different situations.
IFLEVO1	Q87	.746	can import information from different sources.
IFLEVO4	Q90	.842	can accommodate the growing complexity of my work.
IFLEVO5	Q91	.842	can accommodate the growing knowledge base of my work.
			Action Ability (4 items) Alpha = .853
			The software packages at my work:
IFLEVO6	Q92	.748	have add-in features.
IFLEVO7	Q93	.695	are reconfigurable to meet my different needs.
IFLACT1	Q94	.666	inform me the worst case scenario.
IFLACT5	Q98	.668	support the emergent process of deliberation in my workgroup.

Table 3.3.2.6 Factor Analysis – Interpretative Flexibility (Pilot Study)

Pattern Matrix(a)

	Component		
	Self Evolving	Action Ability	Self Deploying
q86	1.016		
q87	.874		
q90	.772		
q91	.697		
q94		1.044	
q93		.772	
q92		.650	
q98		.557	
q82			.958
q81			.955

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
Rotation converged in 5 iterations.

Table 3.3.2.7 Measurement Items for User Empowerment (Pilot Study)

Label	Action	CITC	Item Description
			User Autonomy (3 items) Alpha = .913
EMPUAT1	Q41	.797	I have considerable opportunity for independence in how I use the software for my work process.
EMPUAT2	Q42	.884	I have significant autonomy in determining in how I use software for my work process.
EMPUAT3	Q43	.796	I have a say in how I use this software for my work process.
			Self-efficacy (3 items) Alpha = .874
EMPSEL1	Q44	.722	I am confident about my ability to use the software to complete my work.
EMPSEL2	Q45	.832	I believe in my capabilities to use the software for my work.
EMPSEL3	Q46	.724	I have mastered the skills necessary for using the software for my work.
			Intrinsic Motivation (3 items) Alpha = .903
EMPINT1	Q47	.791	Using the software for my work process is enjoyable.
EMPINT2	Q48	.882	Using the software for my work process is pleasurable.
EMPINT3	Q49	.759	Using the software for my work process foster enjoyment.
			Perceived Impact (3 items) Alpha = .864
EMPPER1	Q50	.741	Using the software increases my productivity.
EMPPER2	Q51	.741	Using the software saves me time
EMPPER3	Q52	.763	Using the software allows me to accomplish more work than would otherwise be possible.

Table 3.3.2.8 Factor Analysis – User Empowerment (Pilot Study)

Pattern Matrix(a)

	Component			
	Self Autonomy	Intrinsic Motivation	Perceived Impact	Self Efficacy
q43	.926			
q42	.906			
q41	.898			
q48		.953		
q47		.910		
q49		.849		
q51			.922	
q50			.866	
q52			.861	
q45				.902
q46				.883
q44				.863

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
Rotation converged in 5 iterations.

Table 3.3.2.9 Measurement Items for Enacted System Use (Pilot Study)

Label	Q #	CITC	Item Description
			Decision Support (3 items) Alpha = .842
ESUDEC1	Q100	.753	I use the computer application to improve the efficiency of the decision process
ESUDEC2	Q101	.735	I use the computer application to help me make explicit reasons for my decision.
ESUDEC3	Q102	.637	I use the computer application to make sense out of data.
			Collaboration
			I use software at my work to:
			(Communication – 4 items) Alpha = .931
ESUCOL1	Q104	.875	communicate with other members in my workgroup.
ESUCOL2	Q105	.862	discuss my interest with other members in my workgroup.
ESUCOL3	Q106	.886	discuss issues with other members in my workgroup.
ESUCOL4	Q107	.823	understand how my tasks are related with the goal of my workgroup.
			(Coordination – 6 items) Alpha = .920
ESUCOL5	Q108	.735	establish mutual understanding with the members in my workgroups
ESUCOL6	Q109	.884	establish the priority of different tasks in my work group.
ESUCOL7	Q110	.801	coordinate with others in my workgroup.
ESUCOL8	Q111	.826	understand how the progress of my tasks are related with other's.
ESUCOL9	Q112	.735	manage the priorities of my tasks.
ESUCOL12	Q115	.847	seek help from other workgroup members.
			(Knowledge Sharing – 4 items) Alpha = .901
ESUCOL10	Q113	.787	retrieve the information documented by my workgroup members.
ESUCOL11	Q114	.796	share information with my workgroup members.
ESUCOL13	Q116	.799	exchange information with my workgroup members.
ESUCOL14	Q117	.740	share my experience with other workgroup members.
			System Reconfiguration (5 items) Alpha = .910
			I modify the computer application to meet the different needs of my works by:
ESUREC1	Q118	.698	changing the parameters of the computer application.

ESUREC2	Q119	.779	rearranging the user interface of the computer application.
ESUREC3	Q120	.807	plugging in different functional component to the computer
ESUREC4	Q121	.787	writing the codes to change the computer application.
ESUREC5	Q122	.797	using the add-in features of the computer application.

Table 3.3.2.10 Factor Analysis – Enacted System Use (Pilot Study)

Pattern Matrix(a)

	Component				
	Coordination	System Reconfiguration	Communication	Knowledge Sharing	Decision Support
q112	.909				
q109	.907				
q111	.890				
q110	.783				
q115	.771				
q108	.574				
q122		.901			
q121		.882			
q119		.878			
q120		.822			
q118		.808			
q106			.910		
q105			.907		
q104			.780		
q107			.734		
q113				.899	
q114				.877	
q116				.614	
q117				.481	
q100					.893
q101					.887
q102					.818

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
Rotation converged in 6 iterations.

Table 3.3.2.11 Measurement Items for Knowledge Work Outcomes (pilot Study)

Label	Q #	CITC	Item Description
			New Idea (3 items) Alpha = .944
			Using the computer application for my work enables me to
KWOIDE1	Q123	.902	generate more new ideas.
KWOIDE2	Q124	.923	come up with different ideas.
KWOIDE4	Q126	.825	re-specify new objectives of my tasks.
			New Interpretation (3 items) Alpha = .933
			Using the computer application for my work enables me to
KWOINT3	Q131	.858	discover new explanations of an existing situation.
KWOINT4	Q132	.879	find alternative solutions for existing problems.
KWOINT5	Q133	.854	try out different solutions for existing problems
			New Processes (4 items) Alpha = .962
			Using computer application for my work enables me to
KWOPRO1	Q134	.890	implement new work methods.
KWOPRO2	Q135	.935	integrate new ideas into my work processes.
KWOPRO3	Q136	.926	implement new processes in my workgroup.
KWOPRO4	Q137	.873	modify my existing work process.
			New Artifacts (2 items) Alpha = .885
			Using computer application for my work enables me to
KOWART3	Q140	.796	create new designs
KOWART4	Q141	.796	develop new products.
			Productivity (4 items) Alpha = .924
			Using computer application for my work enables me
KOWPRO1	Q142	.786	to manage my tasks productively.
KOWPRO2	Q143	.825	to generate quality task outputs.
KOWPRO4	Q145	.845	to make better decision.
KOWPRO5	Q146	.845	to respond to the problems quickly.

Table 3.3.2.12 Factor Analysis – Knowledge Works Outcome

Pattern Matrix(a)

	Component				
	New Process	Productivity	New Interpretation	New Idea	New Artifact
q134	1.039				
q136	.878				
q135	.785				
q137	.760				
q143		.944			
q142		.910			
q146		.815			
q145		.764			
q132			.918		
q131			.914		
q133			.735		
q124				.912	
q123				.848	
q126				.735	
q140					.999
q141					.882

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
Rotation converged in 6 iterations.

Table 3.3.2.13 Personal Interpretative Style: Reliability, Correlation, and Discriminant Validity (Pilot Study)

	Internal/ External	Stable/ Unstable	General/ Specific	Perform Goal	Learning Goal	Product Envision	Process Envision
Internal/ External	α = 0.910 AVE = 0.78						
Stable/ Unstable	0.355** χ^2_{Diff} =67.41	α = 0.850 AVE = 0.66					
General/ Specific	0.522** χ^2_{Diff} = 50.52	0.411** χ^2_{Diff} = 72.65	α = 0.827 AVE = 0.63				
Perform Goal	-0.145 χ^2_{Diff} = 107.23	-0.078 χ^2_{Diff} = 71.33	-0.214 χ^2_{Diff} = 68.68	α = 0.817 AVE = 0.54			
Learning Goal	-0.235 χ^2_{Diff} = 191.35	-0.056 χ^2_{Diff} = 77.13	-0.150 χ^2_{Diff} = 190.74	0.260* χ^2_{Diff} = 89.98	α = 0.909 AVE = 0.72		
Product Envision	-0.078 χ^2_{Diff} = 55.03	0.014 χ^2_{Diff} = 73.44	0.144 χ^2_{Diff} = 59.61	-0.046 χ^2_{Diff} = 48.59	-0.025 χ^2_{Diff} = 56.08	α = 0.790 AVE = 0.56	
Process Envision	0.048 χ^2_{Diff} = 82.45	-0.208 χ^2_{Diff} = 82.43	0.029 χ^2_{Diff} = 79.41	0.019 χ^2_{Diff} = 71.17	0.114 χ^2_{Diff} = 84.17	0.511** χ^2_{Diff} = 31.92	α = 0.853 AVE = 0.67
Mean	3.02	2.80	3.03	3.88	3.12	4.02	3.75
Std. Dev.	1.16	0.99	0.99	0.80	0.99	0.61	0.78

** Correlation is significant at 0.01 level.
* Correlation is significant at 0.05 level.

$\chi^2_{(df=1, p=.01)} = 12.21$

Table 3.3.2.14 Communities of Practice: Reliability, Correlation, and Discriminant Validity (Pilot Study)

	Group Identity	Ability	Benevolence	Integrity	Peer Support
Group Identity	α = 0.855				
	AVE = 0.68				
Ability	0.271*	α = 0.837			
	χ^2_{Diff} = 117.04	AVE = 0.59			
Benevolence	0.075	0.538**	α = 0.879		
	χ^2_{Diff} = 87.75	χ^2_{Diff} = 83.38	AVE = 0.60		
Integrity	0.113	0.402**	0.660**	α = 0.877	
	χ^2_{Diff} = 80.90	χ^2_{Diff} = 102.40	χ^2_{Diff} = 75.18	AVE = 0.62	
Peer Support	0.389**	0.392**	0.294*	0.449**	α = 0.854
	χ^2_{Diff} = 81.23	χ^2_{Diff} = 105.11	χ^2_{Diff} = 166.12	χ^2_{Diff} = 158.28	AVE = 0.55
Mean	2.96	3.92	3.57	3.59	3.87
Std. Dev.	1.075	0.573	0.652	0.534	0.520

** Correlation is significant at 0.01 level. * Correlation is significant at 0.05 level.
$\chi^2_{(df=1, p=.01)} = 10.83$

Table 3.3.2.15 Interpretative Flexibility: Reliability, Correlation, and Discriminant Validity (Pilot Study)

	Self Deploying	Self Evolving	Action Ability
Self Deploying	α = 0.898		
	AVE =		
Self Evolving	0.593**	α = 0.901	
	χ^2_{Diff} = 30.29	AVE = 0.70	
Action Ability	0.428**	0.725**	α = 0.853
	χ^2_{Diff} = 42.22	χ^2_{Diff} = 25.28	AVE = 0.60
Mean	3.63	3.41	2.87
Std. Dev.	0.794	0.787	0.854

** Correlation is significant at 0.01 level.
$\chi^2_{(df=1, p=.01)} = 8.61$

Table 3.3.2.16 User Empowerment: Reliability, Correlation, and Discriminant Validity (Pilot Study)

	Autonomy	Self Efficacy	Intrinsic Motivation	Perceived Impact
Autonomy	α =0.913			
	AVE = 0.78			
Self Efficacy	0.383**	α = 0.874		
	χ^2_{Diff} = 66.18	AVE = 0.71		
Intrinsic Motivation	0.347**	0.331**	α = 0.903	
	χ^2_{Diff} = 84.23	χ^2_{Diff} = 75.35	AVE = 0.77	
Perceived Impact	0.146	0.404**	0.178	α = 0.864
	χ^2_{Diff} = 89.1	χ^2_{Diff} = 64.70	χ^2_{Diff} = 83.05	AVE = 0.69
Mean	3.83	4.13	3.55	4.18
Std. Dev.	1.036	0.725	0.875	0.703

** Correlation is significant at 0.01 level. $\chi^2_{(df=1,\ p=.01)}$ = 9.88

Table 3.3.2.17 Enacted System Use: Reliability, Correlation, and Discriminant Validity (Pilot Study)

	Decision Support	Comm.	Coordination	Knowledge Sharing	System Reconfig.
Decision Support	α = 0.841				
	AVE = 0.65				
Communication	0.440**	α = 0.931			
	χ^2_{Diff} = 57.74	AVE = 0.78			
Coordination	0.506**	0.725**	α =0.920		
	χ^2_{Diff} = 53.57	χ^2_{Diff} = 104.33	AVE = 0.69		
Knowledge Sharing	0.557**	0.681**	0.720**	α = 0.901	
	χ^2_{Diff} = 43.45	χ^2_{Diff} = 87.41	χ^2_{Diff} = 63.33	AVE = 0.70	
System Reconfiguration	0.241	0.284*	0.237	0.170	α = 0.910
	χ^2_{Diff} = 76.11	χ^2_{Diff} = 214.00	χ^2_{Diff} = 256.03	χ^2_{Diff} = 182.10	AVE = 0.68
Mean	3.22	3.23	3.26	3.52	2.02
Std. Dev.	0.852	1.116	0.927	0.958	1.032

** Correlation is significant at 0.01 level.
* Correlation is significant at 0.05 level.
$\chi^2_{(df=1,\ p=.01)}$ = 10.83

Table 3.3.2.18: Knowledge Outcome: Reliability, Correlation, and Discriminant Validity (Pilot Study)

	New Idea	New Interpretation	New Process	New Artifact	Productivity
New Idea	α = 0.944 AVE = 0.86				
New Interpretation	0.768** χ^2_{Diff} = 70.68	α = 0.933 AVE = 0.82			
New Process	0.768** χ^2_{Diff} = 66.00	0.725** χ^2_{Diff} = 75.40	α = 0.962 AVE = 0.86		
New Artifact	0.401** χ^2_{Diff} = 33.77	0.350** χ^2_{Diff} = 30.17	0.509** χ^2_{Diff} = 33.67	α = 0.885 AVE =	
Productivity	0.758** χ^2_{Diff} = 95.97	0.679** χ^2_{Diff} = 93.79	0.680** χ^2_{Diff} = 127.24	0.402** χ^2_{Diff} = 31.54	α = 0.924 AVE = 0.76
Mean	2.96	3.23	2.86	2.74	3.40
Std. Dev.	1.075	1.007	1.082	1.140	1.043

** Correlation is significant at 0.01 level.

$\chi^2_{(df=1,\ p=.01)} = 10.83$

Table 3.3.2.19 Predictive Power of Interpretive Style -Standardized Beta coefficient & R-square (Pilot Study)

Internal	Stable	General	Perform. Goal	Learning Goal	Product Envision	Process Envision	Criteria	R-square
		-0.292	0.277		0.353		**Self Autonomy**	0.283
						0.317	**Self Efficacy**	0.101
			0.269	0.360			**Intrinsic Motivation**	0.258
					0.418		**Perceived Impact**	0.175
		-0.270	**0.326**		**0.435**		**Empowerment**	**0.359**

Internal	Stable	General	Perform. Goal	Learning Goal	Product Envision	Process Envision	Criteria	R-square
-0.322							**Decision Support**	0.103
				0.653			**Communication**	0.427
			0.285	0.461			**Coordination**	0.362
			0.325	0.242			**Knowledge Sharing**	0.206
							System Reconfiguration	
			0.259	**0.357**			**Enact System Use**	**0.243**

Table 3.3.2.20 Predictive Power of Communities of Practice - Standardized Beta coefficient & R-square (Pilot Study)

Group Identity	Ability	Benevolence	Integrity	Peer Support	Criteria	R-Square
					Self Autonomy	
					Self Efficacy	
			0.307		**Intrinsic Motivation**	0.094
					Perceived Impact	
					Empowerment	

Group Identity	Ability	Benevolence	Integrity	Peer Support	Criteria	R-Square
				0.283	**Decision Support**	0.080
			0.342		**Communication**	0.117
			0.399		**Coordination**	0.159
			0.334		**Knowledge Sharing**	0.111
					System Reconfiguration	
					Enacted Use	

Table 3.3.2.21 Predictive Power of Interpretative Flexibility - Standardized Beta coefficient & R-square (Pilot Study)

Self Deploying	Self Evolving	Action Ability	Criteria	R-Square
	0.572		Self Autonomy	0.327
0.383			Self Efficacy	0.147
		0.329	Intrinsic Motivation	0.108
0.396		-0.280	Perceived Impact	0.140
0.496			**Empowerment**	**0.246**

Self Deploying	Self Evolving	Action Ability	Criteria	R-Square
0.346		0.388	Decision Support	0.385
		0.526	Communication	0.277
		0.652	Coordination	0.425
	0.611		Knowledge Sharing	0.373
		0.350	System Reconfiguration	0.123
	0.350	**0.395**	**Enacted Use**	**0.479**

Table 3.3.2.22 Predictive Power of Empowerment - Standardized Beta coefficient & R-square (Pilot Study)

Self Autonomy	Self Efficacy	Intrinsic Motivation	Perceived Impact	Criteria	R-Square
		0.344		**Decision Support**	0.118
		0.457		**Communication**	0.209
		0.439		**Coordination**	0.193
0.345				**Knowledge Sharing**	0.119
0.259				**System Reconfiguration**	0.067
		0.435		**Enacted Use**	**0.190**

Table 3.3.2.23 Predictive Power of Enacted System Use - Standardized Beta coefficient & R-square (Pilot Study)

Decision Support	Com m.	Coordinate	Knowledge Sharing	System Recon..	Criteria	R-Square
0.528			0.359		**New Idea**	0.619
0.391			0.375		**New Interpretation**	0.456
0.318		0.496		0.180	**New Process**	0.609
				0.477	**New Artifact**	0.227
0.438			0.381	0.220	**Productivity**	0.646
0.478		0.348		0.246	**Knowledge Outcome**	0.677

3.3.3 Measurement Items for Large Scale Study

Based on the result of pilot study, existing items are carefully evaluated. Some items that do not perform well for the reliability or discriminant validity are removed from the large scale survey. Each scale in the User Empowerment construct has high reliability and discriminant validity. Thus no modification is needed for the measurements in the User Empowerment construct. For the rest of the constructs where the scale has less than 4 items, new items are added or existing items are reworded for the large scale survey. The items recommend for the large scale survey are re-labeled for the new identification. The suggested items are displayed in Table 3.3.3.1 through Table 3.3.3.6. In the heading of each table, PLABEL is the item label in pilot study, A/R means "Added" or "Reworded", and LLABEL means item label in large scale study.

Table 3.3.3.1 Measurement Items of Personal Interpretive Styles for Large Scale Study (24 items)

PLabel	A/R	LLabel	Item Description
			Attributing Style (9 items)
			The items below describe the attribution of the successful IT use experience.
INTATT10		PIATT1	An aspect of myself / An aspect of the situation
INTATT11		PIATT2	Something inside of me / Something outside of me
INTATT12		PIATT3	Something about me / Something about other
INTATT13		PIATT4	Something permanent / Something temporary
INTATT14		PIATT5	Something stable over time / Something unstable over time
INTATT15		PIATT6	Something unchangeable / Something changeable
INTATT16		PIATT7	Something applies to all situation / Something applies to certain situations only
INTATT17		PIATT8	Something influences all of my tasks / Something influences some of my tasks
INTATT18		PIATT9	Something affects my life in general / Something affects my certain areas only
			Evaluating Style (8 items)
			My primary goal in using software package for my work is to:
INTEVA1		PIEVA1	complete my task quickly.
INTEVA4		PIEVA2	meet the due date of my task.
INTEVA5		PIEVA3	solve a problem immediately.
INTEVA6		PIEVA4	meet my emerging needs.
INTEVA8		PIEVA5	learn new computer skills.
INTEVA9		PIEVA6	gain new knowledge.
INTEVA10		PIEVA7	challenge myself.
INTEVA11		PIEVA8	find different ways of using this software.
			Envisioning Style (7 items)
			When I use software package to do my work:
INTENV1		PIENV1	I have a vivid image of the end result.
	A	PIENV2	I can visualize my intellectual end product.
INTENV2		PIENV3	I can visualize the details of my intellectual end product.
INTENV3		PIENV4	I can visualize what my end product will look like.
INTENV4		PIENV5	I have a vivid image of every work process I need to go through.
INTENV5		PIENV6	I can visualize how to navigate through the different steps of work process.
INTENV6		PIENV7	I can see a vivid image of the map of each work process.

