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Antecedents and Impacts of Knowledge Management Practices Supported by Information Technology: An Empirical Study in Manufacturing Context

by

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Submitted as partial fulfillment of the requirements for
the Doctor of Philosophy degree in
Manufacturing Management and Engineering

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An Abstract of

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In the current economy, organizations increasingly view knowledge as a critical component of their competitive advantage. However, except for anecdotal and case based illustrations of the value of viewing organizational competitiveness from a knowledge based perspective, there is little large-scale empirical evidence to support these claims. It is also widely recognized that individuals within the organization are the basic elements and the source of organizational knowledge. In spite of this, it has become common to view knowledge management as an organizational or group level phenomenon, and the question of how individuals who constitute the group and organization manage what they know has received relatively little attention in the literature.

Drawing on behavioral and learning theories, this research investigates various factors that impact how individuals manage their knowledge, and how such extended behaviors influence the outcomes that are commonly attributed to their better management of knowledge. This research focuses on these individual behaviors in the context of information technology supported knowledge work since today's knowledge work is substantially integrated with diverse information technologies. A manufacturing related environment is chosen to test the proposed hypotheses because of a wide variety of work settings and information technologies available in this context.

Following a pre-test and pilot, large-scale analysis utilized data collected from 252 individuals. The results of the analysis suggest that cognitive effort involved in their work, empowerment and information technology support available significantly impact the individuals' knowledge management practice. Other work characteristics such as virtualness of work and slack time available did not have a significant direct impact on their knowledge management practice. Virtualness, however, contributed to the degree to which the work would be perceived as cognitively demanding. The three dimensions of community of practice also did not have a significant direct impact on the respondent's knowledge management practices. The structural and cognitive aspects, however, had a significant impact on the relational dimension. Further, consistent with other cognitive theories, the relational dimension influenced individuals' knowledge management practices through their cognitive empowerment. Greater engagement in various knowledge management practices by these individuals led to increased task related knowledge and better performance.

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Table of Contents

List of Tables

List of Figures

List of Appendices

CHAPTER 1: INTRODUCTION

There is widespread recognition that businesses and their contexts have changed or is changing significantly from that of the industrial era. The post-industrial environment is viewed as radically different from the earlier industrial era in many respects (Bell, 1973; Huber, 1984; Simon, 1973; Masuda, 1980; Kuhn, 1970; Toffler 1980; Naisbitt 1982; Doll and Vonderembse, 1991). For example, Huber (1984) contents that the post-industrial society will be characterized by more and increasing knowledge, complexity, and turbulence, which will impose distinctly different demands on organizations for decision making, innovation, and information acquisition and distribution. This emerging paradigm is addressed as ‘knowledge economy’, ‘networked economy’, ‘information age’, and ‘knowledge-based society’ among many other labels (Hult, 2003; Malone, 2002; Toffler, 1990; Nonaka and Teece, 2001; Prusak, 1997). ‘Knowledge’ has become a key aspect of this paradigm, where organizations are viewed as creating economic wealth through its transformation.

Many factors are put foreword as reasons for this change, of which, globalization, advancements in technology, changes in managerial practices and other social factors are the most widely held (Prusak, 1997; Champlin and Olson, 1994). For manufacturing, the post-industrial environment is characterized by increased market diversity, changing customer requirements, shorter product life cycles, rapid market and technological change, and the spread of advanced manufacturing technologies (Doll and Vonderembse, 1991; Skinner, 1985). All of these factors in some form or other are related to the continued increase in knowledge, or will contribute to its increase, as indicated by Huber (1984). For example, increased market diversity implies that organizations will try to serve a larger number of market segments, and hence would need to process greater amount of information. Even if they choose to serve a particular market segment, to be competitive, they will need to know more about this market segment than other organizations who are also trying to serve the same market. From such a perspective, many have suggested that the determining factor in the performance of an organization would be the effectiveness with which they manage their knowledge relative to their competition (De Long and Fahey, 2000; Brown and Duguid, 1998; Grant, 1996; Nonaka and Takeuchi, 1995; Leonard-Barton, 1995; Nonaka, Toyama, Konno, 2001; Nelson, 1991; Winter, 1987; Drucker, 1993; Sveiby, 1997).

Though, the primary goal of organizations have always been the accumulation and application of knowledge to produce goods and services (Penrose, 1959), Miles et al., (1998) suggests that knowledge has become more central and pervasive in the emerging paradigm due to changes in the balance between capital goods and knowledge assets required for the creation of economic value. The awareness of the value of knowledge embedded in processes and routines, and awareness of knowledge as a factor in production are also suggested as reasons for the increased interest in knowledge and knowledge management (Prusak, 1997). He further suggests that knowledge could be "a factor of production potentially greater than the traditional triad of land, labor, or capital" (p.ix).

These kinds of realizations have generated tremendous interest among the academic and practitioner communities in understanding knowledge and knowledge management. Several journals dedicated to knowledge management and related fields and the special issues of leading journals from a variety of fields points to this interest (for example, Journal of Knowledge Management, Knowledge Management, Journal of Intellectual Capital, Knowledge and Innovation: Journal of KMCI; Some special issues in leading journals include: Management Science, 2003; California Management Review, 1998; OS, 2002; MISQ, 2003; JMIS, 2001; JMS, 2001; JOM, 2001; BJOM, 2001; DS, 2003; JASIST, 2002; JET-M, 2003; K&PM, 2002; IJAIS, 2002). Similar interest is also evident in many leading firms across the globe. For example, a survey of leading UK firms undertaken in 1998 found that 43 percent of the surveyed firms were undertaking some form of knowledge management initiative at that time (Scarbrough and Swan, 2001). Other leading organizations that have undertaken knowledge management initiatives include: Skandia, IBM, Celemi (Mertins, Heisig and Vorbeck, 2001), Xerox (Kikawada and Holtshouse, 2001), Nokia (Kulkki and Kosonen, 2001), GE, HP (Takeuchi, 2001), Ernst & Young (Hansen, Noharia and Tierney, 1999), Anderson Consulting (Stewart, 1997), Shell (Wenger and Snyder, 2000), and Ford, Monsanto, BP, Dow Chemical, Digital and Buckman Labs (Lucier and Torsilieri, 2001).

There is a tremendous interest in understanding knowledge management from a broad range of fields, including, but not limited to economics, information systems, organizational behavior, psychology, strategic management, linguistics, cognitive science, philosophy, anthropology and sociology to name a few (Argote et al., 2003; Nonaka and Teece, 2001). Such broad range of broad range of perspectives may be one of the reasons for the many different conceptualizations, articulations, and implementations of knowledge management that exists today. On the contrary, the confluence of these varied fields of inquiry may also suggest the inherent theoretical richness of knowledge management, and the importance of this phenomenon for organizational advancement.

In spite of the many different versions of knowledge management, there seem to be a broad recognition and tacit understanding of the importance of it. Most seem to agree that 'knowledge' has become *the* critical resource that can provide organizations sustained competitive advantage in the current and foreseeable economic environments (Bell, 1973, 1979; Alavi and Leidner, 2001; Grant, 1996; De Long and Fahey, 2000; Prahalad and Hamel, 1994; Nonaka and Takeuchi, 1995; Leonard-Barton, 1995; Drucker, 1993; Sveiby, 1997). From a more practical perspective, the fact that firms that use traditional measures of market capitalization reflect ten or more times their book value suggests that there exist a factor more significant than what is accounted for in terms of traditional resources, and this difference could be attributed to the value that is created by leveraging knowledge (Miles et al., 1998).

Knowledge itself has had its presence in the philosophical discussion even before the Socratic era (Prusak, 1997; Takeuchi, 2001). 'Knowledge' as a resource that needs to be managed in an organizational context is what has gained renewed interest. Nonaka and Teece (2001) suggest that the current 'discovery' of knowledge even within the industrial context, is simply a rediscovery, because knowledge was always recognized as valuable, and alchemists and artisans in the past centuries "would frequently endeavor to protect their ‘industrial’ secrets” (p.1). They also indicate that even the patent legislation was guided by the recognition of the value of knowledge.

In the current context, knowledge as an organizational resource is viewed from three major perspectives based on what each considers as knowledgeable entities and based on specific level of abstraction. Some consider organizations as a whole as knowledgeable entity (e.g., Kogut and Zander, 1992; Nonaka and Takeuchi, 1995; Nonaka, Toyama and Konno, 2001; Argyris and Schon, 1978). Others content that it is the individuals within the organizations who can be really knowledgeable, and the organizational capabilities are realized by the interaction of these knowledgeable entities (e.g., Simon, 1991; Grant, 1996, 2001; Davenport and Prusak, 1998). Yet others view that knowledge itself is emergent and is context dependent and is always in a state of flux (e.g., Brown and Duguid, 2000, 2001; Orr, 1996; Weick and Roberts, 1993). Though many use “knowledge” in a loose fashion, frequently interchanging throughout the discourse, each of these perspectives will have distinct implications for implementing knowledge management initiatives.

Based on the fact that organizations are essentially collections of people, whether we choose to abstract the knowledge at the level of organization or at the level of individual, organizational knowledge is intricately dependent on the knowledge of its people. Similarly, even while considering objective knowledge as emergent, individuals could subjectively assess the sufficiency of their knowledge for an organizational action. Organizational knowledge that emerges as a result of the interactions of these entities is also to a large extent a function of what each of the entities know regarding their role in the organization, their knowledge of task based on the division of organizational activities, and their knowledge of other entities within and outside of the organization. Understanding how individuals gain knowledge and how they manage their knowledge in an organizational context gains further significance when all organizational actions are viewed as a result of individuals' or a collection of individuals' action.

Characterization of service and other 'soft' industries as greatly dependent on the 'intellectual capital' or knowledge-based resources have been widely recognized (Miles et al., 1995). In this research we extent this notion to the manufacturing environment and argue that production can also be viewed as a process of knowledge transformation as was indicated earlier based on various research (Grant, 2001; Nonaka and Teece, 2001). What each individual knows will have a greater significance in this context because, in addition to the time, which is not reclaimable, that is invested in creating a product, the transformations applied to the material based on certain knowledge may also be irrevocable in many instances. Such contexts can be characterized as information technology supported knowledge work due to the ubiquitous nature of various information technologies and greater significance of knowledge in the post-industrial manufacturing environment.

Bearing upon this perspective, and recognizing the current interest in understanding organizational knowledge, this research takes a first step in understanding the factors that affect how people create and manage their knowledge (or their knowledge management practices) and how it affects the various outcomes that is of interest to organizations. In addition to theorizing the importance of knowledge management at an individual level, a substantial contribution of this research is also in developing valid and reliable measures of the management of knowledge at the individual level and at an abstraction that will be applicable across broad contexts, without losing the practical usefulness of the measures. This research will also hypothesize and empirically test substantive relationships of individual knowledge management with other related independent and dependent factors.

Based on the assumption that knowledge of the individuals is a crucial factor in production where knowledgeable individuals are responsible for specific organizational actions by which organizations are able to create value, this research attempts to understand how organizations can make the best use of their knowledge, and how they can become more knowledgeable. One way to understand this is by first understanding how individuals within the organization become more knowledgeable for their tasks. Based on these broad areas of inquiry we attempt to understand the following specific questions in this research as it is applicable in the manufacturing context. 1.) How do individuals in manufacturing organizations whose work is highly embedded in information technologies manage their task related knowledge? 2.) To what extent various information technologies help such knowledge workers in managing their knowledge? 3.) How the various factors related to the individuals' work affect their knowledge management practices? 4.) How the various factors related to the communities in which individuals interact (communities of practice) affect their knowledge management practices? 5.) To what extent does such knowledge worker's psychological empowerment impact how they engage in various knowledge management practices? 6.) What impact does these knowledge management practices have on the various individual and group outcomes? Once how individuals manage their knowledge and the factors that impact those behaviors and the outcomes of such behaviors is understood, it may also help us in understanding how it contributes to the collective knowledge of the organization.

Organizations gain new knowledge from the external environment through boundary sensors, and generate new knowledge through the various activates of the individuals within the organization. As different practices that individuals engages in managing their knowledge and factors that impact these practices are identified, organizations can effectively develop interventions to promote these practices within their employees. Understanding the extent to which information technologies impact the individuals' knowledge management practices can also help organizations evaluate the merits of employing various systems that support these practices. Further, looking at how the different information technologies support these practices will help organizations create, promote, and customize information technologies that will meet the specific knowledge needs of their employees.

The findings of this research will help organizations assess the relative importance they need to give for various factors, in helping employees manage what they know to achieve specific outcomes that are of interest to organizations. Valid and reliable measures of knowledge management practices will help organizations and researchers in identifying the factors that are of importance across different contexts, and how it impacts the specific outcomes that are of interest. The results of this research can also guide future research that aim to understand this phenomena at other levels of abstraction such as at group and organizational levels.

CHAPTER 2: THEORY DEVELOPMENT

2.1 Information Technology Supported Knowledge Work

One of the major reasons for the increased interest in *knowledge* in organizations is due to the fact that work is becoming more knowledge oriented (Drucker, 1969; Roe & Meijer, 1990; Roe et al., 1993). Work is increasingly becoming difficult to be partitioned into routine tasks that can be delegated to be performed by specialist individuals (Zuboff, 1988). Part of the reason is that, as computers are becoming increasingly flexible and versatile in what they can do, it becomes economical and efficient to delegate such routine work to computers. This parallels the effort in the beginning of the last century to delegate physical labor to machines. The difference mainly being that, now the more cognitive type of tasks can also be delegated to machines (computers). This implies that humans are increasingly left with what is remaining of the more complex cognitive work.

Even with current levels of automation and machine power, people still do physical work. Similarly, this in no way implies that all cognitive work will be solely performed by computers. But, as computers become better at handling increasingly complex cognitive tasks, human work will also be proportionately pushed towards increasingly complex tasks. Which means our work will require more thought and knowledge than before, at least for the near foreseeable future. This may also suggest that we will increasingly use computers to accomplish our work, and such changes can already be felt at work places. The work that requires individuals to use greater cognitive effort to accomplish their work is defined as knowledge work (Davis, 2002; Helton, 1988). This can be extended to define IT supported knowledge work (virtual knowledge work) as work for which individuals need to think and use their knowledge as they perform the task, and a significant portion of their work is implemented using computers (Doll, Deng & Metts, 2005).

From this perspective, as work becomes increasingly dependent on what we know, it is imperative that we manage our knowledge effectively so that we 'know' better when it is time to take action. Computers already help us store what we know, share our knowledge, retrieve the stored information, stimulate our thoughts in solving problems and help us implement our knowledge through various embedded work processes. Because of the already heightened use of information technology and the intensity of cognitive effort needed in such knowledge work we chose to test our model of information technology enabled knowledge management practices in this environment.

2.2 Conceptualizations of Knowledge

The fuzziest concept in the knowledge management literature is the concept of *knowledge* itself. Though knowledge in its different linguistic variants is one of the most commonly used words, it has been particularly recalcitrant in lending itself to scientific inquiry. It has had a significant presence in the philosophical debate since the pre Socratic era (Prusak, 1997). However, as knowledge is being identified as a significant *resource* that promises sustained competitive advantage for organizations by an increasing number of theorists and practitioners, there is a rising interest in defining knowledge in a more concrete term so that it can enable a more systematic study. Some argue that the difficulties stem from a lack of a theory of knowledge (Tsoukas & Vladimirou, 2001). Others view it as a difficulty in efficiently conceptualizing knowledge. Both of these difficulties are in fact mutually dependent. A theory is difficult to emerge without a working definition. A definition cannot be effectively used without a supporting theory.

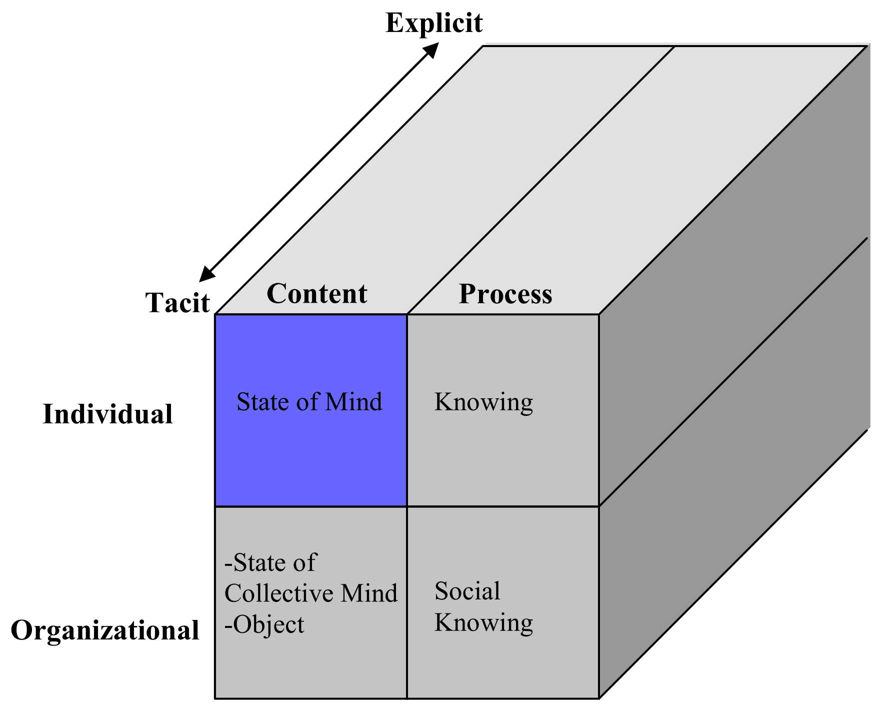
In spite of these difficulties, there seem to be three consistent themes that evolve from the emerging literature (Figure 2.2.1). One is centered on the tacit-explicit nature of knowledge as put forth by Polanyi (1962, 1967, 1975). The question is can knowledge be classified into tacit knowledge and explicit knowledge? In other words can we identify and discern some knowledge as explicit and others as tacit, and is it possible to measure them distinctly?

The other discussion focuses on the issue of individual verses organizational knowledge. There seem to be a general agreement that individuals can be knowledgeable. However, the central question seems to be, can organizations be considered as knowledgeable entities? And if so, can they be knowledgeable while being independent of the individual? Since organization itself implies a collection of individuals, this question is better understood when it is reduced to two other parts. Can a collection of individuals be more knowledgeable than the sum of what each of those individuals know? And can knowledge exist external to the individuals, specifically, in artifacts, processes, routines, etc?

The third theme is centered on the question of conceptualization of the knowledge itself. Is knowledge to be conceptualized as content? Or is it to be conceptualized as a process? Stemming mainly from the earlier difficulty of conceptualizing organizational knowledge in a useful way, there is an emerging consensus that the conventional view of organizational knowledge is insufficient, and this has prompted many to focus on the process of knowing rather than to place emphasis on knowledge as such (Blackler, 1995; Orlikowski, 2002; Cook & Brown, 1999). This preference for knowing rather than knowledge as the focus of study is also based on the recognition that knowledge in organizations are often fluid and overlapping, and that it undergoes construction and transformation in use (Lave, 1993). Similar views are shared by Star (1992) who contents that cognitions are situated, collective, and are also forms of material practice.

Growing interest in activity theory based on the ideas of Russian psychologist Vygotsky also seem to converge along these lines. For example, Brown, Collins and Duguid's (1989) and Lave and Wenger's (1991) work on understanding the process through which people develop shared conceptions, and Hutchins' (1983) and Engestrom's (1987, 1993, 1999) research that investigates the relationship between a community's shared conception of their activities and the resources through which they enact those activities are also suggested to be indications in this direction (Blackler, 1995). From this perspective though knowledge can be seen as a group attribute, we are interested in the more elemental level of knowledge, that is, at the individual level (Figure 2.2.2). This will also enable us to separate the social aspects that contribute to knowledge at a group level.

Figure 2.2.1: Relationships between Major Themes Characterizing Knowledge



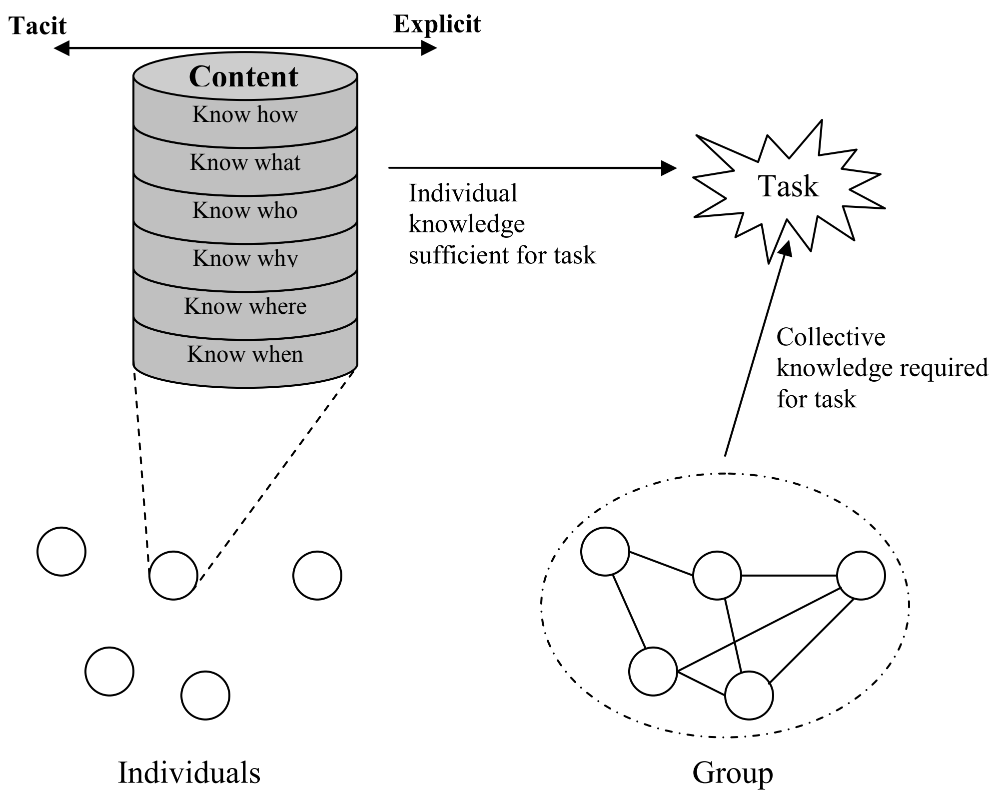
Kogut and Zander (1992) maintains that any characterization of knowledge ultimately confronts the problem of unit of analysis and argues that knowledge can exist at several levels such as individual, group, organization and network. Since the focus of their study was to describe the various distinguishing factors of the knowledge at the various levels, they do not get into how the individual knowledge is integrated into the organizational knowledge. However, Nonaka (1994) for example provides a model of how the knowledge originating at the individual *spirals* up into the group and further towards the organizational level (Figure 2.3.1).

All three themes that help define knowledge will have varying implications for research in knowledge management. However, whether all knowledge resides in the individual minds (Simon, 1991) or it is a characteristic of an organization (as an embedded process or as social cognition) (Spender, 1996; Kay, 1993; Wittgenstein, 1958; Engestrom, 1987, 1993; Blackler, 1993, 1995), there seem to be considerable evidence in the literature that indicate that knowledge is primarily a product of the individual reflection and ultimately results in organizational capability through its implementation by knowledgeable actors (Grover & Davenport, 2001; Huber, 1991; Walsh & Ungson, 1991; Inkpen & Dinur, 1998; Nelson & Winter, 1982; Nonaka, 1994; Grant, 1996; De Long & Fahey, 2000).

This research investigates the various practices by which individuals enhance their knowledge, and what impact these practices and their level of knowledge have on their own and their groups' productivity outcomes. We also investigate the various individual and task characteristics, and the characteristics of the communities of practice they interact, that enable these practices. Focus of knowledge in this research is the individual's knowledge, which is defined as the conceptual content of the individual's mind or as a state of mind (Alavi & Leidner, 2001) (Figures 2.2.1 & 2.2.2).

Conceptualizing knowledge as a process would confound this study because we are also interested in studying the various processes by which knowledge as an individual's mental content is enhanced. Since knowledge is conceptualized here as the individuals mental content/mental models (encompassing routines and frameworks) (Kim, 1993) that provides them the capability to act on a particular task, we do not make a differentiation between tacit and explicit knowledge of the individual. Rather, the focus is in identifying the levels of various types of knowledge the individual needs (whether it is in tacit or explicit form) for successfully performing his/her task and what factors contribute to it (Figure 2.2.2).

Figure 2.2.2: Conceptualization of Individual and Collective Knowledge



Fahey and Prusak (1998) point out that "viewing knowledge as existing predominantly outside the heads of individuals" (p.267) as one of the deadliest sins of knowledge management. The primary assumption that is common in theirs and many other's similar inference, and in this research is that "knowledge is what a knower knows" (ibid, p.267). Further, individual being the primary source of knowledge (Nelson & Winter, 1982; Nonaka, 1994), understanding this phenomenon at the individual level will help us understand knowledge management at higher levels such as among groups and in organizations.

2.3 Managing Knowledge at the Individual Level

The recognition that knowledge is *the* organizational asset that provides them with the competitive edge has also given way to the efforts to manage it. It seems logical to reach such a conclusion because valuable resources of the organizations need to be *managed* if they are to sustain a competitive advantage. But the problem with such a view if we are to study this phenomenon is that, there is no general agreement as to how knowledge itself is to be conceptualized for it to be managed. As seen in the discussion on the various conceptualizations of knowledge, it could be conceptualized as some content of the organization or it can be viewed as a process. It could be viewed essentially as a characteristic of an individual or it could be characterized as a property of the organization. It could be considered as tacit or explicit in its basic nature. Several other variations exist based on these themes on how knowledge is to be conceptualized (Figure 2.2.1). All these different ways of conceptualizing knowledge will have different implications for what it means to manage knowledge within the organization.

Though there is considerable difference in what knowledge management means and how it should be managed, all seem to agree as to the purpose of knowledge management efforts, that is, to identify and leverage all forms of knowledge within the organization to help them compete and adapt in a constantly changing environment (Von Krogh, 1998; Alavi & Leidner, 2001). Other, more specific aims of knowledge management can also be seen in the literature. For example, Davenport and Prusak (1998) identifies the purpose of most knowledge management efforts as, making knowledge visible in the organization, enabling knowledge sharing between the organizational entities, and building knowledge infrastructure.

Majority of the literature on knowledge management considers knowledge as some form of organizational content and knowledge management as a process involving various activities with the knowledge (Alavi & Leidner, 2001). Though the exact number and label for each of these processes are conceptualized slightly differently by different authors, they are all based on the processes of creating, sharing, storing, retrieving and using knowledge (Alavi & Leidner, 2001).

For example, Nonaka's (1994) spiral of knowledge creation from an individual perspective can be conceptualized as composed of these elements. The four main processes through which individual knowledge spirals to the group and organizational level, creating new knowledge from an organizational perspective, is conceptualized as through the processes of combination, socialization, externalization and internalization (Figure 2.3.1). This is well suited for an analysis from an organizational perspective.

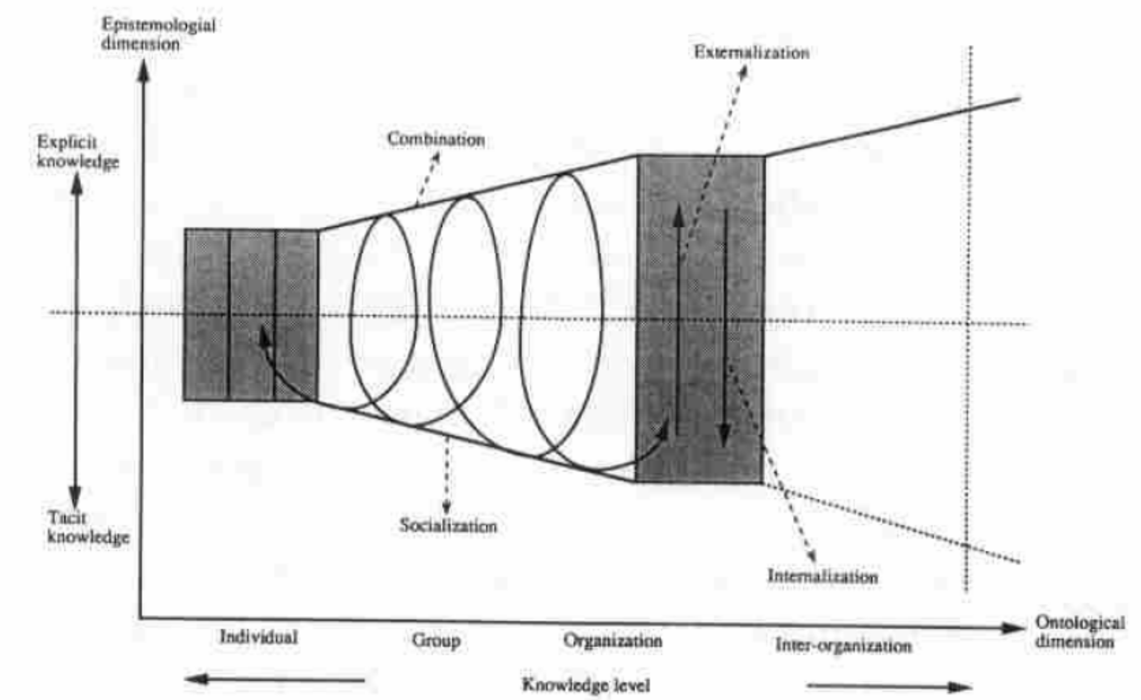
From an individual's perspective, combination is primarily an internal process where existing information is combined and synthesized to create new knowledge. Socialization implies actively sharing or accessing new information from others. The process of externalization mainly involves making explicit what one may know and can be considered mainly as a process of sharing one's knowledge, though it may be done in the process of socialization or during application of one's knowledge. Internalization mainly implies accessing and assimilating (capturing) one's knowledge. Further, the spiral implies that the four processes Nonaka put forth are intertwined. Similarly, the knowledge management process involving knowledge creation, sharing, access, capture and application may be interrelated.

If individuals are considered as the primary source of knowledge and the effect of their application and sharing of knowledge is viewed as spiraling to the group and organizational levels of abstraction (Fahey & Prusak, 1998; Nelson & Winter, 1982; Nonaka, 1994), then understanding how individuals manage their knowledge takes on a strategic role. Further, "taking an organization as the unit of analysis would fail to take into account the fact that organizational knowledge is created through the interaction of individuals and, as a result, would provide little guidance on how management can influence the learning process (Grant, 1996; Hedberg, 1981; Lynn, Railly, & Akgun, 2000)" (Janz & Prasarnphanich, 2003, p. 355).

Though the debate on the organizations as knowledgeable entities and how such knowledge needs to be characterized is unending, the fact remains that the knowledge of individuals within the organization is the building block of organization's knowledge. From such a perspective it becomes important not just how organization manages its knowledge, but also how individuals within the organization manages their knowledge. For example, Marshall, Prusak and Shpilberg (1996) recognize that organizational knowledge management is an attempt to recognize and leverage the knowledge within the individuals so that it can be used by a broader set of individuals within the firm.

Similar perspectives on the importance of enabling the management of knowledge at the point of use can be seen in the communities of practice literature. For instance, Wenger (1999) argues that one of the major advantages of promoting communities of practices within the organizations is to allow the people, who are also part of the work teams, within the organization to manage knowledge so that it can be put to use in their responsibilities. This is what provides real results for organizations because "the management of knowledge is as close as possible to the activities where it creates value." (p. 60).

Figure 2.3.1: The Spiral of Knowledge Creation (Nonaka, 1994).



What does it mean to manage knowledge for an individual? If knowledge is the conceptual content of the individuals mind which enable them to make sense of the environment so that they can act upon a task successfully, just as organizations create, share, capture, retrieve and apply knowledge, individuals also engage in these behaviors.

One would expect that how effectively they engage in these activities in relation to their task would enhance their task related knowledge.

When individuals acquire new knowledge they are said to have learned. In other words, Kim (1993) provides the dictionary definition of learning as "the acquiring of knowledge or skill" (p.38). Though researchers differ on what has to be learned to consider learning has occurred, they agree that some thing new has been created within the individual's mind. Some consider that a conceptual understanding is sufficient; others argue that it has to be manifested as some action to consider what has been newly created as truly learning. Argyris and Schon (1978) take the latter perspective when they consider that learning takes place only when the new knowledge is translated into replicable behaviors. Kim (1993) also is more inclined to this view when he defines learning as "increasing one's capacity to take effective action" (p.38). Nonetheless he considers that learning has two facets of conceptual and operational learning, latter being the part that is close to action. But for Piaget (1970) and Kolb (1984) learning could occur just at the conceptual level where experience could be a source for such learning. These two differences are mainly due to the focus of inquiry, since the first approach is more of a behavioral perspective to learning and the second is largely from a cognitive or psychological lens.

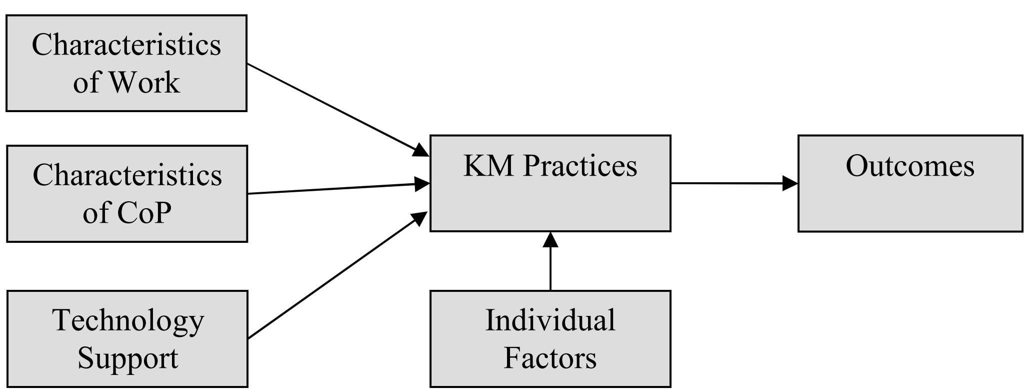
Individuals do not just create knowledge, they share them in the community in which they interact, they store what has been newly learned in their minds and in the external world (Gray & Fu, 2004), they try to remember from their minds and retrieve from external sources when they need that knowledge, they embed them in the processes and artifacts in the course of their work and apply their knowledge in solving problems and in making decisions. These are the activities that organizations want their employees to perform when they implement knowledge management initiatives (Janz & Prasarnphanich, 2003). This not only helps in leveraging individuals' knowledge for the organizational use, but also enhances the individual's own knowledge for successfully performing his/her task within the organization. Thus, when we consider how individuals manage their knowledge we need to consider this whole range of activities.

2.4 Research Model

This research conceptualizes individual level knowledge management practices as a set of sustained behavioral manifestations enacted by organizational actors. To understand the factors that impact these behavioral actions that are closely related to, and in some instances manifested by (as in the case of knowledge creation), their cognitive actions, other behavioral and cognitive theories can provide insights to guide this research. Most widely applicable theories of behavior in the organizational field such as the classical causal model of behavior (Maier, 1955; Davis & Luthans, 1980; Thomas & Velthouse, 1990) and Lewin's (1946) fundamental equation of human behavior stress on several environmental variables affecting individual behavior. Other widely applicable behavioral theories (eg., Skinner, 1938; Thorndike, 1932; Watson, 1930) also suggest to varying degrees the impact an individual's environment has on their behavior. Since individuals' community of practice can be considered as the primary environment in which they interact in gaining and sharing their work related knowledge we use Nahapiet and Ghoshal's (1998) social capital framework to understand the different characteristics of such an environment on individuals knowledge management behavior.

As part of the environmental variables, this research also investigates the impact of work characteristics, which are expected to be closely related to individuals' work knowledge, on their knowledge management practices. Another external variable that is considered is the information technology support available since this is an integral part of how these knowledge workers interact with their environment. Selection of these variables related to the current study is also congruent with sociotechnical systems (STS) theory (Trist & Bamforth, 1951) and activity theory (Engestrom, 1987, 1999; Blackler, 1993; Vygotsky, 1978). Both theories emphasize the dynamic, emergent and interactive nature of human interaction as an embedded actor in a social and technological environment. The community of practice characteristic captures the social aspect and the technology support the technological aspect of individual's environment (Figure 2.4.1).

Figure 2.4.1: Conceptual Research Model



Knowledge as defined in this research is the cognitive content of the individual that enables them to act effectively and efficiently in their work setting by which they may add value to the various organizational processes. Knowledge management behaviors of the individual are then closely connected to the various cognitive elements of the individual. Cognitive theories such as activity theory (Engestrom, 1987, 1999; Blackler, 1993; Vygotsky, 1978), social cognitive theory (Bandura, 1986, 1989) and situated learning theory (Lave & Wenger, 1990) suggest that individual characteristics are a significant factor in determining behavior apart from the situational environmental factors. Finally, individuals' behavioral manifestations need to contribute to their and their group's outcome measures that organizations value. These relationships focusing on the individual knowledge management behaviors are depicted in Figure 2.4.1. The overall conceptual model is similar to the systems theory approach where certain input parameters are viewed as impacting individual processes to produce certain outcomes (Fedor et al., 2003; Hackman & Morris, 1975; Hackman, 1987; Lee & Choi, 2003; Rubenstein-Montano et al., 2001). The following sections explore these relationships to select specific variables within the overall conceptual framework.

2.4.1 Characteristics of IT supported Knowledge Work

What are the characteristics of knowledge work that are relevant in understanding how people manage their knowledge and how IT contributes to it? Knowledge work has been defined from a variety of perspectives. For example, Kelloway and Barling (2000) identify three thematic definitions in addition to their own. For the sake of occupational differentiation, knowledge work is sometimes defined as a profession associated with information technology or high tech industries (Choi & Varney, 1995; Dove, 1998). This definition merely attempts to classify workers as scientists, engineers, professors, and so on as knowledge workers (Nomikos, 1989), and does not provide much information as to the common characteristics that bind these professions as knowledge work. Rather, they are based on the traditional characteristics of the workers such as education or organizational level (Bentley, 1990; Janz et al., 1997).

The other approach is to view knowledge work based on individual characteristics such as innovation and creativity (Tampoe, 1993; Brophy, 1987), and individuals as knowledge workers if they possess these characteristics. This approach is not suited for this study because we are interested in finding if the individuals' knowledge management practices and their knowledge lead to these very outcomes.

The third approach is to view knowledge work as an individual characteristic. Based on this approach knowledge work is all kinds of work that are performed by knowledge workers (individuals who create new ideas, uses greater cognitive effort, work with information, etc.) (Conn, 1984; Helton, 1988; Fox, 1990). This approach however, does not tell us much about the work environment of the knowledge work, and we are interested in how the work characteristics of the knowledge work as an environmental factor affect the individuals' knowledge management practices.

The fourth definition proposed by Kelloway and Barling (2000) themselves is to view knowledge work as individual's discretionary behavior in using knowledge. These behaviors are performed by all workers to a lesser or a greater extent based on their need for knowledge and again does not provide the characteristic nature of the knowledge work.

In trying to identify the “real knowledge worker”, Helton (1987, p.26) uses a set of characteristics that are typical of knowledge work. These work attributes are work range, work structure, control and cognitive effort. The work range is the scope of work that the individual has to perform and measures to what degree work is repetitive, routine, sequential and group dependent. Work structure tries to capture the nature of the work goals, and depends on whether they are fixed or shifting. Control is the amount of discretion that is required in effectively performing the work. The amount and difficulty of reasoning and thought involved in performing the work is characterized by the cognitive effort.

These aspects of work capture the essential characteristics that are important in knowledge work for studying how knowledge workers engage in various knowledge management practices and how technology affects these practices. Since the focus of this study is on the information technology supported knowledge work, a variable to capture the degree to which the work is virtual- that is, the degree to which the work processes or components are embedded or enabled by computer systems is also included (Table 2.4.1).

Another factor that influences whether an individual engages in knowledge management practices is the availability of time to perform these activities. Since these practices may not always be directly related to the immediate task outcome of such knowledge workers, there is a high likelihood that they may not engage in these practices due to the very lack of time for engaging in these activities. If organizations are obsessed with short term results from their employees it is difficult for them to engage in reflection

Table 2.4.1: Work Characteristics

Variables	Definition	Literature Base
Work Range	It relates to the scope of the individual's work in terms of the repetitiveness of the tasks, degree to which it is predetermined, the extent to which it is performed in a particular sequence, and the level of group interaction needed to perform the tasks.	Helton, 1987; McCormick, Jeanneret, Mecham, 1969; Hackman & Lawler, 1971; Sims, Szilagyi & Keller, 1976; Pierce & Dunham, 1976
Work Structure	It is the extent to which task objectives and work goals are changeable or shifting.	Helton, 1987
Discretion	It is the extent to which the work provides freedom of choice in the various aspects of performing the tasks.	Helton, 1987; Hackman & Lawler, 1971; Sims, Szilagyi & Keller, 1976; Pierce & Dunham, 1976
Cognitive Effort	It is the amount and difficulty of reasoning and thought involved in performing the job and resolving work problems.	Helton, 1987
Virtualness	It is the extent to which the work processes are dependent or embedded in computers.	Doll, Deng & Metts, 2005
Slack Time	It is the availability of time in excess of the minimum requirement to perform a task which can be used for reflection and analysis.	Lawson, 2001; Garvin, 1993

and introspection of their work (Lawson, 2001). Lawson (2001) argues that organizations need to have *slack* in terms of time and other resources to adapt to changing circumstances, and for them to "learn and be able to develop and retain knowledge" (p.131). She points out that groups should have sufficient room to evolve as learning communities, by being able to collaborate and share their knowledge. Learning becomes difficult if employees are harried or rushed, and they need to have time for reflection and analysis in a learning organization (Garvin, 1993). The availability of slack time is also considered as one of the best metrics for an organization's knowledge orientation

(Davenport & Prusak, 1998). Based on these discussions we consider availability of slack time as an important work characteristic that will impact to what extent individuals will engage in the various knowledge management practices.

2.4.2 Characteristics of Community of Practice

Wenger and Snyder (2000) define community of practice (CoP) as a "group of people informally bound together by shared expertise and passion for a joint enterprise-engineers engaged in deep-water drilling, for example, consultants who specialize in strategic marketing, or frontline managers in charge of check processing at a large commercial bank." (p. 139). These communities could meet at a physical location or could be virtually connected through various communication media such as email and internet applications (Lesser & Storck, 2001). Though the primary output of communities of practice is knowledge, they have been found to improve organizational performance by driving strategy, generate new lines of business, solving problems, promoting the spread of best practices, developing individuals skills, helping companies to recruit and retain talent and other such activities (Wenger & Snyder, 2000). Communities of practice are formed by formal efforts from the organization or informally as individuals come together to share their knowledge and are different from other social entities such as formal work groups, project teams or informal networks on many aspects. The distinct difference from other forms of organization is that the purpose of community of practice is to develop members' capability and to build and exchange their knowledge; the members are self-selected into the group, and they hold a passion and commitment for the group's expertise (Wenger & Snyder, 2000).

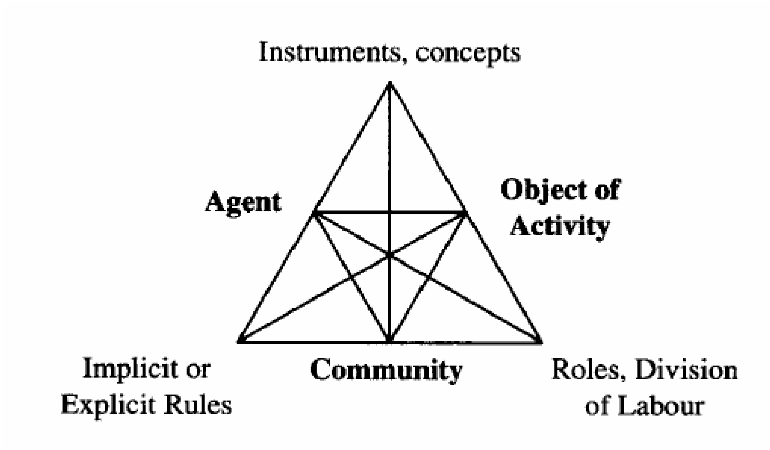
Communities of practice have also been viewed with a less formal flavor- as mostly informal knowledge sharing groups existing in all organizations. Wenger (1999) notes in regard to communities of practice "…they have been around for a long time, and they are everywhere. Organizations are already full of them." (p. 49). This notion of communities of practice is the recognition of the fact that in all organizations there exist groups of individuals who share and access each others knowledge in relation to their task (McDermott, 1999). Organizations may not recognize the existence of such groups but they inevitably exist in them (Brown & Duguid, 1991). Noting how organizations can be blind towards these kinds of communities that exist within the organization, Stamps (2000) talks about what a partner in a California consulting firm observed: "A manager will say something like 'I see you are spending a lot of time with the guys in the sales department. I hope that's not taking time away from your work.'…what the manager does not realize is that the guys in the sales department are helping him do his work." (p. 60). The difference between this view of communities of practice and the former view is merely the difference in the recognition or not of the existence of such communities by the organizations.

Since we are interested in how individual's knowledge management practices are affected by the various characteristics of the communities of practice in which the individual interacts, we will adopt the latter concept of the communities of practice. Taking this perspective helps us to relate the communities of practice to the individual irrespective of its recognition by the organization. It is possible that a later study could explore the role of organizational support for the success of communities of practice within the organization.