Table 3.3.3.2 Measurement Items of Communities of Practice for Large Scale Study (24 items)

PLabel	A/R	LLabel	Item Description
			Group Identity (5 items)
COMIDE1		CPIDE1	When I talk about my workgroup, I always say 'we' rather than 'they'.
COMIDE2	R	CPIDE2	I care about what others think about my workgroup.
COMIDE3		CPIDE3	My workgroup's success is my success.
COMIDE4		CPIDE4	When someone praises my workgroup, it feels like a personal compliment.
COMIDE5	R	CPIDE5	I feel bad when others criticize my workgroup.
			Trust (14 items)
			I believe that my coworkers:
COMTRU1		CPTRU1	have the skills to do their work well.
COMTRU2		CPTRU2	have the expertise to do their work well.
COMTRU4		CPTRU3	have sufficient knowledge about the technology we use.
COMTRU5		CPTRU4	have good judgment on problem solving.
COMTRU6		CPTRU5	would not lie to me.
COMTRU7		CPTRU6	would not do anything to harm our workgroup.
COMTRU8		CPTRU7	would not do anything to harm our relationship.
COMTRU9		CPTRU8	are not egocentric.
COMTRU10		CPTRU9	are loyal to our workgroup.
COMTRU12		CPTRU10	are consistent.
COMTRU12		CPTRU11	keep their promise.
COMTRU13		CPTRU12	do what they said
COMTRU14		CPTRU13	adhere to our workgroup principles.
COMTRU15		CPTRU14	have a strong sense of justice
			Peer Support (5 items)
COMPSU2	R	CPPSU1	I can talk to my coworkers about my work related problems.
COMPSU4		CPPSU2	I can get the helps from my coworkers to solve my problems.
COMPSU5		CPPSU3	My coworkers provide helpful information for my work.
COMPSU6		CPPSU4	With support from my coworkers, I never feel alone.
COMPSU7		CPPSU5	I have the support I need from my coworkers to do my job well.

Table 3.3.3.3 Measurement Items of Interpretive Flexibility for Large Scale Study (15 items)

PLabel	A/R	LLabel	Item Description
			Self-deploying (5 items)
			The software packages at my work:
IFLSDE1		IFSDE1	can accommodates my skill level.
	A	IFSDE2	have friendly user interface.
IFLSDE2		IFSDE3	can guide me for the different applications.
	A	IFSDE4	can coach me when I have questions.
	A	IFSDE5	have help functions.
			Evolving Ability (5 items)
			The software packages at my work:
IFLSDE6		IFEVO1	can accommodate different situations.
IFLEVO1		IFEVO2	can import information from different sources.
IFLEVO4		IFEVO3	can accommodate the growing complexity of my work.
IFLEVO5		IFEVO4	can accommodate the growing knowledge base of my work.
	A	IFEVO5	can accommodate my growing functional requirements.
			Action Ability (5 items) Alpha = .887
			The software packages at my work:
IFLEVO6		IFACT1	have add-in features.
IFLEVO7		IFACT2	are reconfigurable to meet my different needs.
IFLACT1		IFACT3	inform me the worst case scenario.
IFLACT3	R	IFACT4	support my changing requirements.
IFLACT5		IFACT5	support the emergent process of deliberation in my workgroup.

Table 3.3.3.4 Measurement Items of User Empowerment for Large Scale Study (12 items)

PLabel	A/R	LLabel	Item Description
			User Autonomy (3 items)
EMPUAT 1		UEUAT1	I have considerable opportunity for independence in how I use the software for my work process.
EMPUAT 2		UEUAT2	I have significant autonomy in determining in how I use software for my work process.
EMPUAT 3		UEUAT3	I have a say in how I use this software for my work process.
			Self-efficacy (3 items)
EMPSEL 1		UESEL1	I am confident about my ability to use the software to complete my work.
EMPSEL 2		UESEL2	I believe in my capabilities to use the software for my work.
EMPSEL 3		UESEL3	I have mastered the skills necessary for using the software for my work.
			Intrinsic Motivation (3 items)
EMPINT1		UEINT1	Using the software for my work process is enjoyable.
EMPINT2		UEINT2	Using the software for my work process is pleasurable.
EMPINT3		UEINT3	Using the software for my work process foster enjoyment.
			Perceived Impact (3 items)
EMPPER 1		UEPER1	Using the software increases my productivity.
EMPPER 2		UEPER2	Using the software saves me time.
EMPPER 3		UEPER3	Using the software allows me to accomplish more work than would otherwise be possible.

Table 3.3.3.5 Measurement Items of Enacted System Use for Large Scale Study (23 items)

PLabel	A/R	LLabel	Item Description
			Decision Support/Problem Solving (4 items)
ESUDEC1		ESDEC1	I use the software to improve the efficiency of the decision process
ESUDEC2		ESDEC2	I use the software to help me make explicit reasons for my decision.
ESUDEC3		ESDEC3	I use the software to make sense out of data.
ESUDEC4		ESDEC4	I use the software to analyze why problems occur.
			Collaboration (14 items)
			I use software at my work to:
ESUCOL1		ESCOL1	communicate with other members in my workgroup.
ESUCOL2		ESCOL2	discuss my interest with other members in my workgroup.
ESUCOL3		ESCOL3	discuss issues with other members in my workgroup.
ESUCOL4		ESCOL4	understand how my tasks are related to the goals of my workgroup.
ESUCOL5		ESCOL5	establish mutual understanding with the members in my workgroups
ESUCOL6		ESCOL6	establish the priority of different tasks in my work group.
ESUCOL7		ESCOL7	coordinate with others in my workgroup.
ESUCOL8		ESCOL8	understand how the progress of my tasks are related with other's.
ESUCOL9		ESCOL9	manage the priorities of my tasks.
ESUCOL12		ESCOL10	seek help from other workgroup members.
ESUCOL10		ESCOL11	retrieve the information documented by my workgroup members.
ESUCOL11		ESCOL12	share information with my workgroup members.
ESUCOL13		ESCOL13	exchange information with my workgroup members.
ESUCOL14		ESCOL14	share my experience with other workgroup members.
			System Reconfiguration (5 items)
			I modify software to meet the different needs of my works by:

ESUREC1		ESREC1	changing the parameters of the computer application.
ESUREC2		ESREC2	rearranging the user interface of the computer application.
ESUREC3		ESREC3	plugging in different functional component to the computer
ESUREC4		ESREC4	writing the codes to change the computer application.
ESUREC5		ESREC5	using the add-in features of the computer application.

Table 3.2.6 Measurement Items of Knowledge Work Outcomes for Large Scale Study (23 items)

PLabel	A/R	LLabel	Item Description
			New Idea (5 items)
			Using the computer application for my work enables me to
KWOIDE1		KWIDE1	generate more new ideas.
	A	KWIDE2	have more new ideas.
	A	KWIDE3	produce more new ideas.
KWOIDE2		KWIDE4	come up with different ideas.
KWOIDE4		KWIDE5	re-specify new objectives of my tasks.
			New Interpretation (4 items)
			Using the computer application for my work enables me to:
KWOINT3		KWINT1	discover new explanations for an existing situation.
	A	KWINT2	find new explanations for existing problems.
KWOINT4		KWINT3	find alternative solutions for existing problems.
KWOINT5		KWINT4	try out different solutions for existing problems
			New Processes (4 items)
			Using computer application for my work enables me to:
KWOPRO1		KWPRO1	implement new work methods.
KWOPRO		KWPRO2	integrate new ideas into my work

2			processes.
KWOPRO 3		KWPRO3	implement new processes in my workgroup.
KWOPRO 4		KWPRO4	modify my existing work process.
			New Artifacts (5 items)
			Using computer application for my work enables me to:
KOWART1	R	KWART1	create something new.
	A	KWART2	create new documents.
KOWART2	R	KWART3	create new plans.
KOWART3		KWART4	create new designs.
KOWART4		KWART5	develop new products.
			Productivity (5 items)
			Using computer application for my work enables me
KOWPRO 1		KWPRD1	to manage my tasks productively.
KOWPRO 2		KWPRD2	to generate quality task outputs.
KOWPRO 3	A	KWPRD3	to communicate with others effectively
KOWPRO 4		KWPRD4	to make better decision.
KOWPRO 5		KWPRD5	to respond to the problems quickly.

Chapter 4: Results of Large Scale Study

In the phase of large scale study, a revised questionnaire based on the pilot study is used for the data collection. Collected data are then analyzed based on the data analysis method descried in the previous chapter.

The following sections present the results of the large scale study. The first section displays the sample characteristics. The next few sections assess the reliability, convergent validly, and discriminant validity of each scale. Finally, the results of fitting sample data to the proposed structural model are presented and the suggested causal links between each construct are examined.

4.1. Large Scale Data Collection

For the purpose of this study, the respondents of the survey are knowledge workers who use information technology for their tasks. The typical knowledge workers are engineers, IT professionals, managers, researchers, customer services professionals, etc. The selection criteria of the large scale study are the knowledge workers (1) who are managerial or professional workers; (2) who use computer software packages for their work; and (3) whose works involve the activities such as problem solving, decision making, and improvisation. The samples of the large scale study include engineers from service engineering firms, customer support professionals from IT firms, business managers, marketing professionals, researchers, and IT professionals in different geographical areas in the United States.

Data for the large scale study are collected through online survey (see Appendix 2). Subjects are selected from two different channels, including the companies' sponsorship and the selected individual knowledge workers.

The first channel is through the sponsorship of the engineering firms and IT firms in different geographical areas in the United States. The researcher approached thirty companies to participate in this study. Three companies agreed to participate in the survey. Business managers in the sponsored companies were asked to send an e-mail with stated purpose of this study and the online survey link to the selected knowledge workers. Two weeks after the initial e-mailing, the contacted business managers sent a reminder to solicit additional responses. Out of 585 selected knowledge workers, 85 of them responded to this online survey, which accounted for 14.5% of response rate.

The second channel is to solicit knowledge workers in different geographical areas in the United States through researcher's social network. The selected knowledge workers are working in manufacturing firms, IT firms, service firms or educational institutions. The e-mail stating the study purpose and online survey link was send to the selected knowledge workers who met the selection criteria. Out of the pool of 255 potential participants, 126 responses were collected through the second channel that represented 49.4% of response rate.

To determine if the samples collected from two channels differ significantly, t-test is performed to compare six variable means of the two samples. Five variable means out of six variable means are not significant different at $p < 0.05$ level (See Table 4.1.1). The results suggest these two samples are not significantly different for most variables under investigation. Thus, this study makes the assumption that these two samples are from the same population. In order to have sufficient statistical power of structural equation modeling, this study combines the two samples together to yield 211 useful responses and accounted for 25.1% of response rate.

Table 4.1.1 Comparison of Two Sample Groups

	Mean of Group 1 (N=85)	**Mean of Group 2 (N=126)**	**T-value**	**P-value**
Personal Interpretive Styles	3.49	3.46	.376	.707
Communities of Practice	4.16	3.99	2.541	.012
Interpretive Flexibility	3.28	3.36	-.742	.459
User Empowerment	3.76	3.84	-.778	.438
System Use	2.92	2.99	-.638	.526
Knowledge Outcomes	2.84	3.07	-1.88	.062

Group 1 = Company sponsorship
Group 2 = Selected individual knowledge workers

Table 4.1.2 displays the number of respondents by the categories and main work process of their works. Managerial workers are the knowledge workers whose main work process involves in managing people or business processes. Professional workers are the knowledge workers whose main work process involves in providing services to external or internal customers. Analytical workers are the knowledge workers whose main work processes involve in problem solving, creative thinking, and decision making. The number of respondents grouped by gender, education, and experience of using software package are also displayed in the table 4.1.3 through table 4.1.5

Table 4.1.2 Number of Respondents Grouped by Work Process (Large Scale Study)

Category	Work Process	# of Respondent	Percent
Managerial Workers	Administration	16	7.6
	Business Operations	9	4.3
	Management	20	9.5
	Strategy Formulation	6	2.8
	Supply Chain Management	7	3.3
Professional Workers	Customer Support	64	30.3
	Education	8	3.8
	Marketing	9	4.3
	Sales/Accounting/Finance	7	3.3
Analytical Workers	Data Analysis	5	2.4
	Engineering Service	17	8.0
	Manufacturing Engineering	19	9.0
	Product Design	12	5.7
	Research	12	5.7
Total		211	100.0

Table 4.1.3 Number of Respondents Grouped by Gender (Large Scale Study)

Gender	# of Respondents	Percent
Male	159	75.4
Female	52	24.6
Total	211	100.0

Table 4.1.4 Number of Respondents Grouped by Education (Large Scale Study)

Highest Degree	# of Respondent	Percent
High School	10	4.7
Associate	25	11.8
Bachelor	94	44.5
Master	68	32.2
Doctorate	14	6.6
Total	211	100.0

Table 4.1.5 Number of Respondents Group by Experience of Software Usage (Large Scale Study)

Highest Degree	# of Respondent	Percent
Less than 1 Year	37	17.5
1 to 3 Years	62	29.4
3 to 5 Years	43	20.4
More than 5 Years	69	32.7
Total	211	100.0

4.2. Large Scale Measurement Results

In this section, each scale is analyzed and purified by the following steps: (1) Calculate alpha and CITC for each scale. Remove items that has CITC < 0.5 and items that does not contribute to the value of alpha. (2) Perform factor analysis with the criterion of Eigenvalue > 1 and with Promax rotation. If the number of factors extracted is not consistent with the theory suggested, using the number of factors as the criterion. Remove items have factor loading < 0.4 and items are cross-loaded on more than one component and factor loading are both

> 0.4. (3) Fit items to a measurement model. Remove one item when there is correlated error term between two items. (4) Repeat step 1, 2, 3 until the scales are purified. (5) Test discriminant validity by examining average variance extracted (AVE) and χ^2 difference between free model and constrained model.

After analyzing and purified each scale, the purified scales are suggested for the future study and for the aggregate structural analysis.

4.2.1. Personal Interpretive Style

The initial result of the reliability for personal interpretive style is displayed in Table 4.2.1.1. The question Number in the table is corresponding to the question number in the questionnaire in the Appendix 2.

Table 4.2.1.1 Initial Reliability of Personal Interpretive Styles (N = 211)

Q#	Items	CITC
	Attributing Style	
	Internal/External (Alpha = .840)	
Q6	PIATT1	.601
Q7	PIATT2	.789
Q8	PIATT3	.721
	Stable/Unstable (Alpha = .626)	
Q9	PIATT4	.535
Q10	PIATT5	.482
Q11	PIATT6	.303
	Global/Specific (Alpha = .773)	
Q12	PIATT7	.538
Q13	PIATT8	.670
Q14	PIATT9	.617
	Evaluating Style	
	Performance Goal (Alpha = .767)	
Q15	PIEVA1	.603
Q16	PIEVA2	.580
Q17	PIEVA3	.542

Q18	PIEVA4	.533
	Learning Goal (Alpha = .890)	
Q19	PIEVA5	.778
Q20	PIEVA6	.774
Q21	PIEVA7	.783
Q22	PIEVA8	.698
	Envisioning Style	
	Product Envisioning (Alpha = .921)	
Q23	PIENV1	.762
Q24	PIENV2	.859
Q25	PIENV3	.842
Q26	PIENV4	.808
	Process Envisioning (Alpha = .901)	
Q27	PIENV5	.787
Q28	PIENV6	.800
Q29	PIENV7	.825

The alpha values for three attribution styles (internal/external, stable/unstable, and global/specific) are .840, .626, and .773. The corrected item-total correlation (CITC) of most items is above 0.5. However, CITC of measurement item PIATT6 is 0.303. Thus PIATT6 will be removed from the scale of stable/unstable to increase reliability.

The alpha values for two evaluating styles (performance goal and learning goal) are respectively .767 and .890. The alpha values for two envisioning styles (product envisioning and process envisioning) are .921 and .901. The results indicate that both scales of evaluating style and envisioning style having sufficient reliability.

The items in each scale are then entered into a measurement model in LISREL 8 to check the model fit and correlated error terms. Measurement

Model's Chi-square value, degree of freedom, p-value, Root Mean Square Error of Approximation (RMSEA), number of measurement items are displayed in Table 4.2.1.2. PIEVA8 in learning goal is removed from further analysis because of correlated error term. The results of measurement model show good fit for each measurement model. For all measurement models in Table 4.2.1.2, Chi-square value is not significant, RMSEA is less than .1, Non-normed Fit Index (NNFI) and Comparative Fit Index (CFI) are above 0.9.

Table 4.2.1.2 Measurement Model Fit of Personal Interpretive Style (N = 211)

		Chi-square	Degree of Freedom	p-value	RMSEA	NNFI	CFI	# of Items
Attribution	Internal/ External	0	0	1.000	0			3
	Stable/ Unstable	NA	NA	NA	NA	NA	NA	2
	Global/ Specific	0	0	1.000	0	1.00	1.00	3
Evaluating Style	Performance Goal	4.30	2	0.116	0.074	0.97	0.99	4
	Learning Goal	0	0	1.000	0			3
Envisioning Style	Product Envisioning	5.41	2	0.067	0.090	0.98	0.99	4
	Process Envisioning	0	0	1.000	0			3

The remaining items that measure Personal Interpretive Style are entered into exploratory factor analysis in SPSS using principal component as extraction method to examine the factorial structure. The correlation matrix indicates the items that measure personal interpretive styles are correlated. Thus Promax is used as rotation method for the factor analysis. The result is displayed in Table 4.2.1.3. Seven factors are extracted from 22 items. These factors are namely product envisioning, learning goal, process envisioning, performance goal, internal/external, global/specific, and stable/unstable. The corresponding eigenvalues are 5.935, 3.228, 2.511, 1.404, 1.361, 1.325, and 0.967. These seven factors explain 76.047% variance of Personal Interpretive Style. The factor loading of each item is above 0.7, which demonstrates that all items are loaded on their respective factor. The factor analysis result shows that Personal Interpretive Style illustrates a clear factorial structure as the theory proposed. Alpha values are then recalculated for all the seven factors. The result is displayed in Table 4.2.1.4. The alpha value of "stable/unstable" has improved from .625 to .706.

Discriminant validity is assessed by average variance extracted (AVE) and Chi-square difference between the free model and the constrained model. The results are displayed in Table 4.2.1.5. The diagonal cells show the reliability of the respective scale. The rest of the cells display the correlation and Chi-square difference between two scales. All seven scales in the construct of Personal Interpretive Style have alpha value greater than 0.7, which provide the evidence for the sufficient reliability for each scale. Most scales have AVE greater than 0.5 except for the scale of Performance Goal (AVE=0.45). AVE greater than 0.5 provides the evidence for the convergent validity of the scale. Chi-square difference between the constrained model and the free measurement model is also calculated for each pair of scales. All 21 pairs of comparisons show that Chi-square difference is significant at 0.01 level. The statistical results provide the strong evidence for the discriminant validity of each scale.

Table 4.2.1.3 Factor Analysis of Personal Interpretive Style (N=211)

Pattern Matrix(a)

	Component						
	Product Env.	Process Env.	Learning Goal	Perform. Goal	Internal/ External	Global/ Specific	Stable/ Unstable
q24	.973						
q25	.907						
q26	.869						
q23	.805						
q29		.927					
q28		.913					
q27		.802					
q20			.933				
q21			.898				
q19			.831				
q17				.795			
q15				.789			
q16				.765			
q18				.690			
q7					.941		
q8					.855		
q6					.779		
q13						.881	
q14						.799	
q12						.755	
q10							.879
q9							.849

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
Rotation converged in 6 iterations.