Based on our research objective and the broad perspective taken by many researchers (Brown & Duguid, 1991; Lave & Wenger, 1991; Wenger, 1999; McDermott, 1999; Stamps 2000), we define communities of practice from the point of individuals, as any group(s), formal or informal, from which individuals seek, share, and build their task related knowledge.

Based on practice-based theory of learning (Lave & Wenger, 1990), researchers have indicated the importance of communities of practices in the learning process and how learning takes place through social construction in these communities (Brown, et al., 1989; Brown & Duguid, 1991; Pea, 1990). Literature based on activity theory (Engestrom, 1987, 1993, 1999, 2001; Blackler, 1995) also purports a similar concept of learning (Figure 2.4.2.1). Both view learning as a ubiquitous process which occurs through normal working practices and in the context of communities. Their focus is on the social knowledge that is part of the communal interaction and social practice. When studying the factors of individual learning with this perspective, there is a risk of seeing only the social since the individual is subsumed within it (Hodkinson & Hodkinson, 2003). For the level of abstraction of this study, an alternative is possible where the individual is seen as separate from the social, but as interacting with it (Billett, 2001; Hodkinson & Hodkinson, 2003). This conceptualization is also more suited when considering knowledge as content of individuals' mind that enables effective action, as is done in this study, than considering it as a social process. It will also enable us to consider how the characteristics of the communities of practice the individual is involved in affect their knowledge management practices.

Figure 2.4.2.1: Model of Socially Distributed Systems Based on Activity Theory (Blackler, 1995, p.1037)



Orr's (1987, 1990) detailed ethnographic study of service technicians at Xerox show how learning (acquisition and creation of knowledge) occurs through social construction. Many have argued that knowledge belongs to communities based on this perspective (for example, McDermott, 1999). This realization has been heralded as one of the major impetus for the renewed focus on communities of practice. Orr (1987, 1990) documents how the rep and the specialist socially construct a solution, to a particular problem that seemed elusive to documented solutions, through narration and collaboration. This solution may not have been possible with what the rep and the specialist had known separately without social interaction. Communities of practice help individuals to access this kind of shared knowledge to accomplish their task.

Communities of practices help individuals, teams and business units in creating value and building capacities (McDermott, 2002). In helping organizations to assess the impact of communities of practices, McDermott (2002) suggests that they look at the activities, outcomes, the value it creates and its impact on the business results with an integrated view (see Figure 1 on p 27, ibid). He suggests that community activities (which are the result of individual behaviors) should result in outcomes such as increased personal knowledge, stronger relationships between participants and increased access to information.

Based on Nahapiet and Goshal's (1998) framework, Lesser and Storck (2001) identify structural, relational, and cognitive dimensions as the three key dimensions on which communities of practice influence the development of its social capital. Structural dimension relates to the ease of connections the community enables. Relational dimension comprises of four components (Obligation, norms, trust, and identification). The cognitive dimension refers to the extent of shared context within the community (Figure 2.4.2).

2.4.3 Psychological Empowerment

Based on the conceptualization of knowledge in this research, and the role of individuals in creating and managing their task related knowledge, their characteristics can be expected to be a significant factor in their behavioral manifestation. Argote, McEvily and Reagans (2003) in reviewing emerging themes and suggesting an integrative framework for managing knowledge in organizations indicated that characteristics of units could be a key driver of effective knowledge management. Moreover, the perceptual filters people use to interpret the actions and events influences their acquisition and use of knowledge (Daft & Weick, 1984; Fiol, 1994) (as cited in Sabherwal & Becerra-Fernandez, 2003).

Knowledge workers need to be empowered to foster knowledge creation and innovation (Doll, Deng, & Metts, 2005). Empowered workers take an active role in seeking knowledge and other activities whereby they enhance what they know to successfully conduct their task. As organizational tasks become more emergent and knowledge oriented (Marakus et al., 2002), whether individuals are empowered to take appropriate action becomes critical. The value of these actions and decisions they take will greatly depend on their knowledge at the time. In such situations, how effectively they manage their knowledge will be a crucial aspect of their availability of actionable knowledge.

Similar views can be found in the quality literature, where efforts such as TQM are centered on training and empowering workers with the knowledge of statistical process control technique and scientific approaches so that they can make better decisions and take actions based on it. The implicit assumption underlying this is that all human beings are intelligent and capable of learning (Grant, 2000). In other words what they know and how much they know regarding their task are significant elements of their capability for action and decision. This in turn depends on what actions they take to gain relevant knowledge and how they manage what they know.

Apart from motivation and philosophies of individualism and self-determination, empowerment can also be justified from a knowledge-based approach (Grant, 2000). Grant argues that decision making quality is enhanced if "decision making authority is delegated to those with relevant knowledge" (p. 41), especially when knowledge is tacit

Table 2.4.2: Characteristics of Community of Practice

Variables	Definition	Literature Base
Network ties	It is the strength of relationships between the individual and the other members of the community, where strong ties are close and frequent, and weak ties are distant and infrequent.	Pickering & King, 1995; Granovetter, 1973; Nahapiet & Ghoshal, 1998; Krackhardt, 1992; Ahuja, 2000, SMJ; Kraatz, 1998; Walker et al., 1997; Grabher, 1993
Network Configuration	Network configuration is the property of network structure associated with the flexibility and ease of information exchange in the community, and is captured based on the density, connectivity and hierarchy of the networks.	Nahapiet & Ghoshal, 1998; Ibarra, 1992; Krackhardt, 1989; Jacobs, 1965; Granovetter, 1973; Scott, 1991; Lyles & Schwenk, 1992; Hansen, 1999; Orton & Weick, 1990; Szulanski, 1996; McFadyen & Cannella, 2004
Appropriable Organization	It is the extent to which the relationships formed in one social setting are transferred to another setting.	Nahapiet & Ghoshal, 1998; Fukuyama, 1995; Coleman, 1990; Burt, 1992
Shared Norms	It is the extent to which a socially defined right to control an action is held not by the actor but by community, and involve such shared norms as norms of cooperation, openness, teamwork, willingness to value and respond to diversity, and tolerance to failure	Nahapiet & Ghoshal, 1998; Coleman, 1988, 1990; Kramer & Goldman, 1995; Starbuck, 1992; Leonard-Barton, 1995
Mutual Trust	It is the level of belief among the community members that other's indented action will be appropriate for them.	Nahapiet & Ghoshal, 1998; Misztal, 1996; Fukuyama, 1995; Mishra, 1996; Nahapiet, 1996; Ring & Van de Ven, 1992; Kramer & Tyler, 1996; Nooteboom, 1996; Lewis & Weigert, 1985; Kramer et al., 1996; Zolin et al., 2004
Identification	It is the process whereby individuals see themselves as one with another person or the community.	Nahapiet & Ghoshal, 1998; Merton, 1968; Lewicki & Bunker, 1996; Kramer & Goldman, 1995
Obligation	It is the extent individuals maintain a commitment or duty to undertake an activity in the future. It acts as a credit slip for community member's contributions.	Nahapiet & Ghoshal, 1998; Coleman, 1990; Bourdieu, 1986; Fairtlough, 1994; Lawler & Yoon, 1996

Table 2.4.2: Characteristics of Community of Practice (Cont..)

Variables	Definition	Literature Base
Shared Language	The extent to which people in a community share a common language and employ group specific communication codes that facilitate discussion, exchange of information, ask questions, and for conducting business.	Nahapiet & Ghoshal, 1998; Kogut & Zander, 1992; Arrow, 1974; Cohen & Levinthal, 1990; Van Den Bosch et al., 1999, 2003; Zenger & Lawrence, 1989; Wittgenstein, 1958; Tsoukas, 2003; Rommetveit, 1974; Bechky, 2003
Shared Narratives	The extent of use of myths, stories, and metaphors to communicate, create and preserve rich sets of meanings in a community	Nahapiet & Ghoshal, 1998; Weick, 1995; Bruner, 1990; Bateson, 1972; Orr, 1990; Hayes & Walsham, 2003; Bartel & Garud, 2003; Boje, 1995; Lounsbury & Glynn, 2001; Brown & Duguid, 1991
Shared Knowledge Base	It is the extent of knowledge that is common to the members of a community	Nahapiet & Ghoshal, 1998; Hoopes & Postrel, 1999; Kogut, 2000; Larsson et al., 1998; Miles & Snow, 1995; Schulz, 2003
Complexity of Knowledge	The extent of complexity/richness of the knowledge that is shared within the community.	Van Wijk et al., 2003; Nonaka & Takeuchi, 1995; Zander & Kogut, 1995; Galunic & Rodan, 1998; Salk & Simonin, 2003; Chakravarthy et al., 2003

and not readily codifiable. He also recognizes that there is a tradeoff between the cost savings due to decentralized decision making and the rising agency costs.

Malone (1997) argues that globally connected decentralized decision makers will play an increasing role in the emerging knowledge-based economy. He identifies three fundamental decision-making structures through which organizational decision making is carried out. They are the independent and decentralized decision makers, centralized decision makers, and connected decentralized decision makers which he calls “cowboys”, “commanders” and “cyber-cowboys”. In each case irrespective of whether it is they who make the decisions or somebody else based on their aggregated information, what each entity knows and what knowledge is shared will be important. From this perspective it becomes important that the individuals feel empowered not only to make decisions but also to manage what they know by creating new knowledge and sharing what they know.

Empowerment has been defined from a relational (Bacharach & Lawler, 1980; Blau & Alba, 1982) and from a more psychological perspective (Conger & Kanungo, 1988; Thomas & Velthouse, 1990, Spreitzer, 1995). It is also argued that cognitive or psychological empowerment could be viewed from two perspectives: one, a general or a more global kind of empowerment and the other a task specific feeling of empowerment (Thomas & Velthouse, 1990). The task specific empowerment could be conceptualized at different levels of specificity. For example, Spreitzer (1995) contents that her research “develops a work-based measure of psychological empowerment to contrast with previous global measures” (p.1444). Here the level of abstraction of the empowerment construct is the individual’s work as a whole. Individuals’ feeling related to a more specific aspect of their work such as their feeling of empowerment towards using computers for their work can also be effectively conceptualized (Doll, Deng, & Metts, 2005). In this research, due to the broad range of tasks that are involved in managing one's knowledge and the integrated nature of knowing in practice, psychological empowerment at the level of work is more appropriate.

Based on Conger and Kanungo (1988) and Thomas and Velthouse (1990), psychological empowerment is viewed as comprising of four individual cognitions: meaning/intrinsic motivation, competence/self-efficacy, self-determination/autonomy, and perceived impact (Spreitzer, 1995; Spreitzer, Janaz & Quinn, 1999; Doll, Deng, & Metts, 2005). For this research we adopt this view of psychological empowerment as an important individual characteristic that effects how people engage in the various knowledge management practices.

Table 2.4.3: Psychological Empowerment

Variables	Definition	Literature Base
Autonomy	"It is the individual's sense of having choice in initiating and regulating actions".	Spreitzer, 1995, p.1443; Deci, Connell & Ryan, 1989; Deci & Ryan, 1987; Bowen & Lawler, 1992; Spector, 1989; Pelz & Andrews, 1966; Ferris, 1983
Self-efficacy	"It is an individual's belief in his or her capability to perform activities with skill".	Spreitzer, 1995, p.1443; Gist, 1987; Gist & Mitchell, 1992; Bandura, 1977, 1989; Conger & Kanungo, 1988; Bowen & Lawler, 1992
Meaning	"It is the value of work goal or purpose, judged in relation to an individual's own ideals or standards".	Spreitzer, 1995, p.1443; Thomas & Velthouse, 1990; Hackman & Oldham, 1980; Bowen & Lawler, 1992; Breif & Nord, 1990; Polanyi & Prosch, 1975
Perceived Impact	"It is the degree to which an individual can influence strategic, administrative, or operating outcomes of work"	Spreitzer, 1995, p.1443; Ashforth, 1989; Bowen & Lawler, 1992; Harackiewicz, 1979; Hackman & Oldham, 1976

2.4.4 Knowledge Management Practices

Knowledge agents, whether it is an individual, a group or an organizational unit, engage in various processes in dealing with knowledge and information they have. This research conceptualizes these processes as knowledge creation, sharing the knowledge with other entities, capturing such information in various artifacts and processes, accessing knowledge from other entities, and applying their knowledge for various organizational tasks. These processes are depicted in Figure 2.4.5.1. For example, individuals reflect on what they know to create new knowledge and apply their creativity for novel production, groups brainstorm to generate new ideas and their experience is used in new contexts and for new problems, and organizations improvise in novel situations to create new knowledge (Vorbeck & Finke, 2001; Madjar, Oldham & Pratt, 2002; Miner, Bassoff & Moorman, 2001). The new knowledge that is created is used to solve problems or is developed into tangible and intangible artifacts by these knowledge agents. This new knowledge can be then stored in databases or embedded in organizational routines and thus captured by the knowledge agents, or it can be shared between them.

When knowledge agents use their knowledge that is created or accessed from others or from what they have captured, new insights are generated (Vorbeck & Finke, 2001). If not, the experience contributes to reinforcing what is already known and thus still contributes to their knowledge. When the agents use their knowledge, it is often transformed into artifacts which embody their knowledge and thus attain a certain degree of permanence. In a social context, the use of an individual's knowledge becomes the basis for sharing knowledge that is difficult to be made explicit. For example, an apprentice learning a trade from an expert is a situation were the sharing of knowledge occurs as the expert uses his or her knowledge in performing a particular task.

Table 2.4.4: Knowledge Management Practices

Variables	Definition	Literature Base
Knowledge Creation	The extent to which individuals engage in activities that creates new knowledge.	von Krogh, 1998; Alavi & Tiwana, 2003; Alavi & Leidner, 2001; Grover & Davenport, 2001; Nonaka, 1994
Knowledge Capture	The extent to which individuals engage in activities that captures their knowledge.	Walsh, 1995; Alavi & Tiwana, 2003; Alavi & Leidner, 2001; Gray & Fu, 2004; Zollo & Winter, 2003; Serban & Luan, 2002; Grover & Davenport, 2001
Knowledge Sharing	The extent to which individuals engage in activities that share their knowledge with others.	Alavi & Leidner, 2001; Alavi & Tiwana, 2003; Zollo & Winter, 2003; Nevis et al, 1995; Grover & Davenport, 2001
Knowledge Access	The extent to which individuals engage in activities that enable them to access needed information.	Weick, 1995; Alavi & Tiwana, 2003; Alavi & Leidner, 2001; Laing, 1994; Serban & Luan, 2002; Nevis et al, 1995; Brown & Duguid, 1998
Knowledge Application	The extent to which individuals engage in activities by which they apply their knowledge to accomplish their work. It can be seen as realizing the value of one's knowledge.	Alavi & Leidner, 2001; Alavi & Tiwana, 2003; Serban & Luan, 2002; Nevis et al, 1995; Grover & Davenport, 2001

The knowledge agents explicitly engage in the process of capturing or storing knowledge when new knowledge is created and is perceived to be of value for the agent (Vorbeck & Finke, 2001). They store their knowledge when it is expected to be of some use immediately or in the future, in their own memory or in external artifacts (Gray & Fu, 2004). They organize or create mechanisms while storing what they know in ways that will make it easy for them to access this knowledge when it is required. Frequently, capturing one's knowledge also implies an intention to share it with a larger community apart from the agent's own future use.

Knowledge agents share the new knowledge created among others through explicit instruction or through demonstration of their knowledge (Vorbeck & Finke, 2001). Sometimes new knowledge is created solely to be shared among the knowledge agents, and in other instances the use of knowledge is for the lone purpose of sharing one's knowledge as in the case of practical demonstration. Knowledge is shared between the knowledge agents so that it progresses in a knowledge spiral into higher levels (Nonaka, 1994). Sharing of one's knowledge implies its accessibility for other knowledge agents for which it is intended.

Accessing what has already been captured and what other agents share are the primary means of gaining knowledge that is external to the agent. The ease with which knowledge is accessible from what was captured, and the ease with which it is available from other agents or community of agents, is crucial in building one's knowledge (Tiwana, 2000). The knowledge that is accessible is reflected upon to generate new knowledge, and it is also used in performing tasks if it suffices to act upon such tasks.

2.4.5 Information Technology Support

There is no denying that one of the primary reasons for the heightened interest in knowledge management is due to the advances in information and communication technologies. But why has these technologies created such interest in how we can manage knowledge? Grover and Davenport (2001) highlight how the computing technology evolved in business to the point where it generated interest in managing knowledge. It started by enabling processes at the level of transactions at the point of work. Soon these systems were collecting enormous amount of data which needed to be processed to make sense out of it, and hence, the advent of data processing systems. Such vast amount of information needed to be interpreted and applied by the management for effective action and even these reports and aggregated information was becoming too much and had to be managed by management information systems. Personal computers, easy to use interfaces, and internet technologies made it possible to easily organize and capture what one knew so that it can easily be accessed and shared with others as never before. Systems were also created so that it would stimulate one to think and create new knowledge. This progression also parallels Dutta et al.'s (1997) conceptualization of systems that automate, informate and stimulate.

Today it is not just the management work that is becoming more knowledge intensive but the production work is also becoming knowledge intensive (Cusimano, 1995; Kelloway & Barling, 2000). Further, information technology is an integral part of all types of work. As a result of this confluence, ironically the focus has once again shifted to the point of work; the only difference being that this focus is not just on the task that has to be automated or the technology that implements it, rather, it is an integrated focus on the task, technology and the individual who executes his/her task based on their knowledge (DeSanctis & Poole, 1994; Orlikowski, 2000). It is in this light that knowledge management has become a viable and necessary endeavor for organization's competitiveness. How IT supports the various processes of knowledge creation, storage/retrieval, transfer and application at an organizational level is dealt with quite extensively by Alavi and Leidner (2001). IT can also support these processes at an individual level. After all, it is through the use of IT by the organizational actors that organizations realize the benefit of these technologies.

IT in its various forms has enabled individuals and organizations to collect, capture and exchange knowledge as never before, thereby helping them to create new knowledge (Roberts, 2000; Lee & Choi, 2003; Leonard-Barton, 1995). It has also been identified as an important element in knowledge creation (Davenport & Prusak, 1998; Gottschalk, 2000; Gupta & Govindarajan, 2000; Lee & Choi, 2003). Though some view IT as a tool that primarily enables processes dealing with explicit knowledge, it is found to foster both tacit and explicit knowledge creation (Riggins & Rhee, 1999; Scott, 1998). Alavi and Leidner (2001) suggest that as information exposure increases through intranets and other computer networks, individuals may create greater knowledge. They suggest that this may also increase through other technologies such as computer simulation and smart software tutors.

Referring to design of management support systems (MSS) Dutta et al. (1997) identify that MSSs can be designed to automate decision procedures and mechanisms which are primarily products of individual knowledge. But as work becomes more knowledge oriented and emergent, IT systems are becoming more flexible to accommodate users changing requirements (Markus et al., 2002). In a sense the boundary between design and use is diminishing. This means knowledge workers can now embed their knowledge in to the system and process more readily as new knowledge is created (Alavi & Leidner, 2001). They can use their knowledge easily and faster for example by automating them as computer routines.

Table 2.4.5: Information Technology Support

Variables	Definition	Literature Base
Automate	It is the extent to which information technology helps individuals to automate their work processes and implement their knowledge.	Alavi & Leidner, 2001; Alavi & Tiwana, 2003; Dutta et al.,1997; George & Tyran, 1993; Lado &; Tiwana, 1999; Liao, 2003; Mack, Ravin & Byrd, 2001; Zhang, 1998; Zuboff, 1988
Informate	It is the extent to which information technology helps individuals to become more informed by enabling easy access to disparate information.	Alavi & Leidner, 2001; Alavi & Tiwana, 2003; Davis & Bostrom, 1993; Dutta et al.,1997; Liao, 2003; Zuboff, 1988
Stimulate	It is the extent to which information technology stimulates individual's thought and helps them gain new insights.	Alavi & Leidner, 2001, MISQ, 2001, ISR; Alavi & Tiwana, 2003; Dutta et al.,1997; Kozma, 1994; Liao, 2003; Mack, Ravin & Byrd, 2001
Communicate	It is the extent to which information technology helps individuals in sharing their knowledge.	Vance & Eynon, 1998; Vandenbosch & Ginzberg, 1996; Alavi & Tiwana, 2003; Alavi & Leidner, 2001; Liao, 2003
Accumulate	It is the extent to which information technology helps individuals to organize and store their knowledge.	Stein & Zwass, 1995; Walsh & Ungson, 1991; Weiser & Morrison, 1998; Alavi & Tiwana, 2003; Alavi & Leidner, 2001; Fayyad & Uthurusamy, 1996; Mack, Ravin & Byrd, 2001; Liao, 2003

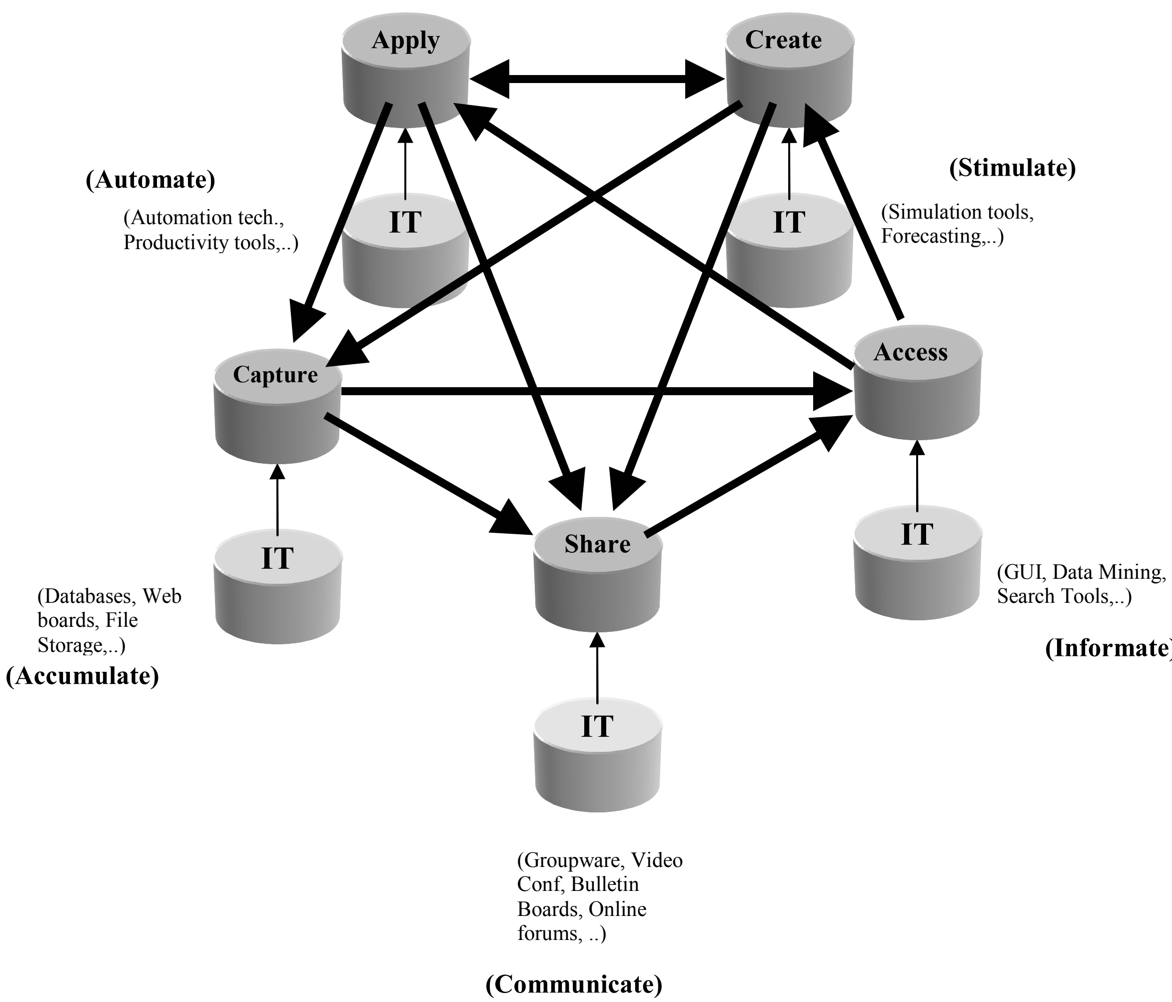
People not only use their knowledge to act on some problem/task, they also try to store their insights or new knowledge that they have created or acquired. They capture their newly acquired knowledge incidentally or with conscious effort. They store them in their memory or in external artifacts (Gray & Fu, 2004). Incidental storage occurs for example, when people implement their knowledge in a computer routine and it becomes part of the technology they use. They can also consciously choose to store their knowledge on company databases, internet bulletin boards or their own personal computers (Vorbeck & Finke, 2001). IT can also help individuals to capture vast amount of rich information which is easily accessible to the memory by just remembering pointers to such information, rather than remembering the information as such.

When individuals capture their knowledge in their memory or in external artifacts, they need to be able to easily access this knowledge either to act upon a particular problem or to create new knowledge based on what was already known. IT can help them access this knowledge in many ways. For example, a class of information systems that informate (Dutta et al., 1997; Zuboff, 1988) may be expected to do just this. Multiple indexing, ability to sort and search in multiple ways, and graphical user interfaces may be some of the ways it can help access stored information in the external world. Help features, alternative scenario suggestions and auto completion common in the current systems may be some simple ways IT can help individuals remember what is stored in their minds. The same principles of suggestion, stimulation and guidance may also be used for complex tasks and to invoke complex set of knowledge. IT can also be successfully used to easily access others knowledge by using tools such as remote operation, real time observation of an expert’s work or online collaboration. Information systems designed as a component of interacting *ba* (Nonaka & Konno, 1998) such as that support collaboration, coordination and communication process can enhance an individuals access to others (Alavi & Leidner, 2001).

One of the most widely upheld uses of information technology from a knowledge management perspective is its role in knowledge sharing (Alavi & Leidner, 2001). This is partly due to the importance social knowledge (or “virtual knowledge” as Cutcher-Gershenfeld, et al., (1998, p. 13) prefers to call) has from an organizations’ point of view. Social knowledge is the knowledge that is created as a result of interaction between organizational entities. Just as the ability of a group is greater than the sum of the capabilities of the individuals in that group, the knowledge of the social entity is also considered as greater than the sum of the knowledge of its individual members. However, this social knowledge is critically dependent on the ease of interaction between the individuals in such a group. It is this interaction through flexible and rich connection that IT is expected to provide even when the individuals are geographically or temporally separated.

At an individual level, apart from enabling easy access to others knowledge, these technologies also enable them to share what they know with others. Computer networks, electronic bulletin boards and computer-mediated communications like email are some such technologies that enable them to share what they know (Alavi & Leidner, 2001; Henderson & Sussman, 1997). Other obvious information technologies that enable sharing of one’s knowledge include, file transfers, interoperable technologies, online collaboration and video conferences. It is also possible to share both tacit and explicit knowledge as it is created or applied using IT. Just as an expert shares his tacit and explicit knowledge by demonstrating his skill to an apprentice while instructing him explicitly the steps and procedures that he feels is important, IT can also be used to share one's explicit and tacit knowledge in the context of knowledge work. Consider a CAD designer or an architect illustrating his knowledge of a particularly difficult aspect of the design to a novice who is half way across the globe in real-time using multiple windows on his CAD machine, all the while directing the novice to use the appropriate commands. These different IT systems and how they impact the specific knowledge management practices as conceptualized in this research is shown in Figure 2.4.5.1.

Figure 2.4.5.1: Role of Information Technology in Knowledge Management



2.4.6 Individual Performance Outcomes

Individuals' knowledge and effective management of their knowledge should lead to performance outcomes for organizations to realize value from these activities (Hult, 2003). Along with how effectively and efficiently people perform their task, organizations are increasingly valuing innovativeness and creativity in their employees. Their innovativeness and creativity are aspects that allow them to solve new problems and generate value and in turn help their team and organization to become innovative and effective in generating value for customers (Hurley & Hult, 1998; Sabherwal & Becerra-Fernandez, 2003; Grover & Davenport, 2001; Janz & Prasarnphanich, 2003). The more effective employees become at their work, the more satisfied they become, and employees who are satisfied perform better at their work.

Development of both tacit and explicit knowledge is also found to have clear positive effect on performance (Argyris & Schon, 1978). Similarly several researchers argue that the skills of the individual are the foundations of organizational capability (Stinchcombe, 1990; Nelson & Winter, 1982; Cohen, 1991). The implicit assumption in this kind of conclusion is that individual's skill and knowledge provide them with the performance outcomes that the organizations value, and helps their teams to achieve their goals.

2.4.6.1 Work Performance

The processes of internalization, externalization, combination and socialization are found to have a significant effect on knowledge management satisfaction (Becerra-

Fernandez & Sabherwal, 2001; Sabherwal & Becerra-Fernandez, 2003). Upon closer examination of their items we find that the KM satisfaction is measured by both satisfaction and perceived task performance and their KM processes capture the various aspects of knowledge creation, capture, sharing, access and application based on Nonaka and Konno (1998) and Nonaka's (1994) conceptualization of the four knowledge creation process in an organization. Extending the vast body of literature based on Nonaka's (1994) work and based on our conceptualization of the knowledge management process at the individual level we expect the various knowledge management process to impact the individual performance and their satisfaction. Similar to Becerra-Fernandez and Sabherwal (2001) and Sabherwal and Becerra-Fernandez's (2003) measure we expect to measure individual performance and satisfaction as perceived by the individual, but treat both as separate elements of knowledge management effectiveness because they clearly represent conceptually distinct aspects of individual outcome.

In an organizational context knowledge is expected to enhance quality and reduce the variability of task performance (March, 1991). In a new product development context, existing knowledge of the firm, conceptualized based on Moorman and Miner's (1997) definition of organizational memory, is found to effect information acquisition efficiency resulting in new product performance (Brockman & Morgan, 2003). Similarly, based on a survey of purchasing managers, Dorge, Claycomb and Germain (2003) also found significant relationship between knowledge application and financial performance of organizations.

Knowledge management practice as conceptualized in this research is viewed as having impact on individuals' work performance and satisfaction (Mikkelsen &

Gronhaug, 1999; Mikkelsen et al., 2000; Janz & Prasarnphanich, 2003). In a study of IS professionals engaged in development Janz and Prasarnphanich (2003) found that their cooperative learning behaviors in creating and sharing knowledge is positively related to work satisfaction and their team performance. They measured the team performance along three dimensions of efficiency, effectiveness and timeliness. This was based on the outcome measures primarily conducted in job characteristic studies and learning, and can be applicable for both individual and team levels (Hackman & Lawler, 1971; Hackman & Oldham, 1980; Edmondson, 1999; Slavin, 1991). For this research we adopt their measure of performance for individual performance.

2.4.6.2 Work Satisfaction

Apart from the actual performance of the individuals their satisfaction is also a critical factor that should be investigated in a study of learning and knowledge management (Janz & Prasarnphanich, 2003). One of the reasons is that unsatisfied workers tend to move out of their work and they take with them the valuable knowledge developed over time, which is highly situated and specific to their job. In such contexts, turnover is already seen as a major issue among knowledge workers (Alavi & Leidner, 2001).

Janz and Prasarnphanich (2003) measures individual job satisfaction based on Hackman and Oldham's (1980) job diagnostic survey and conceptualizes it with the two dimensions of general job satisfaction and growth satisfaction. We use the same measure of work satisfaction in our study due to the similarity of research objectives and the nature of inquiry.

2.4.6.3 Creativity

Teigland and Wasko (2003) found that knowledge sharing had a positive significant effect on individual creativity and general performance. They argue that creation of new knowledge is related to the creativity of the individual. They argue that creativity is important in situations where new problems arise constantly, there is rapid change in technology and where the task demands it- such as in knowledge work considered in this research.

Creativity is often defined as the production of ideas, products and procedures that are novel and useful to the organization (Amabile, 1996; Madjar, Oldham & Pratt, 2002). It may involve recombination of existing ideas, materials and processes or introducing new ideas, materials and processes (Madjar, Oldham & Pratt, 2002). Much work has been done in identifying individual and environmental factors that effect individual's creative performance (Amabile, 1988; Amabile et al., 1996; Oldham & Cummings, 1996; Madjar, Oldham & Pratt, 2002).

Creating new ideas is only one aspect of creativity, the real creative performance of an individual result from his or her creative use of this knowledge in the job and in solving problems. Creative performance also results from using this knowledge creatively to develop products and processes. In this research since we are interested in how the various knowledge management practices including knowledge creation effects individual's creative performance, we distinguish individual's creative performance as the creative application of their knowledge in their work to produce novel artifacts or procedures that is of value to the organization. We use the measures based on Oldham and Cummings (1996) for the individuals' creative performance.

2.4.6.4 Innovation

Innovation is one of the more important individual activities through which organizations create value (Day, 1990). Innovativeness of work is integrally connected to the physical context of use, application, or operation and hence is highly situated in nature (Dougherty, 2001; Tyre & von Hippel, 1997; Schon, 1983). This implies that people who are closest to the work needs to be innovative. At a firm level, Almeida, Phene, and Grant (2003) content that organizations that are adept at sourcing and integrating knowledge are likely to be successful innovators.

Table 2.4.6: Individual Outcomes

Variables	Definition	Literature Base
Work Performance	Individual work performance is measured based on the three dimensions of efficiency, effectiveness and timeliness.	Janz & Prasarnphanich, 2003; Hunter, 1986; Tett, Jackson & Rothstein, 1991; Pritchard & Karasick, 1973; Locke et al., 1984
Creative Performance	The extent to which individuals produce work that is novel and useful to organization.	Oldham & Cummings, 1996; Rogers, 1954; Amabile, 1998, 1996; Amabile et al., 1996; Madjar, Oldham & Pratt, 2002
Innovation	Innovation is a multistage process where ideas are generated which may be novel or adopted, support is built for it, and is finally implemented as an innovative artifact or outcome.	Scott & Bruce, 1994; Day, 1990; Mumford & Gustafson, 1988; Kanter, 1988; Van de Ven, 1986; Schroeder et al., 1989; Basu, 1991; Siegel & Kaemmerer, 1978; Van de Ven, 1986
Work Satisfaction	It is measured based on the two dimensions of general job satisfaction and growth satisfaction.	Johnson & Johnson, 2000; Janz & Prasarnphanich, 2003; Goldstein & Rockart, 1984; Mikkelsen, Ogaard & Lovrich, 2000; Pritchard & Karasick, 1973; Graen, Novak & Sommerkamp, 1982; Gerhart, 1987

Cohen and Levinthal (1990) extend the concept of absorptive capacity to the firm level primarily based on the individual level insights from the cognitive and behavioral sciences, and argue that firms' innovativeness depends on their absorptive capacity which includes their existing knowledge. Using the same analogy back to the individual level it could be argued that individuals' innovativeness will depend on their knowledge and their knowledge management practices.

Scott and Bruce (1994) find that creativity and innovation are often used interchangeable, but argues that they are distinct in that creativity is the production of novel ideas, and innovation is more of production and adoption of useful ideas and idea implementation based on Mumford and Gustafson (1988), Kanter (1988) and Van de Ven (1986). They suggest that it be viewed as a multistage process starting with problem identification and generation of ideas, building support for these ideas, and finally, implementing these ideas. All knowledge management activities as conceptualized in this research such as creation of new knowledge, accessing what others know about the problem domain, and sharing one's knowledge should contribute to the richness of one's ideas, relevant support from others and in the implementation of those ideas.

To be innovative means bringing to fruition all activities involved in the stage model indicated earlier, though not necessarily in a discrete and sequential manner (Schroeder et al., 1989; Scott & Bruce, 1994). The various knowledge management behaviors are centered on enhancing an individual's knowledge which by itself or the enhanced knowledge may contribute to how he or she engages in the whole repertoire of behaviors involved in being innovative. In this research we use the measure of innovation based on Scott and Bruce's (1994) stage model of innovative behavior.

2.4.7 Task Related Knowledge

Another individual level outcome that is considered in this study is the individuals' task knowledge. The focus of this research is in understanding the mechanism of knowledge management and the variables that impacts these processes and how it contributes to the various individual level outcomes. Knowledge management at this level is inherently the process by which individuals engage in the various activities by which they manage their knowledge. But knowledge itself has a broad meaning and is interpreted in many ways as we have seen earlier. For the purpose of this research we had adopted the definition of knowledge as what an individual knows equating it to what their mind holds or as individuals' mental content. In an organizational context, individuals mental content that is or can be closely related to their work is of greater importance. This research conceptualizes this knowledge as their task related knowledge or simply task knowledge. It is this knowledge that helps them solve problems and generate innovative artifacts in their work place.

Traditionally task knowledge is measured based on skill tests or tests that are specific to each kind of job. This approach, though might be most appropriate in certain kind of situations, it is limited in its application as a broad measure applicable across a wide rage of tasks. This may be similar to the tests students take at the end of a particular course to assess their learning during a given period of time. Such assessments are limited in usefulness from a research perspective designed to test substantive relationships between broad measures. Further, the assessment itself is limited to the knowledge contained in such tests and largely need to be defined a priori. Whereas in the daily organizational scenario where knowledge that has to be applied in a constantly emerging environment such as in the case of knowledge work it may not be realistically achieved.

Table 2.4.7 Task Related Knowledge

Variables	Definition	Literature Base
Operational-Know-how	It is related to the knowledge of the *method* of achieving task related outcomes. In other words how to perform what needs to be performed. Often referred to as procedural knowledge.	Garud, 1997; Edmondson et al., 2003; Yoshioka et al., 2001; Kogut et al., 1993; Nonaka & Takeuchi, 1995; Kogut & Zander, 1992, 1995; von Hippel, 1988; Kim, 1993; Pfeffer & Sutton, 1999
Operational-Know-what	It is related to one's knowledge about what tasks are to be performed to achieve required outcomes. In other words it is the *content* of one's knowledge for some action. Often referred to as declarative knowledge or know-that.	Garud, 1997; Edmondson et al., 2003; Yoshioka et al., 2001; Nonaka & Takeuchi, 1995; Kogut & Zander, 1992; Earl, 2001; Pfeffer & Sutton, 1999
Conceptual-Know-why	It is related to the knowledge of the *purpose* of one's actions	Garud, 1997; Yoshioka et al., 2001; Szulanski & Cappetta, 2003; Nonaka & Takeuchi, 1995; Kim, 1993; Pfeffer & Sutton, 1999
Contextual-Know-who	It is related to the knowledge of *people* effected by or related to one's action	Yoshioka et al., 2001; Kogut et al., 1993; Rulke & Galaskiewicz, 2000; ; Earl, 2001
Contextual-Know-where	It is related to the knowledge of *location* of events, things and people related to one's action	Yoshioka et al., 2001; Earl, 2001
Contextual-Know-when	It is the knowledge related to the *timing* of one's action	Yoshioka et al., 2001;

Due these reasons we conceptualize task knowledge as comprising mainly of operational, conceptual and contextual knowledge. Operational knowledge is the task knowledge comprising of know-what and know-how. Sometimes these are referred to as declarative and procedural knowledge. This knowledge is what is critical in the efficient and effective operation of the daily work. Conceptual knowledge is a know-why type of knowledge by which individuals are aware of the deeper purpose of their actions in the context of their work. Contextual knowledge helps the individual to put the operational and conceptual knowledge in perspective, and enhances and embellishes this knowledge. It includes such knowledge as know-where, know-when and know-who relating to the space, time, and people dimension knowing. A brief description and the relevant literature relating to each of these dimensions are shown in Table 2.4.7.1.

2.4.8 Team Performance Outcomes

"Knowledge in groups and in organizations depends on the individuals' knowledge (Cohen & Levinthal, 1990; Fiol, 1994)." (as cited in Sabherwal & Becerra-Fernandez, 2003, p.229). Sabherwal and Becerra-Fernandez (2003) have found that the effectiveness of knowledge management at the individual level facilitates the effectiveness at the group level in their study conducted at the NASA-Kennedy Space Center. They found that the effect of knowledge management is progressively carried from the individual level to the group and subsequently to the organization level. Similar arguments about how knowledge impacts organizations can been seen in Nonaka's (1994) knowledge creation spiral where knowledge is created at the individual level and its effect is transferred to the group and organizational level in a continuous spiral process.

In a group context, knowledge sharing involves both provision and receipt of task information, know-how, feed-back regarding products and processes, information about who knows what, and coordination of expertise by individuals (Hansen, 1999; Faraj & Sproull, 2000; Rulke & Galaskiewicz, 2000). In examining the various kinds of organizational diversity that influence the value of knowledge sharing, knowledge sharing both between the group and external to the group has been found to enhance the group's performance (Cummings, 2004).

The team level outcomes that are investigated in this research are: team performance, team innovativeness, team flexibility and team adaptability. Innovation as described in the earlier section is a multistage process which involves idea generation, building support for the ideas, and implementation of such ideas (Kanter, 1988; Scott & Bruce, 1994). Just as an individual engages in these activities, a team as whole can also be considered to engage in the different behaviors that constitute innovation. We extend Scott and Bruce's (1994) operationalization of individual level innovative behavior to the team level to capture team innovativeness. Team performance is measured based on the three dimensions of efficiency, effectiveness and timeliness, as operationalized by Janz and Prasarnphanich (2003).

Flexibility is the extent to which the team can be flexible to perform a given task. It is related to the degree to which the team members can perform each other's tasks (Barrick et al., 1998; Campion et al., 1993). When individuals in a team actively search for new knowledge related to their own or their team members tasks, share the knowledge they have gained between the team members, it could facilitate greater flexibility in how the team as a whole function.

Adaptability is the team's ability to easily change structure to align with the environment when faced with changing work requirements and responsibilities (Moon et al., 2004). The conceptualization of adaptability is similar to Barrick et al.'s (1998) team viability, where it is operationalized in terms of its ability to continue functioning successfully as a team over time. If the team is successful in changing its structure and efficiently function even when work requirements and environment changes, it is more likely to endure as a team in the organization (DeStephen & Hirokawa, 1988; Evans & Jarvis, 1986).

Table 2.4.7: Team Outcomes

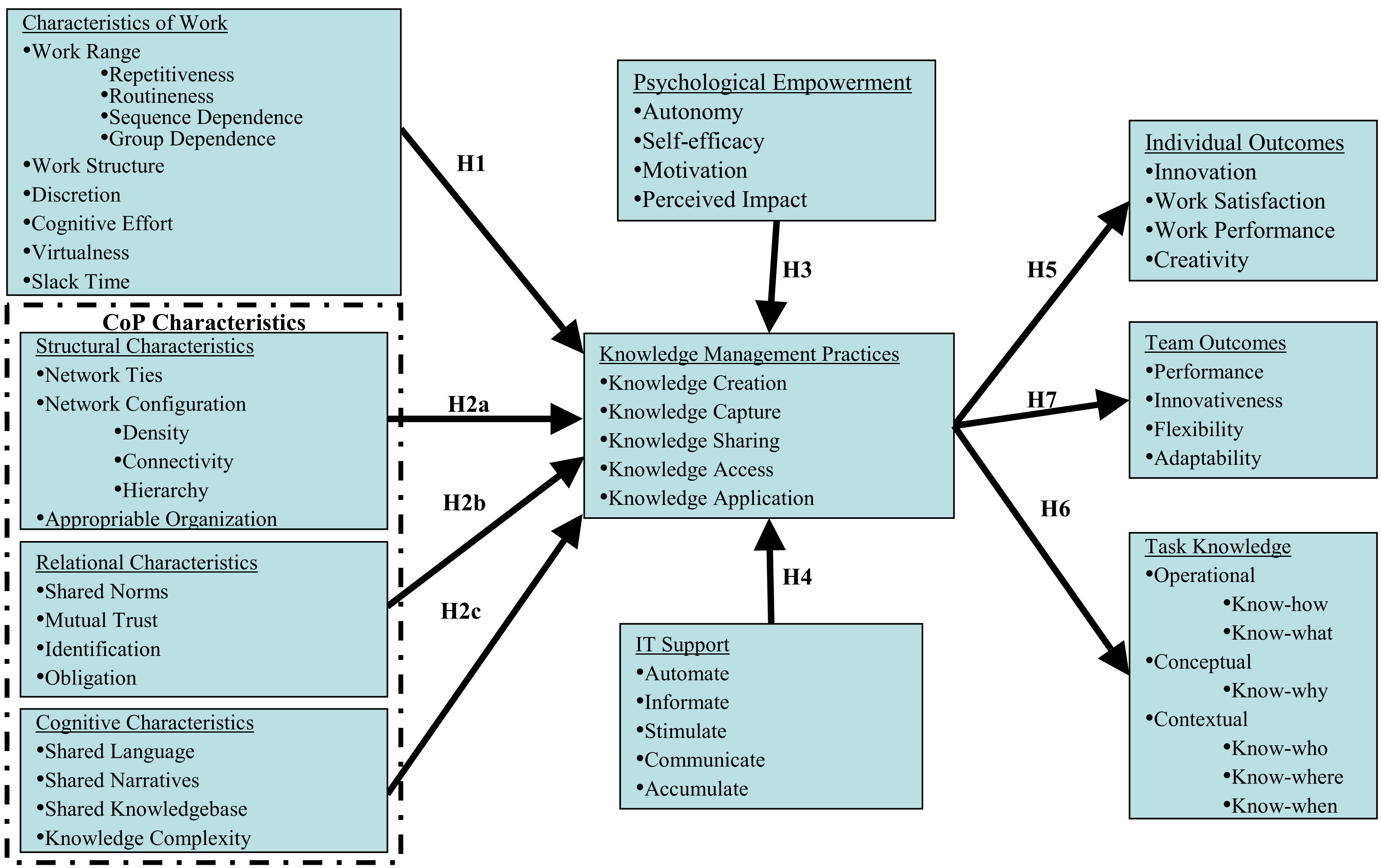
Variables	Definition	Literature Base
Team Innovation	It is the extent to which team generates ideas which may be novel or adopted, builds support for it, and implement it as an innovative artifact or outcome.	Scott & Bruce, 1994; Burns & Stalker, 1961; Leonard & Sensiper, 1998; Van de Ven, 1986; West & Farr, 1989; Dewar & Dutton, 1986
Team Flexibility	It is the extent to which the team can be flexible to perform a given task and is related to the degree to which the team members can perform each other's tasks.	Barrick et al., 1998; Campion et al., 1993; Okhuysen & Eisenhardt, 2002; Okhuysen, 2001; Liebeskind et al., 1996
Team Adaptability	It is the team's ability to easily change structure to align with the environment when faced with changing work requirements and responsibilities.	Moon et al., 2004; DeStephen & Hirokawa, 1988; Evans & Jarvis, 1986; Barrick et al., 1998; Meyer, 1982; Waller, 1999; Pulakos, et al., 2000; Hutchins, 1991
Team Performance	Team performance is measured based on the three dimensions of efficiency, effectiveness and timeliness.	Janz & Prasarnphanich, 2003; Barrick et al., 1998; Hackman, 1987; Edmondson, 1999; Slavin, 1991; Hackman & Oldham, 1980; Weingart, 1992; Weldon, Jehn & Pradhan, 1991; Driskell & Salas, 1992; Guzzo & Dickson, 1996

2.5 Hypotheses Development

To test the relationships depicted in the detailed research framework (Figure 2.5.1), the following sections develop formal hypotheses bearing upon the evidences and insights from existing literature, discussions in the previous sections, and logical arguments. Every research makes abstractions of reality at certain levels so as to effectively and usefully examine the phenomena under study. The broad research questions that guide this research as stated earlier was to understand the various factors that affect individuals' knowledge management practice, and how their knowledge management practice impacts the various outcomes. To achieve this, this research conceptualizes knowledge management practice as a single second order construct, which comprise of the different aspects of knowledge management. Special care is taken to capture the full range of behaviors involved in managing knowledge, while keeping the sub-constructs fairly distinct from each other.