Table 4.2.1.4 Purified Scales of Personal Interpretive Styles (N = 211)

Q#	Items	CITC	Note
	Attributing Style		
	Internal/External (Alpha = .840)		
Q6	PIATT1	.601	
Q7	PIATT2	.789	
Q8	PIATT3	.721	
	Stable/Unstable (Alpha = .706)		
Q9	PIATT4	.546	
Q10	PIATT5	.546	

Q11	PIATT6		Removed (CITC = .303)
	Global/Specific (Alpha = .773)		
Q12	PIATT7	.538	
Q13	PIATT8	.670	
Q14	PIATT9	.617	
	Evaluating Style		
	Performance Goal (Alpha = .767)		
Q15	PIEVA1	.603	
Q16	PIEVA2	.580	
Q17	PIEVA3	.542	
Q18	PIEVA4	.533	
	Learning Goal (Alpha = .881		
Q19	PIEVA5	.752	
Q20	PIEVA6	.793	
Q21	PIEVA7	.760	
Q22	PIEVA8		Removed (correlated error term)
	Envisioning Style		
	Product Envisioning (Alpha = .921)		
Q23	PIENV1	.762	
Q24	PIENV2	.859	
Q25	PIENV3	.842	
Q26	PIENV4	.808	
	Process Envisioning (Alpha = .901)		
Q27	PIENV5	.787	
Q28	PIENV6	.800	
Q29	PIENV7	.805	

To further validate the factorial structure of personal interpretive style, a seven-factor measurement model is generated in LISREL (see Figure 4.1.). CFI = 0.97 and NNFI = 0.96, both CFI and NNFI are above 0.95. Normed Chi-square, the ratio of Chi-square to degree of freedom, is 1.54. Segars and Grover (1998) suggest that normed Chi-square less than 3 represents the model is reasonable fit. Thus the proposed seven-factor model shows the evidence of good measurement model fit. The aggregated score of each item can fairly represent the respective factors in the construct of Personal Interpretive Styles.

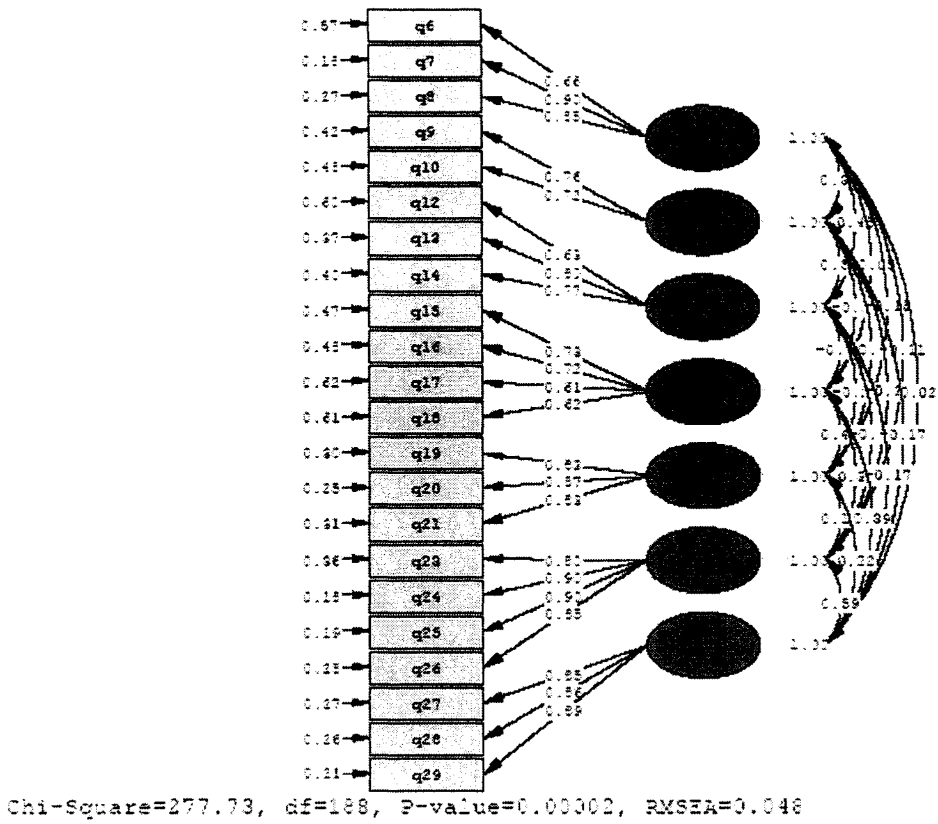
Table 4.2.1.5 Personal Interpretative Style: Reliability, Correlation, and Discriminant Validity (Large Scale)

	Internal/External	**Stable/ Unstable**	**General/ Specific**	**Perform Goal**	**Learning Goal**	**Product Envision**	**Process Envision**
Internal/ External	α = 0.840						
	AVE = 0.66						
Stable/ Unstable	0.275**	α = 0.706					
	χ^2_{Diff} =56.74	AVE =0.55					
General/ Specific	0.441**	0.390**	α = 0.773				
	χ^2_{Diff} = 139.04	χ^2_{Diff} = 44.53	AVE = 0.54				
Perform Goal	0.055	0.142*	0.168*	α = 0.767			
	χ^2_{Diff} = 253.20	χ^2_{Diff} = 61.52	χ^2_{Diff} = 178.76	AVE = 0.45			
Learning Goal	0.149*	0.184**	0.219**	0.406**	α = 0.890		
	χ^2_{Diff} = 256.86	χ^2_{Diff} = 61.70	χ^2_{Diff} = 181.89	χ^2_{Diff} = 176.20	AVE = 0.71		
Product Envision	0.117	0.288**	0.175*	0.316**	0.162*	α = 0.921	
	χ^2_{Diff} = 265.37	χ^2_{Diff} = 57.45	χ^2_{Diff} = 175.72	χ^2_{Diff} = 215.74	χ^2_{Diff} = 311.90	AVE = 0.75	
Process Envision	0.017	0.143**	0.163*	0.315**	0.191**	0.557**	α = 0.901
	χ^2_{Diff} = 364.05	χ^2_{Diff} = 57.12	χ^2_{Diff} = 168.16	χ^2_{Diff} = 218.83	χ^2_{Diff} = 312.09	χ^2_{Diff} = 281.57	AVE = 0.75
Mean	3.20	3.45	3.03	4.00	3.18	3.72	3.45
Std. Dev.	0.955	0.955	0.973	0.751	1.087	0.875	0.904

** Correlation is significant at 0.01 level.
* Correlation is significant at 0.05 level.

$\chi^2_{(df=1, p=.01)} = 12.21$

Figure 4.1. Seven-Factor Model of Personal Interpretive Flexibility (N=211, Standardized Solutions)



4.2.2. Communities of Practice

The initial result of the reliability for Communities of Practice is displayed in Table 4.2.2.1. Five factors are proposed in the construct of Communities of Practice including workgroup identity, ability, benevolence, integrity, and peer support. The initial alpha values for these five factors are respectively .824, .871, .911, .904 and .889. The corrected item-total correlation (CITC) of all items is above 0.5. The initial results indicate that all five scales in Communities of Practice have sufficient reliability.

Table 4.2.2.1 Initial Reliability of Communities of Practice (N=211)

Q#	Label	CITC
	Workgroup Identity (Alpha = .824)	
Q42	CPIDE1	.558
Q43	CPIDE2	.683
Q44	CPIDE3	.698
Q45	CPIDE4	.609
Q46	CPIDE5	.537
	Trust	
	Ability (Alpha = .871)	
Q47	CPTRU1	.796
Q48	CPTRU2	.795
Q49	CPTRU3	.699
Q50	CPTRU4	.600
	Benevolence (Alpha = .911)	
Q51	CPTRU5	.771
Q52	CPTRU6	.790
Q53	CPTRU7	.844
Q54	CPTRU8	.701
Q55	CPTRU9	.758
	Integrity (Alpha = .904)	
Q56	CPTRU10	.733
Q57	CPTRU11	.803
Q58	CPTRU12	.809
Q59	CPTRU13	.757
Q60	CPTRU14	.701
	Peer Support (Alpha = 0.889)	
Q61	CPPSU1	.656
Q62	CPPSU2	.763
Q63	CPPSU3	.732
Q64	CPPSU4	.728
Q65	CPPSU5	.770

All 24 items are entered into the factor analysis in SPSS. The exploratory factor analysis extracts 4 factors instead of 5. The items that measure benevolence and integrity form one factor. The further analysis will treat benevolence/integrity as one factor.

All items in each scale are then entered into a measurement model in LISREL 8 to check the model fit and correlated error terms. Measurement Model's Chi-square value, degree of freedom, p-value, Root Mean Square Error of Approximation (RMSEA), number of measurement items are displayed in Table 4.2.2.2. CPIDE4 in workgroup identity, CPTRU4 in ability, CPTRU5, CPTRU6, CPTRU7, CPTRU11, and CPTRU14 in benevolence/integrity, and CPPSU5 in peer support are removed from further analysis because of correlated error term. The results of measurement model show reasonable fit for each measurement model. For all measurement models in Table 4.2.2.2, Chi-square value is not significant, RMSEA is less than .1, Non-normed Fit Index (NNFI) and Comparative Fit Index (CFI) are above 0.9.

Table 4.2.2.2 Measurement Model Fit of Communities of Practice (N = 211)

		Chi-square	**Degree of Freedom**	**p-value**	**RMSEA**	**NNFI**	**CFI**	**# of Items**
Group Identity		0.65	2	0.723	0	1.00	1.00	4
Trust	Ability	0	0	1.000	0			3
	Benevolence/ Integrity	10.88	5	0.053	0.075	0.98	0.99	5
Peer Support		5.41	2	0.067	0.090	0.99	0.99	4

The remaining items that measure Communities of Practice are entered into exploratory factor analysis in SPSS using principal component as extraction method to examine the factorial structure. The correlation matrix indicates the items that measure communities of practice are correlated. Thus Promax is used as a rotation method to extract factors. The result is displayed in Table 4.2.2.3. Four factors are extracted from 16 items. These factors are namely benevolence/integrity, peer support, workgroup identity, and ability. The corresponding eigenvalues are 6.726, 1.963, 1.409, and 1.353. These four factors explain 71.568% variance of Communities of Practice. The factor loadings of most items are above 0.7 except for CPIDE1 with factor loading .695 and CPPSU4 with factor loading .568. The factor loadings suggest that all items are loaded on their respective factor. Trust study by Mayer et al. (1995) suggests that trust is the belief of peers' ability, benevolence, and integrity. However, the results of the factor analysis can not separate benevolence from integrity. The results of factor analysis suggest that the concepts of benevolence and integrity share the common traits. Thus, in this study, trust will be measured by two factors: ability and benevolence/integrity. Nevertheless, the factor analysis results show that Communities of Practice illustrates a clear factorial structure as the theory proposed. Alpha values are then recalculated for all four factors. The result is displayed in Table 4.2.2.4.

Discriminant validity is assessed by average variance extracted (AVE) and Chi-square difference between the free model and the constrained model. The results are displayed in Table 4.2.2.5. All four scales in the construct of Communities of Practice have alpha value greater than 0.7, which provide the evidence for the sufficient reliability for each scale. All four scales have AVE equal to 0.5 or above 0.5. AVE greater than 0.5 provide the evidence for the convergent validity of the scale. Chi-square difference between the constrained model and the free measurement model is also calculated for each pair of scales. All 6 pairs of comparisons show that Chi-square difference is significant at 0.01 level. The statistical results provide the strong evidence for the discriminant validity of each scale.

Table 4.2.2.3 Factor Analysis of Communities of Practice (N=211)

Pattern Matrix(a)

	Component			
	Benevolence/Integrity	Peer Support	Workgroup Identity	Ability
q55	.891			
q59	.852			
q54	.837			
q56	.837			
q58	.703			
q62		.919		
q61		.908		
q63		.747		
q64		.568		
q43			.878	
q44			.790	
q46			.738	
q42			.695	
q48				.932
q49				.876
q47				.867

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
Rotation converged in 6 iterations.

Table 4.2.2.4 Purified Scales of Communities of Practice (N=211)

Q#	Label	CITC	Note
	Group Identity (Alpha = .792)		
Q42	CPIDE1	.566	
Q43	CPIDE2	.690	
Q44	CPIDE3	.636	
Q45	CPIDE4		Removed (Correlated error term)
Q46	CPIDE5	.506	

	Trust		
	Ability (Alpha = .883)		
Q47	CPTRU1	.819	
Q48	CPTRU2	.808	
Q49	CPTRU3	.676	
Q50	CPTRU4		Removed (Correlated error term)
	Benevolence/Integrity (Alpha = .897)		
Q51	CPTRU5		Removed (Correlated error term)
Q52	CPTRU6		Removed (Correlated error term)
Q53	CPTRU7		Removed (Correlated error term)
Q54	CPTRU8	.695	
Q55	CPTRU9	.790	
Q56	CPTRU10	.720	
Q57	CPTRU11		Removed (Correlated error term)
Q58	CPTRU12	.742	
Q59	CPTRU13	.774	
Q60	CPTRU14		Removed (Correlated error term)
	Peer Support (Alpha = 0.857)		
Q61	CPPSU1	.670	
Q62	CPPSU2	.762	
Q63	CPPSU3	.713	
Q64	CPPSU4	.650	
Q65	CPPSU5		Removed (Correlated error term)

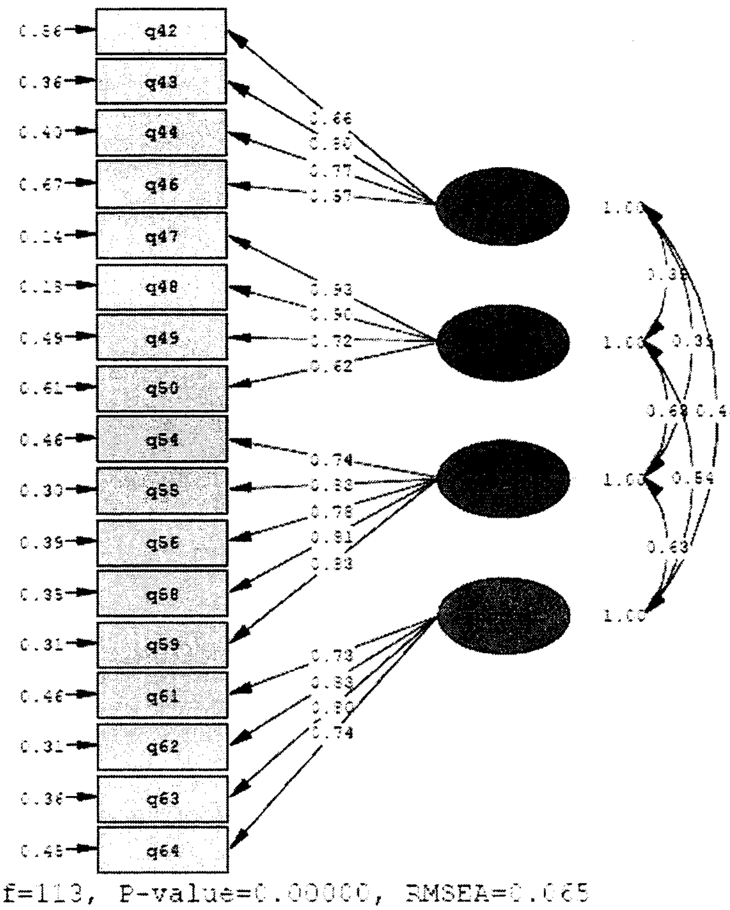
To further validate the factorial structure of Communities of Practice, a four-factor measurement model is generated in LISREL (see Figure 4.2.). Examining the model fix indexes, CFI = 0.98 and NNFI = 0.97, both CFI and NNFI are above 0.95. Normed Chi-square, the ratio of Chi-square to degree of freedom, is 1.89. Since Normed Chi-square is less than 3, the proposed four-factor model shows the evidence of good measurement model fit. The aggregated score of each item can fairly represent the respective factors in the construct of Communities of Practice.

Table 4.2.2.5 Communities of Practice: Reliability, Correlation, and Discriminant Validity (Large Scale)

	Group Identity	Ability	Benevolence/ Integrity	Peer Support
Group Identity	α = 0.792			
	AVE = 0.50			
Ability	0.308**	α = 0.883		
	χ^2_{Diff} = 264.00	AVE = 0.74		
Benevolence/Integrity	0.330**	0.537**	α = 0.897	
	χ^2_{Diff} = 253.99	χ^2_{Diff} = 299.11	AVE = 0.63	
Peer Support	0.393**	0.466**	0.575**	α = 0.857
	χ^2_{Diff} = 230.36	χ^2_{Diff} = 338.81	χ^2_{Diff} = 246.88	AVE = 0.60
Mean	4.268	3.915	3.742	4.088
Std. Dev.	0.594	0.647	0.682	0.640

** Correlation is significant at 0.01 level.
* Correlation is significant at 0.05 level.
$\chi^2_{(df=1,\ p=.01)} = 9.88$

Figure 4.2. Four-Factor Model of Communities of Practice (N=211, Standardized Solutions)



4.2.3. Interpretive Flexibility

The initial result of the reliability for Interpretive Flexibility is displayed in Table 4.2.3.1. Three factors are proposed in the construct of Interpretive Flexibility including self deploying, evolving ability, and action ability. The initial alpha values for these three factors are respectively .883, .920, and .903. The corrected item-total correlation (CITC) of all items is above 0.5. The initial results indicate that all three scales in Interpretive Flexibility have sufficient reliability.

Table 4.2.3.1 Initial Reliability of Interpretive Flexibility (N = 211)

Q#	Label	CITC
	Self Deploying (Alpha =.883)	
Q66	IFSDE1	.642
Q67	IFSDE2	.786
Q68	IFSDE3	.767
Q69	IFSDE4	.752
Q70	IFSDE5	.652
	Evolving Ability (Alpha = .920)	
Q71	IFEVO1	.693
Q72	IFEVO2	.722
Q73	IFEVO3	.875
Q74	IFEVO4	.830
Q75	IFEVO5	.850
	Action Ability (Alpha = .903)	
Q76	IFACT1	.731
Q77	IFACT2	.764
Q78	IFACT3	.729
Q79	IFACT4	.789
Q80	IFACT5	.772

Initial factor analysis extracts 3 factors from 15 items that measure Interpretive Flexibility. However IFSDE5 cross loaded on two factors, thus it is removed from further analysis. The items in each scale are then entered into a measurement model in LISREL 8 to check the model fit and correlated error terms. Measurement model's Chi-square value, degree of freedom, p-value, Root Mean Square Error of Approximation (RMSEA), number of measurement items are displayed in Table 4.2.3.2. IFSDE4 in self deploying, IFEVO5 in evolving ability, and IFACT2 in action ability are removed from further analysis because of correlated error term. The results of measurement model show reasonable fit for each measurement model. For all measurement models in Table 4.2.3.2, Chi-square value is not significant, RMSEA is less than .1, Non-normed Fit Index (NNFI) and Comparative Fit Index (CFI) are above 0.9.

Table 4.2.3.2 Measurement Model Fit of Interpretive Flexibility (N = 211)

	Chi-square	**Degree of Freedom**	**p-value**	**RMSEA**	**NNFI**	**CFI**	**# of Items**
Self Deploying	0	0	1.000	0			3
Evolving Ability	2.08	2	0.353	0.014	1.00	1.00	4
Action Ability	3.03	2	0.219	0.050	0.99	1.00	4

The remaining items that measure Interpretive Flexibility are entered into exploratory factor analysis in SPSS using principal component as extraction method to examine the factorial structure. The correlation matrix indicates the items that measure interpretive flexibility are correlated. Thus Promax is used as a rotation method to extract factors. The result is displayed in Table 4.2.3.3. Three factors are extracted from 11 items. These factors are namely self deploying, evolving ability and action ability. The corresponding eigenvalues are 6.516, 1.006, and 0.912. These three factors explain 76.674% variance of Interpretive Flexibility. The factor loadings of most items are above 0.6 except for IFACT4 with factor loading .588. The factor loadings suggest that all items are loaded on their respective factor. Alpha values are then recalculated for all three factors. The result is displayed in Table 4.2.3.4.

Discriminant validity is assessed by average variance extracted (AVE) and Chi-square difference between the free model and the constrained model. The results are displayed in Table 4.2.3.5. All three scales in the construct of Interpretive Flexibility have alpha value greater than 0.8, which provide the evidence for the sufficient reliability for each scale. All three scales have AVE above 0.6. AVE greater than 0.5 provides the evidence for the convergent validity of the scale. Chi-square difference between the constrained model and the free measurement model is also calculated for each pair of scales. All 3 pairs of comparisons show that Chi-square difference is significant at 0.01 level. The statistical results provide the strong evidence for the discriminant validity of each scale.

Table 4.2.3.3 Factor Analysis of Interpretive Flexibility (N=211)

Pattern Matrix(a)

	Component		
	Evolving Ability	Action Ability	Self Deploying
q72	.925		
q73	.920		
q74	.875		
q71	.605		
q78		1.055	
q80		.755	
q76		.640	
q79		.588	
q66			.893
q68			.872
q67			.868

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
Rotation converged in 6 iterations.