The following hypotheses will be developed at an aggregated level of variables involved in the study rather than testing the micro structure of the relationships, which will enable us to determine to what extent the individual's work characteristics, structural, relational and cognitive characteristics of the community of practice, the information technology support available, and the individual's psychological empowerment impact their knowledge management practice, and how the knowledge management practice impacts their and their team's performance related outcomes.

Figure 2.5.1: Detailed Research Model



2.5.1 Work Characteristics and Knowledge Management Practices

Based on the theory that drives the overall research model, the various characteristics of an individual's work is expected to have an impact on what actions, in terms of the various knowledge management practices, they would engage in. Most of the job characteristics literature had been developed either for job classification purposes (Harvey, 1986; Cornelius, Schmidt & Carron, 1984; Schmidt, Hunter & Pearlman, 1981), for job enrichment (Hackman & Oldham, 1975; Oldham & Hackman, 1981; Hulin, 1971), or to understand how the different characteristics of the job contributes to the general job outcomes such as satisfaction, performance and attendance (Pierce & Dunham, 1976; Mowday, 1978; Griffin, Welsh & Moorhead, 1981). Many self actualization or need related variables were suggested to mediate this relationship. The logic behind such a proposition is that certain task characteristics could be seen as having high "motivating potential" (Hackman & Oldham, 1976; Hackman, 1977). But the results of such models have been so far ambiguous and inconclusive (Griffin, Welsh & Moorhead, 1981).

The ambiguity in findings may have been due to the broad basis on which such research was based. For example, rather than examining the job characteristics in an all encompassing general context, it may be appropriate to look at how the different characteristics affect the various outcomes in a more specific context. Similar arguments can be seen in the empowerment and self-efficacy literature, where researchers have argued in favor of a work-based measure as opposed to a global measure (Sprietzer, 1995; Pierce et al., 1989).

The proposition of most of the job characteristic measures such as the job diagnostic survey (JDS) (Hackman & Oldham, 1976) and job Characteristic Inventory (JCI) (Sims, Szilagyi & Keller, 1976) is that, once the particular characteristics of jobs which contribute to positive employee outcomes such as satisfaction and performance are identified, jobs can be redesigned to have high characteristics that enhance the outcome measures of interest.

There are several problems with such a view. First, all jobs may not be possible or may not lend itself easily to be redesigned to have the desired characteristics because of the inherent nature of the tasks. Next, several mediating variables, mainly centered on personal needs, between the specific job characteristic and the performance outcomes have been suggested. But, the result of the accumulated literature in this aspect has been inconclusive. Most of these need related variables have been very general in nature. While it is reasonable to assume that certain characteristics of the tasks may invoke certain needs within the individual, these may be specific to various contexts, and the subsequent outcomes may be the result of actions which the individual chooses to engage based on his or her needs.

Thus, in this research proposes that first we consider those characteristics which are most appropriate in a information technology supported knowledge work context such as the cognitive effort required, work range, work structure, level of discretion the work allows, availability of slack time, and level of embeddedness of task in information systems- i.e., virtualness. Subsequently, these characteristics are hypothesized to impact various performance outcomes through behavioral manifestations of specific needs- in this case the need to manage one’s knowledge- rather than the need itself impacting their performance outcomes. Hence we posit a positive relation between the job characteristics that enable or require reflection and their behavioral manifestation (knowledge management practices) of the need for managing their knowledge as a result of it. Formally stated:

H1: The more the individuals' work characteristics require or enable reflection, the more extensive will be their knowledge management practices.

2.5.2 Community of Practice Characteristics and Knowledge Management Practices

An organization inherently is a collection of individuals functioning together to achieve a larger goal. In such a sense, individuals are embedded within a social community and are dependent on it for successfully conducting tasks that are of value to the organization. The individual's actions, however, are ultimately the result of individual's knowledge related to the particular task. It is based on these assumptions that community of practice has come to gain a special significance in the organizational context. The characteristic aspect of a community of practice from that of other communities in which individuals are a part is that, it is this community from where individuals primarily acquire the knowledge related to their practice. Whether, the individual's organization has a formal community of practice or require the individual to interact in such a community, they invariably have a social source from which they gain their task related knowledge- however loose or formal their structure may be.

The structural characteristics of the community of practice is conceptualized in terms of the strength of its network ties, appropriableness of other relationships to this community, and its network configuration defined by the density of network connection, the connectivity within the community and the hierarchy of relationships within the community (Nahapiet & Ghoshal, 1998). These characteristics determine the individual's accessibility to the other members of the community. The more accessibility these characteristics provide the individuals to the community, the more they will engage in the knowledge management practice. Stronger network connections between the community members imply that the community may primarily be exchanging rich information (Ahuja, 2000; Kraatz, 1998; Walker et al., 1997; Van Wijk, et al., 2003). Individuals may need to manage their knowledge to a greater extent to interact in such communities due to the need to share and access such rich information. Based on Burt (1992), Nahapiet and Ghoshal (1998) indicate that network ties provide information benefit to individuals through access, timing, and referral. These benefits prompt individuals to access and share knowledge from the communities to a greater extent.

Van Wijk, et al. (2003) argues that individuals in a dense network also enjoy several information benefits since "many actors in such a network share the same direct and indirect ties, and are therefore structurally equivalent". Such structurally equivalent ties enable better accessibility to a wide range of members within the community. Greater accessibility mean individuals may also get greater requests for sharing what they know and thus may need to manage their knowledge to a greater extent. Similarly easier connectivity to other members in the community and less hierarchy within the community for accessing other's knowledge may provide better opportunity to access, share, capture, and hence create and apply knowledge more extensively. The level of relationships that is transferred from other social settings to a particular community can also impact the accessibility of individuals within a community (Nahapiet & Ghoshal, 1998). These prior relationships can provide valuable knowledge resources for the individuals within the community (Nohria, 1992). To maximize the value generated from such knowledge assets individuals may need to manage their knowledge more extensively. Thus it is hypothesized that:

H2a: The more the structural characteristics of the community of practice provide accessibility to its members, the more extensive will be the individual's knowledge management practices.

The level of shared norms, the mutual trust between the community members, the level of identification of the members with the community, and the mutual obligation that is felt within the community members can all be conceptualized as the different components of the relational dimension of a community (Nahapiet & Ghoshal, 1998). In a community of practice, shared norms of cooperation, openness and team work can become binding expectations which provide considerable access to other's knowledge (Kramer & Goldman, 1995; Nahapiet & Ghoshal, 1998). In the presence of such shared norms in the community, people readily share what they know and expect others to do so. In order to make the most use of such knowledge and for them to be able to share what they know effectively, individuals could be expected to manage their knowledge more extensively. Other positive norms that may promote greater knowledge management activities include openness to criticism, tolerance to failure, and wiliness to value diversity (Leonard-Barton, 1995).

Mutual trust within the members of the community of practice is essential for exchanging information effectively between them (Misztal, 1996; Nahapiet & Ghoshal, 1998). Several authors have indicated that individuals engage in social exchange and cooperative interaction when there is a trusting relationship (Nahapiet & Ghoshal, 1998; Van de Ven, 1994; Fukuyama, 1995; Tyler & Kramer, 1996). The greater mutual trust within the community of practice may facilitate individuals to share and access knowledge from others easily, this may also imply that they will create and capture more knowledge and hence ultimately will be able to use their knowledge more extensively. Similarly, greater the members within the community identify as a single group, they may share their knowledge within the community more extensively, and thus enabling individuals interacting in such communities to access knowledge more extensively. Similarly, if greater obligation is felt within the community in which the individual interacts to share their knowledge or to reciprocate when certain knowledge is accessed within the community, they may need to manage their knowledge more extensively to effectively fulfill such obligations. Hence, we propose the following hypotheses between the relational characteristics of the community of practice and individual's knowledge management practice. Thus:

H2b: The more the community of practice shares positive norms, and fosters mutual trust, identification and obligation, greater will be the individual's knowledge management practices.

Nahapiet and Ghoshal (1998) suggest that the shared language and vocabulary, and the shared narratives of a social entity form its cognitive dimension. Similarly, aspects such as a shared knowledgebase (Cohen & Levinthal, 1990) and the complexity of knowledge (Galunic & Rodan, 1998) shared within a community of practice can also be considered as aspects of its cognitive dimension. Language is the primary means of exchanging information in a social context. It not only influences our communication, but influences our perception also (Nahapiet & Ghoshal, 1998). Every community has its peculiar codes and vocabulary; the level of such shared language and the codes enable community members to communicate complex information efficiently and effectively. Greater the community in which the individual interact shares common language, codes, and vocabulary, it enables them to share their knowledge with a larger number of community members, and at the same time enables them to access information from larger number of individuals. This implies that they will need manage what they know more extensively in order to cope with the increased knowledge requirements.

Shared narratives are often expressed through stories, myths, and metaphors, and provide a rich medium for "creating, exchanging, and preserving rich sets of meanings" (Nahapiet & Ghoshal, 1998, p.254) in community of practices. Greater use of narrative communication among the community of practice members in which individual interacts primarily for their task related knowledge may provide incentives to share and access knowledge from the community to a greater extent. Alternatively, the narrative mode of communication within the community may impose greater effort on the individuals to interpret these stories to extract useful information, and thus may also require individuals to manage their knowledge more extensively. Shared knowledgebase similar to shared languages, may help individuals to share and access knowledge to a greater extent by providing an overlap of knowledge between individuals (Nahapiet & Ghoshal, 1998). Greater the complexity of knowledge that is generally exchanged in the community may also imply that individuals need to manage the knowledge that is accessed from such communities so that it can be effectively used when needed. Thus:

H2c: The more the community of practice shares the same language and knowledgebase, uses narrative communication, and exchanges complex knowledge, greater will be the individual's knowledge management practices.

2.5.3 Psychological Empowerment and Knowledge Management Practices

This research conceptualizes empowerment as an individual psychological characteristic or their personal perceptions in relation to their work, i.e., their cognitive task assessments. In this respect, it is different from the more global feeling of empowerment, and is directed at their perceptions of meaning, competence, self-determination and impact in the individual's work setting. Though these cognitions may be shaped by the interaction of the task, technology, and the individual, our focus is on the individuals' feeling of empowerment during the task.

Task centered empowerment is found to be an important aspect of many individual actions such as their innovative behaviors and other performance outcomes (Spreitzer, 1995). Spreitzer (1995) found that access to information related to the various aspects of individual's work such as access to organization's mission and their work unit performance are positively related to their psychological empowerment. Alternately, only when individuals feel empowered will they use such information and proactively implement and incorporate the insights gained from such information at their work. The more empowered they feel to share what they know, and access information from others, the more they may engage in these activities. In the certain knowledge work contexts, Doll, Deng & Metts (2005) content that knowledge creation and innovation ceases without empowered human agents.

Intrinsically motivated individuals engage in more knowledge creation, they are usually more willing to share their knowledge, they proactively seek new knowledge that they can use in the organizational context, and they may also try to capture more knowledge because of their increased knowledge needs. Since empowered individuals feel that they are more autonomous, and that their actions have a greater impact, they could be expected to engage in the various knowledge management activities to a greater extent. Similarly, individuals who feel competent at their work and thus have greater self-efficacy feelings may share their knowledge to a greater extent than individuals who does not feel competent. Such individuals may also generate more knowledge, try to access and capture more of what they know, and use their knowledge to a greater extent than individuals who feel less competent. Thus:

H3: The more psychologically empowered the individuals are, the more extensive will be their knowledge management practices.

2.5.4 Information Technology Support and Knowledge Management Practices

Information technology is generally perceived to moderate various substantive relations in individuals' behavioral outcomes (Middlemist & Hitt, 1981). Most theoretical frameworks that are used in understanding the role of information technologies in a workplace context have been developed during the early period of the commercialization of this technology. However, in the last few years dramatic changes have occurred in the technologies themselves and in how it is used; they have become increasingly flexible, versatile and ubiquitous. The earlier systems were solely developed with automation as a primary purpose especially in a manufacturing context. Now the systems have been widely integrated in all manufacturing related activities and have become increasingly versatile. Individuals are increasingly being interfaced with such versatile systems where their work processes are highly embedded in information technology for product development to production control in a manufacturing enterprise.

In this changed scenario, we identified five generic processes that the information technology can be used from the perspective of managing knowledge as an extension of what has already been proposed. These five functions of current information technologies are: technologies that help automate one's work processes, technologies that help informate one by providing easy access to external information, technologies that help stimulate one's thinking and thus create new knowledge, technologies that help communicate one's knowledge to other entities, and technologies that help capture/store/accumulate one's knowledge in an efficient manner (Figure 2.4.5.1). Greater the available technology supports each of these knowledge related functions, individuals could be expected to engage in the various knowledge management practices more extensively. Formally stated:

H4: Greater the information technology supports the various knowledge management processes (stimulate, accumulate, communicate, informate & automate), greater the individuals will engage in the various knowledge management practices (Create, Capture, Share, Access & Apply).

2.5.5 Knowledge Management Practices and Individual Performance Outcomes

Individual's actions create value for organizations only if it contributes to outcome variables that the organizations are interested in. In the current knowledge based economy, apart from the individual's work related performance, how creative and innovative they are in their work context is increasingly being valued and is becoming the expected norm. In a tumultuous work environment, having satisfied employees is critical if organizations are to gain competitiveness by building upon the knowledge of its employees. Not only is it an essential factor in conducting organizations' tactical operations smoothly but, is also important from a strategic perspective if organizations are to capitalize on the knowledge of their work force. When individuals manage their knowledge by creating, sharing, storing, accessing, and applying their knowledge in their work context, they could be expected to be more creative and innovative, perform better and be more satisfied in what they do. Thus:

H5: Greater the individuals' knowledge management practices, greater will be their performance outcomes (work performance, creativity, innovation & satisfaction).

2.5.6 Knowledge Management Practices and Task Related Knowledge

The major thrust of this research is in understanding the nature of knowledge management at an individual level and the various factors that impact those behaviors and its outcomes of interest to organizations. Several factors as indicated in earlier sections are hypothesized to affect knowledge management practices. Apart from contributing to better performance outcomes of the individual, actively managing one's knowledge by creating, capturing, sharing, accessing and applying knowledge should enhance their knowledge in the area in which they engage in these activities. In the context of work, such actions should lead to more and better knowledge related to their task.

Creating new knowledge in the context of work implies that such actions contribute to increasing knowledge in that field. New knowledge created may be knowledge that helps the individual in performing their job more effectively such as their operational knowledge, or it could be a deeper understanding of the purpose of their actions and their organizations processes (conceptual knowledge), or other contextual knowledge related to the temporal, spatial or people aspects that embellishes their work related knowledge. Individuals do not just create knowledge in vacuum; they create knowledge in a synergistic emergent process interacting with the people and tools in their environment. As we have seen in previous sections, they engage in the full spectrum of activities which contributes and supplements acquisition, learning and knowledge building through various processes of knowledge capture, sharing, accessing, and application, together with true knowledge creation, to varying degrees. Hence:

H6: Greater the individuals' knowledge management practices, greater will be their task knowledge (operational, conceptual and contextual knowledge).

2.5.7 Knowledge Management Practices and Team Performance Outcomes

Organizations are increasingly utilizing teams to achieve tasks that are not easily replicable by its competitors, and it is becoming the norm of how work gets performed in an organization (Goodman, Ravlin & Schminke, 1987; Sundstrom, De Meuse, & Futrell, 1990; Barrick et al., 1998). This is especially true in knowledge work, where the unique capabilities of the organization results from synergistically combining the knowledge of its individual members to achieve a higher function. Similar to the overall research model of this study, teams are also predominantly viewed from an input-process-output perspective, where different inputs combine to influence the intra-group process leading to team outcomes (Gladstein, 1984; Hackman, 1987; Barrick et al., 1998). Several input factors are important in shaping the team outcomes, but the team members are the essential component of all teams. Some theoretical (Klimoski & Jones, 1995; Stevens & Campion, 1994) and empirical (Barrick et al., 1998; Tziner & Eden, 1985) evidence exists that indicate that the knowledge, skills and abilities of the team members have impact on the team outcomes.

In this study we focus on four important outcome variables of the team: team performance, team innovativeness, team flexibility and team adaptability. The effect of individual members of the team on team outcomes can be conceptualized as having additive effect, compensatory effect, conjunctive effect and disjunctive effect depending on the trait and the type of outcome that is of interest (Steiner, 1972). For a given outcome, a particular conceptualization of the effect may be more appropriate. For example, if the outcome variables or the trait is most meaningfully characterized by an additive effect, the mean of the team members score on a variable of interest may be appropriate. The variance of the score within the team, the minimum score, and the maximum score are appropriate for the compensatory effect, conjunctive effect and disjunctive effect respectively.

Since this study intends to collect data at an individual level, it is important that the outcomes selected at a team level have some grounding to be related to its predictors. In a recent study Barrick et al., (1998) found that mean of the general mental ability (GMA) of the team members was most significantly correlated with team performance and viability, and both the maximum and the mean was significantly correlated with flexibility, rather than the variance or the minimum. The team performance, flexibility and viability in their study are similar in conceptualization to the team performance, flexibility and adaptability of this study respectively. The knowledge management practice in our study is comparable with the GMA of their study in that, they both contribute to the knowledgeablity of the individuals. The team innovativeness in our study is also similar to the flexibility and adaptability in its construction as a team variable.

What the preceding discussion entails is whether it is possible to meaningfully get the required data from the individuals, and could it be related to the team level outcomes? It is clear that since the variables selected as team outcomes have an additive and probably conjunctive and disjunctive nature to it both the size of the team and the relative impact of the individual in the team could have a moderating effect in the relationship between the individuals' knowledge management practices and their team's outcomes, and hence, it is important to collect this data as well to meaningfully interpret the relationship. Notwithstanding the above precautions, there is a possibility of a common-method bias when measuring the individual factors and the team outcome related variables from the same individuals. In spite of this shortcoming, which is mainly due to the current scope of this study and due to the focus of other individual level variables, it is worthwhile to collect the team level outcome criteria as a preliminary indication of the far reaching effect of knowledge management practices. Similar hypotheses that relate the individual knowledge management effectiveness to group-level knowledge management effectiveness measured using perceptual responses from individuals have also been reported in the literature (Sabherwal & Becerra-Fernandez, 2003; Nonaka, 1994). Thus:

H7: Greater the individuals' knowledge management practices, greater will be their team's performance outcomes (team's performance, innovativeness, flexibility & adaptability) controlling for the effect of team size and relative impact of the individual on the team.

CHAPTER 3: RESEARCH METHODS

3.1 Ethical Concerns

The primary purpose of this research is to test the research model and the associated hypotheses that were proposed earlier to understand the different factors that affect the individuals' knowledge management behavior and the outcomes of such behaviors in a computer intensive manufacturing environment. As in any research, several ethical considerations have to be borne in this research also. Sproull (1995) identifies at least four such ethical considerations: "(1) protection of human and non-human subjects, (2) appropriate methodology, (3) inferences, conclusions and recommendations based on the actual findings and (4) complete and accurate research reports" (p. 9). As this research involves understanding human behavior in work place and interaction with individuals to gain relevant information that will be used to test the proposed hypotheses, human subjects will be protected following the guidelines proposed by U.S. Department of Health and Human Services (1991) and American Psychological Association (2002). To ensure sufficient scientific rigor the research will be performed in a systematic and objective manner. The exact procedure of the research process will be explicated in the following sections. Further, due diligence will be given to ensure the integrity of data by taking required steps such as, care while coding data into software, checking for discrepancies, maintaining security, and maintaining regular back ups. To ensure fairness in reporting, the results will be presented in a complete and unbiased manner.

3.2 Research Design

This research employs a non-experimental survey based cross-sectional research design to test the proposed research model (Campbell & Stanley, 1963; Pedhazur & Schmelkin, 1991). Since the focus of this research is individuals' knowledge management practices and its antecedence and consequences, the unit of analysis is identified as the individual. In correspondence with the objective of this research in studying knowledge management practice of individuals in computer intensive manufacturing environment and the increasing presence of such knowledge workers, the target population is defined as individuals in various manufacturing and related organizations whose work is cognitively demanding and whose work processes are embedded or enabled by information systems. To enhance generalizability of the research findings, a sample from a wide variety of industries will be selected from such a target population.

3.3 Validity of Research Design

From a research design perspective several validity issues need to be considered. These can broadly be classified into construct validity, statistical conclusion validity, internal validity, and external validity (Cook & Campbell, 1979; Pedhazur & Schmelkin, 1991). Among these, construct validity is also primarily an issue in measurement design, along with other validity issues such as translation and criterion related validity. Often considerations in enhancing these validity types are in conflict with each other, and many researchers have cautioned against overstating the distinctions between these validity types (Pedhazur & Schmelkin, 1991). As a general guideline these issues are dealt based on the focus of the research. Importance of the different validity types is perceived to be different for research with theoretical interests as opposed to applied research. The focus of this research is more on the lines of testing related theories and relationships in how individuals manage their knowledge and its impacts, and for subsequent refinement and development of theories in this field than on being more of an applied research. For this type of research the importance of validity types are generally suggested to be in the order of internal validity being most important followed by construct, statistical conclusion, and external validity respectively (Cook & Campbell, 1979; Pedhazur & Schmelkin, 1991).

The issue of internal validity is mainly concerned with the plausibility of alternative explanations. Many consider this as the “sine qua non of meaningful research” (Pedhazur & Schmelkin, 1991, p.224). In research design context, construct validity is the correspondence between a manipulation and what is being manipulated (or the correspondence between the relationship that is intended to be studied and that which is actually studied). Statistical conclusion validity is related to “the validity of conclusions, or inferences, based on the statistical tests of significance” (Pedhazur & Schmelkin, 1991, p.224), and includes issues such as effect size, Type I and Type II errors, power of statistical tests, and acceptance of Null hypotheses (Cook & Campbell, 1979). External validity refers to the validity of generalizing the findings to a target population, or across different populations. These two aspects of external validity are also often referred to as population and ecological validity respectively (Bracht & Glass, 1968).

3.4 Measurement Issues

Apart from testing the proposed research model and related hypotheses, this research also involves developing valid and reliable measures of several constructs that comprise the research model. To develop psychometrically sound measures, commonly accepted methods for developing standardized instruments will be used (Churchill, 1979; Nunnally, 1978; Stevens, 1946, 1968; Coombs, 1966). These methods ensure dimensionality, validity and reliability of the measures used in the research. Following the identification of the research problem, literature review, model building, and hypotheses formulation, this research process is loosely divided into four stages: item-generation, pre-test, pilot study, and large scale study.

3.4.1 Dimensionality

Assessment of dimensionality is paramount in the evaluation of measurement instruments and for meaningfully assessing its validity and reliability (Hattie, 1985; Netemeyer et al., 2003; Pedhazur & Schmelkin, 1991). This is generally achieved by exploratory and/or confirmatory factor analysis. Once the dimensionality of measures is established, several types of validity issues exist in measurement evaluation. Though no one single classification scheme is universally followed, different aspects of validity can be discussed under three labels: translation validity, criterion related validity, and construct validity (Netemeyer et al., 2003). Here again many researchers have pointed out the danger of oversimplification and confusion in classifying validity into different discrete types (Pedhazur & Schmelkin, 1991).

3.4.2 Validity

The concept of translation validity is often manifested in discussions as content or face validity. Some argue that, this is not a type of validity at all because "validity refers to inferences made about scores, not to an assessment of the content of an instrument" (Pedhazur & Schmelkin, 1991, p.79; Messick, 1981). Most of the authors recognize that the content of the instrument is highly important in its measurement, but it does not constitute as an evidence of validity. In spite of such criticism on content validity, it is useful to view translation validity as the extent to which the measures reflect the content of the constructs when it is operationalized (Trochim, 2002).

Content validity involves the assessment of the relevance and representativeness of the degree to which elements of a measurement instrument reflect the construct and its content for a particular purpose (Haynes et al., 1995). It ensures that the measures will be consistent with the theoretical domain of the construct in all aspects such as item wording, capturing the different facets of the target construct, response format, and instructions (Netemeyer et al., 2003). Both potential users and experts in the field are used in item generation, and for further refining the measures for content validity. Face validity is usually a post hoc evaluation of the items to ensure that nothing went wrong in transforming the concept into a measure (Nunnally & Bernstein, 1994). It involves assessment by potential users, and enhances the use of the instruments in practical situations (Netemeyer et al., 2003).

Criterion related validity is also interchangeably used as predictive validity. A criterion is any variable "one wishes to explain and/or predict" with information from other variable(s) (Pedhazur & Schmelkin, 1991, p.32). Careful selection of the criterion, and its meaningful definition and measurement is foremost for criterion related validation. Criterion related validity assess the validity of measures in relation to other external measures (Nunnally & Bernstein, 1994). Predictive validity is assessed by sizable correlations of the measure with some subsequent criterion. If a different measure of the same variable is available, which has already been validated, concurrent validity can be assessed without expending resources to assess predictive and construct validity (Sproull, 1995). It is evaluated by assessing the degree of correlation between the new measure and another valid measure of the same variable collected simultaneously or "concurrently".

"Construct validation is concerned with validity of inferences about unobserved variables (the constructs) on the basis of observed variables" (Pedhazur & Schmelkin, 1991, p.52). Analysis of convergent and discriminant validity is widely used to assess the construct validity of the measures. Measures are expected to have good convergent validity if significant and strong correlations between different measures of the same construct are present. If the measure does not correlate too highly with measures from which it is supposed to differ, it is expected to possess discriminant validity (Campbell &

Fiske, 1959; Netemeyer et al., 2003). Netemeyer et al., (2003, p.154) provides following rules of thumb as evidence of discriminant validity:

- Confidence interval (±2 standard errors) around the disattenuated (corrected for measurement error) correlation does not contain a value of 1 (Anderson & Gerbing, 1988).
- Chi-square value of unconstrained model is significantly lower than the chi-square value of the constrained model (constrained to 1) (Anderson & Gerbing, 1988).
- AVE for the two factors is greater than the square of the correlations between the two factors (Fornell & Larcker, 1981).

3.4.3 Reliability

Reliability is “the degree to which test scores are free from errors of measurement” (APA, 1985, p.19). Coefficient alpha (Cronbach, 1951) is far the most widely used estimate of internal-consistency (composite or construct reliability) in the literature. As a general guideline, reliability estimates of 0.70 are suggested to be acceptable (Nunnally, 1978; Hair et al., 1998), and estimates of above 0.80 and 0.90 are considered good and excellent respectively (Bagozzi & Yi, 1998). But for the initial stages of research or for exploratory purposes reliabilities of 0.60 or 0.50 are also suggested to be acceptable (Nunnally, 1967). Average variance extracted (AVE) is another internal-consistency diagnostic that is commonly used. AVE “assesses the amount of variance captured by a set of items in a scale relative to measurement error”

(Netemeyer et al., 2003, p.153). A threshold level of AVE >0.45 is recommended for newly developed scales, and values >0.50 are advocated for other situations (Fornell & Larcker, 1981).

3.5 Item Generation

Clear definition of the construct and its content domain is the first and most important step in the scaling process (Churchill, 1979; Nunnally & Bernstein, 1994; Netemeyer et al., 2003). Based on an extensive literature review and relevant theories several constructs are identified and delineated that are related to the knowledge management practices. Specifying the domain and the nomological network of constructs surrounding it is important for developing good measures of the construct. A thorough review of the existing literature can provide a precise handle on the boundaries, dimensions, and content domain of the constructs, which will enhance the validity of the measures (Netemeyer et al., 2003). Based on the extant literature the constructs' dimensionality should be identified, and empirically tested. If the constructs are identified as multidimensional, within their respective dimensions the first order construct should be unidimensional as a prerequisite to assess the validity and reliability of the instrument. Except for random error and measure specificity the higher-order construct should suggest that its dimensions measure the same hierarchical concept (Bagozzi & Heatherton, 1994).

Once the constructs are clearly defined, its dimensionality is specified, and the nomological network surrounding the construct is identified- all based on the literature base and other insights from the context of its application and researcher's experience- a large pool of items are specified based on domain sampling (Nunnally & Bernstein, 1994). Items are also included based on the evaluation of expert judges and potential users from relevant population. It is also important to systematically sample the content areas of the construct in generating the item pool. These steps ensure that the items generated sufficiently represent the content domain of the construct and helps ensure the content validity of the measures (Haynes et al., 1995). Whether the items will be interpreted as intended for this study by the respondents should also be considered while generating the items, this attends to the issue of face validity. This is done by taking care to make items easy to use by the target respondents, keeping it clear and unambiguous, having proper instructions and appropriate response alternatives.

As to the actual number of items to be generated, a pool twice the size of the final scale is considered sufficient for a narrowly defined construct (DeVellis, 1991). Further, several issues such as clarity of wording, wording redundancy, use of positively and negatively worded items, and choice of response format are also considered in developing the items (Netemeyer et al., 2003). Several other issues such as unidimensionality of the questions (single barreled as opposed to double or triple barreled), using loaded or leading questions, and other metrics of question design are also considered in the development to the measures (see Mangione, 1995; de Vaus, 1986; Fowler, 1987; Alreck, 1995).

This research develops measures of knowledge management practices (five variables) and other related constructs in its nomological network. They are structural characteristics of community of practice (three variables), relation characteristics of community of practice (four variables), cognitive characteristics of community of practice (four variables), information technology support (five variables), work characteristics (five variables), task knowledge (three variables), and flexibility and adaptability dimensions of group outcomes. Measures of individual empowerment (four variables), individual outcomes (four variables), and performance and innovativeness dimensions of group outcomes are adapted from the literature. A five point Likert type scale ranging from 1= None or to a very little extent, 2= To a little extent, 3= To a moderate extent, 4= To a great extent, 5= To a very great extent, is intended for most measures. For community of practice characteristics, a five point Likert scale: 1= Strongly disagree, 2= disagree, 3= Neither disagree nor agree, 4= Agree, 5= Strongly agree, is used. For existing measures in the literature adapted for this study, original scales are retained. For flexibility and adaptability dimensions of group outcomes, a seven point Likert type scale ranging from 1= Not at all, to 7= To an exceptional degree, was used consistent with the scales of existing measures of other dimensions.

3.6 Pretest

Pretesting the measurement instrument is a critical component of minimizing measurement error in a survey research (Mangione, 1995). This process helps in resolving several issues related to measurement development. At least five experts and five target respondents are recommended to get feedback on several issues such representativeness of the items for the particular constructs, clarity of questions, questionnaire format, clarity of instructions, and specificity of items (Netemeyer et al., 2003). Both quantitative and qualitative feedback need to be used and corrective steps should be taken where there is high inter-rater agreement on problem areas.

To what extent the participants are knowledge workers in manufacturing related contexts will be assessed during the interview with the pretest respondents. An overall feedback on the appropriateness of the questions to be answered by these respondents will also be elicited. Where modifications or inappropriableness of the items are mentioned, further information that would help gain insight into the problem should be probed.

Once a preliminary round of feedback and modifications are completed, including feedback from experts, the questionnaire in its full form will be pretested among a small sample of the target respondents with an opportunity to gain open feedback and with specific problem areas identified earlier. Since the large scale study is intended to be administered in a web based format, the questionnaire will be converted into a web based format on a secure server at the researcher's institution. Informants will be requested to complete the survey in this format and any further suggestions or problems on the questionnaire and the web based format will also be elicited. Information gained at this stage can be used to further refine the questionnaire, and the web based questionnaire will be prepared for the pilot test.

3.7 Pilot Study

The pilot questionnaire after the suggested modifications is administered in the web based format to a sample of target respondents from various manufacturing firms identified and agreed to participate in the survey. The managers in the firms agreed to participate in the study are approached for a list of potential respondents who are identified as knowledge workers. Their contact information will be gained through this contact personal at each firm, and a unique identification code will be assigned to each target respondents to ensure that no individual will be sampled twice in the study.

A sample of these target respondents will be selected and solicited for participation in this study. Where applicable, a letter indicating the organizations willingness and support for this study will be attached while soliciting participation of target respondents. They will be guided to survey website with an assigned password to ensure that no multiple responses are received from same respondents, and to ensure confidentiality. Where available, arrangements will be made within the participating organization for their employees to access the survey web site with a unique password. Sufficient sample size would be selected to ensure at least fifty responses for the pilot stage.

3.8 Large Scale Data Collection

After instrument purification and refinement, based on the pilot responses the questionnaire will be modified for the large scale study. A larger random sample from the target population identified during the pilot stage will be used to ensure at least 200 responses based on the response rate information gained during this stage. Large scale data collection will also be performed on a web based format similar to the pilot. The data from pilot and large scale data collection will be treated separately for subsequent measurement and hypotheses testing.

CHAPTER 4: ITEM GENERATION AND PRETEST

This chapter details the measurement development for the constructs used in this study and the pretest results. Measures are developed based on generally accepted psychometric principles (Churchill, 1979; Coombs, 1966; Netemeyer et al., 2003; Nunnally, 1978; Pedhazur & Schmelkin, 1991; Stevens, 1968). A detailed introduction to the procedure and the general methodology was explicated in Section 3.5. An overview of the process of generating good measurement instruments involves specifying the domain of the constructs, generating items, refining the items based on the pretest, pilot testing, purification and fine tuning of the instrument based on the pilot data, large scale testing, and instrument assessment. The following sections describe measurement development up to pretest refinement for each instrument in this study.

Following construct definition and item generation based on extensive literature review, pretest was conducted with five experts and five target respondents asking them to rate the items with respect to the construct definitions in terms of the items' representativeness, specificity, and clarity. A 3-point scale was used for all the three indicators. For representativeness, 1= not representative, 2= somewhat representative, and 3= clearly representative were used. For specificity, 1= not at all specific, 2= somewhat specific, and 3= very specific were used. For clarity, 1= not at all clear, 2= somewhat clear, and 3= very clear were used. Scores from the pretest evaluation were summed for each item and the percent to which all respondents agreed that an item was representative, specific to the construct, and clear were computed[1]. Items that had a rating of below 90% were identified for potential elimination or modification.

Representativeness, specificity, and clarity of items were evaluated based on the above mentioned agreement rating with representativeness being the more serious violation, followed by specificity, and then clarity. Raters were also asked to provide any other comments such as, clarity and ambiguity of definitions, appropriateness of the responses and the scale, clarity of the instructions, etc. they were also encouraged to give any other feedback related to the items and the questionnaire they deemed appropriate. The questionnaire used for pretest containing all generated items, and the comments received are displayed in Appendix-A and B respectively.

4.1 Measures for Community of Practice Characteristics

A Community of Practice of an individual is any formal or informal group from which they gain or share their work related knowledge (Brown and Duguid, 1991; Lave and Wenger, 1991; McDermott, 1999). To characterize such a social setting which is often vague yet real and from which individuals gain and share their knowledge, Nahapiet and Goshal's (1998) frame work of social capital which is comprised of structural, relational, and cognitive dimensions was used. To study the different aspects

[1] For example, if all 10 raters responded for an item, that item can get a possible maximum score of 30 (3-point scale * 10 rates) on each indicator. Lets say for representativeness, out of the 10 raters, if two raters rated the item as not representative (=1), one rater rated it somewhat representative (=2), and rest of the seven raters rated it as clearly representative (=3), the item would get a total score of 25 (2*1+1*2+7*3=25). This would yield an 83% agreement.

of a community of practice others have also used this framework using a theoretical treatment (Lesser and Storck, 2001).

4.1.1 Measures of Structural Characteristics

Structural dimension of social capital involved understanding network ties that existed among the members in the community, the configuration of such networks in terms of the density, connectivity and hierarchy of the network, and what proportion of these network relations are transferred from already existing relationships, ie., the appropriableness of the organization of such a network (Nahapiet and Goshal, 1998). Relevant literature was reviewed to generate items for the above structural characteristics of the community of practice scales (See Table 2.4.2). Based on the definition and literature review, 41 items were generated for the five scales. At this point, network configuration was conceptualized in its three sub-dimensions of density, connectivity and hierarchy. A five point Likert scale where 1= Strongly disagree, 2= disagree, 3= Neither disagree nor agree, 4= Agree, 5= Strongly agree, is used through out this section.

After pretest, some items were dropped and some items were modified based on the comments and the insight gained in this stage. To keep the questionnaire to a reasonable length, whether network configuration could be measured at a higher level of abstraction had to be investigated. To achieve this without losing content, items were sampled from the domain areas represented in this construct. Number of scales were reduced to three by collapsing the sub-dimensions of network configuration. A total of 16 items remained at this stage for three scales in structural characteristics of community of practice (Table 4.1.1). The leading text "In my community of practice…" was separated from the item and added at the beginning of section to be connected to each item.

Table 4.1.1: Measurement Items for Structural Dimensions of Community of Practice Characteristics

Construct	Label	Items
Network Ties	CP9	members had strong interpersonal ties
	CP10	members were closely connected to each other
	CP11	members interacted very close to each other
	CP12	members interacted frequently with other members
	CP13	members maintained a great deal of distance with each other
Network Configuration	CP14	members interacted with many members
	CP15	the network of people was very dense
	CP16	members could easily stop interacting with others if needed
	CP17	it was easy to network with others
	CP18	members could access anybody easily
	CP19	we had many levels of hierarchy
Appropriable Organization	CP20	most members knew each other before they joined this community
	CP21	members were mostly friends
	CP22	most members were acquaintances of each other
	CP23	most members kept in touch outside the community
	CP24	most members I interacted with were known to me before I joined this community

4.1.2 Measures of Relational Characteristics

Relational dimension of social capital comprised of shared norms within the community, mutual trust of the community members, level of identification of the community members with the community, and the extent of obligation the community expected from its members (Nahapiet and Goshal, 1998). Relevant literature was reviewed to generate items for the above relational characteristics of the community of practice scales (See Table 2.4.2). Based on the definition and literature review, 36 items were generated for the five scales. Items for mutual trust was adapted form an existing instrument. A five point Likert scale where 1= Strongly disagree, 2= disagree, 3= Neither disagree nor agree, 4= Agree, 5= Strongly agree, is used through out this section. After pretest, some items were dropped and some items were modified based on the comments and the insight gained in this stage. A total of 20 items remained at this stage for four scales in relational characteristics of community of practice (Table 4.1.2). The leading text "In my community of practice…" was separated from the item and added at the beginning of section to be connected to each item.

Table 4.1.2: Measurement Items for Relational Dimensions of Community of Practice Characteristics

Construct	Label	Items
Shared Norms	CP25	members were expected to be open to criticism
	CP26	members were expected to have a team spirit
	CP27	members were expected to be cooperative
	CP28	members were expected to have an open mind
	CP29	members were expected to share what they knew
Mutual Trust	CP30	members trusted each other enough to share all relevant information
	CP31	members believed that all members were acting in good faith
	CP32	members were confident they could trust each other
	CP33	members relied on each other for the truthfulness of the information shared
	CP34	members trusted each other enough to share sensitive information
Identification	CP35	members had a strong sense of belonging to the community
	CP36	members identified with each other as one community
	CP37	members were proud to be part of the community
	CP38	members were concerned about other's well being
	CP39	members were concerned about community's well being
Obligation	CP40	members generally felt obliged to help each other
	CP41	members expected others to help them when they helped
	CP42	members expected others to share their knowledge when they themselves shared
	CP43	members were expected to return favors
	CP44	members expected others to help in return

4.1.3 Measures of Cognitive Characteristics

The extent of shared languages and codes that existed in the community, and the extent the community used shared narratives were considered to be the cognitive characteristics of the community of practice (Nahapiet and Goshal, 1998). Relevant literature was reviewed to generate items for the above cognitive characteristics of the community of practice scales (See Table 2.4.2). Based on the definition and literature review, 21 items were generated for the two scales. A five point Likert scale where 1= Strongly disagree, 2= disagree, 3= Neither disagree nor agree, 4= Agree, 5= Strongly agree, is used through out this section. After pretest, some items were dropped and some items were modified based on the comments and the insight gained in this stage. A total of 10 items remained at this stage for the two scales in this section of community of practice (Table 4.1.3). The leading text "In my community of practice…" was separated from the item and added at the beginning of section to be connected to each item.

Table 4.1.3: Measurement Items for Cognitive Dimensions of Community of Practice Characteristics

Construct	Label	Items
Shared Languages and Codes	CP45	members used a common language
	CP46	a common language was used to share ideas
	CP47	the terms used by members were known to most of us
	CP48	we had our own common words to communicate ideas
	CP49	members used technical terms common among us
Shared Narratives	CP50	members used stories to share their knowledge
	CP51	members used stories to communicate subtle ideas
	CP52	stories and narratives were used to communicate rich sets of ideas
	CP53	stories and metaphors were used to create and preserve rich meaning
	CP54	stories and narratives were used to share hard to communicate ideas

4.2 Measures of Work Characteristics

Helton (1987) identified work range-which is measured in terms of the repetitiveness, routines, sequence dependence and group dependence, work structure- the extent to which work objectives and task goals change, amount of discretion possible in work, and cognitive effort involved as the four essential aspects of knowledge work based on Hackman and Lawler's (1971) job diagnostic survey and other studies. These were thought to be important aspects of one's work which could impact an individual's behavior at work. Since the context of our study involved knowledge work supported by information technology, to what degree a knowledge worker's work is enabled or embedded in computers (virtual) was also considered to be an important aspect of this investigation. In knowledge work, the availability of time for reflection and analysis is important for proper exchange of ideas and knowledge creation (Garvin, 1993; Lawson, 2001). This is conceptualized as slack time and also need to be measured as part of the work characteristic. Relevant literature was reviewed to generate items for the above work characteristics scales (See Table 2.4.1). Based on the definition and literature review, 61 items were generated for the 9 scales in addition to one objective measure for slack time. A five point Likert type scale where 1= None or to a very little extent, 2= To a little extent, 3= To a moderate extent, 4= To a great extent, 5= To a very great extent, is used for this section.

After pretest, some items were dropped and some items were modified based on the comments and the insight gained in this stage. To maintain sufficient focus on the knowledge management practices and to prevent the questionnaire from becoming excessively long, this section was decided to be shortened with only the essential items.

Only cognitive effort and virtualness were considered to be the most essential constructs for this study. A total of 12 items remained at this stage for two scales-cognitive effort and virtualness. The single item objective measure of slack time was also retained since it could be fairly easily measured by asking the percent of working time the individuals had for reflection and exchange of ideas (Table 4.2).

Table 4.2: Measurement Items for Work Characteristics

Construct	Label	Items
Cognitive Effort	WC6	My work required considerable thought
	WC7	My work required significant amount of reasoning
	WC8	My work required significant amount of knowledge
	WC9	My work involved intense thinking
	WC10	My work involved complex analysis
	WC11	My work was mentally challenging
Virtualness	WC12	My work involved work processes that had to be enacted through computers
	WC13	My work involved tasks that depended on computers
	WC14	My work would have been difficult to perform without computers
	WC15	My work had processes embedded in computers
	WC16	My work was virtual rather than real
	WC17	My work was mostly mediated by computers
Slack Time	WC21	During the assignment/project/work about what percentage of your working time was available for reflection and exchange of ideas?