Table 4.2.3.4 Purified Scales of Interpretive Flexibility (N = 211)

Q#	Label	CITC	Note
	Self Deploying (Alpha =.859)		
Q66	IFSDE1	.690	
Q67	IFSDE2	.818	
Q68	IFSDE3	.691	
Q69	IFSDE4		Removed (correlated error term)
Q70	IFSDE5		Cross loading
	Evolving Ability (Alpha = .890)		
Q71	IFEVO1	.679	
Q72	IFEVO2	.720	
Q73	IFEVO3	.856	
Q74	IFEVO4	.786	
Q75	IFEVO5		Removed (correlated error term)
	Action Ability (Alpha = .880)		
Q76	IFACT1	.692	
Q77	IFACT2		Removed (correlated error term)
Q78	IFACT3	.726	
Q79	IFACT4	.761	
Q80	IFACT5	.776	

To further validate the factorial structure of Interpretive Flexibility, a three-factor measurement model is generated in LISREL (see Figure 4.3.). Examining the model fix indexes, CFI = 0.98 and NNFI = 0.98, both CFI and NNFI are above 0.95. Normed Chi-square, the ratio of Chi-square to degree of freedom, is 2.11. Since Normed Chi-square is less than 3, the proposed three-factor model shows the evidence of good measurement model fit. The aggregated score of each item can fairly represent the respective factors in the construct of Interpretive Flexibility.

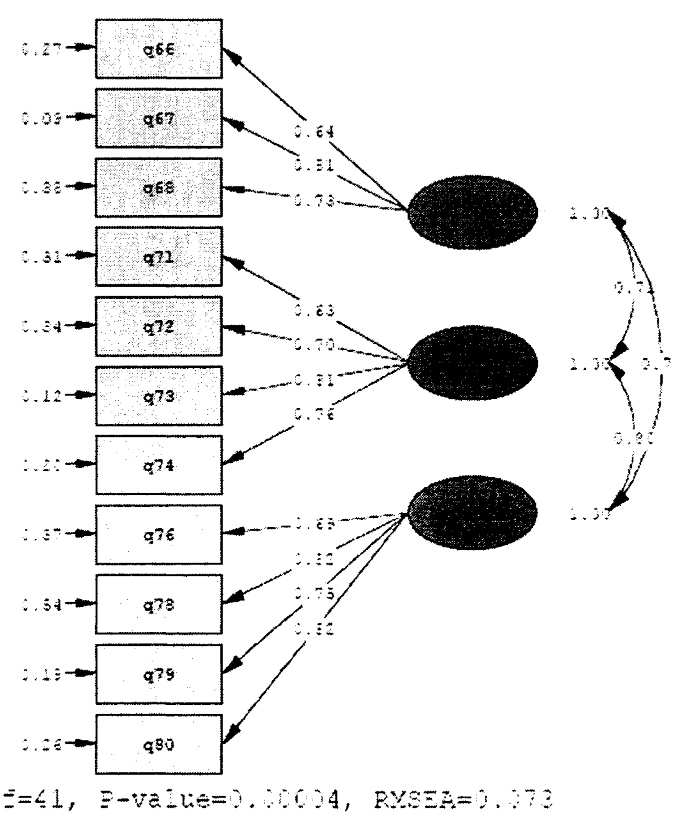
Table 4.2.3.5 Interpretative Flexibility: Reliability, Correlation, and Discriminant Validity (Large Scale)

	Self Deploying	Self Evolving	Action Ability
Self Deploying	α = 0.859		
	AVE = 0.69		
Self Evolving	0.715**	α = 0.890	
	χ^2_{Diff} = 176.16	AVE = 0.68	
Action Ability	0.637**	0.705**	α = 0.880
	χ^2_{Diff} = 152.62	χ^2_{Diff} = 157.20	AVE = 0.65
Mean	3.50	3.47	3.02
Std. Dev.	0.749	0.762	0.824

** Correlation is significant at 0.01 level

$\chi^2_{(df=1, p=.01)} = 8.62$

Figure 4.3. Three-Factor Model of Interpretive Flexibility (N=211, Standardized Solutions)



4.2.4. User Empowerment

The initial result of the reliability for User Empowerment is displayed in Table 4.2.4.1. Four factors are suggested in the construct of User Empowerment including self autonomy, self efficacy, intrinsic motivation, and perceived impacts. The initial alpha values for these four factors are respectively .899, .883, .928, and .923. The corrected item-total correlation (CITC) of all items is above 0.7. The initial results indicate that all four scales in Interpretive Flexibility have sufficient reliability.

Table 4.2.4.1 Initial Reliability of User Empowerment (N = 211)

Q#	Label	CITC
	Self Autonomy (Alpha = .899)	
Q30	UEUAT1	.782
Q31	UEUAT2	.876
Q32	UEUAT3	.743
	Self Efficacy (Alpha = .883)	
Q33	UESEL1	.748
Q34	UESEL2	.846
Q35	UESEL3	.722
	Intrinsic Motivation (Alpha = .928)	
Q36	UEINT1	.821
Q37	UEINT2	.883
Q38	UEINT3	.857
	Perceived Impacts (Alpha = .923)	
Q39	UEPER1	.803
Q40	UEPER2	.890
Q41	UEPER3	.844

Since the degree of freedom in each measurement model is 0, all four measurement models show perfect fit (See Table 4.2.4.2).

Table 4.2.4.2 Measurement Model Fit of User Empowerment (N = 211)

	Chi-square	Degree of Freedom	p-value	RMSEA	NNFI	CFI	# of Items
Self Autonomy	0	0	1.000	0.000			3
Self Efficacy	0	0	1.000	0.000			3
Intrinsic Motivation	0	0	1.000	0.000			3
Perceived Impacts	0	0	1.000	0.000			3

Twelve items that measure User Empowerment are entered into exploratory factor analysis in SPSS using principal component as extraction method to examine the factorial structure. Since the items that measure user empowerment are correlated, Promax is used as a rotation method to extracted factors. The result is displayed in Table 4.2.4.3. Four factors are extracted from 12 items as suggested by empowerment theory. These factors are namely intrinsic motivation, perceived impacts, self autonomy and self efficacy. The corresponding eigenvalues are 5.789, 1.732, 1.640, and 1.070. These four factors explain 85.253% variance of User Empowerment. The factor loadings of all items are above 0.8. The factor loadings suggest that all items are loaded on their respective factor.

Discriminant validity is assessed by average variance extracted (AVE) and Chi-square difference between the free model and the constrained model. The results are displayed in Table 4.2.3.4. All four scales in the construct of User Empowerment have alpha value greater than 0.8, which provide the evidence for the sufficient reliability for each scale. All four scales have AVE above 0.7. AVE greater than 0.5 provides the evidence for the convergent validity of the scale.

Chi-square difference between the constrained model and the free measurement model is also calculated for each pair of scales. All 6 pairs of comparisons show that Chi-square difference is significant at 0.01 level. The statistical results provide the strong evidence for the discriminant validity of each scale.

Table 4.2.4.3 Factor Analysis of User Empowerment (N=211)

Pattern Matrix(a)

	Component			
	Intrinsic Motivation	Perceived Impacts	Self Autonomy	Self Efficacy
q38	.998			
q37	.932			
q36	.842			
q40		.973		
q41		.957		
q39		.843		
q31			.983	
q30			.885	
q32			.860	
q35				.937
q34				.921
q33				.823

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
Rotation converged in 5 iterations.

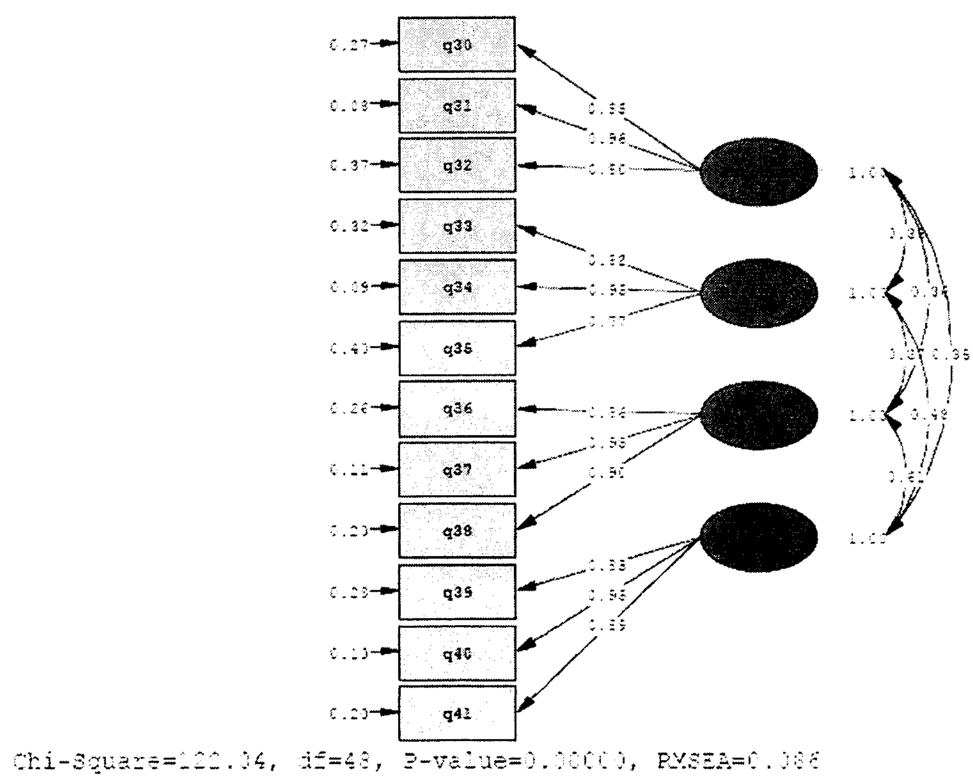
Table 4.2.4.4 User Empowerment: Reliability, Correlation, and Discriminant Validity (Large Scale)

	Autonomy	Self Efficacy	Intrinsic Motivation	Perceived Impact
Autonomy	α =0.899 AVE = 0.76			
Self Efficacy	0.323** χ^2_{Diff} = 309.72	α = 0.883 AVE = 0.73		
Intrinsic Motivation	0.377** χ^2_{Diff} = 303.97	0.374** χ^2_{Diff} = 286.18	α = 0.928 AVE = 0.81	
Perceived Impact	0.396** χ^2_{Diff} = 402.47	0.440** χ^2_{Diff} = 281.67	0.587** χ^2_{Diff} = 377.60	α = 0.923 AVE = 0.83
Mean	3.74	4.06	3.37	4.06
Std. Dev.	1.030	0.802	1.066	0.896

** Correlation is significant at 0.01 level. $\chi^2_{(df=1,\ p=.01)} = 9.88$

To further validate the factorial structure of User Empowerment, a four-factor measurement model is generated in LISREL (see Figure 4.4.). Examining the model fix indexes, CFI = 0.97 and NNFI = 0.96, both CFI and NNFI are above 0.95. Normed Chi-square, the ratio of Chi-square to degree of freedom, is 2.54. Since Normed Chi-square is less than 3, the proposed four-factor model shows the evidence of good measurement model fit. The aggregated score of each item can fairly represent the respective factors in the construct of User Empowerment.

Figure 4.4. Four-Factor Model of User Empowerment (N=211, Standardized Solutions)



4.2.5 Enacted System Use

The initial result of the reliability for Enacted System Use is displayed in Table 4.2.5.1. Five factors are proposed in the construct of Enacted System Use including decision support/problem solving, communication, coordination, knowledge sharing, and system reconfiguration. The initial alpha values for these five factors are respectively .886, .879, .935, .910, and .903. The corrected item-total correlation (CITC) of all items is above 0.6. The initial results indicate that all five scales in Enacted System Use have sufficient reliability.

Table 4.2.5.1 Initial Reliability of Enacted System Use (N = 211)

Q#	Label	CITC
	Decision Support/Problem Solving (Alpha =.886)	
Q81	ESDEC1	.754
Q82	ESDEC2	.811
Q83	ESDEC3	.719
Q84	ESDEC4	.719
	Collaboration	
	Communication (Alpha = .879)	
Q85	ESCOL1	.695
Q86	ESCOL2	.780
Q87	ESCOL3	.817
Q88	ESCOL4	.669
	Coordination (Alpha = .935)	
Q89	ESCOL5	.815
Q90	ESCOL6	.843
Q91	ESCOL7	.802
Q92	ESCOL8	.864
Q93	ESCOL9	.778
Q94	ESCOL10	.741
	Knowledge Sharing (Alpha = .910)	
Q95	ESCOL11	.693
Q96	ESCOL12	.885

Q97	ESCOL13	.882
Q98	ESCOL14	.715
	System Reconfiguration (Alpha = .903)	
Q99	ESREC1	.758
Q100	ESREC2	.757
Q101	ESREC3	.811
Q102	ESREC4	.691
Q103	ESREC5	.778

Table 4.2.5.2. Measurement Model Fit of Enacted System Use (N = 211)

		Chi-square	**Degree of Freedom**	**p-value**	**RMSEA**	**NNFI**	**CFI**	**# of Items**
DS/PS		0	0	1.000	0			3
Collaboration	Communication	5.38	2	0.067	0.090	0.98	0.99	4
	Coordination	6.48	2	0.039	0.103	0.98	0.99	4
	Knowledge Sharing	0	0	1.00	0			3
System Recon.		1.53	2	0.465	0.000	1.00	1.00	4

All 23 items are entered into the factor analysis in SPSS. The exploratory factor analysis extracts 5 factors. However, ESCOL7 and ESCOL14 are cross loaded to two different factors and thus are removed from further analysis.

The items in each scale are then entered into a measurement model in LISREL 8 to check the model fit and correlated error terms. Measurement Model's Chi-square value, degree of freedom, p-value, Root Mean Square Error of Approximation (RMSEA), number of measurement items are displayed in Table 4.2.5.2. ESDEC4 in decision support/problem solving, ESCOL9 in coordination, and ESREC4 in system reconfiguration are removed from further analysis because of correlated error term. The results of measurement model show reasonable fit for each measurement model. For all measurement models in Table 4.2.5.2, Chi-square value is not significant, RMSEA is less than or close to 0.1, Non-normed Fit Index (NNFI) and Comparative Fit Index (CFI) are above 0.9.

The remaining items that measure Enacted System Use are entered into exploratory factor analysis in SPSS using principal component as extraction method to examine the factorial structure. Since the items that measure enacted system use are correlated, Promax is used as a rotation method to extract factors. The result is displayed in Table 4.2.5.3. Five factors are extracted from 18 items. These factors are namely coordination, system reconfiguration, knowledge sharing, decision support/problem solving and communication. The corresponding eigenvalues are 8.136, 2.613, 1.787, 1.005, and 0.861. These five factors explain 80.012% variance of System Enacted Use. The factor loadings of most items are above 0.7 except for ESCOL10 with factor loading .572 and ESCOL2 with factor loading .549. The factor loadings suggest that all items are loaded on their respective factor. Alpha values are then recalculated for all five factors. The result is displayed in Table 4.2.5.4.

Discriminant validity is assessed by average variance extracted (AVE) and Chi-square difference between the free model and the constrained model. The results are displayed in Table 4.2.5.5. All five scales in the construct of Enacted System Use have alpha value greater than 0.8, which provide the evidence for the sufficient reliability for each scale. All five scales have AVE above 0.6. AVE greater than 0.5 provide the evidence for the convergent validity of the scale. Chi-square difference between the constrained model and the free measurement model is also calculated for each pair of scales. All 10 pairs of comparisons show that Chi-square difference is significant at 0.01 level. The statistical results provide the strong evidence for the discriminant validity of each scale.

Table 4.2.5.3 Factor Analysis of Enacted System Use (N=211)

Pattern Matrix(a)

	Component				
	Coordination	System Reconfiguration	Knowledge Sharing	Decision Support/ Problem Solving	Communication
q88	.919				
q90	.901				
q92	.809				
q89	.801				
q103		.894			
q102		.857			
q100		.840			
q99		.808			
q96			.904		
q95			.831		
q97			.815		
q82				.903	
q83				.899	
q81				.829	
q85					.860
q87					.756
q94					.572
q86					.549

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
Rotation converged in 6 iterations.

Table 4.2.5.4 Purified Scales of Enacted System Use (N = 211)

Q#	Label	CITC	
	Decision Support/Problem Solving (Alpha =.865)		
Q81	ESDEC1	.767	
Q82	ESDEC2	.818	
Q83	ESDEC3	.655	
Q84	ESDEC4		Removed (Cross loading)
	Collaboration		
	Communication (Alpha = .879)		
Q85	ESCOL1	.695	
Q86	ESCOL2	.780	
Q87	ESCOL3	.817	
Q94	ESCOL10	.669	
	Coordination (Alpha = .926)		
Q88	ESCOL4	.826	
Q89	ESCOL5	.840	
Q90	ESCOL6	.819	
Q91	ESCOL7		Removed (Cross loading)
Q92	ESCOL8	.825	
Q93	ESCOL9		Removed (correlated error term)
	Knowledge Sharing (Alpha = .910)		
Q95	ESCOL11	.706	
Q96	ESCOL12	.898	
Q97	ESCOL13	.850	
Q98	ESCOL14		Removed (Cross Loading)
	System Reconfiguration (Alpha = .896)		
Q99	ESREC1	.781	
Q100	ESREC2	.769	
Q101	ESREC3		Removed (correlated error term)
Q102	ESREC4	.797	
Q103	ESREC5	.729	

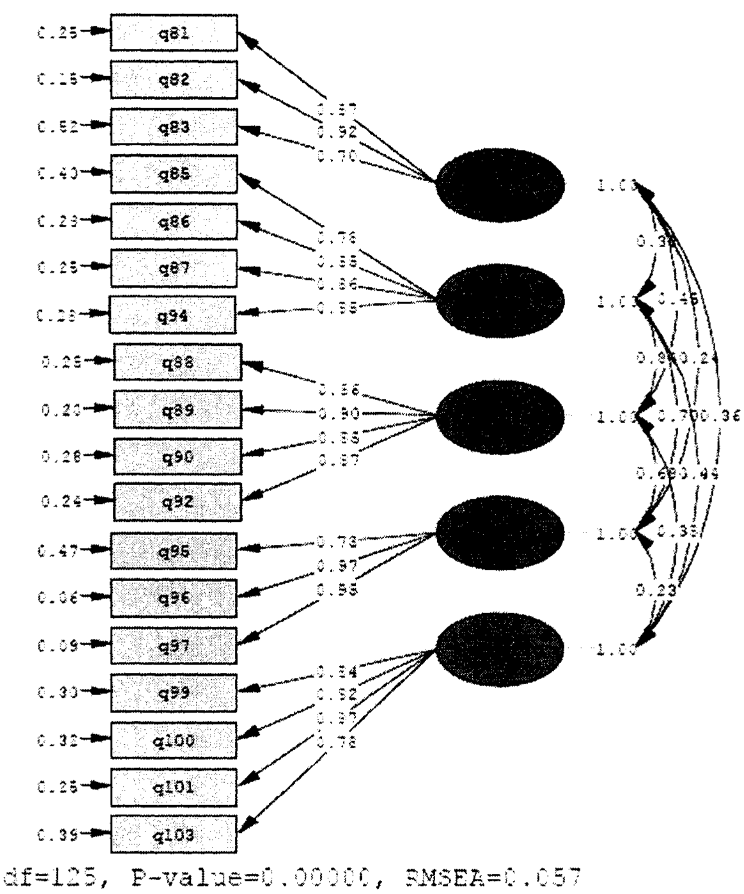
Table 4.2.5.5 Enacted System Use: Reliability, Correlation, and (Large Scale)

	Decision Support	Comm.	Coordinate	Knowledge Sharing	System Recon.
Decision Support	α = 0.865 AVE = 0.70				
Communication	0.327** χ^2_{Diff} = 296.40	α = 0.879 AVE = 0.70			
Coordination	0.393** χ^2_{Diff} = 267.49	0.762** χ^2_{Diff} = 155.76	α =0.926 AVE = 0.72		
Knowledge Sharing	0.212** χ^2_{Diff} = 383.33	0.668** χ^2_{Diff} = 351.02	0.653** χ^2_{Diff} = 304.80	α = 0.910 AVE = 0.79	
System Reconfiguration	0.339** χ^2_{Diff} = 273.43	0.386** χ^2_{Diff} = 547.86	0.340** χ^2_{Diff} = 545.98	0.232** χ^2_{Diff} = 367.67	α = 0.896 AVE = 0.69
Mean	3.447	3.317	3.245	3.687	2.026
Std. Dev.	1.021	1.009	1.033	0.895	1.062

** Correlation is significant at 0.01 level.
* Correlation is significant at 0.05 level.
$\chi^2_{(df=1, p=.01)} = 10.83$

To further validate the factorial structure of Enacted System Use, a five-factor measurement model is generated in LISREL (see Figure 4.5.). Examining the model fix indexes, CFI = 0.99 and NNFI = 0.98, both CFI and NNFI are above 0.95. Normed Chi-square, the ratio of Chi-square to degree of freedom, is 1.67. Since Normed Chi-square is less than 3, the proposed five-factor model shows the evidence of good measurement model fit. The aggregated score of each item can fairly represent the respective factors in the construct of Enacted System Use.

Figure 4.5. Five-Factor Model of Enacted System Use (N=211, Standardized Solutions)



4.2.6 Knowledge Outcomes

The initial result of the reliability for Knowledge Outcomes is displayed in Table 4.2.6.1. Five factors are proposed in the construct of Knowledge Outcomes including new idea, new interpretation, new processes, new artifacts and knowledge worker productivity. The initial alpha values for these five factors are respectively .968, .964, .948, .911, and .911. The corrected item-total correlation (CITC) of all items is above 0.6. The initial results indicate that all five scales in

Knowledge Outcomes have sufficient reliability. However, KWIDE5, KWART1, and KWART5 do not contribute to the respective alpha value. Thus these three items are deleted from their own scale to increase alpha value.

Table 4.2.6.1 Initial Reliability of Knowledge Outcomes (N = 211)

A/R	Label	CITC
	New Idea (Alpha = .968)	
Q104	KWIDE1	.912
Q105	KWIDE2	.927
Q106	KWIDE3	.947
Q107	KWIDE4	.908
Q108	KWIDE5	.839
	New Interpretation (Alpha = .964)	
Q109	KWINT1	.893
Q110	KWINT2	.928
Q111	KWINT3	.923
Q112	KWINT4	.896
	New Process (Alpha = .948)	
Q113	KWPRO1	.867
Q114	KWPRO2	.900
Q115	KWPRO3	.909
Q116	KWPRO4	.824
	New Artifacts (Alpha = .911)	
Q117	KWART1	.754
Q118	KWART2	.792
Q119	KWART3	.863
Q120	KWART4	.838
Q121	KWART5	.620
	Productivity (Alpha = .911)	
Q122	KWPRD1	.788
Q123	KWPRD2	.780
Q124	KWPRD3	.754

Q125	KWPRD4	.744
Q126	KWPRD5	.802

The remaining 20 items are entered into the factor analysis in SPSS. The exploratory factor analysis extracts 5 factors as theory proposed. The items in each factor are then entered into a measurement model in LISREL 8 to check the model fit and correlated error terms. Measurement model's Chi-square value, degree of freedom, p-value, Root Mean Square Error of Approximation (RMSEA), number of measurement items are displayed in Table 4.2.6.2. KWINT4 in new interpretation, KWPRO4 in new processes, and KWPRD5 in productivity are removed from further analysis because of correlated error term. The results of measurement model show reasonable fit for each measurement model. For all measurement models in Table 4.2.6.2, Chi-square value is not significant, RMSEA is less than 0.1, Non-normed Fit Index (NNFI) and Comparative Fit Index (CFI) are above 0.9.

Table 4.2.6.2 Measurement Model Fit of Knowledge Outcomes (N = 211)

	Chi-square	Degree of Freedom	p-value	RMSEA	NNFI	CFI	# of Items
New Idea	3.87	2	0.144	0.067	0.99	1.00	4
New Interpretation	0	0	1.000	0.000			3
New Processes	0	0	1.000	0.000			3
New Artifacts	0	0	1.000	0.000			3
Productivity	3.46	2	0.177	0.059	0.99	1.00	4

Table 4.2.6.3 Factor Analysis of Knowledge Outcomes (N=211)

Pattern Matrix(a)

	Component				
	New Idea	Productivity	New Interpretation	New Artifacts	New Processes
q105	.913				
q106	.882				
q104	.878				
q107	.874				
q124		.933			
q122		.864			
q123		.856			
q125		.634			
q110			.951		
q111			.915		
q109			.884		
q120				.902	
q119				.896	
q118				.877	
q113					.926
q114					.886
q115					.864

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
Rotation converged in 7 iterations.

The remaining items that measure Knowledge Outcomes are entered into exploratory factor analysis in SPSS using principal component as extraction method to examine the factorial structure. Since the items that measure knowledge outcomes are correlated, Promax is used as a rotation method to extract factors. The result is displayed in Table 4.2.6.3. Five factors are extracted from 17 items. These factors are namely new idea, productivity, new interpretation, new artifacts and new processes. The corresponding eigenvalues are 10.517, 1.737, 1.128, 0.860, and 0.632. These five factors explain 87.497% variance of Knowledge Outcome. The factor loadings of most items are above

0.8 except for KWPRD4 with factor loading .634. The factor loadings suggest that all items are loaded on their respective factor. Alpha values are then recalculated for all five factors. The result is displayed in Table 4.2.6.4.

Table 4.2.6.4 Purified Scales of Knowledge Outcomes (N = 211)

A/R	Label	CITC	
	New Idea (Alpha = .970)		
Q104	KWIDE1	.917	
Q105	KWIDE2	.938	
Q106	KWIDE3	.945	
Q107	KWIDE4	.902	
Q108	KWIDE5		Deleted to increase Alpha
	New Interpretation (Alpha = .957)		
Q109	KWINT1	.901	
Q110	KWINT2	.932	
Q111	KWINT3	.890	
Q112	KWINT4		Removed (Correlated error term)
	New Process (Alpha = .947)		
Q113	KWPRO1	.887	
Q114	KWPRO2	.905	
Q115	KWPRO3	.876	
Q116	KWPRO4		Removed (Correlated error term)
	New Artifacts (Alpha = .921)		
Q117	KWART1		Deleted to increase Alpha
Q118	KWART2	.820	
Q119	KWART3	.899	
Q120	KWART4	.800	

Q121	KWART5		Deleted to increase Alpha
	Productivity (Alpha = .885)		
Q122	KWPRD1	.778	
Q123	KWPRD2	.779	
Q124	KWPRD3	.734	
Q125	KWPRD4	.705	
Q126	KWPRD5		Removed (Correlated error term)

Table 4.2.6.5: Knowledge Outcome: Reliability, Correlation, and Discriminant Validity (Large Scale)

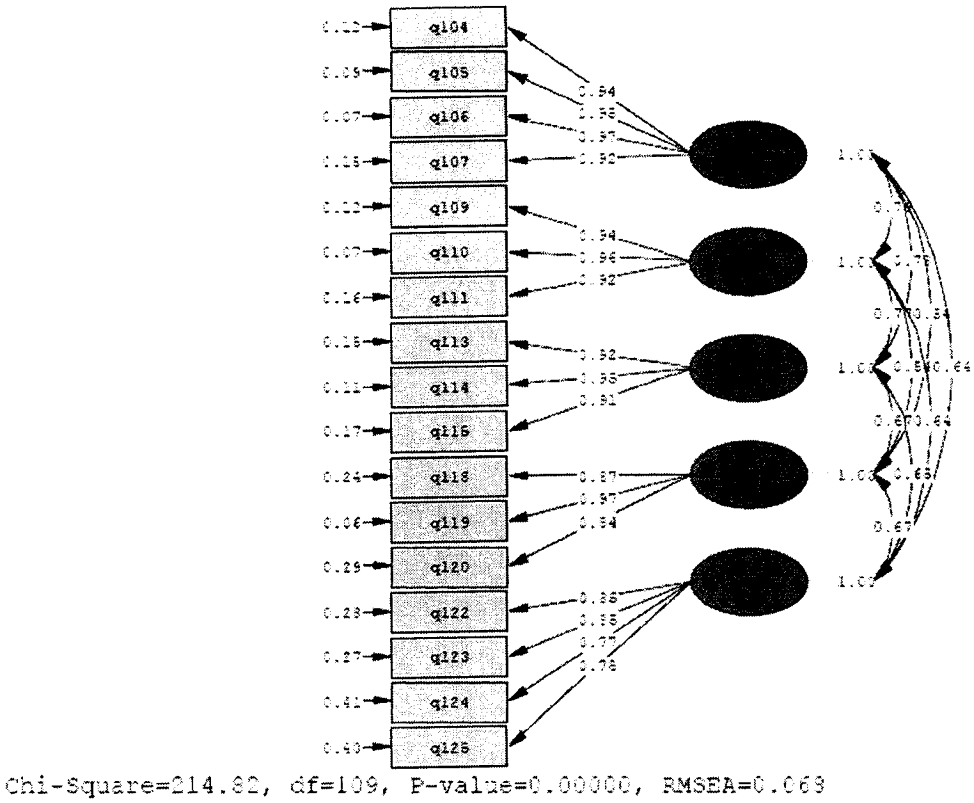
	New Idea	**New Interpretation**	**New Process**	**New Artifact**	**Productivity**
New Idea	α = 0.970 AVE = 0.89				
New Interpretation	0.747** χ^2_{Diff} = 368.50	α = 0.957 AVE = 0.88			
New Process	0.755** χ^2_{Diff} = 315.61	0.737** χ^2_{Diff} = 354.30	α = 0.947 AVE = 0.86		
New Artifact	0.596** χ^2_{Diff} = 339.34	0.536** χ^2_{Diff} = 503.29	0.675** χ^2_{Diff} = 311.64	α = 0.921 AVE = 0.80	
Productivity	0.596** χ^2_{Diff} = 357.40	0.592** χ^2_{Diff} = 345.35	0.593** χ^2_{Diff} = 333.10	0.591** χ^2_{Diff} = 315.80	α = 0.885 AVE = 0.66
Mean	2.794	2.964	2.834	2.870	3.429
Std. Dev.	1.071	1.057	1.081	1.132	0.943

** Correlation is significant at 0.01 level.
$\chi^2_{(df=1,\ p=.01)} = 10.83$

Discriminant validity is assessed by average variance extracted (AVE) and Chi-square difference between the free model and the constrained model. The results are displayed in Table 4.2.6.5. Four out of five scales in the construct of Knowledge Outcomes have alpha value greater than 0.9. The scale of knowledge worker productivity has alpha value .885. High alpha values provide the evidence for the sufficient reliability for each scale. All five scales have AVE above 0.6. AVE greater than 0.5 provide the evidence for the convergent validity of the scale. Chi-square difference between the constrained model and the free measurement model is also calculated for each pair of scales. All 10 pairs of comparisons show that Chi-square difference is significant at 0.01 level. The statistical results provide the strong evidence for the discriminant validity of each scale.

To further validate the factorial structure of Knowledge Outcomes, a five-factor measurement model is generated in LISREL (see Figure 4.6.). Examining the model fix indexes, CFI = 0.99 and NNFI = 0.98, both CFI and NNFI are above 0.95. Normed Chi-square, the ratio of Chi-square to degree of freedom, is 1.97. Since Normed Chi-square is less than 3, the proposed five-factor model shows the evidence of good measurement model fit. The aggregated score of each item can fairly represent the respective factors in the construct of Knowledge Outcomes.

Figure 4.6. Five-Factor Model of Knowledge Outcomes



4.2.7. Summary of the Measurement Results

The measurement results of the large scale study are consistent with the proposed dimensions in each construct. Except for the scale of benevolence and scale of integrity that share the common traits and can not be completely separated. Therefore benevolence and integrity are merged into one factor.

Within 28 scales under analysis, 10 scales have alpha values above 0.9, 14 scales have alpha values between 0.8 and 0.9, and 4 scales have alpha values between 0.8 and 0.7. The statistics provide the evidence that proposed scales have sufficient reliability.

Average variance extracted (AVE) of all scales is greater than 0.5, which indicates the amount of variance captured by the scale is greater than the amount of variance due to measurement error. In addition, AVE of each scale is greater than the squared correlation between two scales. These results suggest the analyzed scales have sufficient convergent validity and discriminant validity.

Pair-wised Chi-square differences are significant at 0.01 levels for all pairs. Fifty six pair-wised Chi-square tests also suggest that there is sufficient discriminant validity for all scales. Based on the results of the measurement analysis, the scores of the scales are aggregated to reflect the scores of their respective dimension for the purpose of further analysis of structural equation modeling.

4.3. Structural Equation Model and Hypotheses Testing

To examine the causal links of the proposed research model in Chapter 2, structural equation modeling is used as a statistical method to test the proposed hypotheses. Several statistics are used to assess structural model fit. Normed Fit Index (NFI), Non-Normed Fit Index (NNFI), and Comparative Fit Index (CFI) are the fit indexes used to compare the null model and perfect model. Values of NFI and CFI range from zero to 1.00. Because NNFI is not normed, its value can extend beyond the range of zero and 1.00. To represent a good model fit, NFI, NNFI, and CFI values have to be 0.9 and above (Segars and Grover, 1993).

Root mean square residual (RMR) is a typical measure for model fit. It is an average of the residuals between observed and estimated input matrices. A smaller value of RMSR represents a better model fit. The recommended maximum value for RMR is 0.10 (Chau, 1997). The root mean square error of approximation (RMSEA) is another measure that attempts to correct the tendency of the Chi-square statistic to reject a specified model with a sufficiently large sample. Values of RMSEA less than 0.05 indicate a good fit, and values as high as 0.08 represent a reasonable fit (Byrne, 1998).

Statistical power is an important concern for structural equation modeling, because it relates to the ability of testing the difference between good and bad models. If the power of test is low, the null hypothesis will seldom be rejected. Thus researcher using structural models may accept a false theory (Fornell and Larcker, 1981). MacCallum et al. (1996) introduce a method for estimating the power associated with test of an entire structural equation model with known sample size and degree of freedom. Their research findings suggest that using large sample to test large model (i.e., those have many degrees of freedom) may have too much power and thus lead to "over-rejection" of "correct" model. McQuitty (2004) applies the method suggested by MacCallum et al. (1996) and run the simulation for the minimum sample size required for structural equation modeling to reach different level of statistical power. His findings suggest that to reach power level of 0.8, it requires that sample size greater than 101 for the degree of freedom = 150, and sample size greater than 84 for the degree of freedom = 200.

The Chi-square statistic is a good global test of a model's ability to reproduce the sample variance/covariance matrix. Normed Chi square, the ratio of chi-square to degrees of freedom, provides information on the relative efficiency of competing models. The value of normed chi-square less than 3 represents the model is reasonable fit (Segars and Grover, 1998). Within the fitted mode, a significant path coefficient supports the hypothesized relationship between two latent variables.

Table 4.3.1 Descriptive Statistics of Indicators (N = 211)

	Minimum	Maximum	Mean	Std. Deviation
Attribution	1.22	5.00	3.2283	.73163
Evaluating	1.50	5.00	3.5954	.77613
Envisioning	1.00	5.00	3.5821	.78499
Identity	1.00	5.00	4.2678	.59360
Trust	2.10	5.00	3.8284	.58223
Peer Support	1.75	5.00	4.0877	.64042
Deploying	1.00	5.00	3.5024	.74880
Evolving	1.25	5.00	3.4727	.76191
Action	1.25	5.00	3.0178	.82446
Autonomy	1.00	5.00	3.7393	1.03022
Efficacy	1.00	5.00	4.0585	.80228
Motivation	1.00	5.00	3.3728	1.06608
Impacts	1.00	5.00	4.0648	.89591
Decision Support	1.00	5.00	3.4471	1.02132
Collaboration	1.11	5.00	3.4167	.87493
System Reconfiguration	1.00	5.00	2.0261	1.06174
New Idea	1.00	5.00	2.7938	1.07079
New Interpretation	1.00	5.00	2.9637	1.05722
New Process	1.00	5.00	2.8341	1.08055
New Artifacts	1.00	5.00	2.8705	1.13206
KW Productivity	1.00	5.00	3.4289	.94254

This study assesses the structural model as an aggregate model. The individual factor, which is the aggregate of its own measurement items, is treated as an indicator of the underlying variable. For example, attribution style, evaluating style, and envisioning style are the indicators for the latent variable –

Personal Interpretive Style. The descriptive statistics of each indicator is listed in Table 4.3.1.

The scores of these 21 indicators are entered into LISREL 8 to fit the proposed structural model. The covariance matrix of the six latent variables is displayed in Table 4.3.2. The results of structural analysis are displayed in Figure 4.7 through Figure 4.11.

Table 4.3.2 Covariance Matrix of the Six Latent Variables

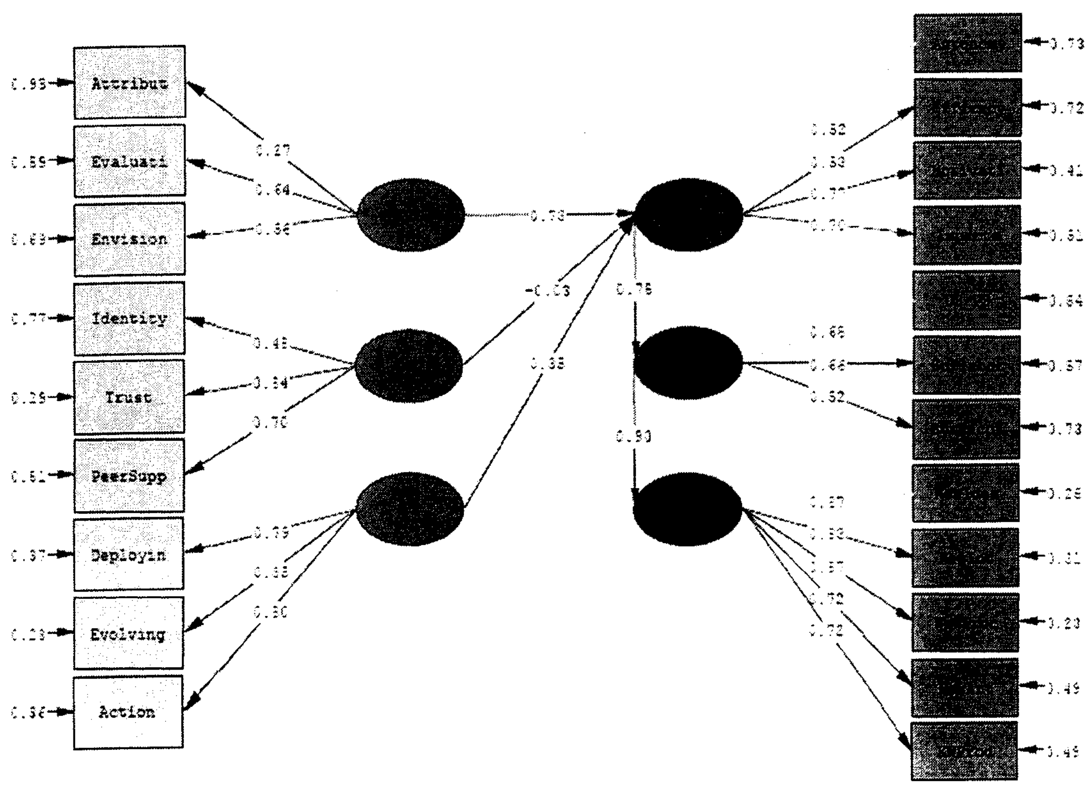
Variable	1	2	3	4	5	6
1. User Empowerment	1.00					
2. Enacted System Use	0.75	1.00				
3. Knowledge Outcomes	0.67	0.90	1.00			
4. Interpretive Styles	0.92	0.69	0.62	1.00		
5. Communities of Practice	0.37	0.28	0.25	0.33	1.00	
7. Interpretive Flexibility	0.74	0.56	0.50	0.55	0.43	1.00

The statistics of the model fitting are displayed along with the basic structure model in Figure 4.7. In term of the overall model fit, the Chi-square statistic is significant (Chi-square = 405.12; df = 181; p = 0.0000) and the ratio of Chi-square to degree of freedom is 2.24, which is less than 3 thus indicate a reasonable fit. Although the non-significant Chi-square statistics are desirable for better model fit, it is very sensitive to sample size. The larger the sample size, the more likely the rejection of the model and more likely the type II error. Thus degree of freedom has to be reported along with Chi-square value to better gauge the model fit (Byrne, 1998). The model fit indexes NFI = 0.92, NNFI=0.95, and CFI = 0.95 also indicate the model is reasonable fit. In addition, RMR =

0.053 and RMSEA = 0.077, both statistics are less than 0.08, which provide another evidence of reasonable model fit.

Alternatively model fit can be improved by examining the modification indices and proposing an alternative model. The basic model with modification indices is reported in Figure 4.11. However, it is not the goal of this research to propose the alternative model.