4.3 Measures of Empowerment

Empowerment of knowledge worker is considered to be an important aspect of their creativity and innovation (Doll, Deng, and Metts, 2005), which could be the result of how they engage in the various knowledge management practices. Empowerment is a widely studied concept and measures are available for this construct in the literature. It is manifested in four individual cognitions of meaning/intrinsic motivation, competence/self-efficacy, self-determination/autonomy, and perceived impact (Spreitzer, 1995; Doll, Deng, and Metts, 2005). To ensure that we are not re-inventing the wheel, we use a widely used measure of empowerment originally proposed by Spreitzer (1995) (See Table 2.4.3). Based on the definition and literature review the measures are slightly adapted for our study and a few items are added. A total of 17 items were generated for the 4 scales. A seven point Likert type scale where 1= Not at all, 2= To a very little extent, 3= To a little extent, 4= To a moderate extent, 5= To a great extent, 6= To a very great extent, 7= To an exceptionally great extent, as originally proposed is used for this section. After pretest, some items were dropped and some items were added or modified based on the comments and the insight gained in this stage. A total of 19 items remained at this stage for the 4 scales. (Table 4.3). The leading text “During the assignment/project work…” was separated from the item and added at the beginning of section to be connected to each item.

4.4 Measures of Information Technology (IT) Support

Dutta et al.’s (1997) originally conceptualized information systems as systems that automate, informate and stimulate. We extent their conceptualization to the referent knowledge work and argue that from the perspective of an individual knowledge worker, information systems can be viewed as that which helps individuals to communicate and accumulate knowledge in addition to their original three characterizations. We review the relevant literature to develop definitions and generate items (See Table 2.4.5). Based on the definition and literature review a total of 37 items were generated for the five scales.

Table 4.3: Measurement Items for Empowerment

Construct	Label	Items
Autonomy	IC1	I had autonomy in determining how I did my job
	IC2	I could decide on my own how to go about doing my work
	IC3	I had opportunity for independence in how I did my job
	IC4	I had freedom in how I did my job
	IC5	I had choice in how I did my job
Self-Efficacy	IC6	I was confident about my ability to do my job
	IC7	I was self-assured about my capabilities to perform my work activities
	IC8	I had mastered the skills necessary to do my job
	IC9	I had the required knowledge to do my job well
	IC10	I was confident about my knowledge for my tasks
Impact	IC11	I had impact on what happened in my department
	IC12	I had control over what happened in my department
	IC13	I had influence over what happened in my department
	IC14	I had impact over the strategic outcomes of my job
	IC15	I had impact over the administrative job outcomes
	IC16	I had impact over the operational job outcomes
Meaning	IC17	the work I did was important to me
	IC18	my job activities were personally meaningful to me
	IC19	the work I did was meaningful to me

A five point Likert type scale where 1= None or to a very little extent, 2= To a little extent, 3= To a moderate extent, 4= To a great extent, 5= To a very great extent, is used for this section. After pretest, some items were dropped and some were added or modified based on the comments and the insight gained in this stage. A total of 30 items remained at this stage for the 5 scales. (Table 4.4). Before answering the questions in this section respondents were asked to specify three most frequently used applications for their work in the order of importance. All questions then referred to these applications that the individual needs to answer the questions based on. The leading text "The above applications have helped me to…" was separated from the item and added at the beginning of section to be connected to each item.

Table 4.4: Measurement Items for IT Support

Construct	Label	Items
Stimulate	IT1	come up with new ideas
	IT2	think through problems
	IT3	gain new knowledge
	IT4	generate new information
	IT5	stimulate my thinking
	IT6	create new knowledge
Accumulate	IT7	store knowledge that I created
	IT8	capture the required information
	IT9	organize my knowledge
	IT10	capture my know-how
	IT11	retain the required information in my mind
	IT12	store my ideas
Communicate	IT13	share my insights
	IT14	share my know-how
	IT15	communicate what I know
	IT16	share my ideas
	IT17	communicate with other people
	IT18	transfer my knowledge
Informate	IT19	become more informed
	IT20	access needed information
	IT21	access other's knowledge
	IT22	access relevant company data
	IT23	to retrieve information form various sources
	IT24	remember the required information
Automate	IT25	automate my work processes
	IT26	automate my decision-making process
	IT27	implement my ideas
	IT28	apply my knowledge at work
	IT29	automate things I had to do
	IT30	automate my problem-solving tasks

4.5 Measures of Knowledge Management Practices

Knowledge management practices are the behaviors individuals engage in creating, sharing, accessing, storing and applying their knowledge. Table 2.4.4 provides the relevant literature and the associated definitions of the five constructs. Based on the definition and literature review a total of 37 items were generated for the five scales. A five point Likert type scale where 1= None or to a very little extent, 2= To a little extent, 3= To a moderate extent, 4= To a great extent, 5= To a very great extent, is used for this section. After pretest, some items were dropped and some were added or modified based on the comments and the insight gained in this stage. A total of 30 items remained at this stage for the 5 scales. (Table 4.5). The leading text “During the assignment/project work…” was separated from the item and added at the beginning of section to be connected to each item.

4.6 Measures of Task Related Knowledge

One of the outcomes of individuals engaging in increased knowledge management practices is to enhance their task related knowledge. Task related knowledge is conceptualized in this research as operational knowledge, conceptual knowledge and contextual knowledge. Operational knowledge involves know-what and know-how type of knowledge. Conceptual knowledge is the knowledge that comes from the understanding of why the individuals perform certain actions related to their job or why certain information is important. This is labeled as know-why. Contextual knowledge includes the contextual information such as who are involved of impacted by certain actions of the individual (know-who), the knowledge related to the location (know-where) and timing (know-when) of their job.

Table 2.4.8 provides the relevant literature and the associated definitions of the six constructs in this section. Based on the definition and literature review a total of 35

Table 4.5: Measurement Items for Knowledge Management Practices

Construct	Label	Items
Knowledge Creation	km1	I have created new knowledge by observing others working
	km2	I have created new knowledge by interacting with others
	km3	I have created new knowledge by expressing what I knew
	km4	I have created new knowledge by applying my knowledge
	km5	I have created new knowledge by combining information that I collected
	km6	I have often created new knowledge
Knowledge Capture	km7	I have stored new knowledge that I created
	km8	I have stored new information whenever I received it
	km9	I have stored new information whenever I used it
	km10	I have retained information in computers/files/or my memory
	km11	I have retained my new ideas in computers/files/or my memory
	km12	I have incorporated new knowledge into my work processes
Knowledge Sharing	km13	I have shared new insights that I have gained
	km14	I have shared my best practices
	km15	I have shared the information that I stored for my own purposes
	km16	I have shared the information at others request
	km17	I have shared the information that I used
	km18	I have shared the information that I have gained from elsewhere
Knowledge access	km19	I have accessed needed information with ease
	km20	I have accessed what my colleagues knew
	km21	I have accessed information from our company’s database, intranet, etc.
	km22	I have retrieved information that I have stored
	km23	I was able to recall the required information with ease
	km24	I could remember things easily
Knowledge Application	km25	I have used the new knowledge that I created
	km26	I have used the information I have taken from others
	km27	I have implemented my ideas in my job
	km28	I have applied my knowledge in my job
	km29	I have applied new information I received in my work
	km30	I have implemented the best practices that I developed

items were generated for the six scales. A five point Likert type scale where 1= None or to a very little extent, 2= To a little extent, 3= To a moderate extent, 4= To a great extent, 5= To a very great extent, is used for this section. After pretest, some items were dropped and some were added or modified based on the comments and the insight gained in this stage. A total of 30 items remained at this stage for the 6 scales. (Table 4.6). The leading text "Towards the end of the assignment/project/work to what extent did you fully know…" was separated from the item and added at the beginning of section to be connected to each item.

Table 4.6: Measurement Items for Task Knowledge

Construct	Label	Items
Know-How	TK1	how to perform the different aspects of your job
	TK2	how to implement your work routines
	TK3	the procedures for doing your job
	TK4	the relevant know-how
	TK5	how to use the relevant software
Know-What	TK6	what information was needed for each task
	TK7	what tasks needed to be accomplished
	TK8	what was expected of you
	TK9	what the functional requirements were
	TK10	what information was needed
Know-Why	TK11	why you were doing things the way you did them
	TK12	the reason(s) for doing what you did
	TK13	the philosophy behind your actions
	TK14	the purpose of your actions
	TK15	the rationale behind your actions
Know-Who	TK16	who your immediate customers were
	TK17	whom to go to for the necessary resources
	TK18	who could get things done
	TK19	who had the relevant expertise
	TK20	who had the required information
Know-Where	TK21	where to find the relevant information
	TK22	where the necessary things were available
	TK23	where to perform all your activities
	TK24	where to find people when you needed them
	TK25	where to find help when needed
Know-When	TK26	exactly when things needed to be done
	TK27	when to gather more information
	TK28	the timing of different tasks
	TK29	when to pursue a particular problem
	TK30	when you needed to do particular tasks

4.7 Measures of Performance Outcomes

Other outcomes related to the knowledge management practices that are investigated in this research are creative performance, innovation, performance- which includes efficiency, effectiveness and timeliness, and satisfaction- comprising of general and growth satisfaction (Janz and Prasarnphanich, 2003). Most of the measures in this section were adapted from the existing literature. The relevant literature base and their corresponding definitions are shown in Table 2.4.6. A total of 37 items- 9 for performance, 14 items for satisfaction, 9 for innovation, and 5 for creative performance were available at this stage. A seven point Likert type scale where 1= Not at all, 2= To a low degree, 3= To a slightly low degree, 4= To a moderate degree, 5= To a slightly high degree, 6= To a high degree, 7= To an exceptionally high degree, is used for innovation and creative performance. A seven point Likert scale where 1= Strongly disagree, 2= disagree, 3= Slightly disagree, 4= Neutral, 5= Slightly agree, 6= Agree, 5= Strongly agree is used for individual performance and satisfaction as per the original scale. After pretest, some items were dropped and some were added or modified based on the comments and the insight gained in this stage. A total of 29 items remained at this stage for the 4 scales (Table 4.7). The leading text "Towards the end of the assignment/project/work…" was separated from the item and added at the beginning of section to be connected to each item in individual performance and satisfaction section. The leading text "During the assignment/project/work…" was separated from the item and added at the beginning of section to be connected to each item in innovation and creative performance sections.

Table 4.7: Measurement Items for Individual Outcomes

Construct	Label	Items
Individual Performance	IO1	I was very efficient at my work
	IO2	I accomplished my tasks within the allocated resource
	IO3	I accomplished a great deal of work with the available resources
	IO4	I was very effective at interacting with others
	IO5	My work was of very high quality
	IO6	I easily met my goals
	IO7	I usually finished my tasks within the expected time limit
	IO8	I usually met my goals as quickly as possible
	IO9	I could have done my tasks faster with the same level of quality compared to the beginning of the project
Satisfaction	IO10	Generally speaking, I was satisfied with my job
	IO11	I was satisfied with my work outcomes
	IO12	I was generally satisfied with the kind of work I did
	IO13	I was satisfied with my personal growth
	IO14	I was satisfied with my growth opportunities
	IO15	I was satisfied with my accomplishments
Innovation	IO16	I searched out new technologies, processes, techniques, and/or product ideas
	IO17	I had generated creative ideas
	IO18	I had promoted my ideas to others
	IO19	I had investigated and secured funds needed to implement new ideas
	IO20	I had developed plans and schedules for the implementation of new ideas
	IO21	I was innovative
	IO22	I had developed innovative ideas, built support for it and implemented it
	IO23	I was the first to use certain ideas in my kind of work
	IO24	ideas that I implemented were the first use of such ideas in my department
	IO25	ideas that I implemented were the first use of such ideas in this type of work
Creative Performance	IO26	my work was original and practical
	IO27	my work was adaptive and practical
	IO28	my work was creative
	IO29	my ideas were novel and useful

4.8 Measures of Team Outcomes

Since knowledge of certain individuals often determine the success of the entire team, what impact the outcomes of an individual can have on the team performance was considered to be worthy of investigation in this context. Performance an outcome similar to those of that was used in individual outcome was considered appropriate. Since performance in terms of efficiency, effectiveness, and timeliness were initially used at the team level (Janz and Prasarnphanich, 2003), we used the same measures for the team level outcomes. The relevant literature base and their corresponding definitions are shown in Table 2.4.7. A total of 9 items for performance were available at this stage. A seven point Likert type scale which ranged from 1= Extremely low to 7= Extremely high were used team performance as per the original instrument. No changes were made at pretest and the same items were retained (Table 4.8). The leading text “For the assignment/project/work you mentioned at the beginning of this survey how would you rate the following aspects of your team…” was separated from the item and added at the beginning of section to be connected to each item. The complete pilot questionnaire is available in Appendix-C.

Table 4.8: Measurement Items for Team Performance

Label	Items
TO1	The efficiency of team operations
TO2	The team’s adherence to budgets
TO3	The amount of work the team produced
TO4	Effectiveness of the team’s interactions with people outside the team
TO5	The quality of work the team produced
TO6	The team’s ability to meet the goals of the project
TO7	The team’s adherence to schedules
TO8	The team could have done its work faster with the same level of quality
TO9	The team met the goals as quickly as possible

CHAPTER 5: PILOT RESULTS

5.1 Data Analysis Methods

Pilot study provides an opportunity to detect problems associated with the psychometric properties of the newly developed instruments and the existing instruments that are adapted for the current study. This stage of the research helps the researcher in identifying areas that may need further attention in terms of possible problems that may have occurred during the translation of theoretical concepts to their possible measures. Initial assessment of the instruments used for this research and their substantive relationships are the main focus in this stage. The instruments are first subjected to purification. Then, their unidimensionality is assessed, followed by evaluating convergent and discriminant validity. Finally, the reliability of the measures is evaluated. To assess the substantive relationship between the instruments, predictive validity is evaluated. Sections 5.1.1 to 5.1.5 briefly describe the general procedure used to conduct these analyses in the pilot stage.

5.1.1 Item Purification

Purification of measurement items related to a particular construct is performed as an initial step in the process of evaluating the psychometric properties of an instrument.

This step eliminates the so called “garbage” items that may confound the interpretation of subsequent analyses. The logic behind eliminating these items is that, if several items are used to measure a particular concept these items have a common core based on the domain sampling theory (Churchill, 1979). So the items that do not correlate with the overall construct may not be part of the concept that is being measured. This may cause factor analysis to produce more factors that may become difficult to interpret. Even so, it is important that the items be eliminated at this stage only if there is some evidence to show that it deviates from the core concept that is being measured, because of the items content, wording, or its structure. Otherwise important subtleties in the concept could be overlooked by eliminating the item.

Purification is performed based on the corrected item-total correlation (CITC) (Churchill, 1979). An item is eliminated if the CITC score is less than 0.50. Items that have a CITC score below 0.60, but greater than 0.50 is flagged to be investigated further for the item wording and content, and is eliminated if sufficient justification is found to deem it problematic. CITC score indicates an item’s correlation with the sum of the other items for that particular construct. If all the items for a scale represent a single construct, they should all be highly inter-correlated.

CITC is assessed in SPSS by pooling all items intended for a particular construct together to assess the reliability of the scale by selecting Analyze> Scale> Reliability Analysis. In the Statistics window, “Scale if item deleted” option is checked and the analysis is performed. Based on the CITC score an item is deleted if it has a CITC less than 0.50. If the item is decided to be eliminated, CITC is evaluated once more without the eliminated item. If more than one item has a CITC score below 0.50, item with the lowest CITC is selected to be eliminated upon evaluation and the analyses is re-run without that item. The process is repeated until satisfactory results are obtained.

5.1.2 Unidimensionality

Unidimensionality is assessed by factor analyzing the items remaining after purification for each construct. An exploratory factor analysis is performed by pooling all the items related to a particular construct retained so far, using Principal Component extraction with Eigen value greater than one and Promax rotation. If all items loaded on a single factor with factor loading greater than 0.60 it was considered to be evidence for unidimensionality. Items with factor loading less than 0.60 were evaluated for possible deletion.

If more than one factor emerged, either the additional factor could be eliminated or the construct may be interpreted as more complex than originally anticipated (Weiss, 1970). If the construct is judged to be more complex based on theory or logical understanding, items with crossloading greater than 0.30, and items with factor loading less than 0.60 are possible candidates for elimination. If there is strong theoretical reason to consider the items to be of a single construct, or there is no plausible indication on the contrary, a confirmatory factor analysis could be performed by forcing the number of factors as one. Even in this case, items with factor loading less than 0.60 are prime candidates for elimination.

5.1.3 Convergent and Discriminant Validity

Next step in evaluating the measurement instruments is to assess the convergent and discriminant validity of the scales. Convergent and discriminant validity is generally assessed using three approaches: exploratory/common factor analysis (Chau, 1997), using the multi-trait-multi-method (MTMM) correlation matrix (Campbell and Fiske, 1959), and structural equation modeling (Baggozi, Yi, Phillips, 1991). The first two approaches have certain shortcomings such as their inability to consider the error correlations between the items (Chau, 1997). Nonetheless, they are widely used and serve as a quick way to evaluate the constructs. All three methods to evaluate convergent and discriminant validity are used in this research. Using all three methods provide several advantages. For example, using all three methods as opposed to a single method provides better indication for the constructs' validity, though using structural equation modeling is generally considered to be a more rigorous test.

First, construct validity is assessed by factor analyzing all the items of a construct with the items of other constructs with which it needs to be discriminated. Care is taken to avoid factor analyzing constructs that are expected to have a causal relation, since it might confound the factor structure because of the correlation between their items, and would become difficult to assess the convergent and discriminant validity. For example, constructs from hypothesized independent and dependent variables are not factor analyzed together. Because of the limited sample size of the pilot, the number of constructs that are factor analyzed together is also judiciously restricted to those that need discrimination the most.

Factor analysis is performed with Maximum Likelihood extraction and Eigen value greater than one with Direct Oblimin rotation whenever the constructs that are expected to have some degree of correlation is used together. Orthogonal rotation is used when the constructs are expected to be not correlated with each other. Factor loading less than 0.30 are suppressed for easier interpretation of the factor structure. Items are evaluated for factor loadings, crossloadings, and loading with conceptually different construct. Items that load on constructs other than which it was initially hypothesized, items that have a loading less than 0.60, and items that crossload with other constructs greater than 0.30, are all identified for possible elimination upon further examination of the content, wording, and structure of the item. Item that has the worst problem is generally eliminated first, and the factor analysis is performed anew. The process is repeated until satisfactory results are obtained.

If items that are expected to load with a certain factor load with that factor and all factor loadings are greater than 0.60, the scale is expected to have sufficient convergent validity. If all items load on their respective factors and there is no crossloadings above 0.30, the constructs can be expected to have sufficient discriminant validity between those constructs that are factor analyzed together.

Though a survey instrument uses only a single method to measure a particular construct, the correlation matrix in the MTMM style can be used to assess the convergent and discriminant validity between the constructs. Similar guidelines are followed as in the factor analysis method in terms of not using constructs that are conceptually dependent because they may have significant correlation between them and may become difficult to evaluate the correlation matrix for discriminant validity.

To assess construct validity using this method, a correlation matrix with all items for the constructs between which discriminant validity is to be evaluated is created. If the correlation between items within a particular construct is significantly different from zero and their magnitude is large, it could be evidenced as an indication of convergent validity. Convergent validity is the extent to which each measure correlates with other measures of the same construct (Chau, 1997).

Discriminant validity is the “extent to which the measure of a construct does not correlate well with measures of other constructs” (Chau, 1997, p.312). The number of violations in the correlation matrix is evaluated to assess discriminant validity. Violations less than half of the possible violations are considered acceptable for discriminant validity by Campbell and Fiske (1959). A violation occurs when an item has a higher correlation with another item of a different construct than the smallest correlation with items of the same construct.

To evaluate the convergent validity using structural equation modeling, measurement models for each construct is evaluated based on the various model to data fit criterions. A non-significant p-value indicates that the data fits well with the theoretical model. In addition to the significance of p-value, generally, multiple fit criteria are recommended to be evaluated in assessing the overall model fit (Bollen and Long, 1993). Segars and Grover (1993) recommend assessing the model fit based on GFI, AGFI, NNFI, CFI and RMSEA. Further, an AVE greater than 0.50 also indicates some evidence for convergent validity (Fornell and Larcker, 1981). Modification indices of the measurement model are also examined to identify any potential problems with the items. Items that have error correlations or low factor loadings are further evaluated for item content or wording modification. All items that are retained at this stage are used to evaluate the discriminant validity between the constructs within each section using a pair-wise analysis.

The modification indices for the pair-wise model when the construct correlations are set free is also evaluated for problematic items. Items that have excessive error correlations or crossloadings based on the modification indices are evaluated for possible reasons for such anomaly. They are either eliminated or modified based on the analysis of the item content with respect to the construct's definition and/or item wording. Difference in chi-square between each pairs of constructs with the final items when the correlation between them is set free and fixed to one is examined. A difference of 3.84 for one degree of freedom indicates a significant difference between the two models at p-value 0.05 or greater. If more than one pair is tested at the same time, the chi-square value with the adjusted p-value has to be used. Larger magnitudes of the chi-square difference between the two models suggests a greater discrimination between the two constructs as opposed to the observed items forming a unidimensional construct (Segars and Grover, 1993). Alternatively, if the AVE of both the constructs is greater than the squared correlations, it demonstrates discriminant validity between the two constructs (Fornell and Larcker, 1981).

5.1.4 Reliability

Once the dimensionality, and convergent and discriminant validity are established, the reliability of the scales can be estimated. Chronbach's (1951) alpha is used to assess the reliability of scales. A reliability score of greater than 0.90 is considered excellent, greater than 0.80 is considered reasonable, and reliabilities above

0.70 are considered acceptable (Nunnally, 1978). Scales are evaluated for improvement in reliability on deletion of any item. Items are either kept or eliminated based on the reliability analysis considering, number of items remaining in the scale, the item content, the magnitude of improvement in reliability, etc.

5.1.5 Predictive Validity

To assess predictive validity, the strength and significance of correlation between the predictors and the dependent scales are examined (Pedhazur and Schmelkin, 1991). A correlation table with all the independent variables and the dependent variables will be generated with their correlation significance. Second order constructs will be used wherever appropriate to keep the analysis compatible with the conceptual model that is being investigated.

5.2 Pilot Study Sample Description

The questionnaire was administered in a web based format on server on the researcher's institution. The initial page provided a brief description of the study and gave an option to login using the username and password that was generated for each potential respondent that was identified by the organization. This would minimize the possibility of individuals outside the target population completing the survey, and enables the researchers to ensure that a respondent not complete the survey multiple times which could lead to multicolliniearity in sample data. The website enabled users to return to the page where they had left off if they were not able to complete the survey at any time.

Each page was designed to contain questions from a particular section and the items were randomized within that page. If a section contained too many questions, as in the case of community of practice characteristics, it was split into multiple pages so as to keep the page to a reasonable length. Complete pilot questionnaire is shown in Appendix-C.

A total of 53 responses were obtained for the pilot. 24 responses were received from the individuals working in the various functions within a few mid-west organizations involved in design, manufacturing or consulting for other manufacturing and engineering firms. Individuals were identified as knowledge workers who used information technology heavily for their daily work, by the managers in their respective organizations that agree to participate in this research. Since the questionnaire was implemented in a web based format, the username and password to access the survey was given to the contact person in the organization to be distributed to the appropriate individuals. A total of 34 individuals were requested to complete the survey from these firms. The rest of the 29 responses were received from primarily MBA students most of whom were working in various positions in the industry similar to our target respondents, which qualified them to be knowledge workers. The 29 responses received were from 34 individuals that were contacted to complete the survey. A total of 53 responses out of the 68 survey requests were obtained to yield 78% response rate. The high response rate is attributed to the fact that respondents were either requested to complete the survey by their managers or supervisors or were personally contacted.

Apart from developing good measures of constructs involved in this study, we wanted to test substantive relationship between how an individual's knowledge management practices are influenced by the different aspects of their environment such as the community in which they interact to gain or share their knowledge, the tools that are available for them to perform knowledge related work, and their own empowerment feelings. Further how these knowledge management practices influence their work related outcomes were also of interest. To assess these rather broad aspects of knowledge work and yet to enable the respondents to maintain a reasonable focus on the environment, knowledge, and behaviors related to their work alone, they were asked to select a particular project or an assignment, or reflect on their work for the past six months to answer all questions in the survey. Out of the 53 respondents 21 responded to the questionnaire based on a particular assignment or project that they had completed most recently and the rest answered the questionnaire based on their work during the past six months (Figure 5.2.1). Those who chose a particular assignment or project were further asked about the name of their assignment/project and its duration to help in their recall of subjective states. The distribution of duration of the assignment or project that they were referring to is indicated in Figure 5.2.2.

Figure 5.2.1: Respondents Selection of Assignment/Project or Past 6 Months of Work to Answer the Questionnaire.

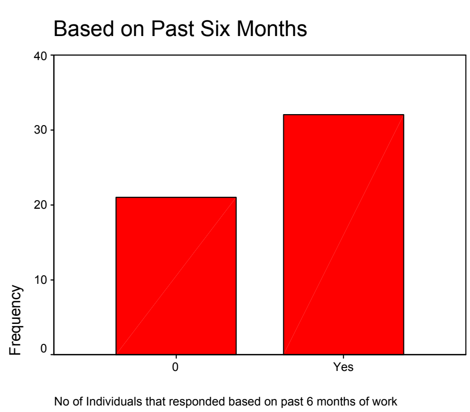


Figure 5.2.2: Distribution of the Duration of Assignment/Project (in Months).

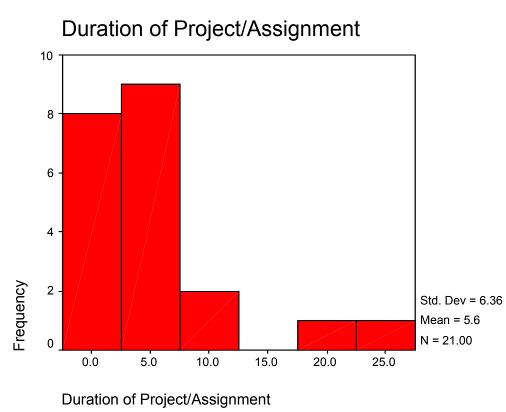


Figure 5.2.3 shows the distribution of respondents based on the industry they are working. Majority were services which is justifiable since a large part of the data came from respondents working in engineering consulting firms primarily catering to the manufacturing sector. Figures 5.2.4 to Figure 5.2.6 shows the size, type and since how long the respondent's organization has been in operation.

Figure 5.2.3: Primary Business of the Respondents' Firm

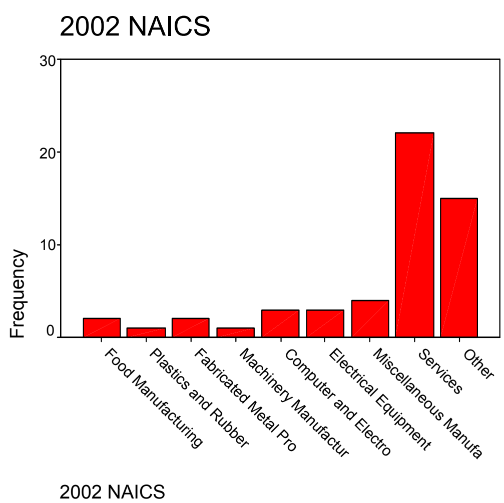


Figure 5.2.4: Size of the organization in which the respondents are employed.

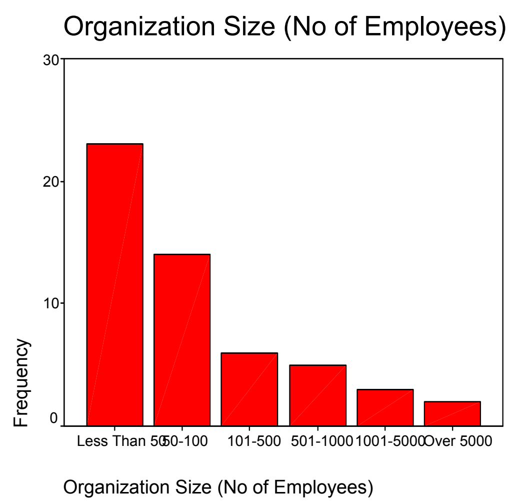


Figure 5.2.5: Type of organization.

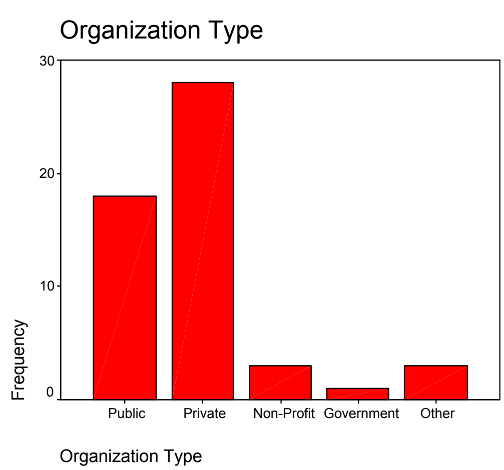


Figure 5.2.6: Age of the organization.

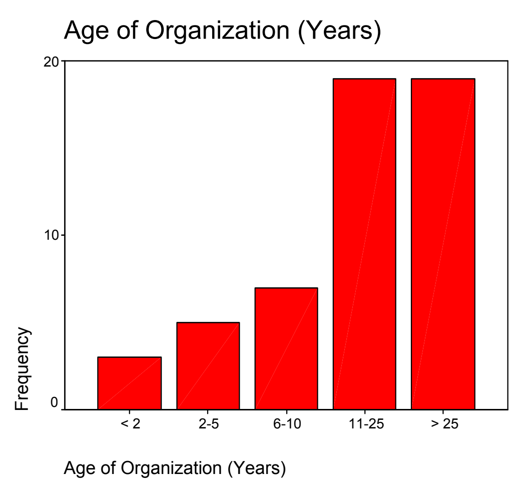


Figure 5.2.7 shows number of individuals who indicated as having some form of a knowledge management initiative within their organization. Out of the 53, 44 individuals responded to the question whether they were involved in the knowledge management initiative at some level. Only 9 indicated that they were involved in any KM initiative at some level in their organization (Figure 5.2.8).

Figure 5.2.7: Number of Respondents' Organization Having a Knowledge Management Initiative.

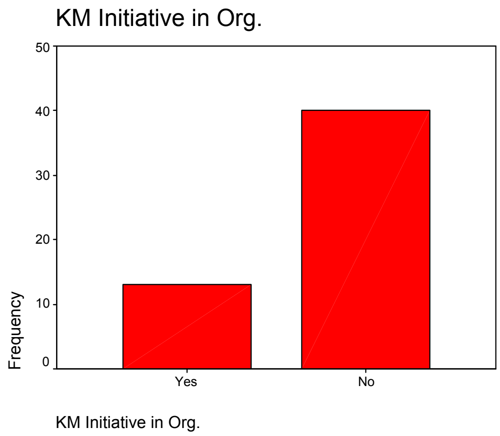
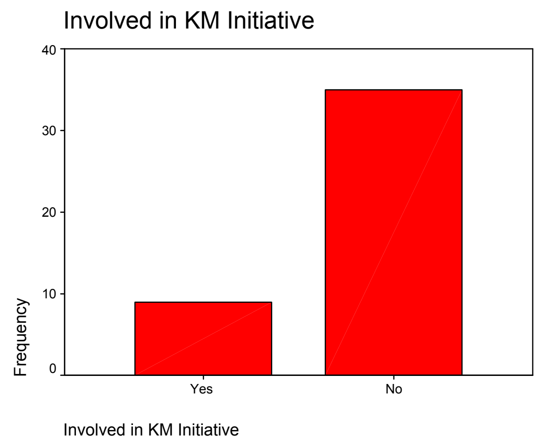
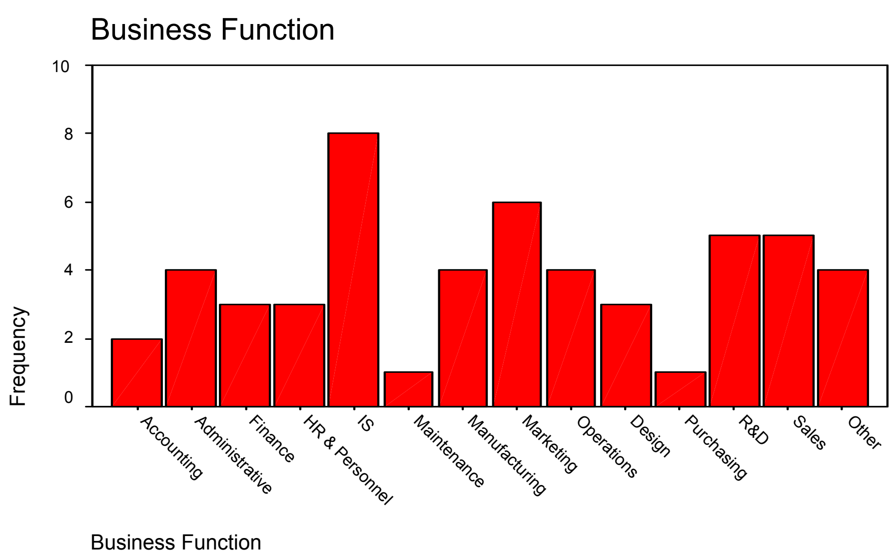


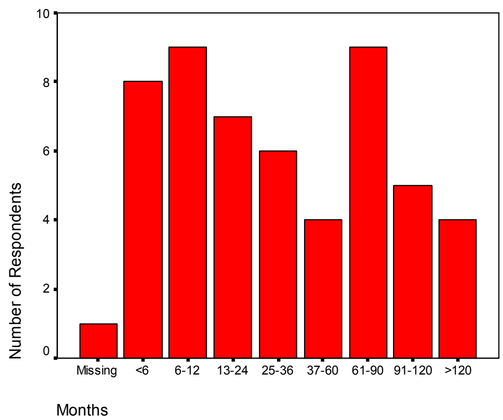
Figure 5.2.8: Proportion of Individuals Involved in a Knowledge Management Initiative in their Organization.



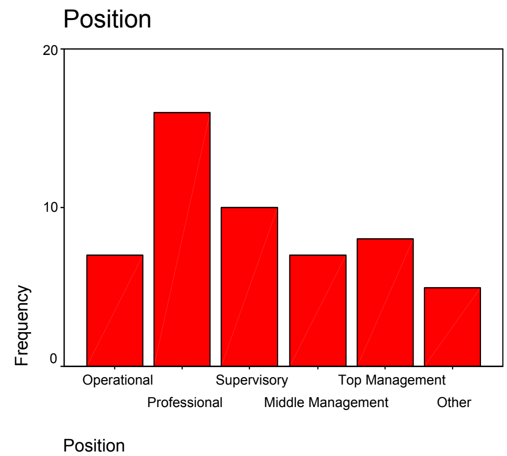
Figures 5.2.9: General Business Function to Which the Respondent is Associated within their Organization.



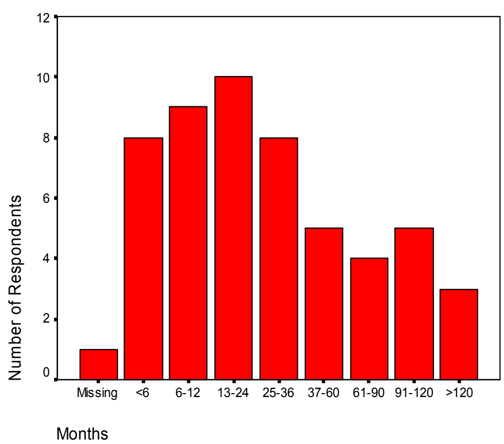
Figures 5.2.10: Duration Respondents have been in the Current Organization.



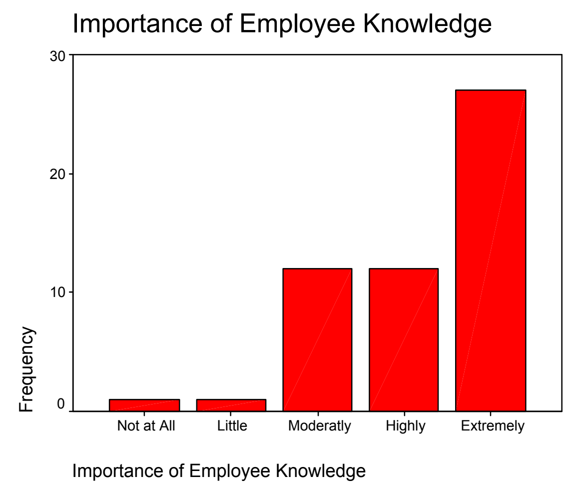
Figures 5.2.11: Current Position of Respondent within the Organization.



Figures 5.2.12: Duration Respondents have been in the Current Position.



Figures 5.2.13: Importance of Respondents' Knowledge for their Department.



Figures 5.2.9, 5.2.10, 5.2.11, and 5.2.12 shows the distribution of respondents' general business function within their organization, how long they have been with the current organization, the position in which they are currently working, and the duration to which they have been working in the current or similar position. Figure 5.2.13 indicates the level of importance they attribute to their knowledge for their department.

Figure 5.2.14: Respondents based on their Highest Degree Earned.

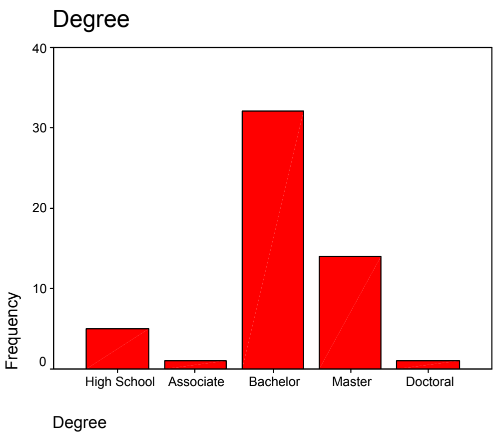


Figure 5.2.15: Age Distribution of the Respondents.

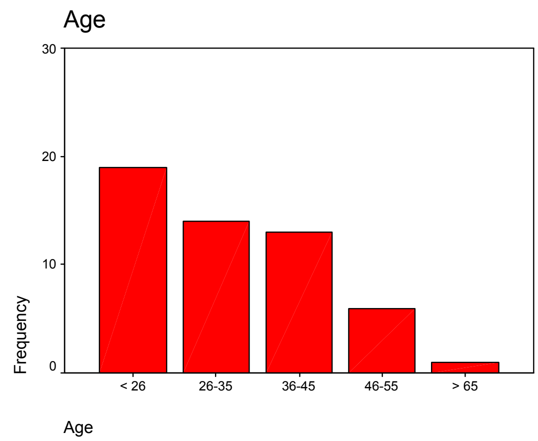
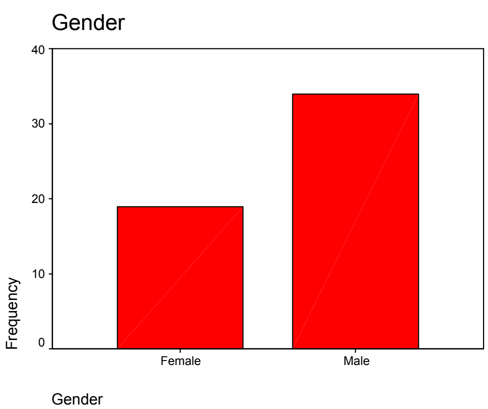


Figure 5.2.16: Respondents based on Gender.



Figures 5.2.14, 5.2.15, and 5.2.16 shows the distribution of respondents based on the highest degree they have earned, their age, and their gender.

5.3 Community of Practice Characteristics Instrument

Community of practice was defined in this research as a formal or informal group from which individuals seek and share their work related knowledge. The respondents were asked a set of objective questions to allow time and thought to give more concrete form to their community of practice in their mind before they answered the questions in this section. This would help them answer the many abstract subjective perceptual questions that were to follow by referring to a well formed framework of what their community of practice means to them. Community of practice being a loosely used term, many people interpret it in many ways. It is possible that the individuals may not be able to readily define their community of practice, which may be because they have not consciously thought about it as a single entity or because they interact in many communities which may not be distinct from each other. Though, a description of what this research defines as a community of practice was provided at the beginning of this section, asking specific objective questions regarding such a community in which they interact can help the individuals to more concretely frame their community of practice. Further ambiguity was reduced by asking them to respond to all questions in this section by referring to only one community in which they interacted the most during the work they have chosen to answer this questionnaire. Figures 5.3.1 to Figures 5.3.9 shows the various objective characteristics that the respondents have specified in defining their community of practice.

Out of the 53 individuals that responded, 42 individuals considered their work team as their primary community of practice from which they have gained and shared most of their work related knowledge (Figure 5.3.1). For 7 individuals out of 53 their community of practice was primarily online (Figure 5.3.2). The Figure 5.3.3 shows the frequency distribution of the respondents' interaction in their community of practice through online medium. In terms of the size of their communities, Figure 5.3.4 shows the frequency distribution of number of members in each respondent's community.

Figure 5.3.1: Number of Respondents Whose Primary Community was same as their Work Group.

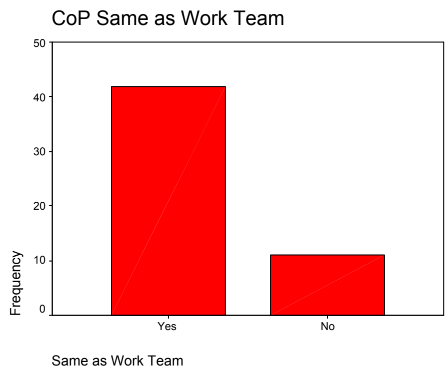


Figure 5.3.2: Number of Respondents who Interacted Primarily Online.

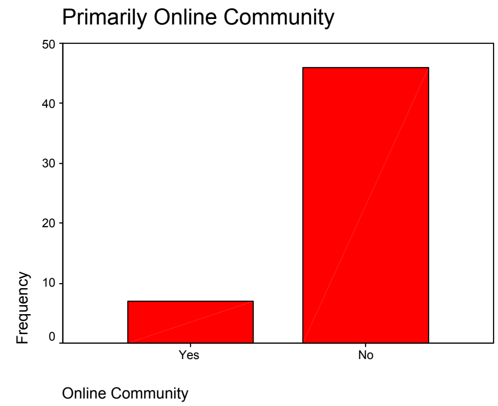


Figure 5.3.3: Percentage of Respondents' Interaction in Community through Online Medium.

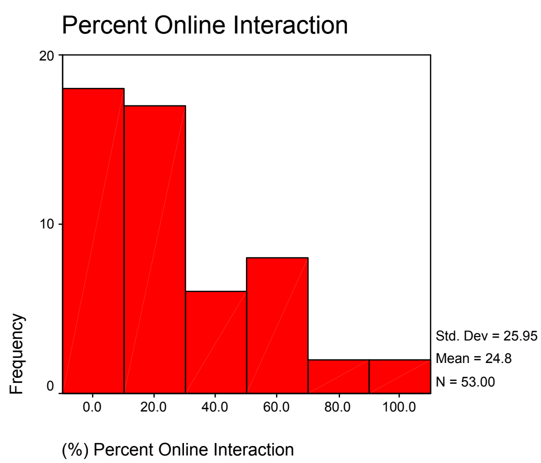
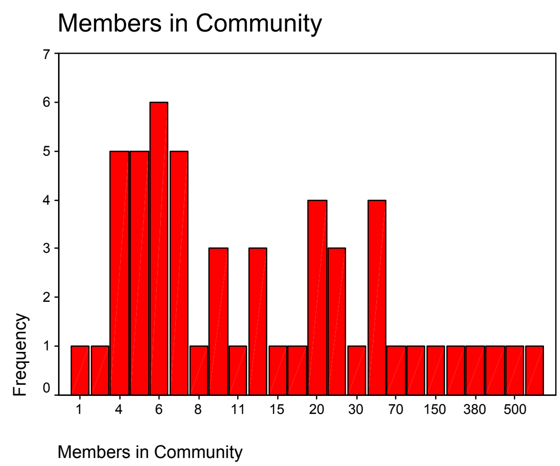


Figure 5.3.4: Distribution of Respondents' Community Size in terms of Number of Members.



The number of members within the community with which the respondents interacted, and the number with which they interacted most frequently is shown in Figure 5.3.5 and Figure 5.3.6 respectively. Out of the 53 that responded, 48 of the individuals interacted with the same individuals in the community most of the time (Figure 5.3.7).

Figure 5.3.8 shows the distribution of how long the respondents have been part of their respective communities in months.

Figure 5.3.5: Number of Individual with whom Respondents Interacted in the Community.

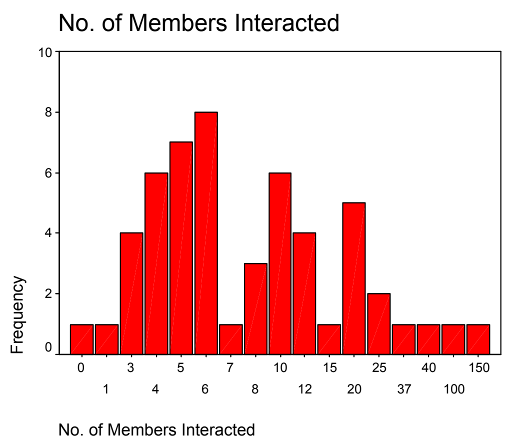


Figure 5.3.6: Number of Individuals with whom the Respondent Interacted on a Regular Basis in the Community.

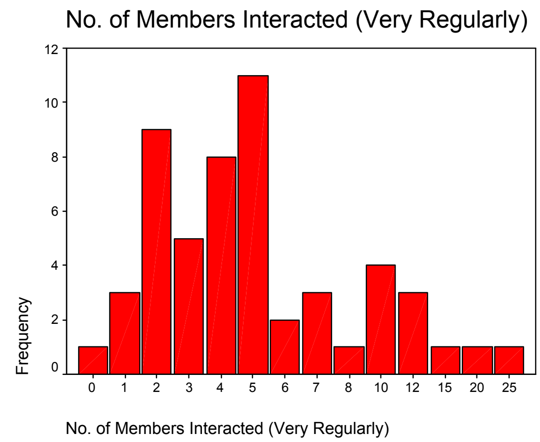


Figure 5.3.7: Distribution of Individuals Who Interacted Mostly with the Same People in the Community.

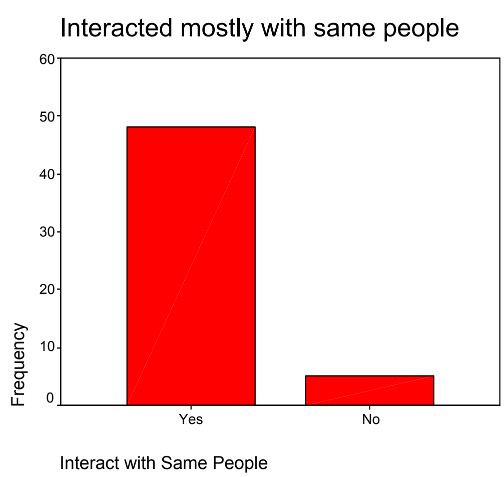
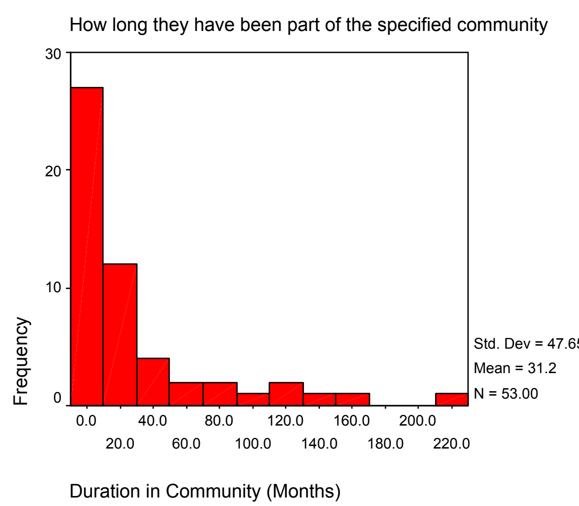


Figure 5.3.8: Duration for which Individuals have been part of the Specified Community.



Initial step in assessing the psychometric properties of a scale is to examine the corrected item-total correlation (CITC) of the items with their respective scales to eliminate so called garbage items and is often referred to as purification (Churchill, 1979). The Table 5.3.1 shows the CITC for items within each proposed constructs. Items with CITC less than 0.60 were identified as potential candidates for elimination. Items that had a CITC score between 0.50 and 0.60 were marked for further investigation of the item content and wording or were retained if number of items for a scale dropped below three. If items are decided to be dropped based on the CITC, they are done so step by step. That is, the item with the lowest CITC score is first selected to be eliminated, once the item is decided to be dropped, CITC scores for the rest of the items are recomputed for further evaluation.

All the scales except network configuration had reasonably good CITC values for their respective items in the first step. Network ties had two items (out of five) with a CITC score less than 0.60, appropriable organization had three items (out of five) with CITC less than 0.60, shared norms and shared languages & codes had one item each (out of five) less than 0.60, obligation had two items (out of five) with CITC less than 0.60. Mutual trust, identification, and shared narratives had all items (five each) with CITC above 0.60. Network configuration scale had all items (six) with a very low (<0.39) CITC score. All the items with CITC below 0.60 appear in bold.

Community of practice characteristics had structural, relational and cognitive dimensions based on the original theorization, and had sub-scales within these three aspects. Network configuration scale within the structural dimension was initially conceptualized based on network density, network connectivity and network hierarchy. But to keep the scope of the research at a manageable level and to prevent the questionnaire from becoming excessively lengthy, which could significantly impact data collection and rigor of the research, network configuration was identified as a possible area to consolidate and measure at a higher level of abstraction rather than making a finer distinction between network density, network connectivity and network hierarchy. Such a conceptualization of network configuration may be considered as a formative measure of the construct as opposed to a reflective scale (Mackenzie, Podsakoff and Jarvis, 2005). Because of this, only a few items from the items generated for these three aspects of network configuration was selected to form a single scale based on the domain sampling theory and the pre-test information. It may be that these items still measure distinctly different aspects of network configuration rather than a similar overreaching aspect as would have been the case in a reflective scale. In such a case conventional methods to assess the psychometric properties of the reflective scales may not be appropriate for network configuration. In a formative scale it is possible that the indicators may not be correlated at all (Mackenzie, Podsakoff and Jarvis, 2005).

Upon further examination, it was decided that only one aspect of network configuration- network hierarchy, will be retained as a reflective measure for the large scale analysis. Due to the limited scope of this research, network density and network connectivity is dropped at this stage because, the other dimensions of the community of practice such as network ties, mutual trust and identification closely relate to these two constructs. This construct is dropped from further data analysis in the pilot stage and may be investigated further during the large scale analysis with re-conceptualized items.

At this stage, after stepwise deletion of items with CITC less than 0.60, two items (CP9, CP13) from network ties, two items (CP21, CP23) from appropriable organization, one item (CP25) from shared norms, two items (CP42, CP40) from obligation, and one

Table 5.3.1: Purification for Community of Practice Characteristics

Construct	Label	Items	Step 1 CITC	Step 2 CITC	Step 3 CITC
Network Ties	CP9	members had strong interpersonal ties	**0.39**	**0.46**	-
	CP10	members were closely connected to each other	0.61	**0.57**	**0.52**
	CP11	members interacted very close to each other	0.71	0.72	0.75
	CP12	members interacted frequently with other members	0.69	0.63	0.72
	CP13	members maintained a great deal of distance with each other	**0.38**	-	-
Network Configuration	CP14	members interacted with many members	**0.39**	**0.41**	**0.48**
	CP15	the network of people was very dense	**0.19**	**0.15**	**-**
	CP16	members could easily stop interacting with others if needed	**-0.18**	-	-
	CP17	it was easy to network with others	**0.21**	**0.29**	**0.26**
	CP18	members could access anybody easily	**0.47**	0.61	0.63
	CP19	we had many levels of hierarchy	**0.29**	**0.33**	**0.35**
Appropriable Organization	CP20	most members knew each other before they joined this community	0.64	0.68	0.64
	CP21	members were mostly friends	**0.40**	-	-
	CP22	most members were acquaintances of each other	0.72	0.74	0.73
	CP23	most members kept in touch outside the community	**0.45**	**0.41**	-
	CP24	most members I interacted with were known to me before I joined this community	**0.59**	**0.57**	0.62
Shared Norms	CP25	members were expected to be open to criticism	**0.57**	-	-
	CP26	members were expected to have a team spirit	0.65	**0.58**	-
	CP27	members were expected to be cooperative	0.76	0.76	0.80
	CP28	members were expected to have an open mind	0.76	0.82	0.82
	CP29	members were expected to share what they knew	0.77	0.78	0.83
Mutual Trust	CP30	members trusted each other enough to share all relevant information	0.84		
	CP31	members believed that all members were acting in good faith	0.71		
	CP32	members were confident they could trust each other	0.80		
	CP33	members relied on each other for the truthfulness of the information shared	0.78		
	CP34	members trusted each other enough to share sensitive information	0.69		
Identification	CP35	members had a strong sense of belonging to the community	0.83		
	CP36	members identified with each other as one community	0.78		
	CP37	members were proud to be part of the community	0.72		
	CP38	members were concerned about other’s well being	0.70		
	CP39	members were concerned about community’s well being	0.69		

Table 5.3.1: Purification for Community of Practice Characteristics (Cont.)

Obligation	CP40	members generally felt obliged to help each other	**0.48**	**0.36**	-
	CP41	members expected others to help them when they helped	0.76	0.75	0.69
	CP42	members expected others to share their knowledge when they themselves shared	**0.47**	-	-
	CP43	members were expected to return favors	0.62	0.72	0.78
	CP44	members expected others to help in return	0.65	0.69	0.77
Shared Languages and Codes	CP45	members used a common language	**0.51**	-	-
	CP46	a common language was used to share ideas	0.70	**0.59**	-
	CP47	the terms used by members were known to most of us	0.65	0.66	0.62
	CP48	we had our own common words to communicate ideas	0.62	0.65	0.64
	CP49	members used technical terms common among us	0.72	0.76	0.78
Shared Narratives	CP50	members used stories to share their knowledge	0.88		
	CP51	members used stories to communicate subtle ideas	0.76		
	CP52	stories and narratives were used to communicate rich sets of ideas	0.91		
	CP53	stories and metaphors were used to create and preserve rich meaning	0.75		
	CP54	stories and narratives were used to share hard to communicate ideas	0.88		

item (CP45) from shared languages and codes were dropped. Though one item (CP26-members were expected to have a team spirit) in shared norms had a CITC less than 0.60, this item is suggested to be an important aspect of shared expectations within the community and was retained. Further, the CITC score for this item (0.58) is also not much lower than the 0.60 cutoff and may be improved in the large scale by slight rewording of the question (members were expected to have team spirit).

To test for the unidimensionality, each scale was factor analyzed separately with their corresponding items that are retained after purification. All items for the respective scales loaded on a single factor and had a factor score above 0.60 indicating good unidimensionality. Respondent to item ratio for a 3-item, 4-item, and 5-item scales in this section were 17, 13, and 10.

Convergent and discriminant validity of the scales are assessed in the pilot stage based on factor analysis and through Campbell and Fiske's (1959) correlation matrix analysis of the measurement items (Chau, 1997). While factor analyzing, it is important to cluster only those items for which the scales are fairly unrelated so as not to confound the factor structure and to be able to interpret it easily. While this is difficult in a purely exploratory factor analysis, when there is some evidence for the underlying structure and sufficient theoretical indication for possible relationships between the scales, this information may be used to offset the weakness inherent in such analysis. Further, unique solutions can be obtained only when items are pre-specified to the constructs (Segars, 1994). A confirmatory factor analysis and a pair-wise measurement model comparison using structural equation measurement modeling is evaluated following the two methods to further assess convergent and discriminant validity.

The scales in the structural, relational, and cognitive dimensions are expected to be interrelated based on theory. Yet, the scales within each dimension of the community of practice should display certain degree of uniqueness. Because of this, the items for the scales within each of the above dimensions are clustered together to analyze the factor structure for convergent and discriminant validity. Further, conducting a factor analysis with all the items for all three dimensions together will result in an extremely low respondent to item ratio and may render the resultant factor structure highly unstable and difficult to interpret. Therefore, items for network ties and appropriable organization are factor analyzed together. Similarly, shared norms, mutual trust, identification and obligation is factor analyzed together, and shared languages and codes, and shared narratives are factor analyzed together. Maximum likelihood extraction method with

Oblimin rotation were used for all factor extraction since there was no evidence for the scales to be not correlated due to the fact that scales within each dimension represented related but distinct aspect of those dimensions. The Tables 5.3.2 to 5.3.4 shows the factor structure and the factor correlations between the scales for structural, relational and cognitive dimensions. Factor loadings below 0.30 are suppressed for easier interpretation of the factor structure.

All the items related to network ties and appropriable organization loaded with their respective scales when factored together indicating evidence for convergent validity (Table 5.3.2). The lowest loading for network ties is 0.556 (CP10) which is slightly lower than the desired loading of at least 0.60. CP10 item is retained in spite of the below desired loading at this stage, and will be slightly modified for the large scale, since dropping this item would reduce the number of items for this scale below three. The lowest factor loading for appropriable organization is 0.711 (CP24) which is above the 0.60 level. There were no crossloadings above 0.30 between the two scales indicating some evidence for discriminant validity.

Items for shared norms, mutual trust, identification and obligation which are part of the relational dimension are factored together. All items corresponding to the respective scales loaded together except for CP38 which had a cross loading of 0.438 with mutual trust. Upon examination of the item, it was decided to be eliminated at this stage. Identification had two items- CP37 (0.521) and CP39 (0.476)- that had a factor loading less than 0.60. Since, this scale had only four items total, both items were kept for the large scale with slight modification. All other scales had a factor loading greater than 0.620 (CP33), indicating evidence for convergent validity. No further cross loadings

Table 5.3.2: Scales in Structural Characteristics

Pattern Matrix[a]

	Factor	
	1	2
CP12	.908	
CP11	.887	
CP10	.556	
CP22		.863
CP20		.752
CP24		.711

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalizatior

a. Rotation converged in 3 iterations.

Factor Correlation Matrix

Factor	1	2
1	1.000	.115
2	.115	1.000

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization

Table 5.3.3: Scales in Relational Characteristics

Pattern Matrix[a]

	Factor			
	1	2	3	4
CP35	1.043			
CP36	.735			
CP37	.521			
CP39	.476			
CP27		.824		
CP28		.793		
CP29		.776		
CP26		.677		
CP43			.888	
CP44			.848	
CP41			.684	
CP31				.831
CP32				.810
CP30				.758
CP34				.683
CP33				.620

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 8 iterations.

Factor Correlation Matrix

Factor	1	2	3	4
1	1.000	.372	.448	.574
2	.372	1.000	.116	.408
3	.448	.116	1.000	.291
4	.574	.408	.291	1.000

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.

Table 5.3.4: Scales in Cognitive Characteristics

Pattern Matrix[a]

	Factor	
	1	2
CP52	.979	
CP50	.933	
CP54	.926	
CP51	.758	
CP53	.717	
CP49		.949
CP48		.731
CP47		.718
CP46		.592

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.
a. Rotation converged in 3 iterations.

Factor Correlation Matrix

Factor	1	2
1	1.000	.243
2	.243	1.000

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.

above 0.30 were observed suggesting all the four scales had certain degree of discrimination between them. Table 5.3.3 shows the final factor structure and the corresponding factor loadings.

Cognitive scales include shared languages and codes, and shared narratives. The items for these scales were factor analyzed together resulting in the factor structure indicated in Table 5.3.4. Items corresponding to each scale loaded on the respective constructs. The lowest factor loading is 0.717 (CP53) except for CP46 in shared languages and codes which had a loading of 0.592. The item is retained for the large scale with slight modifications. No crossloadings above 0.30 were observed between the two scales. The factor structure indicate some evidence for convergent and discriminant validity.

To further assess convergent and discriminant validity, correlation matrix of all the retained items for the scales in community of practice characteristics is generated. High inter-item correlation within each construct indicates convergent validity. Degree to which the measures of a construct do not correlate well with measures of other constructs indicate evidence for discriminant validity (Chau, 1997). Table 5.3.5 shows the correlation between all items for the scales in this section.

The smallest within construct correlations are: network ties (0.46), appropriable organization (0.51), shared norms (0.50), Mutual trust (0.48), identification (0.56), obligation (0.64), shared language and codes (0.48), shared narrative (0.67). These correlations are bolded and occur in the diagonal triangle in the table. All inter-item correlations were significant ($p<0.001$), except for one in mutual trust which is significant at $p<0.005$. The results give good support for convergent validity.

Discriminant validity is evaluated by observing the number of violations for each of the items and the total number of violation for a particular construct from the correlation matrix. A correlation of an item with other items outside of the construct, that is greater than the lowest correlation of that item within the construct, is counted as a violation. Number of violations less than one-half of the possible violations for an item is considered acceptable (Campbell and Fiske, 1959). In our correlation table (Table 5.3.5), 42 violations were noted out of the possible 836. None of the items or constructs by itself had a violation greater than half of the possible counts indicating evidence for discriminant validity. Item number CP46, of shared language and codes had 9 violations out of the 27 possible. This item needs to be further examined and if needed modified for the large scale.

To access the convergent validity of the community of practice scales using structural equation modeling, all items that is retained at this stage is used for the LISREL measurement model. Based on the modification indices of the measurement model some items are either eliminated or modified in this stage. The remaining items are used for discriminant analysis using pair-wise LISREL analysis. Item CP34 of mutual trust was the only item that had error correlation with other items within the construct in the measurement model. This item is eliminated at this stage and is ignored in further analysis. The Table 5.3.6 shows the model-data fit of community of practice scales. The results indicate good convergent validity for the scales in this section.

The results of the discriminant validity using pair-wise LISREL test for community of practice is shown in Table 5.3.7, including the average variance extracted (AVE), Pearson correlation between the constructs (*r*) and the reliabilities (α). The chi-square difference between the models were the construct correlations are set to free and set to one ranges from 21 to 172 indicating reasonable discriminant validity. Item CP50 from the shared narratives is also eliminated at this based on the modification indices from the pair-wise tests.

Since the scales provide sufficient convergent and discriminant validity, they were then subjected to reliability analysis. The scale reliabilities (Chronbach's alpha) are as follows: network ties (0.81), appropriable organization (0.81), shared norms (0.87), Mutual trust (0.90), identification (0.88), obligation (0.87), shared language and codes (0.83), shared narrative (0.92). The reliability scores were satisfactory for the exploratory stage of the research. Deleting the items from the scales did not have any significant improvements for any of the constructs in this section, except for network ties and shared

Table 5.3.5: Correlation Matrix: Convergent and Discriminant Validity of Community of Practice Constructs

	Network Ties			Appropriable Org			Shared Norms				Mutual Trust					identification				Obligation			Shared Language				Shared Narratives					
	CP10	CP11	CP12	CP20	CP22	CP24	CP26	CP27	CP28	CP29	CP30	CP31	CP32	CP33	CP34	CP35	CP36	CP37	CP39	CP41	CP43	CP44	CP46	CP47	CP48	CP49	CP50	CP51	CP52	CP53	CP54	
CP10	1.00																															
CP11	0.51	1.00																														
CP12	**0.46**	0.79	1.00																													
CP20	0.37	0.07	-0.02	1.00																												
CP22	0.25	0.08	-0.06	0.65	1.00																											
CP24	0.08	0.04	-0.14	**0.51**	0.62	1.00																										
CP26	0.20	0.17	0.21	-0.12	-0.14	-0.13	1.00																									
CP27	0.44	0.46	0.55	0.13	0.17	0.08	**0.50**	1.00																								
CP28	0.46	0.41	0.46	0.19	0.13	-0.03	0.59	0.75	1.00																							
CP29	0.38	0.41	0.43	0.15	0.25	0.17	0.52	0.77	0.78	1.00																						
CP30	0.60	0.50	0.47	0.12	0.01	-0.11	0.38	0.50	0.69	0.55	1.00																					
CP31	0.49	0.35	0.26	0.09	-0.03	0.03	0.12	0.25	0.44	0.42	0.72	1.00																				
CP32	0.55	0.39	0.35	0.08	0.07	-0.10	0.16	0.25	0.39	0.33	0.69	0.65	1.00																			
CP33	0.50	0.54	0.62	0.09	0.10	-0.04	0.22	0.54	0.54	0.62	0.80	0.62	0.65	1.00																		
CP34	0.50	0.44	0.39	0.06	0.13	-0.03	0.02	0.28	0.35	0.33	0.62	**0.48**	0.74	0.58	1.00																	
CP35	0.33	0.27	0.34	-0.11	0.04	-0.10	0.22	0.39	0.44	0.47	0.54	0.35	0.51	0.58	0.47	1.00																
CP36	0.38	0.29	0.44	-0.12	0.01	-0.10	0.15	0.33	0.40	0.35	0.49	0.36	0.52	0.52	0.47	0.79	1.00															
CP37	0.47	0.34	0.33	0.08	0.09	-0.09	0.19	0.41	0.47	0.49	0.51	0.51	0.51	0.51	0.47	0.69	0.62	1.00														
CP39	0.38	0.30	0.44	0.01	0.09	-0.10	0.26	0.31	0.39	0.37	0.46	0.24	0.54	0.64	0.51	0.64	0.61	**0.56**	1.00													
CP41	0.28	0.33	0.48	-0.11	0.02	-0.04	0.14	0.45	0.45	0.45	0.39	0.31	0.31	0.55	0.38	0.43	0.51	0.49	0.57	1.00												
CP43	0.17	-0.01	0.09	-0.18	0.04	-0.14	-0.14	0.14	0.06	0.14	0.06	0.02	0.20	0.17	0.35	0.34	0.45	0.28	0.37	0.65	1.00											
CP44	0.23	0.15	0.18	0.03	0.15	0.08	-0.08	0.29	0.20	0.26	0.19	0.28	0.21	0.28	0.34	0.27	0.40	0.42	0.36	**0.64**	0.75	1.00										
CP46	0.36	0.32	0.35	0.19	0.22	0.09	0.06	0.45	0.52	0.54	0.59	0.45	0.44	0.65	0.46	0.53	0.53	0.51	0.49	0.53	0.30	0.38	1.00									
CP47	0.28	0.27	0.21	0.24	0.15	0.16	0.16	0.31	0.49	0.37	0.51	0.39	0.39	0.52	0.38	0.30	0.16	0.18	0.27	0.32	0.07	0.21	0.53	1.00								
CP48	0.27	0.00	-0.04	0.18	0.22	0.28	-0.01	0.18	0.21	0.20	0.41	0.34	0.29	0.36	0.40	0.36	0.32	0.25	0.18	0.31	0.29	0.32	**0.48**	0.48	1.00							
CP49	0.42	0.24	0.19	0.20	0.17	0.23	0.18	0.31	0.43	0.33	0.51	0.27	0.22	0.47	0.39	0.40	0.30	0.22	0.37	0.46	0.25	0.24	0.52	0.66	0.67	1.00						
CP50	0.07	0.00	-0.06	0.12	0.11	-0.09	0.01	-0.03	0.05	-0.01	0.14	0.32	0.38	0.13	0.29	0.28	0.29	0.46	0.22	0.15	0.17	0.37	0.14	0.18	0.13	-0.02	1.00					
CP51	-0.03	0.02	-0.07	-0.08	-0.01	-0.27	0.01	0.00	0.13	0.04	0.17	0.21	0.40	0.21	0.24	0.42	0.33	0.45	0.25	0.04	0.08	0.22	0.27	0.33	0.09	-0.01	0.71	1.00				
CP52	0.12	-0.02	-0.02	-0.08	-0.02	-0.15	0.09	0.05	0.17	0.07	0.21	0.33	0.42	0.21	0.31	0.42	0.38	0.57	0.31	0.26	0.23	0.36	0.17	0.21	0.17	0.04	0.89	0.72	1.00			
CP53	-0.03	-0.04	-0.14	-0.15	0.08	-0.13	-0.07	-0.13	-0.02	-0.15	0.14	0.15	0.34	0.14	0.30	0.45	0.43	0.33	0.17	0.15	0.25	0.21	0.13	0.26	0.34	0.13	0.68	0.69	0.70	1.00		
CP54	0.19	-0.03	-0.06	0.16	0.08	-0.06	0.11	0.07	0.16	0.09	0.28	0.31	0.41	0.24	0.38	0.47	0.41	0.55	0.34	0.14	0.15	0.29	0.18	0.27	0.25	0.12	0.85	**0.67**	0.92	0.70	1.00	
	CP10	CP11	CP12	CP20	CP22	CP24	CP26	CP27	CP28	CP29	CP30	CP31	CP32	CP33	CP34	CP35	CP36	CP37	CP39	CP41	CP43	CP44	CP46	CP47	CP48	CP49	CP50	CP51	CP52	CP53	CP54	
Mean	3.70	3.62	3.85	2.60	2.87	2.51	3.92	4.19	3.96	4.19	3.68	3.77	3.62	3.81	3.51	3.60	3.51	3.55	3.51	3.72	3.23	3.47	3.91	3.91	3.64	3.96	2.85	2.60	2.75	2.60	2.77	
SD	0.87	0.86	0.79	1.23	1.16	1.40	1.09	0.81	0.83	0.81	0.96	0.87	0.84	0.92	0.93	0.91	0.93	0.85	0.82	0.84	0.99	0.93	0.84	0.84	1.02	0.96	1.20	1.10	1.16	1.08	1.10	Total
violatio	6	1	4	0	0	0	0	3	1	3	2	2	0	2	2	1	0	1	2	0	0	0	9	3	0	0	0	0	0	0	0	42
Total	28	28	28	28	28	28	27	27	27	27	26	26	26	26	26	27	27	27	27	28	28	28	27	27	27	27	26	26	26	26	26	836

Table 5.3.6: Model-Data Fit Indices of Community of Practice Scales

Construct	Chi-Square	DF	p-value	RMSEA	GFI	AGFI	NNFI	CFI	# of Items
Network Ties									3
Appropriable Organization									3
Norms	0.31	2	0.855	0.000	1.00	0.99	1.03	1.00	4
Trust	1.82	2	0.403	0.000	0.98	0.91	1.00	1.00	4
Identification	4.37	2	0.112	0.151	0.96	0.80	0.95	0.98	4
Obligation									3
Shared Lang. & Codes	2.75	2	0.253	0.085	0.97	0.87	0.97	0.99	4
Shared Narratives	8.33	5	0.139	0.113	0.94	0.82	0.97	0.99	5

Table 5.3.7: Reliability and Discriminant Validity of Community of Practice Scales

	Network Ties	Appropriable Organization	Norms	Mutual Trust	Identi-fication	Obligation	Shared Language	Narratives
Network Ties	AVE=0.71 α=0.81							
Appropriable Organization	*r=0.10* χ^2=84	AVE=0.67 α=0.81						
Norms	*r=0.51*** χ^2=59	*r=0.07* χ^2=56	AVE=0.74 α=0.87					
Mutual Trust	*r=0.63*** χ^2=21	*r=0.03* χ^2=61	*r=0.52*** χ^2=96	AVE=0.79 α=0.90				
Identification	*r=0.49*** χ^2=44	*r=-0.04* χ^2=65	*r=0.47*** χ^2=144	*r=0.65*** χ^2=84	AVE=0.72 α=0.88			
Obligation	*r=0.27* χ^2=78	*r=-0.03* χ^2=72	*r=0.22* χ^2=77	*r=0.31*** χ^2=61	*r=0.53*** χ^2=57	AVE=0.74 α=0.87		
Shared Language	*r=0.37** χ^2=66	*r=0.28** χ^2=57	*r=0.39*** χ^2=102	*r=0.59*** χ^2=50	*r=0.47*** χ^2=78	*r=0.41*** χ^2=60	AVE=0.65 α=0.83	
Narratives	*r=0.01* χ^2=53	*r=-0.02* χ^2=67	*r=0.08* χ^2=172	*r=0.33** χ^2=141	*r=0.49*** χ^2=113	*r=0.26* χ^2=70	*r=0.20* χ^2=104	AVE=0.81 α=0.92

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).
χ^2 > 9.76 for 1 d.f. is significant at p-value corrected for number of comparisons (0.05/28).

norms. Reliability of network ties improved from 0.81 to 0.88 by deleting CP10 and for shared norms reliability improved from 0.87 to 0.91 by eliminating CP26. Though, there would be some improvement in alpha by eliminating these items, they would reduce the number of items for network ties to two and for shared norms to three. Hence, they were retained for the large scale and the item wording and the content were further examined for modification so as to better represent the construct.

5.4 Work Characteristics Instrument

First, the scales were purified based on the corrected item-total correlation (CITC) of the items with their respective scales to eliminate so called garbage items. The Table 5.4.1 shows the CITC for items within each proposed constructs. Items with CITC less than 0.60 were identified as potential candidates for elimination. Items that had a CITC score between 0.50 and 0.60 were marked for further investigation of the item content and wording or were retained if number of items for a scale dropped below three. If items are decided to be dropped based on the CITC, they are done so step by step. That is, the item with the lowest CITC score is first selected to be eliminated, once the item is decided to be dropped, CITC scores for the rest of the items are recomputed for further evaluation.

Both cognitive effort and virtualness scales had items with good CITC values in the first step. WC14 & WC16 in the virtualness scale were the only items that had CITC values less than 0.60. CITC scores were computed a second time by eliminating WC16 because it had the lowest value (0.40) and examination of item wording indicated ambiguity in its interpretation. All items had reasonable CITC in the second step and the scales are ready to be evaluated for unidimensionality.

Table 5.4.1: CITC for Work Characteristics

Construct	Label	Items	Step 1 CITC	Step 2 CITC
Cognitive Effort	WC6	My work required considerable thought	0.85	
	WC7	My work required significant amount of reasoning	0.76	
	WC8	My work required significant amount of knowledge	0.78	
	WC9	My work involved intense thinking	0.87	
	WC10	My work involved complex analysis	0.84	
	WC11	My work was mentally challenging	0.78	
Virtualness	WC12	My work involved work processes that had to be enacted through computers	0.72	0.74
	WC13	My work involved tasks that depended on computers	0.74	0.78
	WC14	My work would have been difficult to perform without computers	**0.58**	0.64
	WC15	My work had processes embedded in computers	0.70	0.70
	WC16	My work was virtual rather than real	**0.40**	-
	WC17	My work was mostly mediated by computers	0.73	0.70

To test for the unidimensionality, each scale was factor analyzed separately with their corresponding items that are retained after purification. All items for the respective scales loaded on a single factor and had a factor score above 0.60 indicating good unidimensionality. Respondent to item ratio for cognitive effort and virtualness scales were 8 and 10 respectively.

Convergent and discriminant validity of the scales are assessed in the pilot stage based on factor analysis and through Campbell and Fiske's (1959) correlation matrix analysis of the measurement items (Chau, 1997). A confirmatory factor analysis and a pair-wise measurement model comparison using structural equation measurement modeling is evaluated following the two methods to further assess convergent and discriminant validity.

Table 5.4.2: Work Characteristics Scales Factor Analysis

Pattern Matrix[a]

	Factor	
	1	2
WC9	.969	
WC6	.913	
WC10	.834	
WC8	.783	
WC7	.773	
WC11	.754	
WC12		.882
WC13		.806
WC17		.758
WC15		.681
WC14		.648

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.
a. Rotation converged in 4 iterations.

Factor Correlation Matrix

Factor	1	2
1	1.000	.389
2	.389	1.000

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.

Factor analysis is conducted with all items that are retained so far from cognitive effort and virtualness, using maximum likelihood extraction method with oblimin rotation. The Tables 5.4.2 shows the factor structure and the factor correlations between the two scales. Factor loadings below 0.30 are suppressed for easier interpretation of the factor structure.

All the items related to cognitive effort and virtualness loaded with their respective scales when factored together indicating evidence for convergent validity (Table 5.4.2). The lowest loading for cognitive effort is 0.754 (WC11) and for virtualness is 0.648 (WC14) both of which are above the 0.60 level. There were no crossloadings above 0.30 between the two scales indicating some evidence for discriminant validity.

To further assess convergent and discriminant validity of the two work characteristic scales using the correlation matrix analysis in the MTMM style, it was decided to be conducted along with other independent scales in the individual characteristics section. Ability of a scale to discriminate well with more number of other similar scales (ie., independent scales in this context) indicate a better measure of discriminant validity. Hence, the result of this analysis is reported in the next section along with the results of individual characteristics.

Since the scales provide good convergent and discriminant validity based on factor analysis (in this section), and correlation analysis and structural equation modeling (reported in the next section), the reliabilities of the scales are evaluated. The scale reliabilities (Chronbach's alpha) are as follows: cognitive effort (0.92) and virtualness (0.85). The reliability scores were satisfactory for this stage of the research. Deleting the items from the scales did not have any significant improvements in their reliability scores.

5.5 Empowerment Instrument

Before testing for unidimensionality, convergent and discriminant validity, and reliability, the scales were purified based on the corrected item-total correlation (CITC) scores. The Table 5.5.1 shows the CITC for items within each proposed constructs. Items with CITC less than 0.60 were identified as potential candidates for elimination. Items that had a CITC score between 0.50 and 0.60 were marked for further investigation of the item content and wording or were retained if number of items for a scale dropped below three. If items are decided to be dropped based on the CITC, they are done so step by step. That is, the item with the lowest CITC score is first selected to be eliminated, once the item is decided to be dropped, CITC scores for the rest of the items are recomputed for further evaluation.

Most of the items for the scales in this section were based on Spritzer's (1996) instrument for Empowerment, but a few extra items were added since each scale had only three items initially. All scales in this section had items with CITC scores above 0.60 except IC9-"I had the required knowledge to do my job" (0.51) in competence scale. Upon closer examination of the item it was decided to drop the item because, required knowledge to do the job might be a prerequisite to be competent in one's job. Further, this was one of the new items that were added to the original items for this scale. A re-evaluation of this scale without IC9 indicated satisfactory CITC scores.

To test for the unidimensionality, each scale was factor analyzed separately with their corresponding items that are retained after purification. All items for the respective scales loaded on a single factor and had a factor score above 0.60 indicating unidimensionality. Respondent to item ratio for 3-item, 4-item, 5-item, and 6-item scales in this section were 17, 13, 10, and 8 respectively.

Convergent and discriminant validity of the scales are assessed based on factor analysis and through Campbell and Fiske's (1959) correlation matrix analysis of the measurement items (Chau, 1997). A confirmatory factor analysis and a pair-wise measurement model comparison using structural equation measurement modeling is evaluated following the two methods to further assess convergent and discriminant validity.

First, Factor analysis is conducted with all items that are retained so far from the scales in this section using maximum likelihood extraction method with oblimin rotation. The Table 5.5.3 shows the final factor structure and the factor correlations between the scales. Factor loadings below 0.30 are suppressed for easier interpretation of the factor structure.

All the items related to the scales in this section loaded with their respective scales when factor analyzed together except IC15 and IC16. Both the items loaded with self-determination (or Autonomy) and had relatively low loading (Table 5.5.2). IC15 &

Table 5.5.1: CITC for Empowerment:

Construct	Label	Items	Step 1 CITC	Step 2 CITC
Autonomy	IC1	I had autonomy in determining how I did my job	0.76	
	IC2	I could decide on my own how to go about doing my work	0.84	
	IC3	I had opportunity for independence in how I did my job	0.83	
	IC4	I had freedom in how I did my job	0.81	
	IC5	I had choice in how I did my job	0.89	
Self-Efficacy	IC6	I was confident about my ability to do my job	0.76	0.75
	IC7	I was self-assured about my capabilities to perform my work activities	0.77	0.82
	IC8	I had mastered the skills necessary to do my job	0.82	0.79
	IC9	I had the required knowledge to do my job well	**0.51**	-
	IC10	I was confident about my knowledge for my tasks	0.70	0.77
Impact	IC11	I had impact on what happened in my department	0.77	
	IC12	I had control over what happened in my department	0.88	
	IC13	I had influence over what happened in my department	0.87	
	IC14	I had impact over the strategic outcomes of my job	0.73	
	IC15	I had impact over the administrative job outcomes	0.68	
	IC16	I had impact over the operational job outcomes	0.70	
Meaning	IC17	the work I did was important to me	0.89	
	IC18	my job activities were personally meaningful to me	0.89	
	IC19	the work I did was meaningful to me	0.85	

IC16 was not part of the original instrument. These items were newly generated for the impact dimension of empowerment based on the definition of this dimension. The items are: IC15- I had impact over the administrative job outcomes, and IC16-I had impact over the operational job outcomes. Both these items loaded with autonomy scale and their loading was relatively small. It may be that knowledge workers may not feel that they have impacted significantly by just contributing to the operational and administrative aspects of their job, rather, it may simply be indicative of the fact that they have sufficient autonomy to impact operational and administrative aspects of their job. Hence, these two items are deleted from further analysis.

Table 5.5.2: Empowerment Scales Factor Analysis (Initial)

Pattern Matrix[a]

	Factor			
	1	2	3	4
IC4	.920			
IC5	.838			
IC2	.778			
IC3	.758			
IC16	.656			
IC1	.651			
IC15	.595			
IC12		-.922		
IC13		-.893		
IC14		-.696		
IC11		-.669		
IC19			.937	
IC17			.880	
IC18			.830	
IC8				.890
IC7				.813
IC10				.719
IC6				.684

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 12 iterations.

Factor analysis was done a second time without these items, and all items loaded with their specific scales and factor loadings above 0.60. One item, IC3 had a cross loading of 0.308 with impact. This was part of an item in the original scale developed by Spritzer (1996). Closer examination indicated that the item could have been worded in a simpler manner. For example, the original item, "I had opportunity for independence in how I did my job" could be worded in a simplified form, "I had independence in how I

Table 5.5.3: Empowerment Scales Factor Analysis (Final)

Pattern Matrix [a]

	Factor			
	1	2	3	4
IC12	.954			
IC13	.941			
IC11	.714			
IC14	.713			
IC8		.872		
IC10		.779		
IC7		.779		
IC6		.722		
IC19			-.924	
IC17			-.902	
IC18			-.861	
IC4				-.904
IC5				-.896
IC2				-.807
IC1				-.615

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 9 iterations.

Factor Correlation Matrix

Factor	1	2	3	4
1	1.000	.352	-.517	-.462
2	.352	1.000	-.261	-.596
3	-.517	-.261	1.000	.473
4	-.462	-.596	.473	1.000

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.

did my job" and may measure autonomy more directly. This item is removed from further analysis at this stage and the modified form will be used in the large scale. The result of the final factor analysis eliminating IC15, IC16 and IC3 is shown in Table 5.5.3.

All the items related to the specific scales loaded on their respective scales when factored together indicating evidence for convergent validity (Table 5.5.3). The lowest loading for autonomy is 0.615 (IC1), for self-efficacy it is 0.722 (IC6), for impact it is 0.713 (IC14), and for meaning it is 0.861 (IC18), all of which are above the 0.60 level. There were no crossloadings above 0.30 between the scales in the final structure indicating some evidence for discriminant validity.

To further assess convergent and discriminant validity, a correlation matrix is generated with all the retained items for the scales in this section and for cognitive effort and virtualness. High inter-item correlation within each construct indicates convergent validity. Degree to which the measures of a construct do not correlate well with measures of other constructs indicate evidence for discriminant validity (Chau, 1997). Table 5.5.4 shows the correlation between all items for the scales in this section. The smallest within construct correlations are: Cognitive effort (0.62), Virtualness (0.46), Autonomy (0.66), Self-efficacy (0.64), Impact (0.61), and Meaning (0.82). These correlations are bolded and occur in the diagonal triangle in the table. All inter-item correlations were significant ($p<0.001$). The results give good support for convergent validity

Discriminant validity is evaluated by observing the number of violations for each of the items and the total number of violation for a particular construct from the correlation matrix. A correlation of an item with other items outside of the construct, that is greater than the lowest correlation of that item within the construct, is counted as a

Table 5.5.4: Correlation Matrix: Convergent and Discriminant Validity of Work Characteristics and Empowerment Constructs

	Cognitive Effort						Virtualness					Autonomy				Self-efficacy				Percieved Impact				Meaning			
	WC6	WC7	WC8	WC9	WC10	WC11	WC12	WC13	WC14	WC15	WC17	IC1	IC2	IC4	IC5	IC6	IC7	IC8	IC10	IC11	IC12	IC13	IC14	IC17	IC18	IC19	
WC6	1.00																										
WC7	0.68	1.00																									
WC8	0.82	0.64	1.00																								
WC9	0.80	0.70	0.70	1.00																							
WC10	0.76	0.67	0.69	0.82	1.00																						
WC11	0.65	0.70	**0.62**	0.75	0.73	1.00																					
WC12	0.09	0.16	0.19	0.05	0.25	0.26	1.00																				
WC13	0.32	0.34	0.41	0.24	0.43	0.40	0.68	1.00																			
WC14	0.32	0.24	0.31	0.23	0.35	0.48	0.63	0.54	1.00																		
WC15	0.43	0.37	0.52	0.29	0.51	0.50	0.52	0.70	0.52	1.00																	
WC17	0.10	0.21	0.24	0.18	0.34	0.23	0.64	0.60	**0.46**	0.60	1.00																
IC1	0.52	0.39	0.41	0.39	0.37	0.44	-0.14	0.11	0.00	0.29	-0.06	1.00															
IC2	0.33	0.40	0.38	0.21	0.21	0.33	0.00	0.21	0.01	0.30	-0.01	0.70	1.00														
IC4	0.26	0.18	0.26	0.13	0.18	0.29	-0.22	0.03	-0.01	0.22	-0.09	**0.66**	0.74	1.00													
IC5	0.41	0.34	0.40	0.18	0.22	0.33	0.00	0.19	0.08	0.28	-0.07	0.71	0.83	0.81	1.00												
IC6	0.20	0.16	0.24	-0.01	0.01	0.08	0.12	0.21	0.10	0.13	-0.06	0.56	0.55	0.36	0.54	1.00											
IC7	0.26	0.21	0.29	0.01	0.09	0.16	0.04	0.16	0.21	0.24	-0.08	0.57	0.53	0.49	0.59	0.71	1.00										
IC8	0.31	0.26	0.35	0.17	0.24	0.24	0.11	0.28	0.22	0.41	-0.04	0.49	0.52	0.36	0.50	**0.64**	0.77	1.00									
IC10	0.06	-0.04	0.05	-0.08	0.05	0.05	0.00	0.18	0.11	0.25	0.00	0.45	0.55	0.50	0.48	0.68	0.68	0.71	1.00								
IC11	0.27	0.17	0.27	0.17	0.15	0.18	-0.23	-0.15	-0.05	0.08	-0.16	0.33	0.39	0.52	0.44	0.30	0.32	0.19	0.25	1.00							
IC12	0.30	0.29	0.22	0.16	0.13	0.19	-0.22	-0.07	-0.13	0.06	-0.31	0.39	0.36	0.40	0.45	0.39	0.42	0.34	0.24	0.80	1.00						
IC13	0.41	0.39	0.37	0.27	0.22	0.29	-0.17	-0.03	-0.04	0.06	-0.28	0.46	0.40	0.41	0.52	0.43	0.44	0.32	0.18	0.77	0.91	1.00					
IC14	0.41	0.44	0.36	0.36	0.29	0.38	-0.20	0.00	-0.04	0.07	-0.22	0.52	0.43	0.26	0.41	0.45	0.46	0.34	0.26	**0.61**	0.76	0.76	1.00				
IC17	0.28	0.19	0.24	0.17	0.13	0.14	-0.31	-0.22	-0.22	-0.05	-0.30	0.35	0.43	0.48	0.46	0.27	0.36	0.25	0.31	0.57	0.47	0.49	0.44	1.00			
IC18	0.26	0.31	0.21	0.17	0.10	0.19	-0.27	-0.12	-0.20	0.01	-0.29	0.46	0.49	0.45	0.50	0.37	0.38	0.27	0.30	0.50	0.50	0.51	0.52	0.88	1.00		
IC19	0.25	0.29	0.20	0.18	0.15	0.25	-0.27	-0.19	-0.10	0.05	-0.21	0.24	0.33	0.38	0.34	0.05	0.29	0.21	0.16	0.51	0.47	0.39	0.42	**0.82**	0.82	1.00	
	WC6	WC7	WC8	WC9	WC10	WC11	WC12	WC13	WC14	WC15	WC17	IC1	IC2	IC4	IC5	IC6	IC7	IC8	IC10	IC11	IC12	IC13	IC14	IC17	IC18	IC19	
Mean	3.96	3.92	4.09	3.83	3.72	4.00	4.09	4.17	4.57	3.83	3.57	5.40	5.81	5.58	5.60	5.79	5.62	5.60	5.79	5.15	4.58	4.91	5.11	5.26	5.28	5.43	
SD	0.90	0.87	0.84	1.01	1.08	0.85	1.02	0.89	0.75	1.09	1.07	1.45	1.21	1.25	1.31	1.13	1.00	1.04	0.95	1.38	1.93	1.56	1.44	1.42	1.51	1.35	Total
No Vio	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
																											558

violation. Number of violations less than one-half of the possible violations for an item is considered acceptable (Campbell and Fiske, 1959). In the above correlation table (Table 5.5.4), 1 violation out of the 558 were observed, indicating evidence for discriminant validity between the above scales.

To assess the convergent validity using structural equation modeling, LISREL Measurement model for each constructs were evaluated. Item WC6 was eliminated at this stage due to the error correlation with other items in the construct. Similarly, error component of WC15 was correlated with errors of WC12 and WC13. This item, "my work had processes embedded in computers" could be better modified to "my work processes were embedded in computers", which modifies it to imply that most processes were embedded in computers, as the construct intents to measure. The model-data fit statistics are shown in Table 5.5.5, indicating good convergent validity.