Figure 4.7. Basic Model with Standardized Solution



Chi-Square = 405.12, df = 181, P-value = 0.00000, RMSEA = 0.077
RMR = 0.053, NNFI = 0.95, NFI = 0.92, CFI = 0.95, Chi-Square/df = 2.238

Figure 4.8. Basic Model with T-value

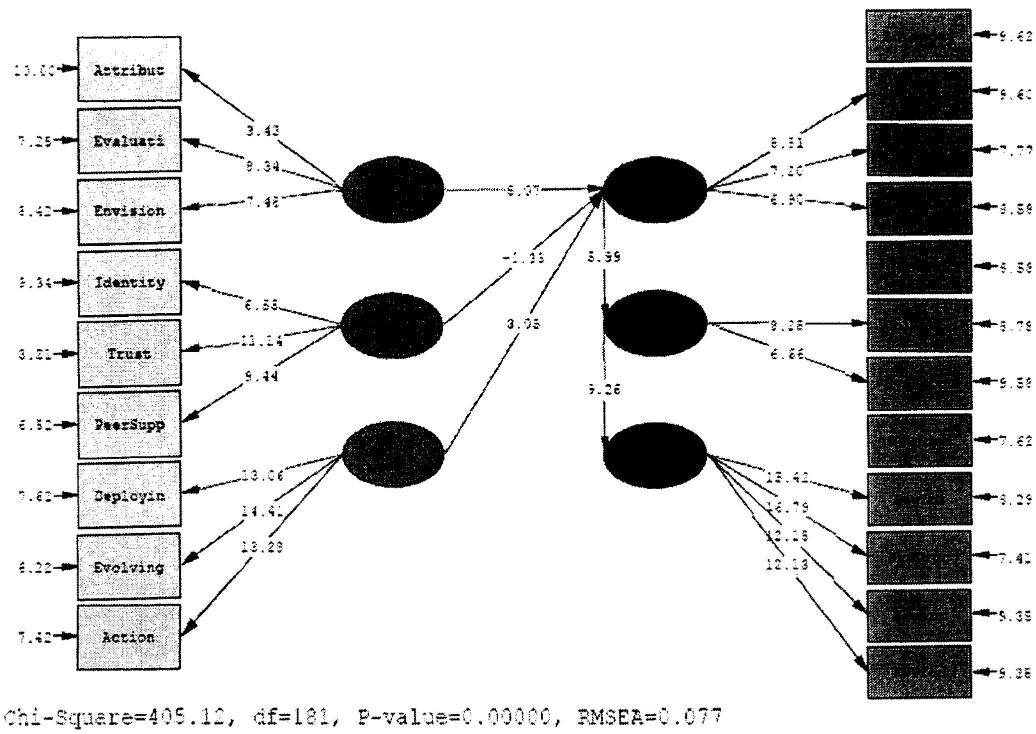


Figure 4.9. Structure Model with Standardized Solution

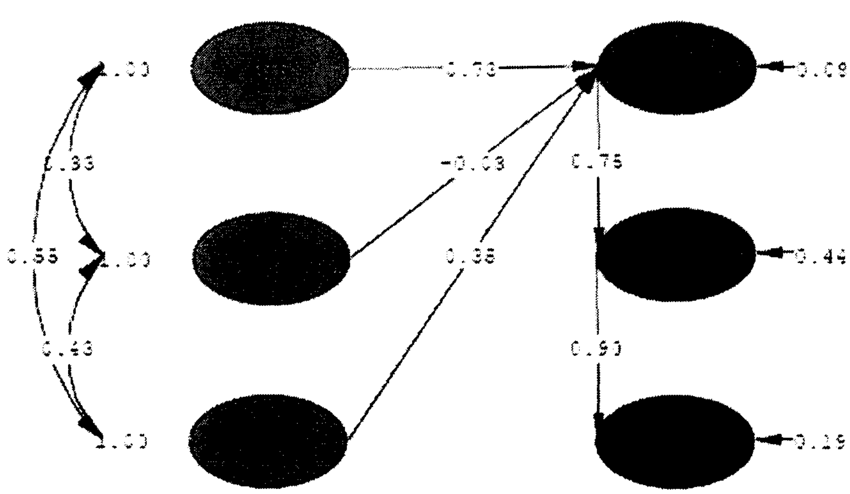


Figure 4.10. Structure Model with T- value

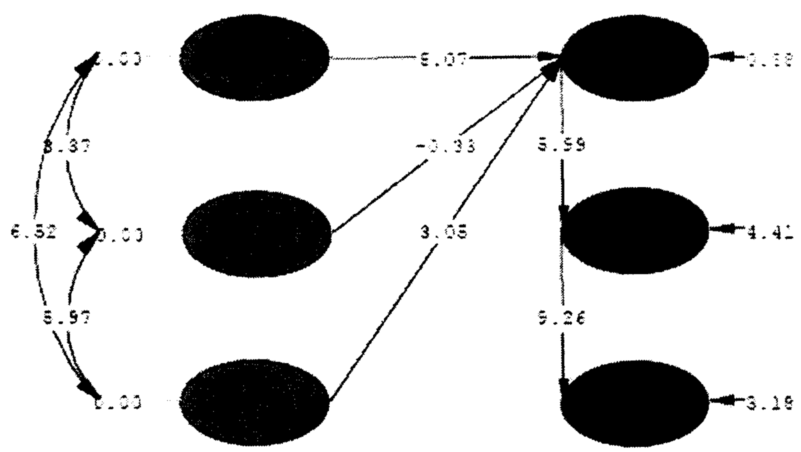
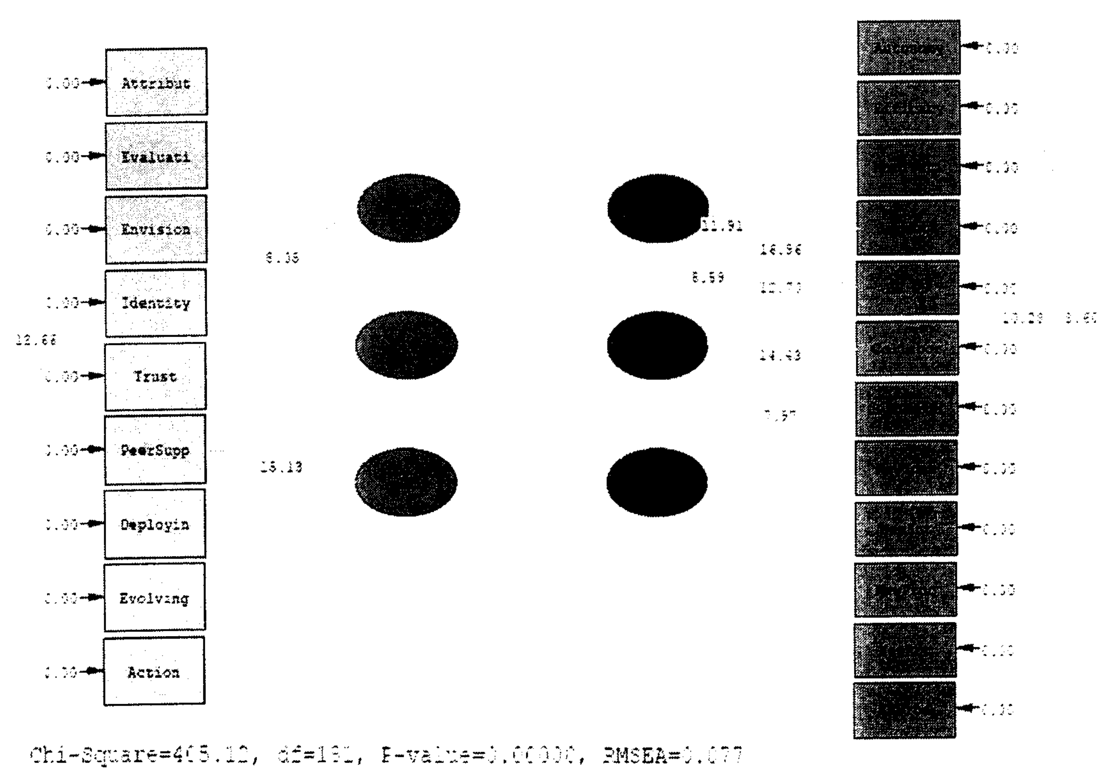


Figure 4.11. Basic Model with Modification Indices



The effects of exogenous variables and endogenous variables in the structural model are summarized in Table 4.3.3. Examining the relationship from exogenous variables to endogenous variable, the findings of structural equation modeling shows that two path coefficients are significant. The path coefficient from personal interpretive style to user empowerment ($\Gamma = 0.73$, $t = 5.07$) and the path coefficient from interpretive flexibility to user empowerment ($\Gamma = 0.35$, $t = 3.05$) are both positive and significant. The results support H1 and H3. However, the path coefficient from communities of practice to user empowerment is negative and non-significant ($\Gamma = -0.03$, $t = -0.33$). Thus, H2 is not supported. The beta coefficients indicate there are strong causal relationships between user empowerment and enacted system use ($B = 0.75$, $t = 5.99$), and between enacted system use and knowledge outcomes ($B = 0.90$, $t = 9.26$). Therefore, H4 and H5 are supported by the findings. The tests of the hypotheses are displayed in Table 4.3.4.

Table 4.3.3 Decomposition of Effects: Direct and Indirect Effects (Standard Coefficients and T-values)

From	To	Direct Effect	Indirect Effect
Personal Interpretive Style	User Empowerment	0.73 (5.07**)	
Personal Interpretive Style	Enacted System Use		0.55 (5.22**)
Personal Interpretive Style	Knowledge Outcomes		0.49 (5.52**)
Communities of Practice	User Empowerment	-0.03 (-0.33)	
Communities of Practice	Enacted System Use		-0.02 (-0.33)
Communities of	Knowledge		-0.02

Practice	Outcomes		(-0.33)
Interpretive Flexibility	User Empowerment	0.35 (3.05**)	
Interpretive Flexibility	Enacted System Use		0.26 (3.08**)
Interpretive Flexibility	Knowledge Outcomes		0.24 (3.14**)
User Empowerment	Enacted System Use	0.75 (5.99**)	
User Empowerment	Knowledge Outcomes		0.67 (6.45**)
Enacted System Use	Knowledge Outcomes	0.90 (9.26**)	

**t-value is significant at 0.01 level (t-value > 2.33)

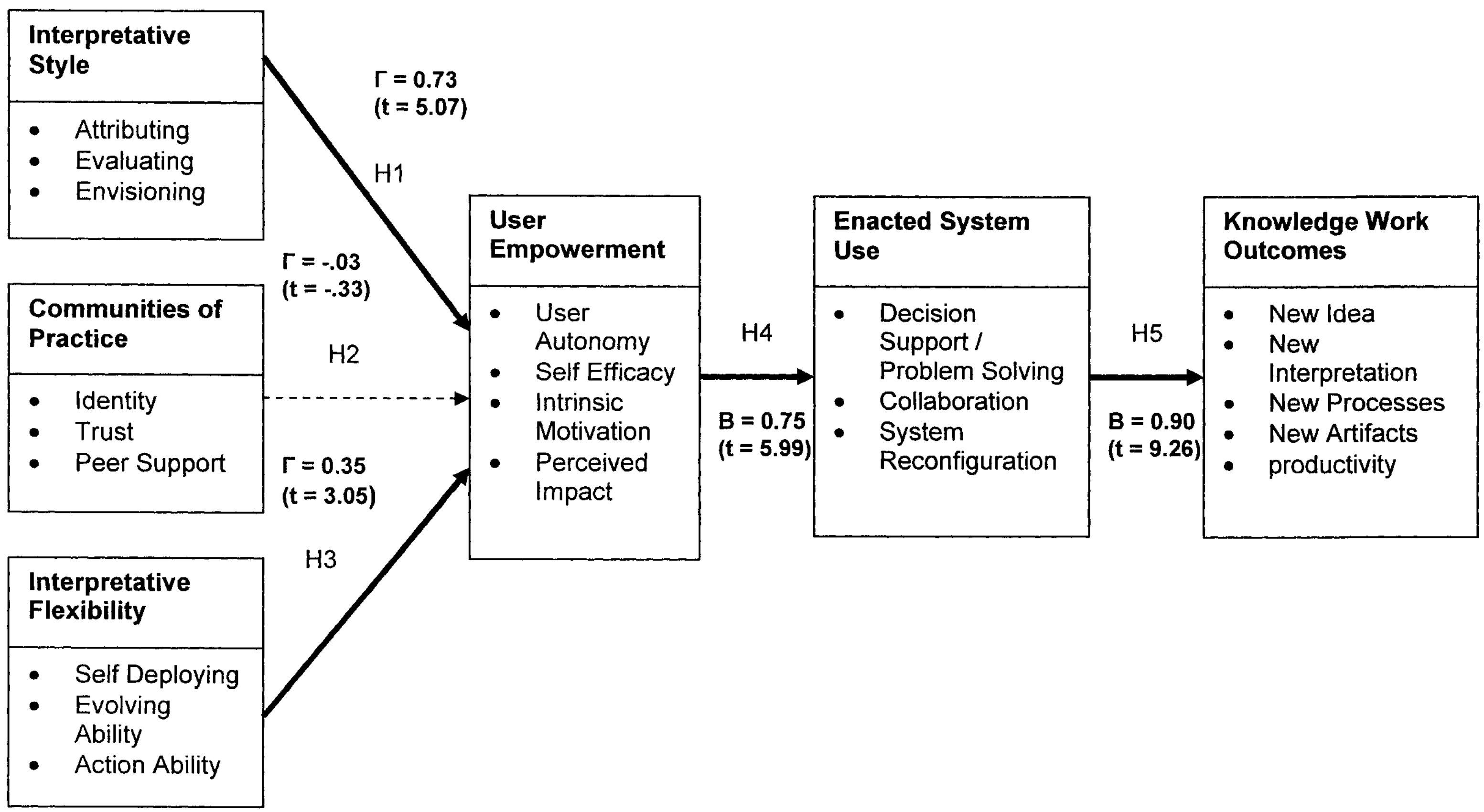
Squared multiple correlation (R-square) are also calculated for three endogenous variables. R-square values for user empowerment, enacted system use, and knowledge outcomes are respectively 0.92, 0.52, and 0.42. This means that suggested structural model can explain 92% variance of user empowerment, 52% variance of enacted system use, and 42% variance of knowledge outcomes.

Table 4.3.4 Results of Hypothesis Testing

Hypothesis	**Result**	**t-value**
H1: Interpretive Styles → User Empowerment	Accepted	5.07
H2: Communities of Practice → User Empowerment	Rejected	-0.33
H3: Interpretive Flexibility → User Empowerment	Accepted	3.05
H4: User Empowerment → Enacted System Use	Accepted	5.99
H5: Enacted System Use → Knowledge Outcomes	Accepted	9.26

Overall, the proposed structure model shows reasonable fit with the sample of 211 knowledge workers. Critical N (CN) is the estimated sample size to yield an adequately model fit for a Chi-square test (Hu and Bentler, 1996). CN of the specified model from LISREL 8 output is 120.91. The sample size of this study is 211, which is the adequate sample size for fitting sample data to the specified model. The significant gamma coefficients provide evidence that Personal Interpretive Styles and Interpretive Flexibility lead to User Empowerment. However, the causal link between Communities of Practice and User Empowerment is not supported, because the gamma coefficient is not significant. There are strong evidences that User Empowerment leads to Enacted System Use (beta = 0.75, t = 5.99), and Enacted System Use leads to Knowledge Outcomes (beta = 0.90, t = 9.26). The summary of the hypotheses testing is displayed in Figure 4.12.

Figure 4.12. Summary of Hypothesis Testing



Chapter 5: Discussion and Implications

This chapter is divided into two sections. First, the antecedents and consequences of the enacted information system use are discussed. Second, theoretical and practical implications are offered.

5.1. Discussions

This research takes the initial efforts to establish a framework to understand the information technology use in the context of emergent knowledge process. Knowledge workers use information technology for decision support, problem solving, collaboration, and sometimes even system reconfiguration for their situated tasks. Items of decision support and problem solving in the construct of enacted system use are adopted from the previous study (Doll et al., 2004). Measurements of collaboration and system reconfiguration are developed in this research to frame the information system use in the context of emergent knowledge process. The results of the large scale study provide strong evidence that the measurements of enacted system use show high level of reliability, convergent validity, and discriminant validity.

In addition to the measurements of enacted system use, measurements of personal interpretive styles, communities of practice, and interpretive flexibility of technology are also developed in this research to understand the indirect effects of people, process, and technology to the information systems use. This research suggests that the availability of information system alone doesn't guarantee the information system use. Rather, it is the empowered individual making the good use of information systems for their tasks. Thus user empowerment is the antecedent of enacted information systems use.

The purpose of information system use is to benefit individual users. For the knowledge workers in the emergent knowledge process, the outcomes that can gauge the success of information systems use are to generate new idea, new interpretation, new processes and new artifacts more often, and to increase productivity more often. The measurements of the knowledge work outcome are developed in this study to test the effects of the enacted system use.

The six constructs, including personal interpretive styles, communities of practice, interpretive flexibility, user empowerment, enacted system use, and knowledge outcomes are placed in the nomological network of information technology use. Then structural equation modeling is used as statistical method to examine the causes and effects of information technology use with the sample data of 211 knowledge workers. The causes and effects of information system are discussed in the following sections.

5.1.1 Antecedents of Information Technology Use

User empowerment consists of four user's cognition: self autonomy, self efficacy, intrinsic motivation, and perceived impacts (Doll et al, 2004). The study results show the strong evidence (B = 0.75, t = 5.99) that user empowerment is related to enacted information system use. Empowered users usually feel competent about their skills and knowledge of information systems. At the same time they also understand the impacts of using information technology for their tasks. The impacts of information systems use could be making better decisions, learning faster, and finding better solutions, or communicating with others more efficiently. However, if end users don't have motivation to use information systems or don't feel they have choices of their own to use information system, they may not use information system efficiently or effectively. Thus, user empowerment involves all four cognitions instead of single cognition. Nevertheless, within these four cognitions, the factor loading of intrinsic motivation (λ = 0.82, t = 7.20) is higher than the rest of three cognitions. The statistic implies that users' intrinsic motivation weigh more for their empowerment cognition toward information systems use. Since knowledge works are difficult to monitor, the quality knowledge outcomes mostly rely on the self motivated knowledge workers. When the knowledge workers enjoy using the information systems for their tasks, they are the true empowered users. Knowledge workers who are lack of motivation may decide not to use information systems for their tasks at all.

The theory developed in this study suggests that personal interpretive style, communities of practice, and interpretive flexibility of technology are preconditions of user empowerment. The results of structural equation modeling show that personal interpretive styles and interpretive flexibility have significantly positive relationship with user empowerment. But the relationship between communities of practice and user empowerment is not significant

Personal interpretive styles (Γ= 0.73, t = 5.07) are significantly related to user empowerment. Three dimensions, including attribution style (λ = 0.27, t = 3.43), evaluating style (λ = 0.64, t = 8.34), and envisioning style (λ = 0.56, t = 7.48), are underlying the variable personal interpretive style. The statistic implies that knowledge workers who have more optimistic attribution style are more empowered for information systems use. The optimistic attribution style means that end users attribute the successful IT use experience to themselves (internal), the successful experience is long lasting (stable), and successful experience has broad applicability (global). Knowledge workers who have higher scores on both learning goal and performance goal are more empowered user for information technology. Users, who set learning goal, strive to seek new skills to increase their competence. People adopting performance goal attempt to get their job done and gain favorable judgment from others. Envision capability is also related to user empowerment. End users who can envision what end products will look like and the processes they will go through are more empowered users for information system use as well.

The relationship between communities of practice and user empowerment is not significant (Γ= -0.03, t = -0.33). Three indicators that measure communities of practice are workgroup identity, trust, and peer support. Although these indicators have sufficient reliability and validity, they don't have significant effects on user empowerment or information system use. One plausible explanation is that the focus of communities of practice is work practice, rather than using information technology. As knowledge workers identify with their workgroups, trust their peers, and gain supports from their peers, they are more interested in sharing personal experience about their work practices. If the Information technology use is not the core of their work practices, the communities of practice may not have effects on how members feel empowered about information technology use. On the contrary, members may rely more on the help from other members in the communities of practice for the emergent situations. That explains why the relationship between communities of practice and user empowerment is slightly negative.

Interpretive flexibility of technology ($\Gamma = 0.35$, $t = 3.05$) is significantly related to user empowerment. The three indicators underlying interpretive flexibility are self deploying ($\lambda = 0.79$, $t = 13.06$), evolving ability ($\lambda = 0.85$, $t = 14.41$), and action ability ($\lambda = 0.80$, $t = 13.28$). These three factors are evenly loaded on the interpretive flexibility variable. The statistics provide the evidence that information technology with greater extent of flexibility does empower end users to use information technology. Information systems that are designed to adapt to the different skill levels of users make novice users feel less intimidate and allow experienced users to be more sophisticated. Thus, self deploying feature of information systems empowers end users to use IT. As the tasks of knowledge workers become complicated and situated, information systems that can adapt to users' evolving situations and provide useful information for users to act upon will encourage end users to continue using IT also. Therefore, evolving ability and action ability of IT empower end users to use IT.