Table 5.5.5: Model-Data Fit Indices of Work Characteristics and Empowerment Scales

Construct	**Chi-Square**	**DF**	**p-value**	**RMSEA**	**GFI**	**AGFI**	**NNFI**	**CFI**	**# of Items**
Cognitive	2.91	5	0.713	0.000	0.98	0.93	1.01	1.00	5
Virtual	2.92	2	0.232	0.094	0.97	0.86	0.98	0.99	4
Autonomy	1.52	2	0.459	0.000	0.99	0.93	1.01	1.00	4
Self-efficacy	9.69	2	0.008	0.272	0.91	0.57	0.86	0.95	4
Impact	0.77	2	0.679	0.000	0.99	0.96	1.02	1.00	4
Meaning			1.000						3
ALL	188.8	174	0.210	0.040	0.74	0.66	0.92	0.93	24

The results of the discriminant validity using pair-wise LISREL test for Work characteristics and Empowerment constructs are reported in Table 5.5.6. the chi-square difference between the models were the construct correlations are set to free and set to one ranges from 101 to 190 indicating good discriminant validity. The average variance extracted (AVE), Pearson correlation between the constructs (*r*) and the reliabilities (α) are also shown in the same table.

Next, the reliabilities of the scales in this section are evaluated. The reliabilities (Chronbach's alpha) are as follows: Autonomy (0.92), Self-efficacy (0.90), Impact (0.93), and Meaning (0.94). The reliability scores were excellent for this stage of the research. Deleting the items from the scales did not have any substantial improvements in their reliability scores.

Table 5.5.6: Reliability and Discriminant Validity of Work Characteristics and Empowerment Scales

	Cognitive	Virtual	Autonomy	Self-efficacy	Impact	Meaning
Cognitive	AVE=0.80 α=0.92					
Virtual	*r=0.37*** χ^2= 133	AVE=0.71 α=0.85				
Autonomy	*r=0.38*** χ^2= 190	*r=0* χ^2= 136	AVE=0.81 α=0.92			
Self-efficacy	*r=0.16* χ^2= 169	*r=0.12* χ^2= 143	*r=0.64*** χ^2= 127	AVE=0.80 α=0.90		
Impact	*r=0.32** χ^2= 188	*r=-0.21* χ^2= 140	*r=0.51*** χ^2= 144	*r=0.42*** χ^2= 157	AVE=0.84 α=0.93	
Meaning	*r=0.23* χ^2= 110	*r=-0.29** χ^2= 138	*r=0.48*** χ^2= 104	*r=0.32** χ^2= 159	*r=0.56*** χ^2= 101	AVE=0.88 α=0.94

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).
χ^2> 8.62 for 1 d.f. is significant at p-value corrected for number of comparisons (0.05/15).

5.6 IT Support Instrument

First, the scales are purified based on the corrected item-total correlation (CITC) scores. The Table 5.6.1 shows the CITC for items within each proposed constructs. Items with CITC less than 0.60 were identified as potential candidates for elimination. Items that had a CITC score between 0.50 and 0.60 were marked for further investigation of the item content and wording or were retained if number of items for a scale dropped below three. If items are decided to be dropped based on the CITC, they are done so step by step. That is, the item with the lowest CITC score is first selected to be eliminated, once the item is decided to be dropped, CITC scores for the rest of the items are recomputed for further evaluation.

Total of four items had CITC scores less than 0.60, and were eliminated at this stage. IT10 from accumulate, IT22 and IT24 from informate, and IT28 from automate were the items that were removed. The CITC for each item at each step is shown in Table 5.6.1. A re-evaluation of this scale without the eliminated items indicated satisfactory CITC scores to proceed to the next step to evaluate unidimensionality.

To test for unidimensionality, each scale was factor analyzed separately with their corresponding items that are retained after purification. All items for the respective scales loaded on a single factor and had a factor score above 0.60 indicating unidimensionality. Respondent to item ratio for 4-item, 5-item, and 6-item scales in this section were 13, 10, and 8 respectively.

Convergent and discriminant validity of the scales are assessed based on factor analysis and through Campbell and Fiske's (1959) correlation matrix analysis of the measurement items (Chau, 1997). A confirmatory factor analysis and a pair-wise

Table 5.6.1: CITC for IT Support:

Construct	Label	Items	Step 1 CITC	Step 2 CITC	Step 3 CITC
Stimulate	IT1	come up with new ideas	0.75		
	IT2	think through problems	0.80		
	IT3	gain new knowledge	0.80		
	IT4	generate new information	0.85		
	IT5	stimulate my thinking	0.85		
	IT6	create new knowledge	0.84		
Accumulate	IT7	store knowledge that I created	0.84	0.86	
	IT8	capture the required information	0.69	0.61	
	IT9	organize my knowledge	0.80	0.80	
	IT10	capture my know-how	**0.56**	-	
	IT11	retain the required information in my mind	0.62	0.64	
	IT12	store my ideas	0.72	0.78	
Communicate	IT13	share my insights	0.91		
	IT14	share my know-how	0.78		
	IT15	communicate what I know	0.91		
	IT16	share my ideas	0.94		
	IT17	communicate with other people	0.89		
	IT18	transfer my knowledge	0.81		
Informate	IT19	become more informed	0.74	0.70	0.76
	IT20	access needed information	0.73	0.74	0.69
	IT21	access other's knowledge	0.63	**0.59**	0.64
	IT22	access relevant company data	**0.43**	**0.50**	-
	IT23	to retrieve information form various sources	0.69	0.67	0.62
	IT24	remember the required information	**0.40**	-	-
Automate	IT25	automate my work processes	0.84	0.85	
	IT26	automate my decision-making process	0.62	0.65	
	IT27	implement my ideas	0.69	0.61	
	IT28	apply my knowledge at work	**0.58**	-	
	IT29	automate things I had to do	0.79	0.79	
	IT30	automate my problem-solving tasks	0.74	0.77	

measurement model comparison using structural equation measurement modeling is evaluated following the two methods to further assess convergent and discriminant validity.

Factor analysis is conducted with items for the stimulate and communicate scales separately from that of accumulate, informate and automate scales. This is done so because possible relationship between accumulate and stimulate and communicate may be expected. For example, a system that does not allow users to Store and Organize (Accumulate) the required information may not be much help in thinking through the problems and to disseminate the ideas that would have been generated or acquired. The Table 5.6.2 shows the final factor structure for stimulate and communicate and the factor correlations between those scales. The Table 5.6.3 shows the final factor structure for accumulate, informate, and automate and the factor correlations between those scales. Factor loadings below 0.30 are suppressed for easier interpretation of the factor structure.

All the items related to the scales in this section loaded with their respective scales when factor analyzed together. IT1-"the above applications have helped me come up with new ideas" is deleted at this stage because of low factor loading (0.582) with its scale, stimulate. "Coming up with new ideas" may be better viewed as the result of information systems that "stimulates" thinking rather than the process itself. The results of the factor analysis without item IT1 is shown in Table 5.6.2. All items had a factor loading greater than 0.60 with their respective scales. Lowest loading for stimulate is 0.652 (IT5), and for communicate it is 0.681 (IT14), indicating some evidence for convergent validity. There were no crossloadings above 0.30 between the scales in the final structure indicating some evidence for discriminant validity.

Similarly, items from accumulate, informate, and automate were factor analyzed together. IT8 had a crossloading above 0.30 with informate and low factor loading (0.424). IT27 Also had a crossloading of 0.472 with informate and low factor loading (0.440). These items seem to be too broad in what they are trying to measure. Hence, they are deleted and factor analysis was re-run. Factor structure of the analysis is shown in Table 5.6.3. Items IT11 and IT26 had loadings less than 0.60, and item IT9 had a crossloading with informate scale. Due to the low number of items for each scale they are retained in this stage, and are further investigated as to how they could be improved on for the large scale survey. No other items had crossloadings above 0.30 or factor loadings below 0.60 indicating reasonable evidence for convergent and discriminant validity between the three scales.

Table 5.6.2: Stimulate and Communicate Scales Factor Analysis

Pattern Matrix[a]

	Factor	
	1	2
IT16	1.008	
IT15	.987	
IT17	.943	
IT13	.829	
IT18	.782	
IT14	.681	
IT6		.974
IT4		.936
IT3		.805
IT2		.777
IT5		.652

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.
a. Rotation converged in 4 iterations.

Factor Correlation Matrix

Factor	1	2
1	1.000	.641
2	.641	1.000

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.

Correlation matrix in the MTMM style is developed to assess convergent and discriminant validity between the IT Support scales. Table 5.6.4 shows the correlation between all items for the scales in this section. The smallest within construct correlations are: Stimulate (0. 59), Accumulate (0. 55), Communicate (0. 61), Informate (0. 42), and Automate (0. 50). These correlations are bolded and occur in the diagonal triangle in the table. All inter-item correlations were significant ($p<0.000$), except for one item in informate, which was significant at $p< 0.001$. The results indicate some evidence for convergent validity.

Table 5.6.3: Factor Analysis for Accumulate, Informate and Automate

Pattern Matrix[a]

	Factor		
	1	2	3
IT29	.965		
IT25	.931		
IT30	.637		
IT26	.581		
IT12		-.971	
IT7		-.894	
IT9		-.725	.370
IT11		-.492	
IT19			.903
IT21			.686
IT20			.674
IT23			.644

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.
a. Rotation converged in 7 iterations.

Factor Correlation Matrix

Factor	1	2	3
1	1.000	-.395	.511
2	-.395	1.000	-.466
3	.511	-.466	1.000

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.

Table 5.6.4: Correlation Matrix: Convergent and Discriminant Validity of IT Support Constructs

	Stimulate					Accumulate				Communicate						Informate				Automate				
	IT2	*IT3*	*IT4*	*IT5*	*IT6*	*IT7*	*IT9*	*IT11*	*IT12*	*IT13*	*IT14*	*IT15*	*IT16*	*IT17*	*IT18*	*IT19*	*IT20*	*IT21*	*IT23*	*IT25*	*IT26*	*IT29*	*IT30*	
IT2	1.00																							
IT3	**0.59**	1.00																						
IT4	0.84	0.71	1.00																					
IT5	0.72	0.75	0.72	1.00																				
IT6	0.75	0.78	0.84	0.70	1.00																			
IT7	0.52	0.39	0.47	0.53	0.42	1.00																		
IT9	0.61	0.50	0.59	0.57	0.54	0.76	1.00																	
IT11	0.61	0.52	0.44	0.65	0.46	0.62	0.59	1.00																
IT12	0.40	0.32	0.40	0.48	0.31	0.86	0.75	**0.55**	1.00															
IT13	0.56	0.60	0.57	0.69	0.58	0.70	0.85	0.62	0.75	1.00														
IT14	0.63	0.46	0.51	0.56	0.54	0.59	0.83	0.50	0.52	0.77	1.00													
IT15	0.52	0.41	0.49	0.55	0.45	0.74	0.84	0.56	0.74	0.84	0.79	1.00												
IT16	0.58	0.49	0.52	0.63	0.48	0.76	0.82	0.65	0.79	0.88	0.75	0.91	1.00											
IT17	0.55	0.42	0.51	0.59	0.43	0.75	0.81	0.58	0.75	0.84	0.69	0.82	0.89	1.00										
IT18	0.55	0.52	0.57	0.60	0.45	0.64	0.74	0.50	0.73	0.77	**0.61**	0.76	0.82	0.79	1.00									
IT19	0.60	0.69	0.56	0.69	0.54	0.37	0.55	0.48	0.27	0.55	0.50	0.46	0.51	0.55	0.51	1.00								
IT20	0.43	0.36	0.47	0.48	0.32	0.33	0.38	0.19	0.26	0.36	0.40	0.38	0.35	0.40	0.48	0.60	1.00							
IT21	0.47	0.56	0.46	0.55	0.41	0.34	0.39	0.39	0.20	0.42	0.38	0.27	0.40	0.40	0.42	0.66	0.58	1.00						
IT23	0.46	0.38	0.40	0.47	0.40	0.40	0.59	0.29	0.37	0.52	0.54	0.52	0.51	0.58	0.47	0.62	0.57	**0.42**	1.00					
IT25	0.48	0.42	0.48	0.39	0.48	0.38	0.31	0.40	0.31	0.35	0.24	0.33	0.40	0.35	0.29	0.50	0.33	0.45	0.40	1.00				
IT26	0.39	0.42	0.34	0.31	0.55	0.37	0.35	0.42	0.28	0.38	0.41	0.42	0.40	0.35	0.30	0.36	0.09	0.23	0.42	0.62	1.00			
IT29	0.43	0.32	0.46	0.35	0.38	0.34	0.23	0.33	0.28	0.27	0.14	0.27	0.32	0.27	0.24	0.42	0.30	0.40	0.25	0.87	**0.50**	1.00		
IT30	0.47	0.37	0.39	0.37	0.48	0.47	0.32	0.42	0.36	0.39	0.37	0.39	0.41	0.37	0.34	0.37	0.34	0.30	0.49	0.63	0.76	0.64	1.00	
	IT2	*IT3*	*IT4*	*IT5*	*IT6*	*IT7*	*IT9*	*IT11*	*IT12*	*IT13*	*IT14*	*IT15*	*IT16*	*IT17*	*IT18*	*IT19*	*IT20*	*IT21*	*IT23*	*IT25*	*IT26*	*IT29*	*IT30*	
Mean	3.43	3.72	3.74	3.55	3.51	3.98	3.94	3.64	3.91	3.74	3.98	3.91	3.81	3.94	3.92	3.77	4.21	3.77	4.00	3.62	3.13	3.57	3.26	
SD	1.35	1.20	1.27	1.15	1.27	1.03	1.15	1.04	1.04	1.23	1.17	1.16	1.14	1.22	1.05	1.10	0.86	1.09	1.21	1.27	1.18	1.23	1.24	Total
No Viol	4	2	0	5	0	5	7	6	5	1	2	1	3	3	3	2	0	5	10	0	1	0	0	65
total	18	18	18	18	18	19	19	19	19	17	17	17	17	17	17	19	19	19	19	19	19	19	19	420

Discriminant validity is evaluated by observing the number of violations for each of the items and the total number of violation for a particular construct from the correlation matrix. A correlation of an item with other items outside of the construct, that is greater than the lowest correlation of that item within the construct, is counted as a violation. Number of violations less than one-half of the possible violations for an item is considered acceptable (Campbell and Fiske, 1959). In the above correlation table (Table 5.6.4), 65 violation out of the 420 were observed. Item IT23 (of Informate) had 10 violations out of 19. Out of the 65 violations, most of them were observed in accumulate (23) and in informate (17) scales. This could be explained because of their conceptual relationship with other scales. Number of violations is still well below half the possible violations indicating some evidence for discriminant validity between the scales. IT23 is subjected to further investigation and modification if needed.

Convergent validity using structural equation modeling is assessed by evaluating the LISREL measurement model for each constructs with the items that are not subjected to modification or elimination so far. Items IT3, IT7, IT14 and IT30 were eliminated at this stage due to the correlated errors of these items with other items in their respective measurement model. These items were either too abstract or broad as compared to other items within each construct. In item IT7 "the above applications have helped me store knowledge that I created", the storage of knowledge is contingent on creation of knowledge rather than focusing on storage alone. Item IT13 is retained in spite of its error correlation with another item in the same construct because being able to share the insights is an important aspect of being able to share one's knowledge. The model data fit indices are shown in Table 5.6.5. Results indicate reasonable convergent validity.

Table 5.6.5: Model-Data Fit Indices of IT Support Scales

Construct	Chi-Square	DF	p-value	RMSEA	GFI	AGFI	NNFI	CFI	# of Items
Stimulate	3.64	2	0.162	0.126	0.97	0.83	0.97	0.99	4
Accumulate	1.14	2	0.567	0.000	0.99	0.95	1.02	1.00	4
Communicate	13.29	5	0.021	0.179	0.91	0.72	0.96	0.98	5
Informate	6.85	2	0.033	0.216	0.94	0.69	0.86	0.95	4
Automate	0	0	1.000	-	-	-	-	-	3

The results of the discriminant validity using pair-wise LISREL test for IT Support is shown in Table 5.6.6. the chi-square difference between the models were the construct correlations are set to free and set to one ranges from 24 to 127 indicating reasonable discriminant validity, except between Accumulate and Communicate which had a chi-square difference of 1.29. Many items within the Accumulate construct have already been suggested to be modified or is regenerated which may help it better discriminate between the constructs in the large scale. The average variance extracted (AVE), Pearson correlation between the constructs (r) and the reliabilities (α) are also shown in Table 5.6.6.

Next, the reliabilities of the scales in this section are evaluated. The reliabilities (Chronbach's alpha) of the scales in this section are as follows: Stimulate (0. 93), Accumulate (0. 89), Communicate (0. 98), Informate (0. 90), and Automate (0. 90). All reliabilities are in the acceptable range. Deleting the items from the scale did not have any significant improvement in the scale reliabilities except for accumulate scale, whose reliability increased to 0.92 if IT11 could be deleted. Item IT11 was identified earlier for low factor loading also. Rather than delete the item, it is examined to see if it can be modified to better reflect the construct.

Table 5.6.6: Reliability and Discriminant Validity of IT Support Scales

	Stimulate	Accumulate	Communicate	Informate	Automate
Stimulate	AVE=0.82 α=0.93				
Accumulate	*r=0.74*** χ^2= 24	AVE=0.67 α=0.84			
Communicate	*r=0.64*** χ^2= 127	*r=0.88*** χ^2=1.29	AVE=0.90 α=0.96		
Informate	*r=0.64*** χ^2= 92	*r=0.58*** χ^2= 71	*r=0.60*** χ^2= 84	AVE=0.69 α=0.84	
Automate	*r=0.53*** χ^2= 46	*r=0.43*** χ^2= 74	*r=0.40*** χ^2= 58	*r=0.49*** χ^2= 71	AVE=0.80 α=0.86

**Correlation is significant at the 0.01 level (2-tailed).
χ^2> 7.88 for 1 d.f. is significant at p-value corrected for number of comparisons (0.05/10).

5.7 Knowledge Management Practices Instrument

Knowledge management practices instrument that was developed in the pilot did not discriminate well between the scales in this instrument, although, they showed no evidence for not being unidimensional. Factor analysis of the items after purification failed to yield meaningful factors (Table 5.7.1). Further examination of these items revealed that many items were trying to measure multiple aspects of knowledge management practices within a single item. New set of items that distinctly reflect each dimension of knowledge management practices were needed in order to have good scales that discriminate well. New items were generated based on the content area represented by old items for each construct. Pre-testing the new instrument before the large scale was important, since it would help in identifying any further problem area, and in developing psychometrically sound instrument for knowledge management practices.

Table 5.7.1: Knowledge Management Practices Scales Factor Analysis (Pilot-1)

Pattern Matrix[a]

	Factor			
	1	2	3	4
KM6	1.057			
KM7	.746			
KM3	.705			
KM11	.649			
KM15	.605		.423	
KM5	.592			
KM12	.518			.319
KM4	.509			
KM14	.447			.440
KM28		-.860		
KM26		-.529		
KM25	.350	-.423		.398
KM10			.817	
KM17			.813	
KM19			.777	
KM16			.709	
KM23			.706	
KM22		-.340	.667	
KM8			.657	
KM13			.437	
KM18			.408	
KM9			.376	
KM1				.606
KM30			.339	.581
KM29			.425	.519
KM27		-.313		.493
KM2				.389

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 15 iterations.

Factor Correlation Matrix

Factor	1	2	3	4
1	1.000	-.359	.570	.551
2	-.359	1.000	-.443	-.373
3	.570	-.443	1.000	.503
4	.551	-.373	.503	1.000

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.

The new instrument for knowledge management practices is re-piloted among university students, since they are involved in the full spectrum of creating, retrieving, sharing, storing, and applying knowledge and can be compared to knowledge intensive workers from this perspective. The items were slightly modified to focus their attention to the behaviors they engaged in creating, retrieving, sharing, storing, and applying their knowledge for a particular course work during the entire semester. This could be comparable to the questions directed to the knowledge workers in asking about similar behaviors they have engaged in during a particular assignment or project. The questionnaire used to conduct the re-pilot for this section is shown in Appendix D. A total of 93 responses were received for the analysis at this stage.

The new data from the second pilot were subjected to the same sequence of analysis involving purification, check for unidimentionality, convergent and discriminant validity, and reliability. First, the scales were purified based on the corrected item-total correlation (CITC) scores. The Table 5.7.2 shows the CITC for items within each proposed constructs. Items with CITC less than 0.60 were identified as potential candidates for elimination. None of the items had a CITC score below 0.60. Hence, all items were retained for further analysis.

To test for the unidimensionality, each scale was factor analyzed separately with their corresponding items that are retained after purification. All items for the respective scales loaded on a single factor and had a factor score above 0.60 indicating unidimensionality. Respondent to item ratio for 7-item, 8-item, and 10-item scales in this section were 13, 11, and 9 respectively.

Convergent and discriminant validity of the scales are assessed based on factor analysis and through Campbell and Fiske's (1959) correlation matrix analysis of the measurement items (Chau, 1997). A confirmatory factor analysis and a pair-wise measurement model comparison using structural equation measurement modeling is evaluated following the two methods to further assess convergent and discriminant validity.

First, Factor analysis is conducted with all items that are retained so far from the scales in this section using maximum likelihood extraction method with oblimin rotation. The Table 5.7.3 shows the final factor structure and the factor correlations between the scales. Factor loadings below 0.30 are suppressed for easier interpretation of the factor structure.

Five factors corresponding to the five constructs emerged when all items in this section were factor analyzed together. Items KMRP1, KMRP34 & KMRP21 had cross loading, and KMRP25 loaded on a different factor. After examining these items, they were decided to be dropped from further analysis. Factor analysis was done a second time with the remaining items. In this stage, item KMRP11 was eliminated because of a low factor score. Item KMRP30 had a crossloading above 0.30 with another construct, and was also decided to be dropped from further analysis. Factor analysis of the remaining items yielded a 5 factor solution without any cross loading above 0.30 and all factor loading on the respective scales greater than 0.60 indicating good convergent and discriminant validity between the scales. The result of the final factor analysis eliminating is shown in Table 5.7.3.

Table 5.7.2: CITC for Knowledge Management Practices (Pilot-2):

Construct	Label	Items	CITC
Create	KMRP1	created new skills	0.73
	KMRP2	created new ideas	0.83
	KMRP3	created new insights	0.86
	KMRP4	created new knowledge	0.66
	KMRP5	created new knowledge relevant to my work	0.75
	KMRP6	created new thinking	0.85
	KMRP7	created new ways of doing things	0.85
	KMRP8	created new ways of interpreting situations	0.79
	KMRP9	created new ways of working	0.80
	KMRP10	created new work methods	0.83
Capture	KMRP11	stored appropriate information	0.78
	KMRP12	stored data related to my work	0.81
	KMRP13	stored important information	0.79
	KMRP14	stored information essential for my work	0.86
	KMRP15	stored information needed for my work	0.84
	KMRP16	stored information that I might need later	0.77
	KMRP17	stored pertinent information	0.83
	KMRP18	stored relevant information	0.87
Share	KMRP19	shared information my co-workers needed	0.78
	KMRP20	shared information with others	0.88
	KMRP21	shared my expertise with others	0.81
	KMRP22	shared my insights with others	0.89
	KMRP23	shared my know-how with others	0.87
	KMRP24	shared my knowledge with others	0.88
	KMRP25	shared techniques relevant to my work	0.60
	KMRP26	shared the work-related knowledge with others	0.83
Access	KMRP27	retrieved required information from various sources	0.85
	KMRP28	retrieved information relevant to my work	0.91
	KMRP29	retrieved information needed for my work	0.87
	KMRP30	retrieved information from external sources	0.81
	KMRP31	retrieved documents essential to my work	0.84
	KMRP32	retrieved data required for my work	0.91
	KMRP33	retrieved work-related information	0.83
Apply	KMRP34	applied my knowledge	0.68
	KMRP35	applied my know-how	0.86
	KMRP36	applied my intuitive thinking skills	0.83
	KMRP37	applied my intuitive judgment	0.90
	KMRP38	applied my insights	0.87
	KMRP39	applied my analytical skills	0.86
	KMRP40	applied my expertise	0.88

Table 5.7.3: Knowledge Management Practices Scales Factor Analysis (Pilot-2)

Pattern Matrix [a]

	Factor				
	1	2	3	4	5
KMRP17	.842				
KMRP13	.745				
KMRP15	.745				
KMRP18	.711				
KMRP12	.668				
KMRP14	.656				
KMRP16	.627				
KMRP3		.958			
KMRP6		.793			
KMRP8		.760			
KMRP9		.758			
KMRP7		.714			
KMRP10		.710			
KMRP2		.708			
KMRP5		.675			
KMRP4		.666			
KMRP37			-.924		
KMRP39			-.831		
KMRP40			-.789		
KMRP35			-.778		
KMRP36			-.720		
KMRP38			-.708		
KMRP24				-.961	
KMRP20				-.888	
KMRP22				-.869	
KMRP23				-.697	
KMRP19				-.644	
KMRP26				-.618	
KMRP32					-.895
KMRP29					-.891
KMRP28					-.843
KMRP31					-.801
KMRP33					-.771
KMRP27					-.660

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 10 iterations.

Factor Correlation Matrix

Factor	1	2	3	4	5
1	1.000	.489	-.377	-.577	-.535
2	.489	1.000	-.469	-.500	-.217
3	-.377	-.469	1.000	.358	.482
4	-.577	-.500	.358	1.000	.485
5	-.535	-.217	.482	.485	1.000

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.

To further assess convergent and discriminant validity, a correlation matrix is generated with all the retained items for the scales in this section. Table 5.7.4 shows the correlation between all items for the scales in this section. The smallest within construct correlations are: Knowledge Creation (0.48), Knowledge Capture (0.57), Knowledge Sharing (0.70), Knowledge Retrieval (0.74), and Knowledge Application (0.72). These correlations are bolded and occur in the diagonal triangle in the table. All within construct correlations were significant at $p< 0.000$, indicating evidence for convergent validity.

Discriminant validity is evaluated by observing the number of violations for each of the items and the total number of violation for a particular construct from the correlation matrix. A correlation of an item with other items outside of the construct, that is greater than the lowest correlation of that item within the construct, is counted as a violation. Number of violations less than one-half of the possible violations for an item is considered acceptable (Campbell and Fiske, 1959).

For correlation of items with measures of other construct, a total of 31 violations out of 918 were observed. Out of the 31 violations, 27 violations were within knowledge creation. This could have been due to the possible relationship between knowledge creation and other knowledge management practices. No single item had more than half of the possible violations. Results indicate some evidence for discriminant validity between the scales.

To access the convergent validity of the knowledge management practices scales using structural equation modeling, all items that is retained at this stage is used for the LISREL measurement model. Based on the modification indices of the measurement model some items are either eliminated or modified in this stage. The remaining items are used for discriminant analysis using pair-wise LISREL analysis. In knowledge creation construct items KMRP2, KMRP3 and KMRP4 items are decided to be eliminated based on the modification indices because of error correlation between other items within the construct. These items upon evaluation were found to be too abstract and general compared to other items with which their errors are correlated. When items can be broadly interpreted, respondents have the opportunity to interpret them in different ways and may not be able to relate to specific occurrences of such behavior.

Similarly, items KMRP12, KMRP15, KMRP19, KMRP31, KMRP27 and KMRP37 were eliminated due to error correlation between the other items of their respective constructs based on the modification indices in the measurement model. In item KMRP27, extra word “required” may be causing some ambiguity in the interpretation of its meaning and was retained for large scale with slight modification. In item KMRP37, “applied intuitive judgment”, may have been interpreted not so much as the application of one’s knowledge, but as a “sudden” intuitive response to particular situation. The Table 5.7.5 shows the model-data fit of knowledge management practices scales. The results indicate good convergent validity of the scales in this section.

The results of discriminant validity using pair-wise LISREL model is shown in Table 5.7.6. The table also shows the average variance extracted (AVE), Pearson correlation between the constructs (r) and the reliabilities (α) for each construct. Item KMRP5 in knowledge creation, crossloads with capture, share, and access constructs and is eliminated from further analysis. The item is “created new knowledge relevant to my

Table 5.7.4: Correlation Matrix: Convergent and Discriminant Validity of Knowledge Management Practices Constructs

	KMRP2	KMRP3	KMRP4	KMRP5	KMRP6	KMRP7	KMRP8	KMRP9	KMRP10	KMRP12	KMRP13	KMRP14	KMRP15	KMRP16	KMRP17	KMRP18	KMRP19	KMRP20	KMRP22	KMRP23	KMRP24	KMRP26
KMRP2	1.00																					
KMRP3	0.72	1.00																				
KMRP4	0.51	0.66	1.00																			
KMRP5	0.70	0.69	0.53	1.00																		
KMRP6	0.74	0.73	0.57	0.69	1.00																	
KMRP7	0.84	0.73	0.49	0.69	0.81	1.00																
KMRP8	0.76	0.72	**0.48**	0.64	0.67	0.72	1.00															
KMRP9	0.64	0.76	0.61	0.61	0.75	0.71	0.66	1.00														
KMRP10	0.76	0.68	0.54	0.65	0.78	0.80	0.70	0.73	1.00													
KMRP12	0.44	0.50	0.48	0.49	0.39	0.47	0.31	0.50	0.47	1.00												
KMRP13	0.38	0.54	0.53	0.48	0.39	0.39	0.31	0.48	0.38	0.76	1.00											
KMRP14	0.38	0.41	0.44	0.51	0.44	0.48	0.34	0.56	0.49	0.71	0.65	1.00										
KMRP15	0.43	0.36	0.48	0.46	0.35	0.44	0.31	0.39	0.39	0.74	0.68	0.76	1.00									
KMRP16	0.47	0.40	0.36	0.50	0.44	0.45	0.40	0.48	0.48	**0.57**	0.62	0.66	0.62	1.00								
KMRP17	0.40	0.41	0.46	0.49	0.45	0.46	0.26	0.52	0.46	0.74	0.72	0.73	0.67	0.71	1.00							
KMRP18	0.48	0.38	0.42	0.51	0.49	0.49	0.32	0.48	0.50	0.70	0.65	0.78	0.76	0.72	0.78	1.00						
KMRP19	0.38	0.27	0.23	0.53	0.40	0.46	0.38	0.41	0.36	0.52	0.38	0.54	0.42	0.57	0.58	0.54	1.00					
KMRP20	0.48	0.40	0.36	0.61	0.51	0.54	0.48	0.54	0.45	0.55	0.42	0.56	0.48	0.53	0.46	0.52	**0.70**	1.00				
KMRP22	0.54	0.41	0.37	0.62	0.50	0.53	0.54	0.53	0.45	0.50	0.43	0.45	0.46	0.56	0.45	0.52	0.73	0.83	1.00			
KMRP23	0.49	0.45	0.38	0.64	0.60	0.58	0.49	0.55	0.46	0.54	0.46	0.47	0.45	0.51	0.53	0.50	0.71	0.80	0.80	1.00		
KMRP24	0.47	0.38	0.34	0.56	0.60	0.57	0.42	0.50	0.51	0.54	0.41	0.45	0.40	0.47	0.46	0.48	0.71	0.82	0.79	0.79	1.00	
KMRP26	0.45	0.37	0.35	0.62	0.57	0.57	0.46	0.51	0.48	0.63	0.48	0.65	0.55	0.53	0.55	0.60	0.77	0.76	0.74	0.73	0.73	1.00
KMRP27	0.30	0.22	0.23	0.33	0.20	0.24	0.30	0.41	0.29	0.47	0.35	0.46	0.45	0.43	0.37	0.51	0.48	0.44	0.50	0.43	0.34	0.51
KMRP28	0.25	0.26	0.28	0.42	0.27	0.26	0.23	0.42	0.29	0.58	0.46	0.63	0.51	0.53	0.53	0.59	0.53	0.49	0.47	0.50	0.34	0.59
KMRP29	0.28	0.31	0.28	0.44	0.26	0.27	0.22	0.44	0.28	0.58	0.45	0.60	0.54	0.44	0.49	0.57	0.46	0.47	0.44	0.46	0.32	0.49
KMRP31	0.23	0.22	0.26	0.37	0.19	0.22	0.12	0.31	0.19	0.51	0.47	0.55	0.52	0.45	0.45	0.56	0.42	0.42	0.37	0.44	0.30	0.46
KMRP32	0.29	0.24	0.26	0.43	0.27	0.29	0.20	0.40	0.30	0.57	0.45	0.60	0.52	0.54	0.51	0.60	0.49	0.49	0.47	0.52	0.32	0.53
KMRP33	0.28	0.29	0.26	0.45	0.35	0.34	0.16	0.43	0.33	0.63	0.50	0.70	0.57	0.55	0.61	0.67	0.56	0.50	0.44	0.49	0.42	0.64
KMRP35	0.46	0.43	0.41	0.39	0.40	0.49	0.40	0.48	0.54	0.45	0.37	0.57	0.47	0.45	0.41	0.51	0.41	0.39	0.38	0.45	0.32	0.40
KMRP36	0.53	0.45	0.36	0.38	0.51	0.51	0.45	0.53	0.62	0.50	0.40	0.49	0.45	0.47	0.50	0.49	0.39	0.33	0.40	0.43	0.30	0.43
KMRP37	0.52	0.42	0.32	0.39	0.42	0.51	0.49	0.47	0.55	0.37	0.27	0.46	0.39	0.45	0.34	0.46	0.39	0.37	0.41	0.37	0.30	0.39
KMRP38	0.54	0.44	0.36	0.41	0.44	0.50	0.47	0.52	0.50	0.44	0.31	0.48	0.50	0.41	0.39	0.49	0.44	0.44	0.47	0.48	0.36	0.41
KMRP39	0.50	0.42	0.29	0.36	0.41	0.45	0.42	0.43	0.48	0.37	0.28	0.44	0.41	0.42	0.36	0.46	0.28	0.34	0.31	0.36	0.21	0.30
KMRP40	0.48	0.42	0.34	0.34	0.49	0.49	0.41	0.52	0.47	0.40	0.33	0.47	0.45	0.43	0.38	0.50	0.38	0.38	0.38	0.45	0.31	0.46
	KMRP2	KMRP3	KMRP4	KMRP5	KMRP6	KMRP7	KMRP8	KMRP9	KMRP10	KMRP12	KMRP13	KMRP14	KMRP15	KMRP16	KMRP17	KMRP18	KMRP19	KMRP20	KMRP22	KMRP23	KMRP24	KMRP26
Mean	3.35	3.49	3.70	3.43	3.45	3.29	3.42	3.23	3.24	3.62	3.64	3.56	3.67	3.59	3.53	3.58	3.38	3.37	3.28	3.19	3.32	3.18
SD	1.12	1.12	0.97	1.07	1.06	1.08	1.06	1.12	1.11	1.00	0.95	0.99	0.90	0.93	0.97	0.91	1.19	1.11	1.19	1.15	1.10	1.24
No Viol	4	0	1	4	6	8	2	0	2	1	0	1	0	0	0	1	0	0	0	0	0	0
total	25	25	25	25	25	25	25	25	25	27	27	27	27	27	27	27	28	28	28	28	28	28

Table 5.7.4: Correlation Matrix: Convergent and Discriminant Validity of Knowledge Management Practices Constructs (Continued).

	KMRP19	KMRP20	KMRP22	KMRP23	KMRP24	KMRP26	KMRP27	KMRP28	KMRP29	KMRP31	KMRP32	KMRP33	KMRP35	KMRP36	KMRP37	KMRP38	KMRP39	KMRP40	
KMRP2																			
KMRP3																			
KMRP4																			
KMRP5																			
KMRP6																			
KMRP7																			
KMRP8																			
KMRP9																			
KMRP10																			
KMRP12																			
KMRP13																			
KMRP14																			
KMRP15																			
KMRP16																			
KMRP17																			
KMRP18																			
KMRP19	1.00																		
KMRP20	**0.70**	1.00																	
KMRP22	0.73	0.83	1.00																
KMRP23	0.71	0.80	0.80	1.00															
KMRP24	0.71	0.82	0.79	0.79	1.00														
KMRP26	0.77	0.76	0.74	0.73	0.73	1.00													
KMRP27	0.48	0.44	0.50	0.43	0.34	0.51	1.00												
KMRP28	0.53	0.49	0.47	0.50	0.34	0.59	0.79	1.00											
KMRP29	0.46	0.47	0.44	0.46	0.32	0.49	0.75	0.86	1.00										
KMRP31	0.42	0.42	0.37	0.44	0.30	0.46	0.75	0.76	**0.74**	1.00									
KMRP32	0.49	0.49	0.47	0.52	0.32	0.53	0.75	0.90	0.86	0.82	1.00								
KMRP33	0.56	0.50	0.44	0.49	0.42	0.64	0.67	0.80	0.81	0.79	0.83	1.00							
KMRP35	0.41	0.39	0.38	0.45	0.32	0.40	0.51	0.56	0.52	0.50	0.56	0.48	1.00						
KMRP36	0.39	0.33	0.40	0.43	0.30	0.43	0.48	0.51	0.47	0.35	0.50	0.44	0.75	1.00					
KMRP37	0.39	0.37	0.41	0.37	0.30	0.39	0.59	0.54	0.50	0.50	0.48	0.45	0.84	0.79	1.00				
KMRP38	0.44	0.44	0.47	0.48	0.36	0.41	0.56	0.59	0.65	0.45	0.55	0.50	0.75	0.78	0.83	1.00			
KMRP39	0.28	0.34	0.31	0.36	0.21	0.30	0.57	0.53	0.55	0.50	0.51	0.46	0.74	**0.72**	0.86	0.80	1.00		
KMRP40	0.38	0.38	0.38	0.45	0.31	0.46	0.57	0.58	0.54	0.53	0.56	0.53	0.79	0.75	0.81	0.79	0.79	1.00	
	KMRP19	KMRP20	KMRP22	KMRP23	KMRP24	KMRP26	KMRP27	KMRP28	KMRP29	KMRP31	KMRP32	KMRP33	KMRP35	KMRP36	KMRP37	KMRP38	KMRP39	KMRP40	
Mean	3.38	3.37	3.28	3.19	3.32	3.18	3.32	3.53	3.60	3.33	3.51	3.56	3.55	3.55	3.47	3.56	3.60	3.54	
SD	1.19	1.11	1.19	1.15	1.10	1.24	1.06	1.06	1.05	1.14	1.07	1.04	1.02	0.93	1.03	1.08	1.02	0.97	
No Viol	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	31
total	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	918

Table 5.7.5: Model-Data Fit Indices of Knowledge Management Practices Scales

Construct	Chi-Square	DF	p-value	RMSEA	GFI	AGFI	NNFI	CFI	# of Items
Create	7.20	5	0.206	0.068	0.97	0.91	0.99	1	5
Capture	12.67	5	0.027	0.126	0.95	0.85	0.97	0.98	5
Share	7.52	5	0.185	0.072	0.97	0.91	0.99	1	5
Access	5.43	2	0.066	0.134	0.97	0.86	0.98	0.99	4
Use	5.73	5	0.333	0.039	0.98	0.93	1	1	5

work". This again is a rather broad item even though it restricts to knowledge that is relevant to the respondent's work. Even though the item reflects the knowledge creation construct well on the surface, it may be difficult for the respondents to think of a specific instance of such an activity. Further, it could be argued that when an individual engages in certain actions involving storing, sharing, or accessing certain information, an individual is in a sense creating new knowledge in his/her mind. The chi-square difference between the models where the construct correlations are set to free and set to one ranges from 378 to 671 indicates good discriminant validity.

Table 5.7.6: Reliability and Discriminant Validity of KM Practices Scales

Constructs	Create	Capture	Share	Access	Apply
Create	AVE=0.83 α=0.93				
Capture	*r=0.55*** χ^2= 476	AVE=0.79 α=0.92			
Share	*r=0.64*** χ^2= 520	*r=0.65*** χ^2= 423	AVE=0.87 α=0.95		
Access	*r=0.36*** χ^2= 477	*r=0.67*** χ^2= 378	*r=0.57*** χ^2= 525	AVE=0.93 α=0.95	
Apply	*r=0.59*** χ^2= 544	*r=0.55*** χ^2= 495	*r=0.47*** χ^2= 671	*r=0.63*** χ^2= 531	AVE=0.85 α=0.94

** Correlation is significant at the 0.01 level (2-tailed).

χ^2> 7.88 for 1 d.f. is significant at p-value corrected for number of comparisons (0.05/10).

The reliabilities (Chronbach's alpha) for the scales in this section are: Knowledge Creation (0.93), Knowledge Capture (0.92), Knowledge Sharing (0.95), Knowledge Retrieval (0.95), and Knowledge Application (0.94). The reliability scores were excellent for this stage of the research. Deleting the items from the scales did not have any substantial improvements in their reliability scores.

5.8 Task Knowledge Instrument

Task knowledge was conceptualized as consisting of operational, conceptual, and contextual knowledge. Each of these three dimensions had further components. Operational consisted of know-how and know-what, conceptual was measured based on know-why, and contextual was measured based on know-who, know-where and know-when. It was unclear whether individuals could make this fine grained distinction. Initial examination of data revealed evidence for a three factor structure, therefore further analysis were done to check for a 3 factor model as conceptualized earlier

Before testing for unidimensionality, convergent and discriminant validity, and reliability, the scales were purified based on the corrected item-total correlation (CITC) scores. The Table 5.8.1 shows the CITC for items within each proposed constructs. Items with CITC less than 0.60 were identified as potential candidates for elimination. Items that had a CITC score between 0.50 and 0.60 were marked for further investigation of the item content and wording or were retained if number of items for a scale dropped below three. If items are decided to be dropped based on the CITC, they are done so step by step. All scales in this section had items with CITC scores above 0.60. Hence, no item was eliminated at this stage.

Operational and conceptual scales had items that loaded on their respective factors only and had loadings greater than 0.60. Factor analysis of contextual scale extracted two factors. This may be due to the large number of items in this scale (15) at this time. Know-where seemed to factor separately from know-who and Know-when. There were also a large number of crossloadings > 0.30 between the two factors and

Table 5.8.1: CITC for Task Knowledge

Construct	Label	Items	CITC
Operational Knowledge	TK1	how to perform the different aspects of your job	0.88
	TK2	how to implement your work routines	0.91
	TK3	the procedures for doing your job	0.81
	TK4	the relevant know-how	0.90
	TK5	how to use the relevant software	0.68
	TK6	what information was needed for each task	0.86
	TK7	what tasks needed to be accomplished	0.82
	TK8	what was expected of you	0.78
	TK9	what the functional requirements were	0.87
	TK10	what information was needed	0.90
Conceptual Knowledge	TK11	why you were doing things the way you did them	0.79
	TK12	the reason(s) for doing what you did	0.80
	TK13	the philosophy behind your actions	0.78
	TK14	the purpose of your actions	0.86
	TK15	the rationale behind your actions	0.82
Contextual Knowledge	TK16	who your immediate customers were	0.64
	TK17	whom to go to for the necessary resources	0.72
	TK18	who could get things done	0.85
	TK19	who had the relevant expertise	0.79
	TK20	who had the required information	0.74
	TK21	where to find the relevant information	0.84
	TK22	where the necessary things were available	0.85
	TK23	where to perform all your activities	0.78
	TK24	where to find people when you needed them	0.70
	TK25	where to find help when needed	0.79
	TK26	exactly when things needed to be done	0.75
	TK27	when to gather more information	0.83
	TK28	the timing of different tasks	0.78
	TK29	when to pursue a particular problem	0.72
	TK30	when you needed to do particular tasks	0.67

many items had factor loadings less than 0.60. Since the respondent to item ratio is small at this stage the factor analysis results needs to be interpreted cautiously. Forcing a one factor solution yielded factor loading greater than the desired 0.60 for all items. Though the evidence for unidimensionality of the contextual scale is weak, further investigation needs to be made regarding this scale.

Factor analysis with Eigen value > 1 extracted 4 factors initially. Items that had significant cross loading and low factor loading were identified as potential candidates for deletion subjected to further examination of the item content. Items that had problematic wording or content were deleted one at a time and subsequent factor analysis was conducted with remaining items. Finally, items TK18, TK6, TK8, TK11, TK1, TK7, and TK30 were eliminated at this stage in that order. Remaining items yielded a 3 factor structure with the items loading on their respective scales. At this stage two more items (TK19 & TK23) remained that had cross loading between 0.30 & 0.40 and 5 items (TK19, TK20, TK21, TK23 & TK28) including the above two had factor loading between 0.50 and 0.60. Deletion of these two items did not improve the percentage variance explained, and the number of factors extracted also dropped to 2 with many more cross loading and low factor loadings. Rather than deleting these items, they were identified for possible rewording and modifications. The final structure is shown in Table 5.8.2 and provides moderate evidence for convergent and discriminant validity.

To further assess convergent and discriminant validity, a correlation matrix is generated with all the retained items for the scales in this section and for cognitive effort and virtualness. High inter-item correlation within each construct indicates convergent validity. Degree to which the measures of a construct do not correlate well with measures of other constructs indicate evidence for discriminant validity (Chau, 1997). Table 5.8.3 shows the correlation between all items for the scales in this section. The smallest within construct correlations are: Operational (0.60), Conceptual (0.64), and Contextual (0.46). These correlations are bolded and occur in the diagonal triangle in the table. All inter-item correlations were significant ($p<0.000$). The results give good support for convergent validity

For correlation of items with measures of other constructs, a total of 55 violations out of 208 were observed (Table 5.8.3). Items TK10, TK21, TK27 and TK28 had violations that exceeded more than half of their possible violations. Out of the 55 violations, 35 violations were within contextual knowledge. The items identified here are subjected to further investigation and modification for the large scale.

Convergent and discriminant validity is further assessed using the structural equation modeling. The results of the measurement model fit statistics are provided in Table 5.8.4. The results show good model-data fit, which indicates good convergent validity.

The results of discriminant validity using pair-wise LISREL model is shown in Table 5.8.5. The table also shows the average variance extracted (AVE), Pearson correlation between the constructs (r) and the reliabilities (α) for each construct. Items TK19, TK20, TK25 had correlated error terms. These were the same items that had identified earlier for modification. Upon examination some of these items were modified or eliminated from further analysis. The chi-square difference between the models indicates good discriminant validity. Chi-square difference ranges from 56 to 349 between the constructs.

Table 5.8.2: Task Knowledge Scales Factor Analysis

Pattern Matrix [a]

	Factor		
	1	2	3
TK22	1.033		
TK25	.923		
TK24	.774		
TK16	.702		
TK17	.662		
TK27	.600		
TK23	.593	-.375	
TK21	.588		
TK19	.588		.335
TK28	.547		
TK20	.533		
TK9		-.854	
TK5		-.852	
TK2		-.844	
TK4		-.682	
TK3		-.679	
TK10		-.671	
TK13			.808
TK14			.787
TK15			.653
TK12			.614

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.
a. Rotation converged in 9 iterations.

Factor Correlation Matrix

Factor	1	2	3
1	1.000	-.521	.661
2	-.521	1.000	-.605
3	.661	-.605	1.000

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.

Next, the reliabilities of the scales in this section are evaluated. The reliabilities (Chronbach's alpha) are as follows: Operational (0.95), Conceptual (0.91), and Contextual (0.92). The reliability scores were in the desired range for this stage of research. Deleting the items from the scales did not have any substantial improvements in their reliability scores.

Table 5.8.3: Correlation Matrix: Convergent and Discriminant Validity of Task Knowledge Constructs

	Operational						Conceptual				Contextual								
	TK2	*TK3*	*TK4*	*TK5*	*TK9*	*TK10*	*TK12*	*TK13*	*TK14*	*TK15*	*TK16*	*TK17*	*TK21*	*TK22*	*TK24*	*TK25*	*TK27*	*TK28*	
TK2	1.00																		
TK3	0.78	1.00																	
TK4	0.87	0.70	1.00																
TK5	0.70	0.60	0.71	1.00															
TK9	0.84	0.78	0.79	0.76	1.00														
TK10	0.86	0.70	0.86	**0.60**	0.81	1.00													
TK12	0.67	0.62	0.65	0.45	0.64	0.71	1.00												
TK13	0.51	0.52	0.62	0.26	0.49	0.56	**0.64**	1.00											
TK14	0.66	0.60	0.75	0.46	0.63	0.69	0.76	0.78	1.00										
TK15	0.75	0.55	0.73	0.53	0.65	0.67	0.72	0.73	0.76	1.00									
TK16	0.28	0.28	0.33	0.21	0.30	0.42	0.35	0.47	0.36	0.33	1.00								
TK17	0.42	0.36	0.40	0.33	0.36	0.42	0.52	0.45	0.45	0.59	0.48	1.00							
TK21	0.63	0.55	0.74	0.46	0.60	0.73	0.65	0.67	0.68	0.67	0.53	0.64	1.00						
TK22	0.54	0.42	0.58	0.34	0.45	0.62	0.50	0.57	0.51	0.48	0.59	0.65	0.77	1.00					
TK24	0.46	0.41	0.50	0.30	0.31	0.51	0.54	0.52	0.47	0.43	0.56	0.56	0.65	0.71	1.00				
TK25	0.52	0.42	0.53	0.30	0.43	0.56	0.52	0.62	0.57	0.52	0.60	0.62	0.73	0.88	0.73	1.00			
TK27	0.55	0.48	0.62	0.48	0.49	0.65	0.58	0.53	0.59	0.57	**0.46**	0.64	0.67	0.70	0.57	0.61	1.00		
TK28	0.56	0.40	0.57	0.41	0.56	0.68	0.52	0.51	0.52	0.56	0.51	0.62	0.70	0.66	0.49	0.55	0.69	1.00	
	TK2	*TK3*	*TK4*	*TK5*	*TK9*	*TK10*	*TK12*	*TK13*	*TK14*	*TK15*	*TK16*	*TK17*	*TK21*	*TK22*	*TK24*	*TK25*	*TK27*	*TK28*	
Mean	4.30	4.38	4.21	4.21	4.28	4.32	4.36	4.23	4.40	4.23	4.13	4.26	4.30	4.17	4.15	4.25	4.23	4.08	
SD	0.70	0.74	0.82	0.82	0.74	0.80	0.83	0.78	0.74	0.82	0.96	0.71	0.75	0.78	0.82	0.81	0.67	0.87	Total
No Vic	1	1	3	0	0	7	4	1	0	2	1	2	9	1	4	3	9	7	55
total	12	12	12	12	12	12	14	14	14	14	10	10	10	10	10	10	10	10	208

Table 5.8.4: Model-Data Fit Indices of Task Knowledge Scales

Construct	Chi-Square	DF	p-value	RMSEA	GFI	AGFI	NNFI	CFI	# of Items
Operational	17.48	9	0.042	0.135	0.90	0.76	0.95	0.97	6
Conceptual	1.83	2	0.401	0.000	0.98	0.91	1.00	1.00	4
Contextual	30.66	20	0.060	0.101	0.87	0.77	0.95	0.95	8

Table 5.8.5: Reliability and Discriminant Validity of Task Knowledge Scales

	Operational	Conceptual	Contextual
Operational	AVE=0.79 α=0.95		
Conceptual	*r=0.64*** χ^2= 56	AVE=0.85 α=0.91	
Contextual	*r=0.75*** χ^2= 349	*r=0.71*** χ^2=74	AVE=0.74 α=0.92

** Correlation is significant at the 0.01 level (2-tailed).

χ^2> 5.73 for 1 d.f. is significant at p-value corrected for number of comparisons (0.05/3).

5.9 Individual Outcomes Instrument

Before testing for unidimensionality, convergent and discriminant validity, and reliability, the scales were purified based on the corrected item-total correlation (CITC) scores. The Table 5.9.1 shows the CITC for items within each proposed constructs. Items with CITC less than 0.60 were identified as potential candidates for elimination. If items are decided to be dropped based on the CITC, they are done so step by step. Based on their CITC scores and subsequent examination of the item content, items IO3, IO9, IO12, IO13, IO19 and IO27 were deleted from further analysis. All scales had items that loaded on single factor. All factor loadings were greater than 0.60, indicating evidence for unidimensionality

Items for all the scales were factor analyzed together, which yielded a 3 factor solution. Items for creative performance and innovation loaded on a single factor. Since they both measure the creative outcome of individuals work to some degree and are very closely related concepts, respondents may not be making a distinction between the two. Further, if the outcome scales have a causal relationship, it may confound the factor structure. Because of this, items from creative performance and innovation were separately factor analyzed from other outcome scales to confirm their factor structure.

All the items loaded on a single factor further suggesting that items in both the scale measure a single concept. Items that indicate creative performance seem to load stronger on the factor suggesting that the combined scale is measuring creative performance more than innovation. For the sake of parsimony, only the items that reflected creative performance (IO17, IO23, IO24, IO26, IO28 & IO29) is retained for this scale for further analysis.

Item IO11 from satisfaction scale had a cross loading on performance and was also eliminated at this stage. No other crossloadings above 0.30 were observed. The lowest loading for individual performance is 0.568 (IO2), for satisfaction is -0.713 (IO15), and for creative performance is 0.769 (IO29) all of which are above or close to the 0.60 level. The final structure is shown in Table 5.9.2 and provides some evidence for convergent and discriminant validity.

Table 5.9.1: CITC for Individual Outcomes

Construct	Label	Items	Step 1 CITC	Step 2 CITC	Step 3 CITC
Individual Performance	IO1	I was very efficient at my work	0.74	0.78	0.74
	IO2	I accomplished my tasks within the allocated resource	**0.52**	0.63	0.64
	IO3	I accomplished a great deal of work with the available resources	0.60	**0.59**	-
	IO4	I was very effective at interacting with others	0.62	0.63	0.61
	IO5	My work was of very high quality	0.74	0.72	0.68
	IO6	I easily met my goals	**0.55**	**0.60**	0.63
	IO7	I usually finished my tasks within the expected time limit	0.70	0.72	0.75
	IO8	I usually met my goals as quickly as possible	0.64	0.66	0.66
	IO9	I could have done my tasks faster with the same level of quality compared to the beginning of the project	**-0.26**	-	-
Innovation	IO16	I searched out new technologies, processes, techniques, and/or product ideas	0.69	0.71	
	IO17	I had generated creative ideas	0.90	0.91	
	IO18	I had promoted my ideas to others	0.73	0.72	
	IO19	I had investigated and secured funds needed to implement new ideas	**0.49**	-	
	IO20	I had developed plans and schedules for the implementation of new ideas	0.81	0.78	
	IO21	I was innovative	0.75	0.76	
	IO22	I had developed innovative ideas, built support for it and implemented it	0.87	0.85	
	IO23	I was the first to use certain ideas in my kind of work	0.80	0.80	
	IO24	ideas that I implemented were the first use of such ideas in my department	0.78	0.79	
	IO25	ideas that I implemented were the first use of such ideas in this type of work	0.73	0.74	
Creative Performance	IO26	my work was original and practical	0.82	0.81	
	IO27	my work was adaptive and practical	**0.58**	-	
	IO28	my work was creative	0.76	0.79	
	IO29	my ideas were novel and useful	0.85	0.86	

Table 5.9.1: CITC for Individual Outcomes (Cont.)

Satisfaction	IO10	Generally speaking, I was satisfied with my job	0.90	0.92	0.86
	IO11	I was satisfied with my work outcomes	0.62	0.63	0.68
	IO12	I was generally satisfied with the kind of work I did	**0.57**	**0.55**	-
	IO13	I was satisfied with my personal growth	**0.56**	-	-
	IO14	I was satisfied with my growth opportunities	0.70	0.70	0.68
	IO15	I was satisfied with my accomplishments	0.80	0.79	0.83

Table 5.9.2: Individual Outcomes Scales Factor Analysis

Pattern Matrix[a]

	Factor		
	1	2	3
IO17	.953		
IO26	.903		
IO24	.887		
IO23	.848		
IO28	.813		
IO29	.769		
IO10		-.961	
IO14		-.800	
IO15		-.713	
IO1			.856
IO7			.804
IO5			.710
IO6			.680
IO8			.654
IO4			.646
IO2			.568

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.
a. Rotation converged in 8 iterations.

Factor Correlation Matrix

Factor	1	2	3
1	1.000	-.138	.307
2	-.138	1.000	-.392
3	.307	-.392	1.000

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.

Table 5.9.3: Correlation Matrix: Convergent and Discriminant Validity of Individual Outcomes Constructs

	Performance						Satisfaction			Creative Performance						
	IO1	*IO2*	*IO5*	*IO6*	*IO7*	*IO8*	*IO10*	*IO14*	*IO15*	*IO17*	*IO23*	*IO24*	*IO26*	*IO28*	*IO29*	
IO1	1.00															
IO2	0.61	1.00														
IO5	0.72	**0.36**	1.00													
IO6	0.55	0.49	0.52	1.00												
IO7	0.57	0.57	0.54	0.49	1.00											
IO8	0.43	0.54	0.42	0.57	0.68	1.00										
IO10	0.18	0.48	0.34	0.20	0.39	0.38	1.00									
IO14	0.11	0.27	0.22	0.05	0.26	0.20	0.76	1.00								
IO15	0.24	0.48	0.35	0.30	0.50	0.47	0.77	**0.64**	1.00							
IO17	0.25	0.19	0.29	0.14	0.10	0.10	0.14	0.08	0.13	1.00						
IO23	0.29	0.24	0.30	0.33	0.04	0.15	0.24	0.22	0.16	0.79	1.00					
IO24	0.23	0.12	0.29	0.22	0.02	0.03	0.08	0.03	0.05	0.82	0.82	1.00				
IO26	0.28	0.26	0.33	0.15	0.06	0.13	0.23	0.13	0.10	0.83	0.77	0.74	1.00			
IO28	0.36	0.30	0.42	0.22	0.22	0.21	0.31	0.17	0.19	0.81	0.68	0.72	0.72	1.00		
IO29	0.44	0.29	0.57	0.24	0.30	0.31	0.24	0.14	0.17	0.78	0.66	**0.62**	0.81	0.79	1.00	
	IO1	*IO2*	*IO5*	*IO6*	*IO7*	*IO8*	*IO10*	*IO14*	*IO15*	*IO17*	*IO23*	*IO24*	*IO26*	*IO28*	*IO29*	
Mean	5.94	6.02	6.04	5.43	6.08	6.02	5.85	5.40	5.96	4.98	4.34	4.53	4.94	5.11	4.91	
SD	1.05	0.97	0.88	1.15	1.17	0.99	1.29	1.50	1.21	1.68	1.84	1.86	1.62	1.45	1.46	Total
No Violat	1	2	2	0	1	1	0	0	0	0	0	0	0	0	0	7
Total	10.00	10.00	10.00	10.00	10.00	10.00	12.00	12.00	12.00	10.00	10.00	10.00	10.00	10.00	10.00	156

To further assess convergent and discriminant validity, a correlation matrix is generated with all the retained items for the scales in this section and for cognitive effort and virtualness. High inter-item correlation within each construct indicates convergent validity. Degree to which the measures of a construct do not correlate well with measures of other constructs indicate evidence for discriminant validity (Chau, 1997). Table 5.9.3 shows the correlation between all items for the scales in this section. The smallest within construct correlations are: Performance (0. 36), Satisfaction (0.64), and Creative Performance (0.62). These correlations are bolded and occur in the diagonal triangle in the table. All within construct correlations were significant at $p < .000$, except for five correlations within performance, least of which was significant at $p=0.007$, indicating some evidence for convergent validity. For correlation of items with measures of other construct, a total of 7 violations out of 156 were observed (Table 5.9.3). All violations were within the performance scale. Results provide some evidence for discriminant validity.

Convergent and discriminant validity is further assessed using the structural equation modeling. The results of the measurement model fit statistics are provided in Table 5.9.4. The results show reasonable model-data fit, indicating sufficient convergent validity. Items IO2, IO8in individual performance, IO11 in satisfaction, IO29 in creative performance and TO4 in team performance were eliminated due to error correlations in the measurement model.

The results of discriminant validity using pair-wise LISREL model is shown in Table 5.9.5. The table also shows the average variance extracted (AVE), Pearson correlation between the constructs (r) and the reliabilities (α) for each construct. Items

IO4, IO5 and TO6 had error correlation with errors of some items in other constructs. These items were noted for potential modification for the large scale. The chi-square difference between the models indicates good discriminant validity. Chi-square difference ranges from 38 to 314 between the constructs. All reliabilities are in the acceptable range. Deleting the items from the scale did not have any significant improvement in the scale reliabilities.

Table 5.9.4: Model-Data Fit Indices of Outcome Scales

Construct	Chi-Square	DF	p-value	RMSEA	GFI	AGFI	NNFI	CFI	# of Items
Individual Performance	9.73	5	0.083	0.135	0.93	0.79	0.91	0.96	5
Satisfaction		0	1						3
Creative Performance	10.60	5	0.060	0.147	0.92	0.77	0.96	0.98	5
Team Performance	22.36	14	0.072	0.107	0.89	0.78	0.94	0.96	7

Table 5.9.5: Reliability and Discriminant Validity of Outcome Scales

	Individual Performance	Satisfaction	Creative Performance	Team Performance
Individual Performance	AVE=0.64 α=0.85			
Satisfaction	*r=0.38*** χ^2=72	AVE=0.72 α=0.88		
Creative Performance	*r=0.30** χ^2=156	*r=0.18* χ^2=75	AVE=0.82 α=0.94	
Team Performance	*r=0.36*** χ^2=129	*r=0.63*** χ^2=38	*r=0.23* χ^2=314	AVE=0.73 α=0.95

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).
χ^2> 6.96 for 1 d.f. is significant at p-value corrected for number of comparisons (0.05/6).

5.10 Team Performance Instrument

Before testing for unidimensionality, convergent and discriminant validity, and reliability, the scales were purified based on the corrected item-total correlation (CITC) scores. The Table 5.10.1 shows the CITC for items within each proposed constructs. Items with CITC less than 0.60 were identified as potential candidates for elimination. If items are decided to be dropped based on the CITC, they are done so step by step. Only item TO8 had a CITC below 0.60. This was the only item that was reverse coded among all the items in this section. This item was removed from further analysis.

All scales had items that loaded on single factor. All factor loadings were greater than 0.60, indicating evidence for unidimensionality. Since only one scale was present in this section, factor analysis is conducted with other outcome scales in the individual outcomes to assess discriminant and convergent validity. The analysis should be interpreted with caution since some of the individual outcomes could have an impact on team performance as per the initial hypotheses. All items loaded on the respective scales

Table 5.10.1: CITC for Team Outcomes:

Label	Items	Step 1 CITC	Step 2 CITC
TO1	The efficiency of team operations	0.82	0.84
TO2	The team's adherence to budgets	0.64	0.66
TO3	The amount of work the team produced	0.89	0.89
TO4	Effectiveness of the team's interactions with people outside the team	0.74	0.78
TO5	The quality of work the team produced	0.83	0.84
TO6	The team's ability to meet the goals of the project	0.85	0.86
TO7	The team's adherence to schedules	0.82	0.84
TO8	The team could have done its work faster with the same level of quality	**-0.34**	-
TO9	The team met the goals as quickly as possible	0.84	0.86

Table 5.10.2: Individual and Team Outcome Scales Factor Analysis

Pattern Matrix[a]

	Factor			
	1	2	3	4
IO10	.987			
IO14	.705			
IO15	.543			
IO17		.947		
IO24		.897		
IO26		.886		
IO23		.839		
IO28		.824		
IO29		.774		
TO3			.939	
TO7			.918	
TO9			.877	
TO1			.831	
TO5			.811	
TO6			.802	
TO4			.696	
TO2			.644	
IO8				.833
IO7				.826
IO6				.687
IO2				.562
IO5				.527
IO4				.516

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.
a. Rotation converged in 4 iterations.

Factor Correlation Matrix

Factor	1	2	3	4
1	1.000	.132	.551	.326
2	.132	1.000	.188	.264
3	.551	.188	1.000	.392
4	.326	.264	.392	1.000

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.

and no cross loading were observed above 0.30. The factor loadings for team performance were all above 0.60. The lowest loading for team performance is 0.644 (TO2). The final structure is shown in Table 5.10.2.

The results indicate evidence for convergent and discriminant validity between other outcome scales. The alpha for Team Performance is 0.95. Deleting TO2 would improve the alpha value to 0.96, since this is only a marginal improvement all items in this section are retained at this stage for the large scale study. MTMM style correlation analysis is not performed on this scale for assessing convergent and discriminant validity, since this is the only scale in this section, and factor analysis with other scales from individual outcomes have already provided sufficient indication for convergent and discriminant validity. LISREL measurement model and the pair-wise discriminant analysis between other outcome variables are shown in the previous section (Tables 5.9.4 & 5.9.5).

5.11 Predictive Validity

To assess predictive validity, a second order factor structure for IT support, empowerment, and task knowledge were used. Since knowledge management practices measures were regenerated and tested in a second pilot that data cannot be included in interpreting the predictive power of the instruments from the first pilot. KM practices are the key behaviors of the individuals that intervene between the independent variables such as the CoP characteristics, work characteristics, Empowerment, and IT support with the outcome measures, task knowledge, individual outcomes and team outcomes.

Therefore, completely ignoring the KM practices from the analysis will render the analysis hard to interpret.

Alternatively, since KM practice measures that were used in the first pilot reflected similar content of the revised KM practice measures, and the main problem area was in discriminating the different practices within the instrument, the items may reflect KM practices as one concept. This could be viewed as similar to a second order construct of KM practices and this combined scale will be used for KM practices in the predictive validity analysis because of the key role of this concept in the model. Though this has its shortcomings, the results could be cautiously interpreted.

The predictive validity analysis using correlations between the constructs will be easier to interpret by using the second order factors for IT support, Empowerment, KM practices and task knowledge because of the large number of scales in the full model. The correlation table of the constructs is shown in Table 5.11.1. KM practices had a sizable correlation with the task knowledge and other outcome measures and were all significant a $p<0.01$, except for satisfaction (0. 31, $p < 0.05$) and team performance (0.30, $p < 0.05$). This may be due to the fact that rather than as a direct outcome of KM practices, satisfaction and team performance are the result of other more direct individual outcomes such as task knowledge, individual performance, and creative performance. As expected, both empowerment (0.51) and IT support (0.74) also had high correlations with KM practices and were significant at $p<0.01$.

From work characteristics, cognitive effort had a significant correlation with KM practices (0.50, $p=0.000$). Virtualness had a correlation of 0.20 but was not significant at $p<0.05$. From CoP Characteristics only identification (0.28, $p<0.05$) and shared language

Table 5.11.1: Correlation Table for Predictive Validity Analysis

	Network Ties	Network Configuration	Appropriable Org.	Shared Norms	Mutual Trust	Identification	Obligation	Shared Language-Codes	Shared Narratives	Cognitive Effort	Virtualness	Empowerment	IT Support	KM Practices	Task Knowledge	Individual Performance	Creative Performance	Satisfaction	Team Performance
Network Ties	1.00																		
Network Configuration	0.61**	1.00																	
Appropriable Organization	0.10	0.06	1.00																
Shared Norms	0.51**	0.34**	0.07	1.00															
Mutual Trust	0.63**	0.50**	0.03	0.52**	1.00														
Identification	0.49**	0.42**	-0.04	0.47**	0.65**	1.00													
Obligation	0.27*	0.34**	-0.03	0.22	0.31*	0.53**	1.00												
Shared Language-Codes	0.34**	0.42**	0.28*	0.39**	0.59**	0.47**	0.41**	1.00											
Shared Narratives	0.01	-0.05	-0.02	0.08	0.33**	0.48**	0.26*	0.20	1.00										
Cognitive Effort	0.31*	0.48**	0.21	0.19	0.26*	0.26*	0.36**	0.62**	-0.07	1.00									
Virtualness	0.27*	0.40**	-0.03	0.12	0.23*	0.11	0.33**	0.27*	-0.03	0.37**	1.00								
Empowerment	0.16	0.23*	-0.04	0.14	0.24*	0.39**	0.05	0.40**	0.09	0.36**	-0.15	1.00							
IT Support	0.04	0.18	-0.10	-0.10	-0.04	0.13	0.16	0.07	0.19	0.40**	0.21	0.42**	1.00						
KM Practices	0.04	0.22	-0.12	-0.01	0.10	0.28*	0.21	0.24*	0.13	0.50**	0.20	0.51**	0.74**	1.00					
Task Knowledge	0.22	0.26*	-0.14	0.21	0.34**	0.28*	0.14	0.47**	0.08	0.44**	0.15	0.58**	0.52**	0.64**	1.00				
Individual Performance	0.00	0.08	-0.30*	0.14	0.26*	0.36**	0.16	0.39**	0.18	0.07	-0.03	0.48**	0.17	0.46**	0.61**	1.00			
Creative Performance	0.18	0.29*	0.04	0.07	0.10	0.30*	0.20	0.13	0.14	0.45**	0.11	0.32**	0.35**	0.57**	0.26*	0.30*	1.00		
Satisfaction	0.03	0.16	0.12	0.20	0.37**	0.29*	0.00	0.49**	0.11	0.28*	-0.09	0.51**	0.14	0.31*	0.31*	0.38**	0.18	1.00	
Team Performance	0.01	0.07	-0.06	0.31*	0.17	0.19	-0.09	0.32**	0.00	0.20	-0.07	0.35**	0.10	0.30*	0.31*	0.36**	0.23*	0.63**	1.00

** Correlation is significant at the 0.01 level (1-tailed).

* Correlation is significant at the 0.05 level (1-tailed).

and codes (0.24, $p<0.05$) had a reasonable correlation with KM practices. This may because, the different aspects of the community of practice characteristics impact only specific aspects of knowledge creation, sharing, access, storage and application, rather than KM practices as a whole; this needs to be explored further in the large scale with the new instrument that was developed for KM practices, which is expected to be able to discriminate between the different KM practices better than the instrument used in the first pilot. Results indicate reasonable predictive power, though it should be interpreted with caution because of the problems in the KM practices instrument that is used at this stage.

The main focus of this research is to develop measures of individual knowledge management practices and to investigate its relationships between the various antecedents and consequents. The pilot study provides a preliminary understanding of these relationships, and should guide us to fine tune and to make modifications of the questionnaire based on these insights. One of the concerns faced at this stage is the substantial length of the questionnaire, which may deter the respondents in providing thoughtful responses to all questions, which in turn may affect the validity of these scales.

Based on the pilot results some scales were re-conceptualized, some of the measures were modified, some items were deleted and for some scales new items were added as appropriately needed. Many of the scales have been trimmed to retain only the best items without losing the important aspects of their domain. This has substantially reduced the questionnaire length from the pilot. The final large scale questionnaire has 156 questions including the demographic items. Community of Practice had 38 items, Work Characteristics-11 items, empowerment- 16 items, IT support- 25 items, KM practices- 25 items, Task related knowledge- 19 items, performance outcomes- 10 items, and general information- 12 items (Tables 5.12.1 thru 5.12.7). The first column of the tables indicates the label used for each item at the pilot stage. The second column indicates the label used to identify the items in the large scale. The Status column indicates whether the items have been modified or revised (R) or if it is a new item that is generated at the pilot (N) or it has been adopted as it is from the pilot (blank space).

Another approach taken to reduce the length of the questionnaire is to keep only those items which reflect the scales that are most closely related to the knowledge management practices. Based on this, work satisfaction and team performance are decided to be dropped at this stage. Though, the overall KM practices scale is correlated to these constructs ($p < 0.050$), they have a stronger correlation to other individual outcome measures, suggesting that KM practices may be having only an indirect effect on satisfaction and team performance which may be caused primarily through other outcome measures. The final questionnaire that is used for the large scale study is displayed in Appendix F. The updated research model based on the pilot results is shown in Figure 5.1.

Figure 5.1: Updated Research Model after Pilot

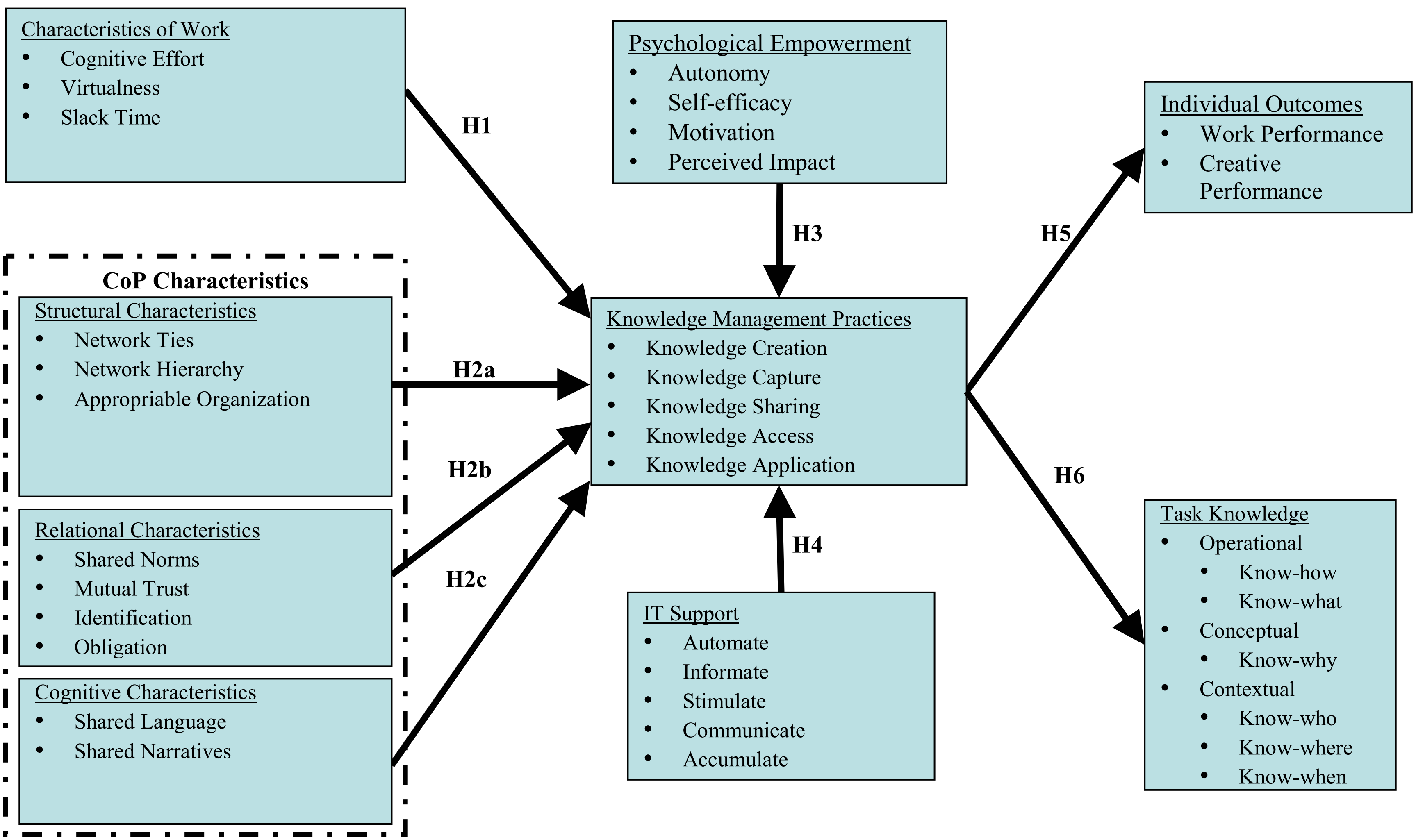


Table 5.12.1: Measurement Scales for Community of Practice used in the Large Scale Study (32 items).

PS Label	LS Label	Status	Items
Network Ties			
cp10	LSCP7	R	members knew other members closely
cp11	LSCP8		members interacted very close to each other
cp12	LSCP9		members interacted frequently with other members
Network Hierarchy			
cp14	LSCP10	R	members could directly access any other member
	LSCP11	N	we had to go through many people to get to some members
cp19	LSCP12	N	members could directly communicate with any other member
Appropriable Organization			
cp20	LSCP13		most members knew each other before they joined this community
cp22	LSCP14		most members were acquaintances of each other
cp24	LSCP15		most members I interacted with were known to me before I joined this community
Shared Norms			
cp26	LSCP16	R	members were expected to have team spirit
cp27	LSCP17		members were expected to be cooperative
cp28	LSCP18		members were expected to have an open mind
cp29	LSCP19		members were expected to share what they knew
Mutual Trust			
cp30	LSCP20		members trusted each other enough to share all relevant information
cp31	LSCP21		members believed that all members were acting in good faith
cp32	LSCP22		members were confident they could trust each other
cp33	LSCP23		members relied on each other for the truthfulness of the information shared
Identification			
cp35	LSCP24		members had a strong sense of belonging to the community
cp36	LSCP25		members identified with each other as one community
cp37	LSCP26	R	members felt as one community
cp38	LSCP27	R	members cared for other members' well being
Obligation			
cp41	LSCP28		members expected others to help them when they helped
cp43	LSCP29		members were expected to return favors
cp44	LSCP30		members expected others to help in return

Table 5.12.1: Measurement Scales for Community of Practice used in the Large Scale Study (32 items) (Cont.).

Shared Languages & Codes			
cp46	LSCP31		a common language was used to share ideas
cp47	LSCP32		the terms used by members were known to most of us
cp48	LSCP33		we had our own common words to communicate ideas
cp49	LSCP34		members used technical terms common among us
Shared Narratives			
cp51	LSCP35		members used stories to communicate subtle ideas
cp52	LSCP36		stories and narratives were used to communicate rich sets of ideas
cp53	LSCP37		stories and metaphors were used to create and preserve rich meaning
cp54	LSCP38		stories and narratives were used to share hard to communicate ideas

Table 5.12.2: Measurement Scales for Work Characteristics used in the Large Scale Study (10 items).

PS Label	LS Label	Status	Items
Cognitive effort			
wc7	LSWC1		My work required significant amount of reasoning
wc8	LSWC2		My work required significant amount of knowledge
wc9	LSWC3		My work involved intense thinking
wc10	LSWC4		My work involved complex analysis
wc11	LSWC5		My work was mentally challenging
Virtualness			
wc12	LSWC6		My work involved work processes that had to be enacted through computers
wc13	LSWC7		My work involved tasks that depended on computers
wc14	LSWC8		My work would have been difficult to perform without computers
wc15	LSWC9	R	My work processes were embedded in computers
wc17	LSWC10		My work was mostly mediated by computers

Table 5.12.3: Measurement Scales for Empowerment used in the Large Scale Study (16 items).

PS Label	LS Label	Status	Items
Autonomy			
ic1	LSIC1		I had autonomy in determining how I did my job
ic2	LSIC2		I could decide on my own how to go about doing my work
ic3	LSIC3	R	I had independence in how I did my job
ic4	LSIC4		I had freedom in how I did my job
ic5	LSIC5		I had choice in how I did my job

Table 5.12.3: Measurement Scales for Empowerment used in the Large Scale Study (16 items) (Cont.).

Self-Efficacy			
ic6	LSIC6		I was confident about my ability to do my job
ic7	LSIC7		I was self-assured about my capabilities to perform my work activities
ic8	LSIC8		I had mastered the skills necessary to do my job
ic10	LSIC9		I was confident about my knowledge for my tasks
Impact			
ic11	LSIC10		I had impact on what happened in my department
ic12	LSIC11		I had control over what happened in my department
ic13	LSIC12		I had influence over what happened in my department
ic14	LSIC13	R	I had impact over the outcomes of my job
Meaning			
ic17	LSIC14		the work I did was important to me
ic18	LSIC15		my job activities were personally meaningful to me
ic19	LSIC16		the work I did was meaningful to me

Table 5.12.4: Measurement Scales for IT Support Used in the Large Scale Study (25 items).

PS Label	LS Label	Status	Items
Stimulate			
it1	LSIT1	R	generate new ideas
it2	LSIT2		think through problems
it4	LSIT3		generate new information
it5	LSIT4		stimulate my thinking
it6	LSIT5		create new knowledge
Accumulate			
it8	LSIT6	R	store needed information
it9	LSIT7	R	retain my knowledge
	LSIT8	N	store work related data
it11	LSIT9	R	retain required information
it12	LSIT10		store my ideas
Communicate			
it13	LSIT11		share my insights
it15	LSIT12		communicate what I know
it16	LSIT13		share my ideas
it17	LSIT14		communicate with other people
it18	LSIT15		transfer my knowledge
Informate			
it19	LSIT16		become more informed
it20	LSIT17		access needed information
	LSIT18	N	access information from others
it23	LSIT19	R	access required information
	LSIT20	N	access useful information

Table 5.12.4: Measurement Scales for IT Support Used in the Large Scale Study (25 items) (Cont.).

Automate			
it25	LSIT21		automate my work processes
it26	LSIT22	R	automate decision-making
	LSIT23	N	automate my work routines
	LSIT24	N	automate my tasks
it29	LSIT25		automate things I had to do

Table 5.12.5: Measurement Scales for Task Knowledge used in the Large Scale Study (19 items).

PS Label	LS Label	Status	Items
Operational			
tk2	LSTK1		how to implement your work routines
tk3	LSTK2		the procedures for doing your job
tk4	LSTK3		the relevant know-how
	LSTK4	N	the technological developments in your area
	LSTK5	N	your job requirements
	LSTK6	N	what actions you need to take
Conceptual			
tk12	LSTK7	R	the reasons behind your actions
tk13	LSTK8		the philosophy behind your actions
tk14	LSTK9		the purpose of your actions
tk15	LSTK10		the rationale behind your actions
Contextual Knowledge			
tk17	LSTK11		whom to go to for the necessary resources
	LSTK12	N	who could help when you get stuck
tk20	LSTK13	R	who were the most knowledgeable people at work
tk21	LSTK14	R	where to find the required information
tk22	LSTK15		where the necessary things were available
	LSTK16	N	where you could get the required resources
tk26	LSTK17	R	when different things had to be done
tk27	LSTK18	R	when to get more information
	LSTK19	N	when to share information

Table 5.12.6: Measurement Scales for Individual Outcome used in the Large Scale Study (10 items).

PS Label	LS Label	Status	Items
Individual Performance			
io1	LSIO1		I was very efficient at my work
io4	LSIO2	R	I was very effective in my work
io5	LSIO3		My work was of very high quality
io6	LSIO4		I easily met my goals
io7	LSIO5		I usually finished my tasks within the expected time limit

Table 5.12.6: Measurement Scales for Individual Outcome used in the Large Scale Study (10 items) (Cont.).

Creative Performance			
io17	LSIO6		I had generated creative ideas
io23	LSIO7		I was the first to use certain ideas in my kind of work
io24	LSIO8		ideas that I implemented were the first use of such ideas in my department
io26	LSIO9		my work was original and practical
io28	LSIO10		my work was creative

Table 5.12.7: Measurement Scales for Knowledge Management Practices Used in the Large Scale Study (25 items).

PS Label	LS Label	Status	Items
Create			
KMRP6	LSKM1		created new thinking
KMRP7	LSKM2		created new ways of doing things
KMRP8	LSKM3		created new ways of interpreting situations
KMRP9	LSKM4		created new ways of working
KMRP10	LSKM5		created new work methods
Capture			
KMRP13	LSKM6		stored important information
KMRP14	LSKM7		stored information essential for my work
KMRP16	LSKM8		stored information that I might need later
KMRP17	LSKM9		stored pertinent information
KMRP18	LSKM10		stored relevant information
Share			
KMRP20	LSKM11		shared information with others
KMRP22	LSKM12		shared my insights with others
KMRP23	LSKM13		shared my know-how with others
KMRP24	LSKM14		shared my knowledge with others
KMRP26	LSKM15	R	shared my work-related knowledge with others
Access			
KMRP27	LSKM16	R	retrieved information from various sources
KMRP28	LSKM17		retrieved information relevant to my work
KMRP29	LSKM18		retrieved information needed for my work
KMRP32	LSKM19		retrieved data required for my work
KMRP33	LSKM20		retrieved work-related information
Apply			
KMRP35	LSKM21		applied my know-how
KMRP36	LSKM22	R	applied my skills
KMRP38	LSKM23		applied my insights
KMRP39	LSKM24		applied my analytical skills
KMRP40	LSKM25		applied my expertise

CHAPTER 6: LARGE SCALE RESULTS

To conduct the large scale survey various email lists were evaluated for feasibility, and for accessibility of target respondents for this study through these email lists, which included knowledge workers in manufacturing and related industries. Many professional associations representing our target population were approached for access to their email list. All such associations contacted indicated that sharing their email lists were against the policies of their association. Next, various commercial organizations that provide various marketing email lists were approached. Among the various vendors evaluated, Manufacturers' News Inc was selected based on several criteria.

Manufacturers' News Inc "is the world's leading publisher & provider of information profiling U.S. manufacturers" (www.manufacturersnews.com, 4/8/2006) and have been compiling such information since 1912. Their database provided highly versatile search ability based on several criteria and contained sufficient email addresses to generate the required number of usable responses. The number of email addresses that is available through such open access databases was important due to very low click-through rates they are expected to generate (click-through rates of 1%-5% are the norm in such open access email lists). This list also had a competitive pricing and did not have any restriction regarding the number of times the email could be used, which is advantageous for sending multiple waves of mailing to achieve the required number of responses. One disadvantage of this email list was that though it provided the name of the specific individual working in a particular position, a large proportion of email address did not appear to be the specific to the individual, rather it appeared to be the common email for the department or the company for which that individual worked for such as "info@company.com". In spite of this shortcoming, this email list was used because of number of other advantages mentioned earlier.

After checking for duplicates and invalid emails, a total of 24,279 unique email addresses were obtained from this database of individuals working in Engineering, Management or Information Technology functions within U.S. manufacturing industries, represented by NAICS codes starting with 31, 32 and 33. Two waves of email were send out to these email addresses with a brief introduction to the study and requesting them to complete the survey on the web address provided in the email (For the cover letter and the questionnaire, see Appendix E and F respectively). In the second wave, three options were provided to complete the survey: one, access the survey online by creating a username and password of their choosing with the access code provided in the email by clicking on the given URL- this was the same method used in the first wave. Second, print a PDF copy of the questionnaire, complete it and fax to the number provided, and third, request a printed copy of the questionnaire and a self addressed stamped envelope to be completed and returned to the researcher. Only one request for a printed copy was received, and no completed survey through that method was received within two weeks of sending the printed material. All the completed responses were obtained through the online survey. As an added incentive for completing the survey, respondents were offered to be eligible for a cash prize drawing of hundred US dollars to be given to five randomly selected respondents from the first two hundred individuals who completes the survey. A summary of their results in comparison to the rest of the respondents were also made available on the website in order to generate further interest in completing the questionnaire.

6.1 Large Scale Sample Description

The statistics of the mailing and the responses are indicated in Table 6.1.1. Since, online surveys with email requests allow the researcher to track a variety of information regarding the user behavior; it is possible to calculate various types of response rates. For this research the response rate is calculated based on the number of click-through's the emailing has generated and total number that is converted to a completed survey. After two waves of emailing a total of 798 (5.36%) click-through's were generated and 264 completes were obtained to provide a response rate of 33%. The first wave produced 147 usable responses (55.7%) and the second wave yielded a usable response of 117 data points (44.3%). Response rate based on the click-through's may represent a better measure for email surveys, because many bulk emails sent out in this fashion end up as spam in the respondents email program and may never be retrieved or viewed by the target respondent. Since it is nearly impossible or highly difficult to track this information accurately, a more appropriate measure would be to base the analysis on number of people who have visited the site and have had an opportunity to review the request and purpose of this study and then have declined to complete the survey based on any number of reasons.

Similar to the approach used in the pilot study, the respondents were asked to select a particular project or an assignment, or reflect on their work for the past six months to answer all questions in the survey. Out of the 252 usable responses 38.9% responded to the questionnaire based on a particular assignment or project that they had completed most recently and the rest answered the questionnaire based on their work during the past six months (Figure 6.1.1). Those who chose a particular assignment or project were further asked about the name of their assignment/project and its duration to help in their recall of subjective states. The distribution of duration of the assignment or project that they were referring to is indicated in Figure 6.1.2.

Table 6.1.1: Response Rates

		% Based On			
	Number	**Total Sent**	**Effective Sent**	**Click Through**	**Completes**
Total Sent	24,279	-			
Undeliverable/ Failure	9,386	38.66%			
Effective Sent	14,893	61.34%	-		
Click Through	798	3.29%	**5.36%**	-	
Completes	264	1.09%	1.77%	**33.08%**	-
Completes with < 50% missing	252	1.04%	1.69%	**31.58%**	95.45%
Completes with No missing	232	0.96%	1.56%	**29.07%**	87.88%

Figure 6.1.3 shows the distribution of respondents based on the industry they are working. 63% of the respondents were from various manufacturing industries, 18.5% indicated that they were part of service industry, and rest of the 18.5% indicated that they were from other than manufacturing or service industry. Figures 6.1.4 and 6.1.5 show the size of the respondents' organizations and how long they have been in operation.