5.1.2. The Consequences of Information Technology Use

The structural model suggests that enacted system use lead to knowledge works outcomes (B = 0.90, t = 9.26). There are five factors underlying knowledge works outcomes variable: new idea (λ = 0.87), new interpretation (λ = 0.83), new processes (λ = 0.87), new artifacts (λ = 0.72), and knowledge work productivity (λ = 0.72). All five factor loadings are all above 0.7 that shows these five factors can portray the knowledge works outcomes adequately.

Innovation and creativity is the core of knowledge works. Knowledge does not add values to individuals or companies unless it is new or creative. Innovation is about more than designing new products. It is also about reinventing business processes and finding the new ideas. Especially, when Internet and globalization widen the pool of new ideas, innovation is about selecting, interpreting, and executing new ideas in a record time. Thus, by using information systems for their task, knowledge workers are able to generate new ideas, new interpretations, new processes, and new artifacts more often.

Knowledge works are about quality rather than quantity. Information systems not only assist knowledge workers being more innovative, they also assist knowledge workers being more productive. Knowledge workers use information systems to reduce the risks of making mistakes and thus improve the quality of their work. Information systems also improve efficiency of knowledge workers, because of the revocability of information technology. Knowledge workers can use information systems to try and error repeatedly in a relatively short time. By using information systems knowledge workers save time for their tasks, and thus are more productive.

5.2 Implications

System success has been a critical research area. System use and individual impacts are two important components in DeLone and McLean's (1992) system success model. Most Information systems researchers find the empirical evidence that supports the link between the system use and individual impacts. Systems use is typically measured as frequency of use, time of use, and number of access. Individual impacts are usually measured in terms of job performance and decision making performance (DeLone and Mclean, 2003). This research broadens the domain of the systems use concept and places systems use in a context of the emergent knowledge process. In the emergent knowledge process, knowledge works can not be completely preplanned. Knowledge works require knowledge workers apply their judgment, interpretation, and decision to the existing information to create new knowledge that adds value to individual or company. Thus, measuring information systems use in terms of decision support, problem solving, collaboration, and system reconfiguration will fit into the context of knowledge works more than the traditional measures.

The findings of this research yield some theoretical implications. First, the impacts of systems use are beyond improving job performance. The research findings suggest that information systems use also facilitates individual's innovativeness. When knowledge workers use information systems for decision support, problem solving, collaboration, and system reconfiguration, they generate new ideas, new interpretations, new processes, and new artifacts more often. This finding implies that information systems use may increase knowledge workers' improvisation capability.

Second, end users' cognition is an important factor that facilitates information systems use. This study finds that user empowerment has strong relationship with information systems use. This means people factor is critical in order to sufficiently explain system success. Technology has its duality. It is created by people and also is used by people. Although system quality and information quality are important for system success, if end users are not willing to use information systems, system will definitely fail. Empowered end users are more willing to use information systems for their tasks, thus increasing the chance of system success.

Third, interpretive flexibility of information systems has indirect effect to information system success. The findings of this study show that interpretive flexibility of information systems has positive direct effect to user empowerment and positive indirect effect to enacted system use. It can be inferred that information systems designed with embedded interpretive flexibility will empower end users to use information systems more often. Since knowledge works can not be closely supervised, most knowledge workers use information systems for their work voluntarily. Knowledge workers would avoid using the information systems that have too much constraint.

Fourth, individual's interpretive styles have indirect influence to information system success. Thomas and Velthouse (1990) suggest personal interpretive styles can produce additional information that assists the four cognitions (senses of impact, competence, meaningfulness, and choice) of psychology empowerment. This study provides the statistical evidence that personal interpretive style does lead to the empowerment of information systems use. Knowledge workers, who have optimistic attributions style, take both learning goal and performance goal, and can envision the end product and process, feel more empowered for information systems use. The empirical findings of this research suggest that personal interpretive styles have significant indirect effects on enacted system use and knowledge outcome. The role of individual's characteristics in interpretation of system success can be further explored to add to knowledge body of system success.

Innovation and creativity have become essential part of competitive advantages. Innovative companies, such as Apple, IBM, and Procter and Gamble, rely on the talents of knowledge workers to build up their profit margin. Knowledge workers' capability of innovation and improvisation is very important for companies' growth. Several practical implications can also be derived from the findings of this research.

First, companies should invest in the information technology that can enable their knowledge workers to support their decisions, to solve problems, collaborate with others, and to reconfigure the information systems to adapt to the evolving situations. The empirical findings of this research support that knowledge workers using information systems in the aforementioned context have more innovative productions, such as new idea, new interpretation, new processes, and new artifacts. Information technology has been an inseparable component of knowledge works. Companies want to invest in the information technology that can expand the potential of knowledge workers' innovativeness.

Second, companies should employ the knowledge workers with optimistic interpretive styles from onset to increase the potential of innovation at the company level. The empirical findings support that positive interpretive styles have significant indirect effects on information systems use and innovative knowledge works outcomes. Individuals with positive interpretive styles are more confident and self motivated. And thus they empower themselves to use information systems to facilitate the innovative activities. Business managers should also cultivate the working environments that foster knowledge workers developing positive personal interpretive styles. Business practices, such as breaking down the communication barriers and increasing communication among the knowledge workers inside and outside of the organizational boundaries, can help knowledge workers develop positive attribution styles, goal orientation, and envisioning aptitude.

Third, Information systems designers should incorporate the characteristics of interpretive flexibility into the information system design. Knowledge workers are usually using information voluntarily for their tasks. If the information systems put too much constraint on their applications, they may minimize the time of using information systems or they may avoid using information systems for their work completely. Information systems can enable knowledge workers to be more innovative, if they can accommodate users at different skill levels, adapt to users' evolving situations, and provide user useful information for their action.

Chapter 6: Conclusion and Recommendation for Future Research

The pressures of globalization and outsourcing have driven companies to pay more attention to their knowledge assets. One of the largest challenges of the companies is to keep their workforces innovative in order to revamp their existing products or to bring the new products to the untapped markets in a record time. Information technology has been so closely integrated into knowledge works. It is critical to understand the relationship between the information technology use and the innovative knowledge works outcomes.

This research is one of the large scale studies that explore the causal links among the factors that affect the information technology use and the effects of information technology use to the knowledge work outcomes. The following sections present the conclusion of this research and offer the recommendations for the future research.

6.1. Conclusion

This research proposes a research model of information systems use in the context of emergent knowledge processes. Several measurements are developed to measure the constructs of personal interpretive styles, communities of practice, interpretive flexibility, enacted system uses, and knowledge outcomes. The measurement of user empowerment is adopted from the study of Doll et al. (2004). In the initial phase of this research, pilot study was conducted to examine the reliability and validity of the proposed scales. The result measurement items from the pilot study are then used for the data collection in the large scale study. 211 responses from knowledge workers in different industries are collected in the large scale study to test the proposed research model. The items that measure 29 proposed scales are analyzed once more for their reliability, convergent validity, and discriminant validity. Within these 29 scales, benevolence and integrity, two scales that measure trust, form one factor in the factor analysis. Thus 28 scales are included for further analysis.

The results of measurement analysis indicate these 28 scales have sufficient reliability, convergent validity, and discriminant validity. The items that measured each scales are aggregated to reflect the score of the respective scale. Each scale then becomes an indicator of the respective construct. For example the average score of the items that measure self deploying become the scores of self deploying. And self deploying is one of the indicators of Interpretive Flexibility.

A structural model is specified with 21 indicators to explain six latent variables (see Figure 4.7.). Fitting the sample data to the specified structural model, the fitting indexes suggest the model is reasonable fit. The path coefficients of the structural model provide the evidence for the following conclusions: (1) optimistic personal interpretive styles are positively related to user empowerment; (2) communities of practice has no effects on user empowerment; (3) interpretive flexibility of technology has positive effects on user empowerment; (4) user empowerment is positively related with the enacted systems use; and (6) enacted systems use is positively related with the innovative knowledge productions and knowledge workers' productivity.

The primary contribution of this research is to develop the reliable and valid measurements for the following constructs: (1) personal interpretive styles; (2) communities of practice; (3) interpretive flexibility; (4) enacted systems use; and (5) knowledge works outcomes. The measurement items of aforementioned construct are exhibited in Appendix 3. These measurement items can serve as the valuable instruments for future research in the interdisciplinary areas of system success, knowledge management, information technology management, and manufacturing management.

Another major contribution of this research is the development of the theoretical framework of information technology use in the context of emergent knowledge processes and the hypotheses testing with LISREL structural modeling. The results of the hypotheses testing have provided the reference framework for understanding the antecedents and consequences of information technology use.

6.2. Recommendations for Future Research

This research uses the convenient samples in the data collection process. Since the samples are not randomly selected, it imposes the limitations to generalize current research findings. For the future research, a more rigorous sampling frame should be applied to the data collection process. The data collected form a consistent sampling frame can be used to further validate the suggested measurements and the research model.

Two types of benchmarking study can be spawned from current research. First, the future study can benchmark the information systems usage of knowledge workers from different firms in the same industry. The results of the benchmarking study can help companies to identify their strength and weakness in term of using information technology to facilitate innovative knowledge production. Second, the future study can benchmark the information systems usage of knowledge workers across different industries. Knowledge workers' information usage patterns may be different in various industries. Knowledge workers in the manufacturing industry and the technology industry may need to reconfigure information technology more often than the knowledge workers in the service industry. The results of comparison can be used to fine tune the current theoretical model.

In current research, three factors including self deploying, evolving ability, and action ability are evenly loaded on the latent variable – interpretive flexibility. The further research can explore interpretive flexibility as a second order construct with three first order factors. A potential link between interpretive flexibility and enacted system use, and the link between interpretive flexibility and knowledge works outcomes can further be explored with interpretive flexibility as an independent variable.

Finally, future research can also examine the direct effect of the personal interpretive styles to enacted system use. It is plausible that individual's characteristics may affect how individual use information technology for their knowledge production.

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Appendix 1: The Online Questionnaire for Pilot Study

Information Technology Use in Knowledge Work

Instructions

The purpose of this survey is to explore how individuals use computer software for their emergent knowledge work processes. In this survey, the word "software" refers to all the software packages that you use in your work process. Each question requires that you choose the alternative that best reflects your experiences.

Work Process

1. Please select one of the following business processes that best describes your work:

<Select>

2. If your selection in above question is "Other", please enter a business process that best describes your work in the space below:

Unsuccessful Experience

3. When I think back on a recent unsuccessful experience in using software for my work, the most likely cause could be described as (enter brief description in your own words below):

Attribution Style (Unsuccessful Experience)

http://www.businessfaculty.utoledo.edu/survey/achou2/ITUseInEKP(Pilot).HTM (1 of 15)4/11/2006 7:50:04 AM

The items below enable you to describe how you attribute or see the cause of the unsuccessful experience recalled above. For each question below, click one number that best indicates how you see the cause. For example, in question 4 below, if you see the cause as being entirely due to an attribute of yourself, you might click on the #1 button.

	1	2	3	4	5	
4. An aspect of myself	○	○	○	○	○	An aspect of the situation
5. Something inside of me	○	○	○	○	○	Something outside of me
6. Something about me	○	○	○	○	○	Something about other
7. Something permanent	○	○	○	○	○	Something temporary
8. Something stable over time	○	○	○	○	○	Something unstable over time
9. Something unchangeable	○	○	○	○	○	Something changeable
10. Something applies to all situations	○	○	○	○	○	Something applies to certain situations only
11. Something influences all of my tasks	○	○	○	○	○	Something influences some of my tasks
12. Something affects my life in general	○	○	○	○	○	Something affects certain areas only

Successful Experience

13. When I think back on a recent successful experience in using software for my work, the most likely cause could be described as (enter brief description in your own words below):

Attribution Style (Successful Experience)

The items below enable you to describe how you attribute or see the cause of the successful experience recalled above. For each question below, click one number that best indicates how you see the cause.

	1	2	3	4	5	
14.An Aspect of myself	○	○	○	○	○	An Aspect of the situation
15.Something inside of me	○	○	○	○	○	Something outside of me
16.Something about me	○	○	○	○	○	Something about other
17.Something Permanent	○	○	○	○	○	Something temporary
18.Something stable over time	○	○	○	○	○	Something unstable over time
19.Something unchangeable	○	○	○	○	○	Something changeable
20.Something applies to all situations	○	○	○	○	○	Something applies to certain situations only
21.Something influences all of my tasks	○	○	○	○	○	Something influences some of my tasks
22.Something affects my life in general	○	○	○	○	○	Something affects certain areas only

Evaluating Style

My primary goal in using software packages for my work is to:

	Almost never	Sometimes	About half of the time	Most of the time	Almost always
23. complete my task quickly.	○	○	○	○	○
24. do my task right	○	○	○	○	○
25. follow the standard of operations of my company.	○	○	○	○	○
26. meet the due date of my task.	○	○	○	○	○
27. solve a problem immediately.	○	○	○	○	○
28. meet my emerging needs.	○	○	○	○	○
29. have fun.	○	○	○	○	○
30. learn new computer skills.	○	○	○	○	○

31. gain new knowledge.	○	○	○	○	○
32. challenge myself.	○	○	○	○	○
33. find different ways of using this software.	○	○	○	○	○
34. explore how to use this software for different applications.	○	○	○	○	○

Envisioning Style

When I use software packages to do my work:

	Almost never	Sometimes	About half of the time	Most of the time	Almost always
35. I have a vivid image of the end result.	○	○	○	○	○
36. I can visualize the details of my intellectual end product.	○	○	○	○	○
37. I can visualize what my end product will look like.	○	○	○	○	○
38. I have a vivid image of every work process I need to go through.	○	○	○	○	○
39. I can visualize how to navigate through the different steps of work process.	○	○	○	○	○
40. I can see a vivid image of the map of each work process.	○	○	○	○	○

User Empowerment

	Almost never	Sometimes	About half of the time	Most of the time	Almost always
41. I have considerable opportunity for independence in how I use the software for my work process.	○	○	○	○	○
42. I have significant autonomy in determining in how I use software for my work process.	○	○	○	○	○
43. I have a say in how I use software for my work process.	○	○	○	○	○
44. I am confident about my ability to use the software to complete my work.	○	○	○	○	○
45. I believe in my capabilities to use the software for my work.	○	○	○	○	○
46. I have mastered the skills necessary for using the software for my work.	○	○	○	○	○
47. Using the software for my work process is enjoyable.	○	○	○	○	○
48. Using the software for my work process is pleasurable.	○	○	○	○	○
49. Using the software for my work process foster enjoyment.	○	○	○	○	○
50. Using the software increases my productivity.	○	○	○	○	○
51. Using the software saves me time.	○	○	○	○	○
52. Using the software allows me to accomplish more work than would otherwise be possible.	○	○	○	○	○

Workgroup Identity

The following statements describe feelings of belonging to the group of people you

work with. Please indicate the extent of your agreement or disagreement about each statement below.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
53. When I talk about my workgroup, I always say 'we' rather than 'they'.	○	○	○	○	○
54. I am very interested in what others think about my workgroup.	○	○	○	○	○
55. My workgroup's success is my success.	○	○	○	○	○
56. When someone praises my workgroup, it feels like a personal compliment.	○	○	○	○	○
57. If my workgroup is criticized, I would feel embarrassed.	○	○	○	○	○

Trust

I believe that my coworkers:

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
58. have the skills to do their work well.	○	○	○	○	○
59. have the expertise to do their work well.	○	○	○	○	○
60. have sufficient knowledge about our business processes.	○	○	○	○	○
61. have sufficient knowledge about the technology we use.	○	○	○	○	○
62. have good judgment on problem solving.	○	○	○	○	○
63. would not lie to me.	○	○	○	○	○
64. would not do anything to harm our workgroup.	○	○	○	○	○

65. would not do anything to harm our relationship.	○	○	○	○	○
66. are not egocentric.	○	○	○	○	○
67. are loyal to our workgroup.	○	○	○	○	○
68. are consistent.	○	○	○	○	○
69. keep their promises.	○	○	○	○	○
70. do what they say.	○	○	○	○	○
71. adhere to our workgroup principles.	○	○	○	○	○
72. have a strong sense of justice.	○	○	○	○	○
73. are not self-serving.	○	○	○	○	○

Peer Support

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
74. My coworkers value my opinions of job related issues.	○	○	○	○	○
75. My coworkers listen to me about work related problems.	○	○	○	○	○
76. I help my coworkers to solve their problems.	○	○	○	○	○
77. I can get the helps from my coworkers to solve my problems.	○	○	○	○	○
78. My coworkers provide helpful information for my work.	○	○	○	○	○
79. With support from my coworkers, I never feel alone.	○	○	○	○	○
80. I have the support I need from my coworkers to do my job well.	○	○	○	○	○

Software Flexibility

Please indicate the extent that software at your work is flexible in each statement below.

The software packages at my work:

	Not at all	To a small extent	To a moderate extent	To a great extent	To a very great extent
81. can accommodate my skill level.	○	○	○	○	○
82. can guide me for the different applications.	○	○	○	○	○
83. can help me with examples.	○	○	○	○	○
84. can help me with explanations.	○	○	○	○	○
85. can respond my different needs.	○	○	○	○	○
86. can accommodate different situations.	○	○	○	○	○
87. can import information from different sources.	○	○	○	○	○
88. can export information to other computer applications.	○	○	○	○	○
89. can plug in a new component.	○	○	○	○	○
90. can accommodate the growing complexity of my work.	○	○	○	○	○
91. can accommodate the growing knowledge base of my work.	○	○	○	○	○
92. have add-in features.	○	○	○	○	○
93. are reconfigurable to meet my different needs.	○	○	○	○	○
94. inform me the worst case scenario.	○	○	○	○	○
95. display the trade-off of my alternative decisions.	○	○	○	○	○
96. support my changing work process.	○	○	○	○	○
97. support my decision in different situations.	○	○	○	○	○

98. support the emergent process of deliberation in my workgroup.	○	○	○	○	○
99. provide information for offline actions.	○	○	○	○	○

Decision Support/Problem Solving

Please indicate how often you have the experience stated in each statement below in using computer software at work.

	Almost never	Sometimes	About half of the time	Most of the time	Almost always
100. I use the software to improve the efficiency of the decision process.	○	○	○	○	○
101. I use the software to help me make explicit reasons for my decision.	○	○	○	○	○
102. I use the software to make sense out of data.	○	○	○	○	○
103. I use the software to analyze why problems occurs.	○	○	○	○	○

Collaboration

I use software at my work to:

	Almost never	Sometimes	About half of the time	Most of the time	Almost always
104. communicate with other members in my workgroup.	○	○	○	○	○
105. discuss my interest with other members in my workgroup.	○	○	○	○	○

106.discuss issues with other members in my workgroup.	O	O	O	O	O
107.understand how my tasks are related to the goals of my workgroup.	O	O	O	O	O
108.establish mutual understanding with the members in my workgroup.	O	O	O	O	O
109.establish the priority of different tasks in my work group.	O	O	O	O	O
110.coordinate with others in my workgroup.	O	O	O	O	O
111.understand how the progress of my tasks are related with other's.	O	O	O	O	O
112.manage the priorities of my tasks.	O	O	O	O	O
113.retrieve the information documented by my workgroup members.	O	O	O	O	O
114.share information with my workgroup members.	O	O	O	O	O
115.seek help from other workgroup members.	O	O	O	O	O
116.exchange information with my workgroup members.	O	O	O	O	O
117.share my experience with other workgroup members.	O	O	O	O	O

System Reconfiguration

I modify software to meet the different needs of my works by:

	Almost never	Sometimes	About half of the time	Most of the time	Almost always

118.changing the parameters of the computer application.	○	○	○	○	○
119.rearranging the user interface of the computer application.	○	○	○	○	○
120.plugging in different functional component to the computer.	○	○	○	○	○
121.writing the codes to change the computer application.	○	○	○	○	○
122.using the add-in features of the computer application.	○	○	○	○	○

Knowledge Work Outcomes

Using the computer application for my work enables me to:

	Almost never	Sometimes	About half of the time	Most of the time	Almos alway
123.generate more new ideas.	○	○	○	○	○
124.come up with different ideas.	○	○	○	○	○
125.have more sources to generate new ideas.	○	○	○	○	○
126.re-specify new objectives of my tasks.	○	○	○	○	○
127.reformulate new objective of my tasks.	○	○	○	○	○
128.discover new patterns in existing data.	○	○	○	○	○
129.see old problems in a new way.	○	○	○	○	○
130.identify different causes of existing problems.	○	○	○	○	○
131.discover new explanations of an existing situation.	○	○	○	○	○

132.find alternative solutions for existing problems.	O	O	O	O	O
133.try out different solutions for existing problems.	O	O	O	O	O
134.implement new work methods.	O	O	O	O	O
135.integrate new ideas into my work processes.	O	O	O	O	O
136.implement new processes in my workgroup.	O	O	O	O	O
137.modify my existing work process.	O	O	O	O	O
138.create something new such as document, spreadsheet, drawing and etc.	O	O	O	O	O
139.create something different such as codes, template, macro, and etc.	O	O	O	O	O
140.create new designs.	O	O	O	O	O
141.develop new products.	O	O	O	O	O
142.manage my tasks productively.	O	O	O	O	O
143.generate quality task outputs.	O	O	O	O	O
144.shorten my learning cycle.	O	O	O	O	O
145.make better decision.	O	O	O	O	O
146.respond to problems quickly.	O	O	O	O	O

General Information

Please provide the following information for statistical purpose.

147. Are you required to use the software for your work process?

O Yes

O No

148. Are you formally assigned to a work team?

O Yes

○ No

149. Do you need to work with people who are located at different offices than yours?

○ Yes
○ No

150. How would you rate the complexity of your major tasks?

○ Very Low
○ Low
○ Moderate
○ High
○ Very High

151. How would you rate your knowledge and skills in using software for your work process compared to someone who can make full use of the same software?

○ Less than 20%
○ 20-39%
○ 40-59%
○ 60-79%
○ 80% and above

152. How satisfied are you with the software capabilities in your work environment?

○ Very unsatisfied
○ Unsatisfied
○ Neutral
○ Satisfied
○ Very Satisfied

153. Does management sponsor efforts to improve work process?

○ Not at all
○ A little
○ Moderately
○ Much
○ Very much

154. **Does management sponsor the hardware and software you need for your work?**

- ○ Not at all
- ○ A little
- ○ Moderately
- ○ Much
- ○ Very much

155. **Does management sponsor the necessary information technology training for your work?**

- ○ Not at all
- ○ A little
- ○ Moderately
- ○ Much
- ○ Very much

156. **How long have you been using this current software package for your major tasks ?**

- ○ Less than 1 year
- ○ 1 to 3 years
- ○ 3 to 5 years
- ○ More than 5 years

157. **Please indicate your gender**

- ○ Male
- ○ Female

158. **Please click one category that best indicate your position within your organization:**

- ○ Top level management
- ○ Middle level management
- ○ First level supervisor
- ○ Professional employees without supervisory responsibility
- ○ Other

159. **Please indicate the highest degree you have received.**

○ High school
○ Associate
○ Bachelor
○ Master
○ Doctorate

160. **Please enter your e-mail address, if you like to have summary findings. (optional)**

[ ]

Please click the button below to complete your survey.

[Submit Your Responses]

Thank you very much for your assistance.

Appendix 2: The Online Questionnaire for Large Scale Study

Information Technology Use in Knowledge Work

Instructions

The purpose of this survey is to explore how individuals use computer software for their emergent knowledge work processes. In this survey, the word "software" refers to all the software packages that you use in your work process. Each question requires that you choose the alternative that best reflects your experiences.

Work Process

1. Please enter the name of your organization unit in the space below. (optional)

2. Please enter the name of your workgroup in the space below. (optional)

3. Please select one of the following business processes that best describes your work:

   <Select>

4. If your selection in above question is "Other", please enter a business process that best describes your work in the space below:

Successful Experience

5. When I think back on a recent successful experience in using software for my work, the most likely cause could be described as (enter brief description in your own words below):

Attribution Style (Successful Experience)

The items below enable you to describe how you attribute or see the cause of the successful experience recalled above. For each question below, click one number that best indicates how you see the cause. For example, in question 6 below, if you see the cause as being entirely due to an attribute of yourself, you might click on the #1 button.

	1	2	3	4	5	
6. An Aspect of myself	O	O	O	O	O	An Aspect of the situation
7. Something inside of me	O	O	O	O	O	Something outside of me
8. Something about me	O	O	O	O	O	Something about other
9. Something Permanent	O	O	O	O	O	Something temporary
10.Something stable over time	O	O	O	O	O	Something unstable over time
11.Something unchangeable	O	O	O	O	O	Something changeable
12.Something applies to all situations	O	O	O	O	O	Something applies to certain situations only
13.Something influences all of my tasks	O	O	O	O	O	Something influences some of my tasks
14.Something affects my life in general	O	O	O	O	O	Something affects certain areas only

Evaluating Style

My primary goal in using software packages for my work is to:

	Almost never	Sometimes	About half of the time	Most of the time	Almost always
15. complete my task quickly.	○	○	○	○	○
16. meet the due date of my task.	○	○	○	○	○
17. solve a problem immediately.	○	○	○	○	○
18. meet my emerging needs.	○	○	○	○	○
19. learn new computer skills.	○	○	○	○	○
20. gain new knowledge.	○	○	○	○	○
21. challenge myself.	○	○	○	○	○
22. find different ways of using this software.	○	○	○	○	○

Envisioning Style

When I use software packages to do my work:

	Almost never	Sometimes	About half of the time	Most of the time	Almost always
23. I have a vivid image of the end result.	○	○	○	○	○
24. I can visualize my intellectual end product.	○	○	○	○	○
25. I can visualize the details of my intellectual end product.	○	○	○	○	○
26. I can visualize what my end product will look like.	○	○	○	○	○
27. I have a vivid image of every work process I need to go through.	○	○	○	○	○
28. I can visualize how to navigate through the different steps of work process.	○	○	○	○	○

29. I can see a vivid image of the map of each work process.	○	○	○	○	○

User Empowerment

	Almost never	Sometimes	About half of the time	Most of the time	Almost always
30. I have considerable opportunity for independence in how I use the software for my work process.	○	○	○	○	○
31. I have significant autonomy in determining in how I use software for my work process.	○	○	○	○	○
32. I have a say in how I use software for my work process.	○	○	○	○	○
33. I am confident about my ability to use the software to complete my work.	○	○	○	○	○
34. I believe in my capabilities to use the software for my work.	○	○	○	○	○
35. I have mastered the skills necessary for using the software for my work.	○	○	○	○	○
36. Using the software for my work process is enjoyable.	○	○	○	○	○
37. Using the software for my work process is pleasurable.	○	○	○	○	○
38. Using the software for my work process foster enjoyment.	○	○	○	○	○
39. Using the software increases my productivity.	○	○	○	○	○
40. Using the software saves me time.	○	○	○	○	○

41. Using the software allows me to accomplish more work than would otherwise be possible.	○	○	○	○	○

Workgroup Identity

The following statements describe feelings of belonging to the group of people you work with. Please indicate the extent of your agreement or disagreement about each statement below.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
42. When I talk about my workgroup, I always say 'we' rather than 'they'.	○	○	○	○	○
43. I care about what others think about my workgroup.	○	○	○	○	○
44. My workgroup's success is my success.	○	○	○	○	○
45. When someone praises my workgroup, it feels like a personal compliment.	○	○	○	○	○
46. I feel bad when others criticize my workgroup.	○	○	○	○	○

Trust

I believe that my coworkers:

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
47. have the skills to do their work well.	○	○	○	○	○
48. have the expertise to do their work well.	○	○	○	○	○

49. have sufficient knowledge about the technology we use.	○	○	○	○	○
50. have good judgment on problem solving.	○	○	○	○	○
51. would not lie to me.	○	○	○	○	○
52. would not do anything to harm our workgroup.	○	○	○	○	○
53. would not do anything to harm our relationship.	○	○	○	○	○
54. are not egocentric.	○	○	○	○	○
55. are loyal to our workgroup.	○	○	○	○	○
56. are consistent.	○	○	○	○	○
57. keep their promises.	○	○	○	○	○
58. do what they say.	○	○	○	○	○
59. adhere to our workgroup principles.	○	○	○	○	○
60. have a strong sense of justice.	○	○	○	○	○

Peer Support

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
61. I can talk to my coworkers about work related problems.	○	○	○	○	○
62. I can get the helps from my coworkers to solve my problems.	○	○	○	○	○
63. My coworkers provide helpful information for my work.	○	○	○	○	○
64. With support from my coworkers, I never feel alone.	○	○	○	○	○
65. I have the support I need from my coworkers to do my job well.	○	○	○	○	○

Software Flexibility

Please indicate the extent that software at your work is flexible in each statement below.

The software packages at my work:

	Not at all	To a small extent	To a moderate extent	To a great extent	To a very great extent
66. can accommodate my skill level.	○	○	○	○	○
67. have friendly user interface.	○	○	○	○	○
68. can guide me for the different applications.	○	○	○	○	○
69. can coach me when I have questions.	○	○	○	○	○
70. have help functions.	○	○	○	○	○
71. can accommodate different situations.	○	○	○	○	○
72. can import information from different sources.	○	○	○	○	○
73. can accommodate the growing complexity of my work.	○	○	○	○	○
74. can accommodate the growing knowledge base of my work.	○	○	○	○	○
75. can accommodate my growing functional requirements.	○	○	○	○	○
76. have add-in features.	○	○	○	○	○
77. are reconfigurable to meet my different needs.	○	○	○	○	○
78. inform me the worst case scenario.	○	○	○	○	○
79. support my changing requirements.	○	○	○	○	○
80. support the emergent process of deliberation in my workgroup.	○	○	○	○	○

Decision Support/Problem Solving

Please indicate how often you have the experience stated in each statement below in using computer software at work.

	Almost never	Sometimes	About half of the time	Most of the time	Almost always
81. I use the software to improve the efficiency of the decision process.	○	○	○	○	○
82. I use the software to help me make explicit reasons for my decision.	○	○	○	○	○
83. I use the software to make sense out of data.	○	○	○	○	○
84. I use the software to analyze why problems occur.	○	○	○	○	○

Collaboration

I use software at my work to:

	Almost never	Sometimes	About half of the time	Most of the time	Almost always
85. communicate with other members in my workgroup.	○	○	○	○	○
86. discuss my interest with other members in my workgroup.	○	○	○	○	○
87. discuss issues with other members in my workgroup.	○	○	○	○	○
88. understand how my tasks are related to the goals of my workgroup.	○	○	○	○	○

89. establish mutual understanding with the members in my workgroup.	○	○	○	○	○
90. establish the priority of different tasks in my work group.	○	○	○	○	○
91. coordinate with others in my workgroup.	○	○	○	○	○
92. understand how the progress of my tasks are related with other's.	○	○	○	○	○
93. manage the priorities of my tasks.	○	○	○	○	○
94. seek help from other workgroup members.	○	○	○	○	○
95. retrieve the information documented by my workgroup members.	○	○	○	○	○
96. share information with my workgroup members.	○	○	○	○	○
97. exchange information with my workgroup members.	○	○	○	○	○
98. share my experience with other workgroup members.	○	○	○	○	○

System Reconfiguration

I modify software to meet the different needs of my works by:

	Almost never	Sometimes	About half of the time	Most of the time	Almost always
99. changing the parameters of the computer application.	○	○	○	○	○
100. rearranging the user interface of the computer application.	○	○	○	○	○
101. plugging in different functional component to the computer.	○	○	○	○	○

102.writing the codes to change the computer application.	○	○	○	○	○
103.using the add-in features of the computer application.	○	○	○	○	○

Knowledge Work Outcomes

Using the computer application for my work enables me to:

	Almost never	Sometimes	About half of the time	Most of the time	Almost always
104.generate more new ideas.	○	○	○	○	○
105.have more new ideas.	○	○	○	○	○
106.produce more new ideas.	○	○	○	○	○
107.come up with different ideas.	○	○	○	○	○
108.re-specify new objectives of my tasks.	○	○	○	○	○
109.discover new explanations of an existing situation.	○	○	○	○	○
110.find new explanations for existing problems.	○	○	○	○	○
111.find alternative solutions for existing problems.	○	○	○	○	○
112.identify different causes of existing problems.	○	○	○	○	○
113.implement new work methods.	○	○	○	○	○
114.integrate new ideas into my work processes.	○	○	○	○	○
115.implement new processes in my workgroup.	○	○	○	○	○
116.modify my existing work process.	○	○	○	○	○
117.create something new.	○	○	○	○	○

118.create new documents.	O	O	O	O	O
119.create new plans.	O	O	O	O	O
120.create new designs.	O	O	O	O	O
121.develop new products.	O	O	O	O	O
122.manage my tasks productively.	O	O	O	O	O
123.generate quality task outputs.	O	O	O	O	O
124.communicate with others effectively.	O	O	O	O	O
125.make better decision.	O	O	O	O	O
126.respond to problems quickly.	O	O	O	O	O

General Information

Please provide the following information for statistical purpose.

127. Are you required to use the software for your work process?

- O Yes
- O No

128. Are you formally assigned to a work team?

- O Yes
- O No

129. Do you need to work with people who are located at different offices than yours?

- O Yes
- O No

130. How would you rate the complexity of your major tasks?

- O Very Low
- O Low
- O Moderate
- O High

○ Very High

131. How would you rate your knowledge and skills in using software for your work process compared to someone who can make full use of the same software?

○ Less than 20%

○ 20-39%

○ 40-59%

○ 60-79%

○ 80% and above

132. How satisfied are you with the software capabilities in your work environment?

○ Very unsatisfied

○ Unsatisfied

○ Neutral

○ Satisfied

○ Very Satisfied

133. Does management sponsor efforts to improve work process?

○ Not at all

○ A little

○ Moderately

○ Much

○ Very much

134. Does management sponsor the hardware and software you need for your work?

○ Not at all

○ A little

○ Moderately

○ Much

○ Very much

135. Does management sponsor the necessary information technology training for your work?

○ Not at all

○ A little

○ Moderately

○ Much

○ Very much

136. How long have you been using this current software package for your major tasks ?

○ Less than 1 year

○ 1 to 3 years

○ 3 to 5 years

○ More than 5 years

137. Please indicate your gender

○ Male

○ Female

138. Please click one category that best indicate your position within your organization:

○ Top level management

○ Middle level management

○ First level supervisor

○ Professional employees without supervisory responsibility

○ Other

139. Please indicate the highest degree you have received.

○ High school

○ Associate

○ Bachelor

○ Master

○ Doctorate

140. Please enter your e-mail address, if you like to have summary findings. (optional)

[ ]

Please click the button below to complete your survey.

[Submit Your Responses]

http://www.businessfaculty.utoledo.edu/survey/achou2/ITUseInKW(Large).HTM (13 of 14)4/11/2006 8:18:39 AM

Appendix 3: Recommended Measurement Items for Future Research

Item Description
Attributing Style (8 items)
The items below describe the attribution of the successful IT use experience.
Internal/External
An aspect of myself / An aspect of the situation
Something inside of me / Something outside of me
Something about me / Something about other
Stable/Unstable
Something permanent / Something temporary
Something stable over time / Something unstable over time
Global/Specific
Something applies to all situation / Something applies to certain situations only
Something influences all of my tasks / Something influences some of my tasks
Something affects my life in general / Something affects my certain areas only
Evaluating Style (7 items)
Performance Goal
My primary goal in using software package for my work is to complete my task quickly.
My primary goal in using software package for my work is to meet the due date of my task.
My primary goal in using software package for my work is to solve a problem immediately.
My primary goal in using software package for my work is to meet my emerging needs.
Learning Goal
My primary goal in using software package for my work is to learn new computer skills.
My primary goal in using software package for my work is to gain new knowledge.
My primary goal in using software package for my work is to challenge myself.
Envisioning Style (7 items)
Product Envisioning
When I use software package to do my work I have a vivid image of the end result.
When I use software package to do my work I can visualize my intellectual end product.
When I use software package to do my work I can visualize the details of my intellectual end product.
When I use software package to do my work I can visualize what my end product will look like.

Process Envisioning
When I use software package to do my work I have a vivid image of every work process I need to go through.
When I use software package to do my work I can visualize how to navigate through the different steps of work process.
When I use software package to do my work I can see a vivid image of the map of each work process.
Workgroup Identity (4 items)
When I talk about my workgroup, I always say 'we' rather than 'they'.
I care about what others think about my workgroup.
My workgroup's success is my success.
I feel bad when others criticize my workgroup.
Trust (9 items)
Ability
I believe that my coworkers have the skills to do their work well.
I believe that my coworkers have the expertise to do their work well.
I believe that my coworkers have sufficient knowledge about the technology we use.
I believe that my coworkers have good judgment on problem solving.
Benevolence/Integrity
I believe that my coworkers are not egocentric.
I believe that my coworkers are loyal to our workgroup.
I believe that my coworkers are consistent.
I believe that my coworkers do what they say.
I believe that my coworkers adhere to our workgroup principles.
Peer Support (4 items)
I can talk to my coworkers about my work related problems.
I can get the helps from my coworkers to solve my problems.
My coworkers provide helpful information for my work.
With support from my coworkers, I never feel alone.
Self Evolving (3 items)
The software packages at my work can accommodates my skill level.
The software packages at my work have friendly user interface.
The software packages at my work can guide me for the different applications.
Evolving Ability (4 items)
The software packages at my work can accommodate different situations.
The software packages at my work can import information from different sources.
The software packages at my work can accommodate the growing complexity of my work.

The software packages at my work can accommodate the growing knowledge base of my work.
Action Ability (4 items)
The software packages at my work have add-in features.
The software packages at my work inform me the worst case scenario.
The software packages at my work support my changing requirements.
The software packages at my work support the emergent process of deliberation in my workgroup.
Self Autonomy (3 items)
I have considerable opportunity for independence in how I use the software for my work process.
I have significant autonomy in determining in how I use software for my work process.
I have a say in how I use this software for my work process.
Self Efficacy (3 items)
I am confident about my ability to use the software to complete my work.
I believe in my capabilities to use the software for my work.
I have mastered the skills necessary for using the software for my work.
Intrinsic Motivation (3 items)
Using the software for my work process is enjoyable.
Using the software for my work process is pleasurable.
Using the software for my work process foster enjoyment.
Perceived Impact (3 items)
Using the software increases my productivity.
Using the software saves me time.
Using the software allows me to accomplish more work than would otherwise be possible.
Decision Support/Problem Solving (3 items)
I use the software to improve the efficiency of the decision process.
I use the software to help me make explicit reasons for my decision.
I use the software to make sense out of data.
Collaboration (11 items)
Communication
I use software at my work to communicate with other members in my workgroup.
I use software at my work to discuss my interest with other members in my workgroup.
I use software at my work to discuss issues with other members in my

workgroup.
I use software at my work to seek help from other workgroup members.
Coordination
I use software at my work to understand how my tasks are related to the goals of my workgroup.
I use software at my work to establish mutual understanding with the members in my workgroups
I use software at my work to establish the priority of different tasks in my work group.
I use software at my work to understand how the progress of my tasks is related with others.
Knowledge Sharing
I use software at my work to retrieve the information documented by my workgroup members.
I use software at my work to share information with my workgroup members.
I use software at my work to exchange information with my workgroup members.
System Reconfiguration (4 items)
I modify software to meet the different needs of my works by changing the parameters of the computer application.
I modify software to meet the different needs of my works by rearranging the user interface of the computer application.
I modify software to meet the different needs of my works by writing the codes to change the computer application.
I modify software to meet the different needs of my works by using the add-in features of the computer application.
New Idea (4 items)
Using the computer application for my work enables me to generate more new ideas.
Using the computer application for my work enables me to have more new ideas.
Using the computer application for my work enables me to produce more new ideas.
Using the computer application for my work enables me to come up with different ideas.
New Interpretation (3 items)
Using the computer application for my work enables me to discover new explanations for an existing situation.
Using the computer application for my work enables me to find new explanations for existing problems.
Using the computer application for my work enables me to find alternative solutions for existing problems.

New Processes (3 items)
Using computer application for my work enables me to implement new work methods.
Using computer application for my work enables me to integrate new ideas into my work processes.
Using computer application for my work enables me to implement new processes in my workgroup.
New Artifacts (3 items)
Using computer application for my work enables me to create new documents.
Using computer application for my work enables me to create new plans.
Using computer application for my work enables me to create new designs.
Productivity (4 items)
Using computer application for my work enables me to manage my tasks productively.
Using computer application for my work enables me to generate quality task outputs.
Using computer application for my work enables me to communicate with others effectively.
Using computer application for my work enables me to respond to the problems quickly.