Figure 6.1.1: Respondents Selection of Assignment/Project or Past 6 Months of Work to Answer the Questionnaire

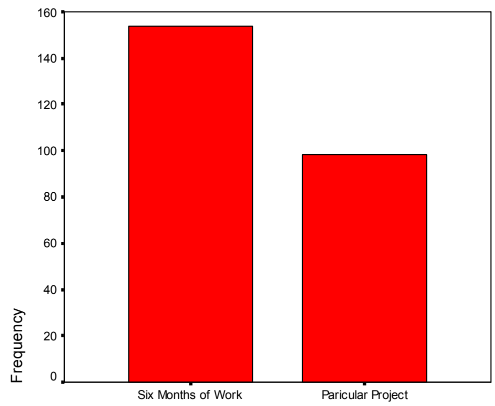


Figure 6.1.2: Distribution of the Duration of Assignment/Project (in Months)

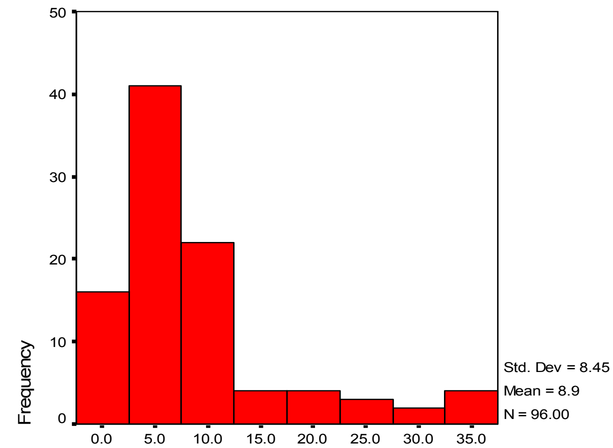


Figure 6.1.3: Primary Business of the Respondents' Firm (Based on 2002 NAICS)

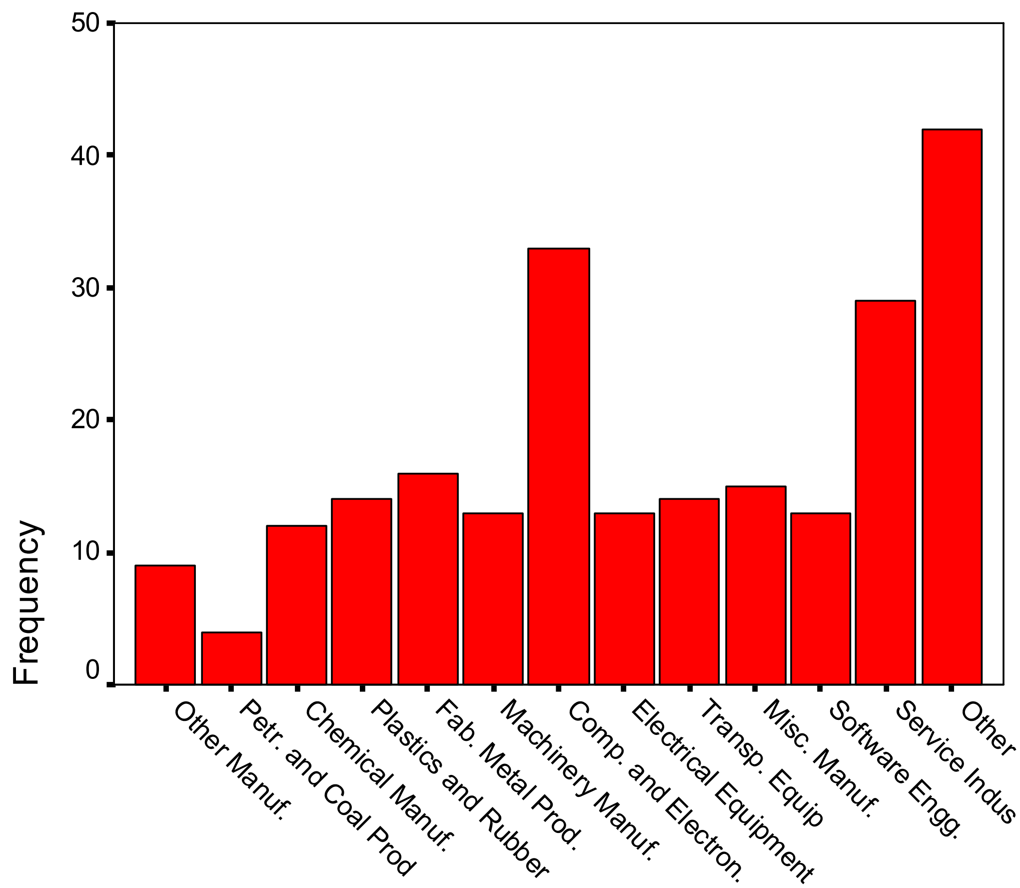


Figure 6.1.4: Size of the Organization in which the Respondents are Employed

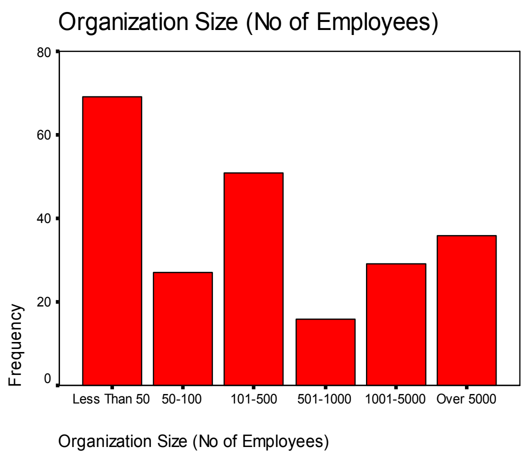


Figure 6.1.5: Age of the Organization

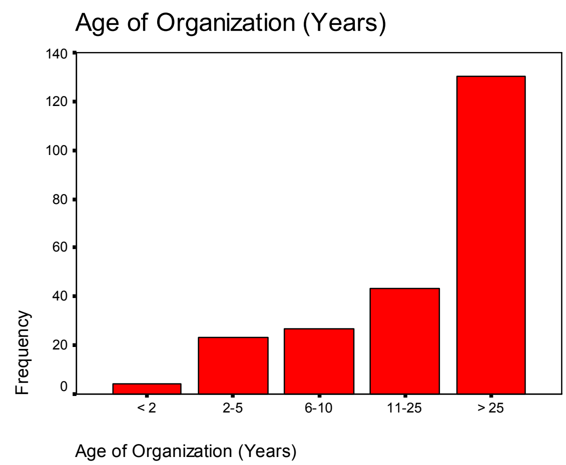


Figure 6.1.6: Number of Respondents' Organization Having a Knowledge Management Initiative

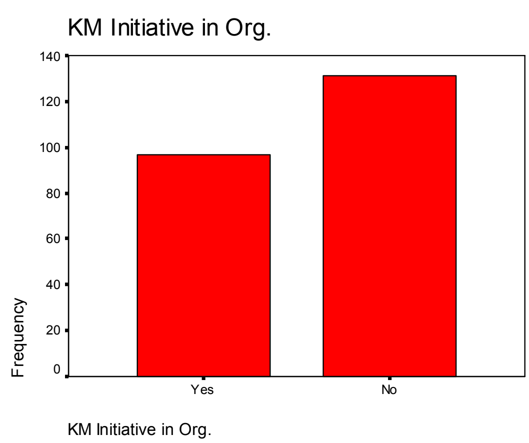


Figure 6.1.7: Proportion of Individuals Involved in a Knowledge Management Initiative in their Organization

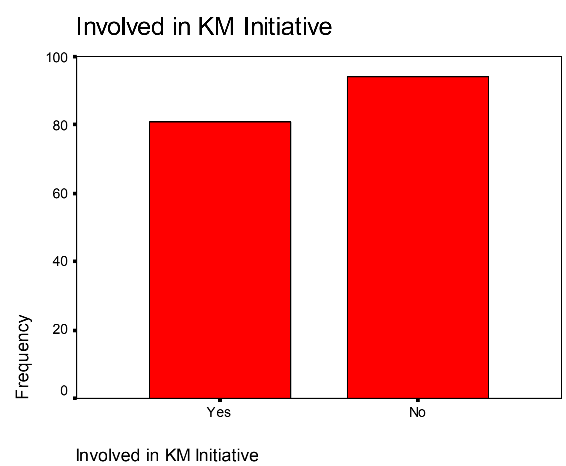


Figure 6.1.6 shows number of individuals who indicated as having some form of a knowledge management initiative within their organization. Out of the 97 (42.5%) individuals who indicated that their organization had some form of knowledge

management initiative, 81 (83.5%) individuals were involved in such initiative at some level (Figure 6.1.7).

Figure 6.1.8: General Business Function to Which the Respondent is Associated within their Organization

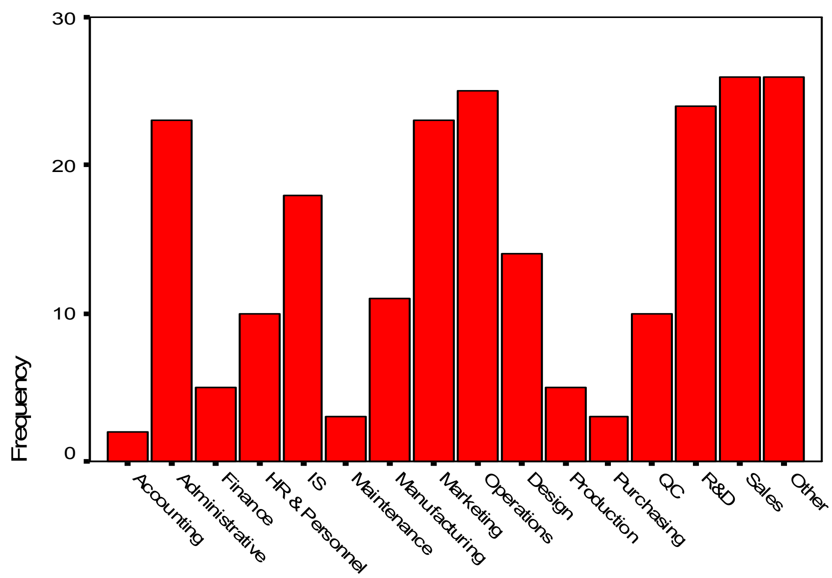


Figure 6.1.9: Tenure of Respondents in the Current Organization

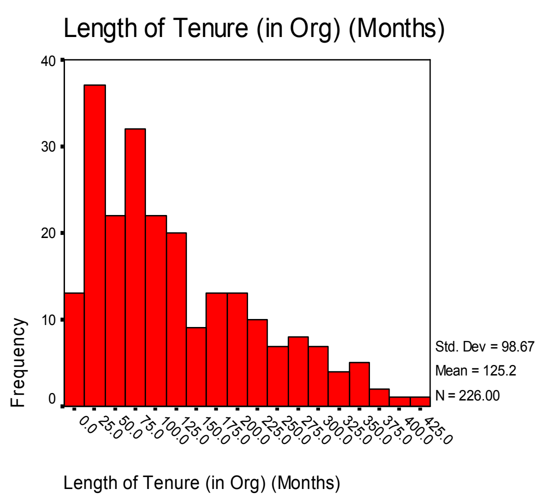


Figure 6.1.10: Tenure of Respondents in the Current Position

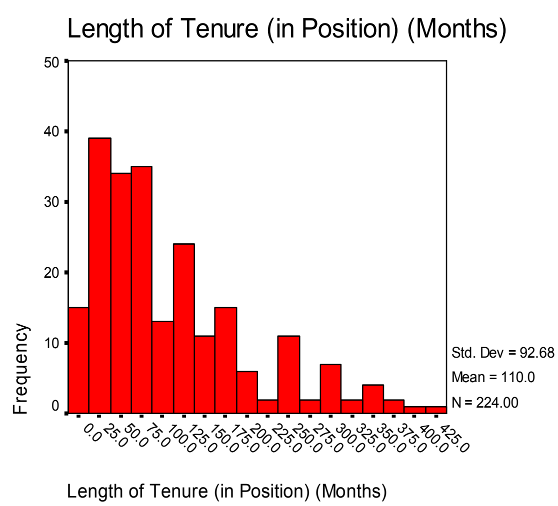


Figure 6.1.11: Current Position of Respondent within the Organization

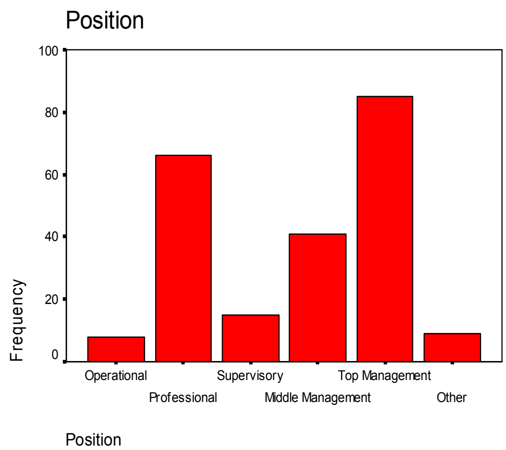


Figure 6.1.12: Respondents based on their Highest Degree Earned

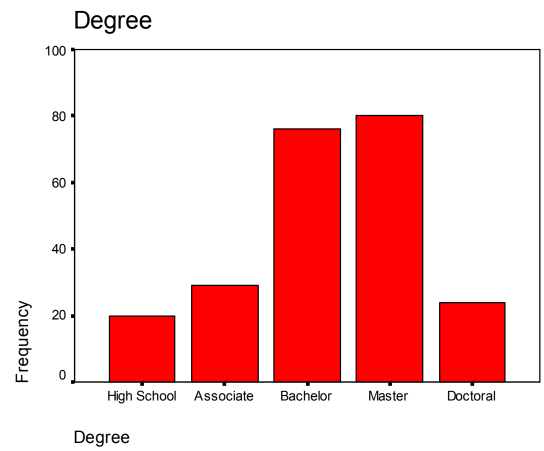


Figure 6.1.13: Age Distribution of the Respondents

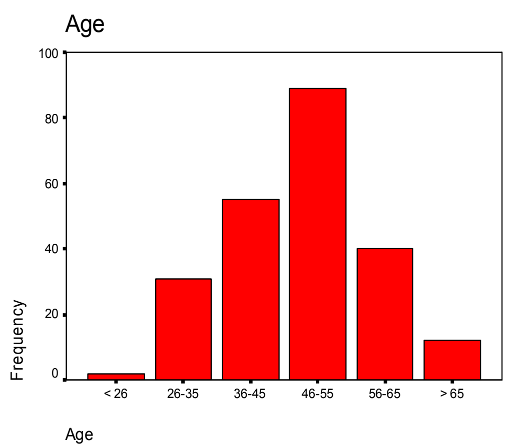
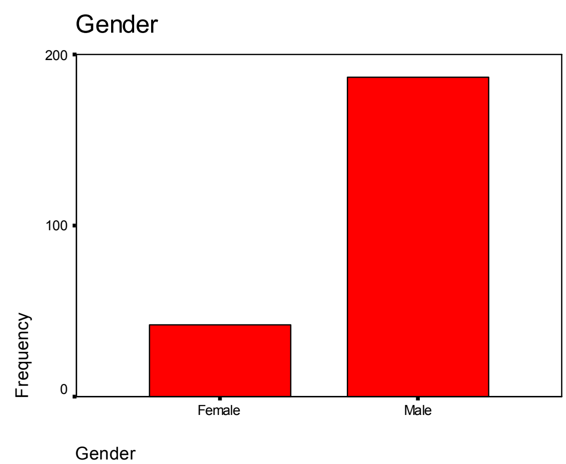


Figure 6.1.14: Respondents Based on Gender



Figures 6.1.8, 6.1.9, 6.1.10, and 6.1.11 shows the distribution of respondents' general business function within their organization, how long they have been with the current organization, the duration to which they have been working in the current or similar position and the position in which they are currently working. Majority of the respondents were professionals or in middle management or above positions, suggesting that the sample represents knowledge intensive workers well. Figures 6.1.12, 6.1.13, and

6.1.14 shows the distribution of respondents based on the highest degree they have earned, their age, and their gender.

6.1.1 Non-Response Bias Analysis

Non-response is an important issue in any survey research. It is the bias introduced "when respondents to a survey are different from those who did not respond in terms of demographic or attitudinal variables" (Sax, Gilmartin and Bryant, 2003, p.411). In fact, even when survey yields a low response rate, that by itself need not be biasing when the characteristics of respondents and non respondents are similar (Dillman, 1991; Krosnick, 1999). When such demographic information of the population is not available before hand as in this research, a common practice is to compare the characteristics of the early and late responders, or the respondents of from different waves of data collection (Smith, 1983; Stinchcombe, Jones and Sheatsley, 1981). Even though this method may not capture the true extent of non-response bias, it can still provide useful information regarding any possible such biases in the data.

Due to the unavailability of the demographic information of the population before hand from the mailing list, this research compares between the various characteristics of first and second wave of respondents. A Chi-square test of goodness-of-fit is used to test if distributions of various demographic variables are different between the first and the second wave of data collection. The result of the comparisons between the two waves of data collection is shown in Table 6.1.1.1. The results indicate that there is no significant difference between the various demographic variables and the variables relating to their community of practice analyzed. All comparisons were non-significant with p-values

Table 6.1.1.1: Test for Response Bias between First and Second Wave

Variables	First Wave	Second Wave	Chi-Square Test
Whether Responding to the Questionnaire Based on Past Six Months of Work			
Six Months of Work	90	64	χ^2=2.49 df=1 p>0.10
Particular Project/Assignment	50	48	
Missing	0	0	
Total	***140***	***112.00***	
Type of Organization Based on NACIS 2002 Code			
Other Manufacturing	4	5	χ^2=15.85 df=12 p>0.10
Chemical Manufacturing	8	4	
Plastics and Rubber Products Manufacturing	10	4	
Fabricated Metal Product Manufacturing	10	6	
Machinery Manufacturing	8	5	
Computer and Electronic Product Manufacturing	15	18	
Electrical Equip., Appl., and Component Manuf.	7	6	
Transportation Equipment Manufacturing	5	9	
Miscellaneous Manufacturing	10	5	
Software Engineering and Development	7	6	
Services	15	14	
Other	26	20	
Missing	15	10	
Total	***140***	***112***	
Number of Employees in the Organization			
Less Than 50	43	26	χ^2=5.39 df=6 p>0.10
50-100	13	14	
101-500	29	22	
501-1000	8	8	
1001-5000	14	15	
Over 5000	19	17	
Missing	14	10	
Total	***140***	***112***	
Time Since the Organization had been Established.			
< 2	2	2	χ^2=9.86 df=5 p>0.05
2-5	18	5	
6-10	17	10	
11-25	21	22	
> 25	68	62	
Missing	14	11	
Total	***140***	***112***	
Whether They have any Kind of KM Initiative in Organization			
Yes	48	49	χ^2=4.95 df=2 p>0.05
No	79	52	
Missing	13	11	
Total	***140***	***112***	

6.1.1.1: Test for Response Bias between First and Second Wave (Cont.)

Whether they are Involved in any KM Initiative			
Yes	40	41	χ^2=4.16 df=2 p>0.10
No	57	37	
Missing	43	34	
Total	***140***	***112***	
Business Function of the Respondents			
Administrative	12	11	χ^2=11.60 df=10 p>0.10
HR & Personnel	5	5	
IS	10	8	
Manufacturing	7	4	
Marketing	14	9	
Production/Operations	18	12	
Design	5	9	
QC	4	6	
R&D	15	9	
Sales	14	12	
Other	23	16	
Missing	13	11	
Total	***140***	***112***	
Current Position in The Organization			
Operational	5	3	χ^2=5.88 df=6 p>0.10
Professional	34	32	
Supervisory	9	6	
Middle Management	20	21	
Top Management	50	35	
Other	7	2	
Missing	15	13	
Total	***140***	***112***	
Highest Degree Attained by the Respondents			
High School	13	7	χ^2=4.83 df=5 p>0.10
Associate	18	11	
Bachelor	41	35	
Master	40	40	
Doctoral	15	9	
Missing	13	10	
Total	***140***	***112***	
Age of the Respondents			
< 26	1	1	χ^2=9.12 df=6 p>0.10
26-35	22	9	
36-45	29	26	
46-55	45	44	
56-65	21	19	
> 65	9	3	
Missing	13	10	
Total	***140***	***112***	

6.1.1.1: Test for Response Bias between First and Second Wave (Cont.)

Gender of the Respondents			
Female	24	18	χ^2=0.12 df=2 p>0.10
Male	103	84	
Missing	13	10	
Total	***140***	***112***	
Was the Community Primarily Online?			
Yes	37	23	χ^2=3.09 df=2 p>0.10
No	100	88	
Missing	3	1	
Total	***140***	***112***	
Number of Members in the Specified CoP			
<5	25	19	χ^2=15.69 df=9 p>0.05
6-10	51	36	
11-15	13	7	
16-20	11	7	
21-25	4	6	
26-50	9	14	
51-100	11	6	
101-250	4	5	
>250	9	11	
Missing	3	1	
Total	***140***	***112***	
How long Respondents have been part of the Specified CoP			
<6	29	34	χ^2=10.42 df=7 p>0.10
7-12	26	21	
13-24	18	17	
25-36	11	9	
37-60	19	10	
61-120	22	14	
>120	11	6	
Missing	4	1	
Total	***140***	***112***	
Number of Communities in Which they Interacted During the Specified Period			
1	32	20	χ^2=12.31 df=8 p>0.10
2	22	15	
3	34	27	
4	16	16	
5	6	11	
6-10	14	15	
11-25	6	4	
>25	4	2	
Missing	5	3	
Total	***140***	***112***	

above 0.10, except for time since the organization had been established, whether they had any kind of KM initiative and the number of members in the respondents' community of practice, which were non-significant based on p-values above 0.05.

6.2 Measurement Instrument Analysis

Measurement instruments are evaluated in the large scale study by following similar procedure used in the pilot stage. The steps involved item purification, evaluation of factor structure, unidimensionality, convergent and discriminant validity, and predictive validity. Details of each of these steps are indicated in Section 5.1. Upon satisfactory evaluation of the instruments, the substantive relationships and the specific hypotheses were tested as specified in Section 6.3.

6.2.1 Community of Practice Characteristics

The CITC scores for each construct are shown in Table 6.2.1.1. All the scales except network ties, network hierarchy, and shared language & codes had good CITC values for their respective items. Item LSCP9 in network ties had a CITC score of 0.57, item LSCP11R in network hierarchy had a CITC score 0.41, and items LSCP31 and LSCP33 had CITC scores 0.57 and 0.48 respectively. Since most of the scores were close to the 0.60 cutoff they were retained for further analysis. These items are shown with a boldface CITC score in the Table 6.2.1.1.

To test for the unidimensionality, each scale was factor analyzed separately with their corresponding items that are retained after purification. All items for the respective

Figure 6.2.1.1: Number of Respondents who's Primary Community is same as their Work Group

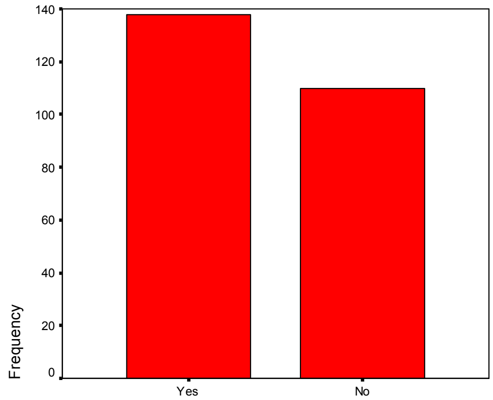


Figure 6.2.1.2: Number of Respondents who's Primary Community is Online

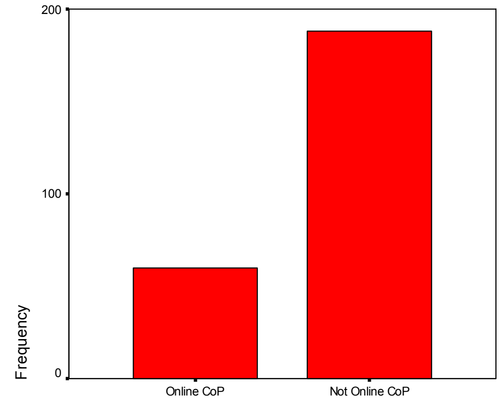


Figure 6.2.1.3: Percentage of Respondents' Online Interaction

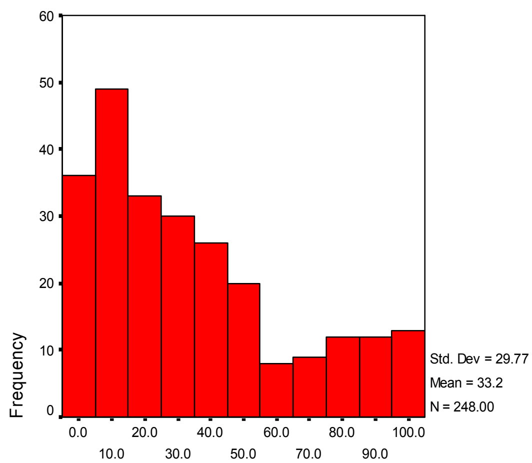


Figure 6.2.1.4: Distribution of Respondents Community Size in terms of Number of Members

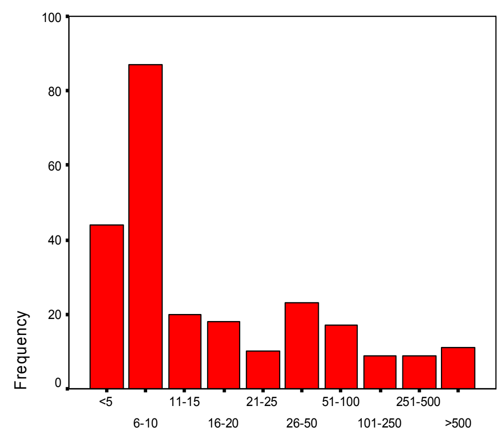


Figure 6.2.1.5: Duration to Which the Respondents have been Part of the Particular Community (in months)

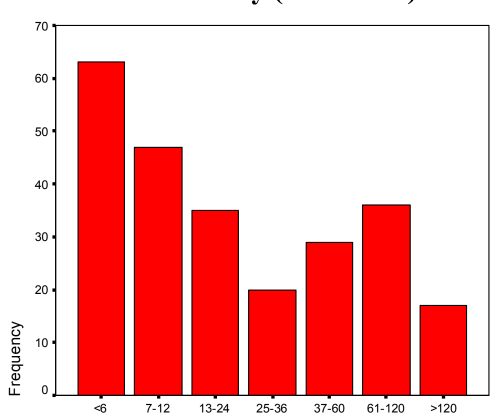


Figure 6.2.1.6: Number of Communities in which Respondents Interacted During the Specified Duration

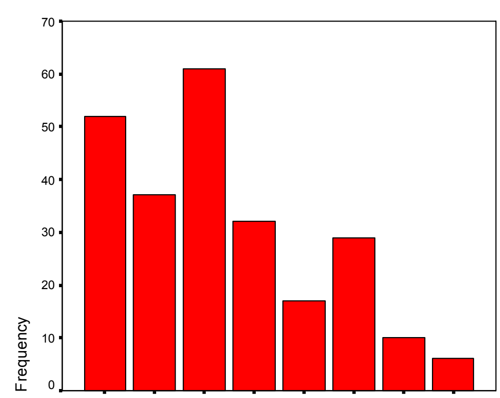


Table 6.2.1.1: Purification for Community of Practice Characteristics

Construct	Label	Items	CITC
Network Ties	LSCP7	members knew other members closely	0.63
	LSCP8	members interacted very close to each other	0.75
	LSCP9	members interacted frequently with other members	**0.57**
Network Hierarchy	LSCP10	members could directly access any other member	0.64
	LSCP11R	we had to go through many people to get to some members	**0.41**
	LSCP12	members could directly communicate with any other member	0.68
Appropriable Organization	LSCP13	most members knew each other before they joined this community	0.82
	LSCP14	most members were acquaintances of each other	0.73
	LSCP15	most members I interacted with were known to me before I joined this community	0.69
Shared Norms	LSCP16	members were expected to have team spirit	0.71
	LSCP17	members were expected to be cooperative	0.82
	LSCP18	members were expected to have an open mind	0.85
	LSCP19	members were expected to share what they knew	0.66
Mutual Trust	LSCP20	members trusted each other enough to share all relevant information	0.76
	LSCP21	members believed that all members were acting in good faith	0.83
	LSCP22	members were confident they could trust each other	0.84
	LSCP23	members relied on each other for the truthfulness of the information shared	0.76
Identification	LSCP24	members had a strong sense of belonging to the community	0.77
	LSCP25	members identified with each other as one community	0.81
	LSCP26	members felt as one community	0.82
	LSCP27	members cared for other members' well being	0.68
Obligation	LSCP28	members expected others to help them when they helped	0.72
	LSCP29	members were expected to return favors	0.75
	LSCP30	members expected others to help in return	0.79
Shared Languages and Codes	LSCP31	a common language was used to share ideas	**0.57**
	LSCP32	the terms used by members were known to most of us	0.69
	LSCP33	we had our own common words to communicate ideas	**0.48**
	LSCP34	members used technical terms common among us	0.61
Shared Narratives	LSCP35	members used stories to communicate subtle ideas	0.85
	LSCP36	stories and narratives were used to communicate rich sets of ideas	0.90
	LSCP37	stories and metaphors were used to create and preserve rich meaning	0.89
	LSCP38	stories and narratives were used to share hard to communicate ideas	0.87

scales loaded on a single factor and had a factor score above 0.60 indicating unidimensionality. To assess the convergent and discriminant validity, first the items were factor analyzed. Following which, the measurement models of each construct were analyzed in a pair-wise fashion using LISREL. As performed in the pilot stage, constructs in the structural, relational and cognitive dimensions of the community of practice were evaluated separately due to the possible relationships between them.

The exploratory factor analysis results for the three dimensions are shown in Tables 6.2.1.2 to 6.2.1.4. Factor loadings below 0.30 are suppressed for easier interpretation of the factor structure. All the items corresponding to each construct loaded on their respective factors with a factor loading greater than 0.60 indicating some evidence for convergent validity. The lowest factor loading was 0.638 for LSCP33 in shared language and codes. There were no crossloadings greater than 0.30, except for LSCP10 (0.335) in Network hierarchy, indicating that the constructs are distinct from each other.

Next, an individual measurement model was constructed for each construct with their respective items loading on the construct to evaluate the model-data fit. This would also enable us to identify any extreme cases of correlated errors between the items within the construct. This may be further used to examine the cause of such error correlations in the light of available theory and could be used to either account for such error correlations in the model or eliminate an item in consideration for the parsimony of the measurement model. Item LSCP33 in Shared Language and item LSCP35 in Narratives were eliminated due to high error correlations between other items in the same construct,

Table 6.2.1.2: Factor Analysis of Structural Characteristics Items

Pattern Matrix[a]

	Component		
	1	2	3
LSCP8	.853		
LSCP9	.845		
LSCP7	.746		
LSCP13		-.906	
LSCP15		-.878	
LSCP14		-.848	
LSCP12			.843
LSCP11r			.790
LSCP10	.335		.732

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 6 iterations.

Component Correlation Matrix

Component	1	2	3
1	1.000	-.223	.265
2	-.223	1.000	-.089
3	.265	-.089	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

resulting in three items for each constructs. There were two error correlations between the items for the Identification construct. Upon examination of the items there were no justification to have an error correlation from a theoretical perspective and hence no action was taken. The modification indices for the error correlations were also not very high (11.05).

Measurement models in this section indicated good fit. But the p-values for Norms and Identification were lower than the recommended 0.05 level. The ratio of chi-square to degrees of freedom ranged from 1.35 to 5.54 (Identification) indicating a reasonable fit (March and Hocevar, 1985). All measurement models with only three items had a perfect fit (chi-square= 0 and P-value=1) since they are saturated models. The model-data fit statistics for the all the constructs in this section are shown in Table 6.2.1.5.

To further access the convergent and discriminant validity of the community of practice scales using structural equation modeling, all constructs were subjected to pair-wise comparison in LISREL. The results are shown in Table 6.2.1.6, including the

Table 6.2.1.3: Factor Analysis of Relational Characteristics Items

Pattern Matrix[a]

	Component			
	1	2	3	4
LSCP21	.917			
LSCP22	.900			
LSCP20	.815			
LSCP23	.728			
LSCP29		.935		
LSCP30		.904		
LSCP28		.809		
LSCP16			-.870	
LSCP17			-.861	
LSCP18			-.856	
LSCP19			-.705	
LSCP24				-.875
LSCP25				-.874
LSCP26				-.871
LSCP27				-.739

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.
a. Rotation converged in 9 iterations.

Component Correlation Matrix

Component	1	2	3	4
1	1.000	.172	-.445	-.504
2	.172	1.000	-.292	-.328
3	-.445	-.292	1.000	.456
4	-.504	-.328	.456	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

Table 6.2.1.4: Factor Analysis of Cognitive Characteristics Items

Pattern Matrix[a]

	Component	
	1	2
LSCP37	.944	
LSCP36	.943	
LSCP38	.930	
LSCP35	.908	
LSCP32		.865
LSCP31		.807
LSCP34		.795
LSCP33		.638

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Component Correlation Matrix

Component	1	2
1	1.000	.117
2	.117	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

average variance extracted (AVE), Pearson correlation between the constructs (*r*) and the reliabilities (α). The chi-square difference between the models with construct correlations set to free and set to one ranges from 145 to 730 indicating good discriminant validity. Correlation of a scale with another scale below 0.70 is also generally accepted as a good indication of discriminant validity (Ping, 2004). Correlation of the scales in this section rages from 0.06 to 0.58 suggesting discriminant validity between the measures. Another good measure of convergent validity in mono-method studies is Fornell and Larker's (1981) AVE (Ping, 2004). AVE can range form 0 to 1, but a value above 0.50 indicates adequate convergent validity for the construct, and indicates that the measures contain less than 50% of error variance (Fornell and Larker, 1981). AVE for the measures in this section ranges form 0.57 to 0.85 indicating good convergent validity.

Table 6.2.1.5: Measurement Model Fit Statistics.

Construct	Chi-Square	DF	p-value	RMSEA	GFI	AGFI	NNFI	CFI	# of Items
Network Ties	0.00	0	1.000	0.000					3
Network Hierarchy	0.00	0	1.000	0.000					3
Appropriable Organization	0.00	0	1.000	0.000					3
Norms	7.12	2	0.030	0.101	0.99	0.93	0.98	0.99	4
Mutual Trust	0.89	2	0.640	0.000	1.00	0.99	1.00	1.00	4
Identification	11.08	2	0.004	0.134	0.98	0.89	0.95	0.98	4
Obligation	0.00	0	1.000	0.000					3
Shared Language	0.00	0	1.000	0.000					3
Narratives	0.00	0	1.000	0.000					3
Cognitive	6.77	5	0.238	0.038	0.99	0.97	1.00	1.00	5
Virtual	8.34	2	0.015	0.112	0.98	0.92	0.97	0.99	4
Autonomy	8.59	2	0.014	0.115	0.98	0.92	0.98	0.99	4
Self-efficacy	0.00	0	0.000	0.000					3
Impact	7.39	2	0.025	0.104	0.99	0.93	0.98	0.99	4
Meaning	0.00	0	1.000	0.000					3
Stimulate	17.79	2	0.000	0.177	0.97	0.83	0.92	0.97	4
Accumulate	0.00	0	1.000	0.000					3
Communicate	8.37	2	0.015	0.113	0.98	0.92	0.98	0.99	4
Informate	1.80	2	0.407	0.000	1.00	0.98	1.00	1.00	4
Automate	6.19	2	0.045	0.091	0.99	0.94	0.99	1.00	4
Create	0.00	0	1.000	0.000					3
Capture	18.19	2	0.000	0.180	0.97	0.83	0.94	0.98	4
Share	1.83	2	0.401	0.000	1.00	0.98	1.00	1.00	4
Access	5.86	2	0.053	0.088	0.99	0.94	0.98	0.99	4
Apply	0.00	0	1.000	0.000					3
Operational Knowledge	3.23	2	0.199	0.049	0.99	0.97	0.99	1.00	4
Conceptual Knowledge	12.28	2	0.002	0.143	0.98	0.88	0.97	0.99	4
Contextual Knowledge	16.56	5	0.005	0.096	0.97	0.92	0.95	0.98	5
Individual Performance	0.81	2	0.666	0.000	1.00	0.99	1.01	1.00	4
Creative Performance	12.01	2	0.003	0.141	0.98	0.88	0.95	0.98	4

Next, the measures in each dimension of the community of practice were analyzed together as a correlated measurement model for model-data fit. The Figures 6.2.1.7 to 6.2.1.12 show the standardized solution and t-values of the loadings respectively. Though the modifications indices suggested few error correlations and crossloadings for the items in the structural and relational dimensions, examination of the items did not reveal any explicit reasons for such error correlations to be specified in the model. Further, the largest modification index for items in the structural dimension was 20.3 for a crossloading of Appropriable Organization to LSCP9, and in the relational dimension it was 12.3 for an error correlation between items LSCP25 and LSCP27. These were interpreted as not high modification indices given the size of the model and the sample size used for the analysis. The researcher needs to be careful in these situations so as to not to overly correct the model based on data so that it becomes data driven approach rather than theory driven. Specifying the modifications in the model almost always provides a better fit with the data but when it is atheoretical they are not replicable in a different dataset (Hair et al., 1998). Chi-square values for structural and relational dimensions had a significant p-value (<0.05), whereas for cognitive dimension it was non-significant (>0.05). Since chi-square value is sensitive to sample size and to departures from multivariate normality, it should be interpreted with caution (Bollen, 1989; Joreskog and Sorbom, 1989). But the ratios of chi-square to degrees of freedom (March and Hocevar, 1985) indicate good fit and are: 2.53 for structural dimension, 2.22 for relational dimension, and 0.55 for cognitive dimension. Other fit statistics as indicated earlier such as GFI, AGFI, NFI, NNFI, CFI and RMSEA also need to be evaluated in

Figure 6.2.1.7: Standardized Solution for the Correlated Structural Dimension of CoP.

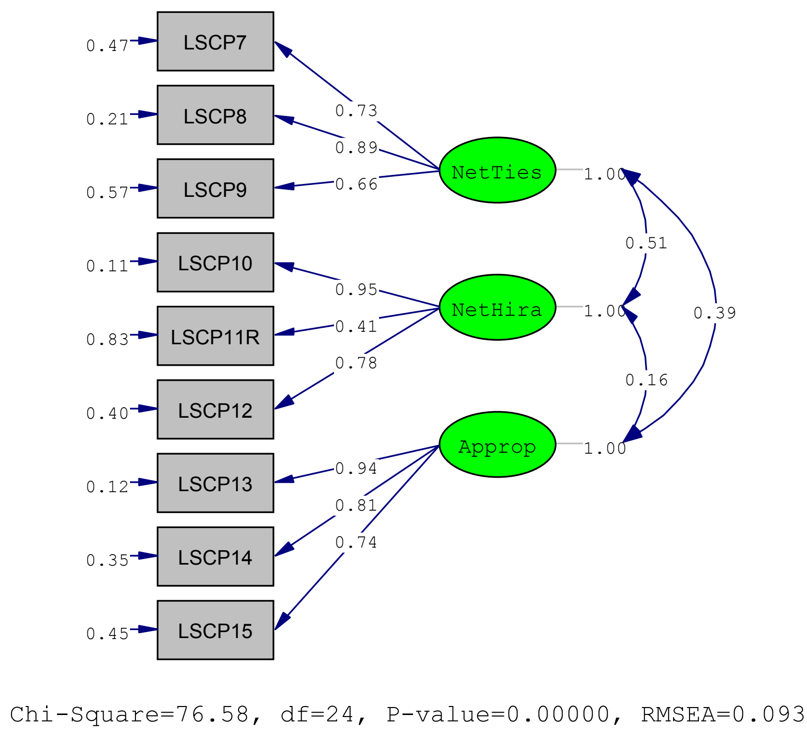


Figure 6.2.1.8: t-Values for the Correlated Structural Dimension of CoP.

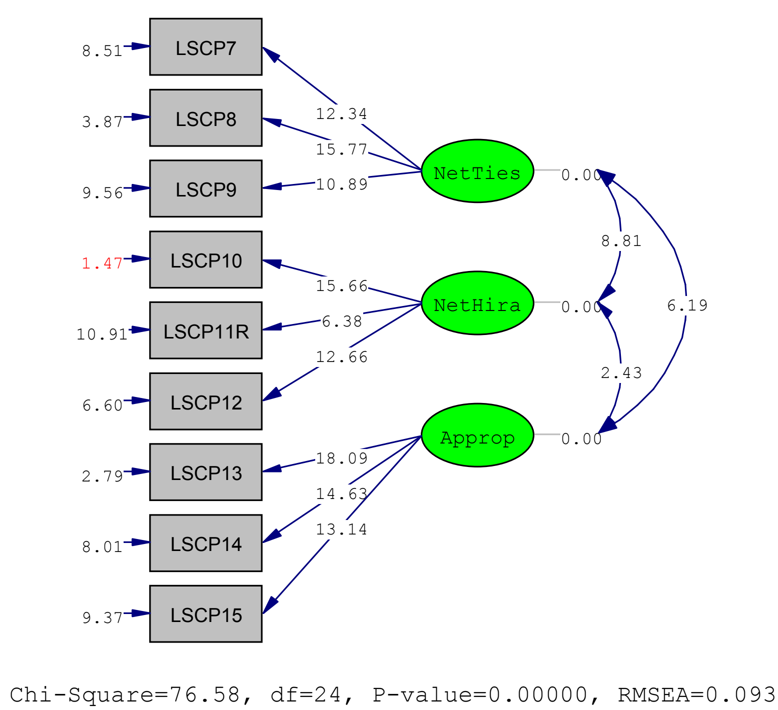
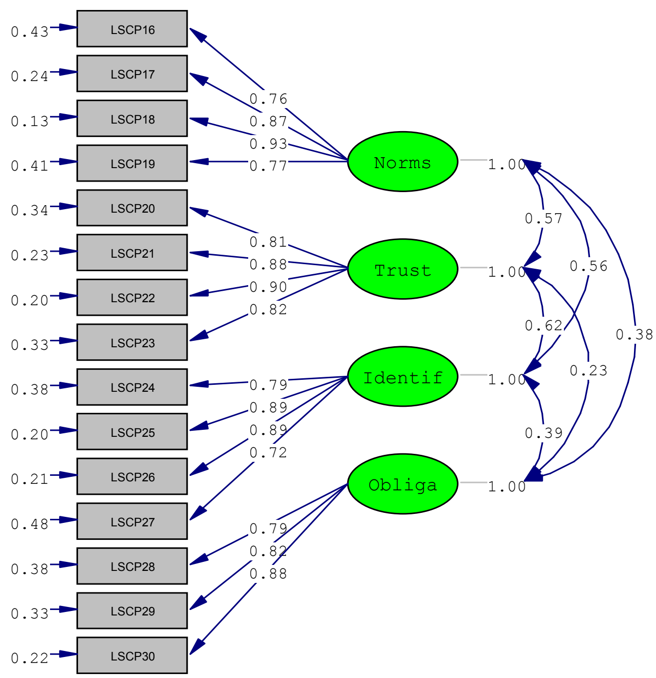
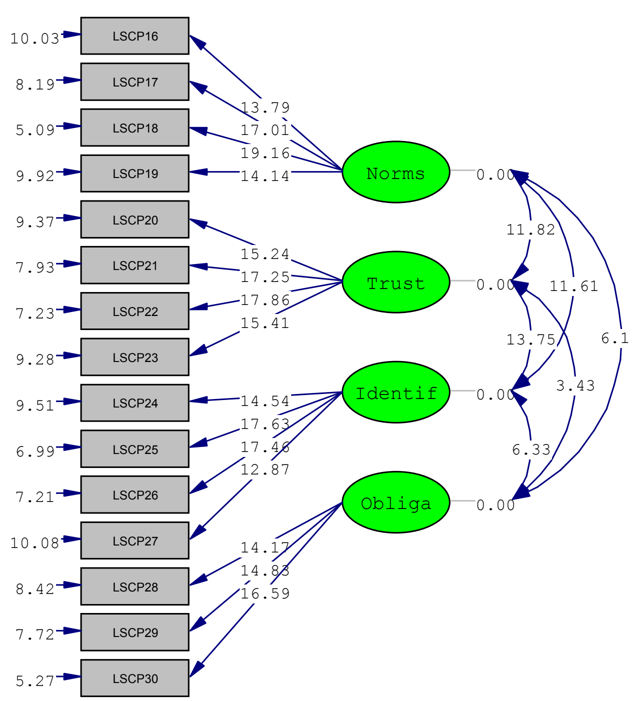


Figure 6.2.1.9: Standardized Solution for the Correlated Relational Dimension of CoP.



Chi-Square=186.72, df=84, P-value=0.00000, RMSEA=0.070

Figure 6.2.1.10: t-Values for the Correlated Relational Dimension of CoP.



Chi-Square=186.72, df=84, P-value=0.00000, RMSEA=0.070

Figure 6.2.1.11: Standardized Solution for the Correlated Cognitive Dimension of CoP.

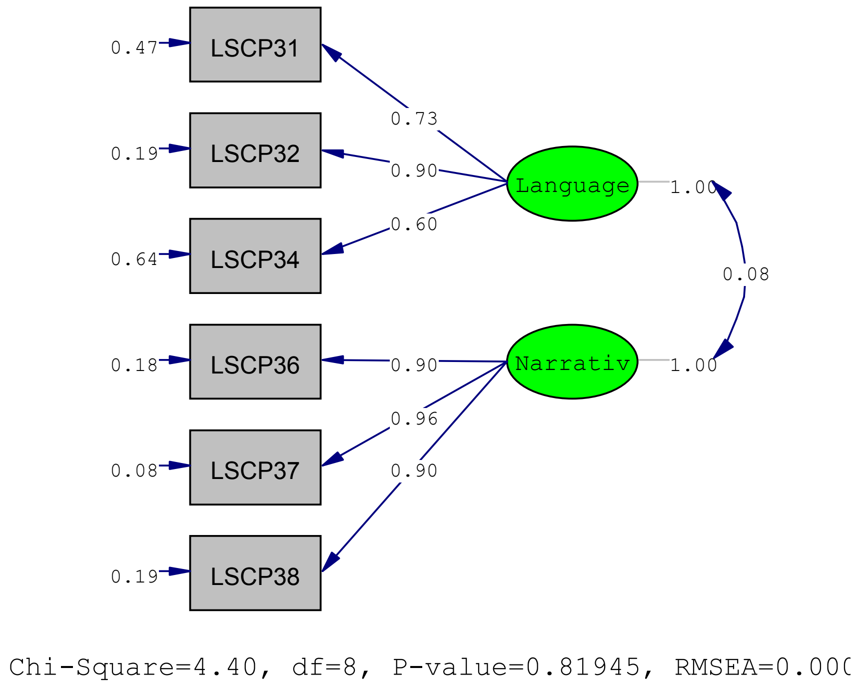


Figure 6.2.1.12: t-Values for the Correlated Cognitive Dimension of CoP.

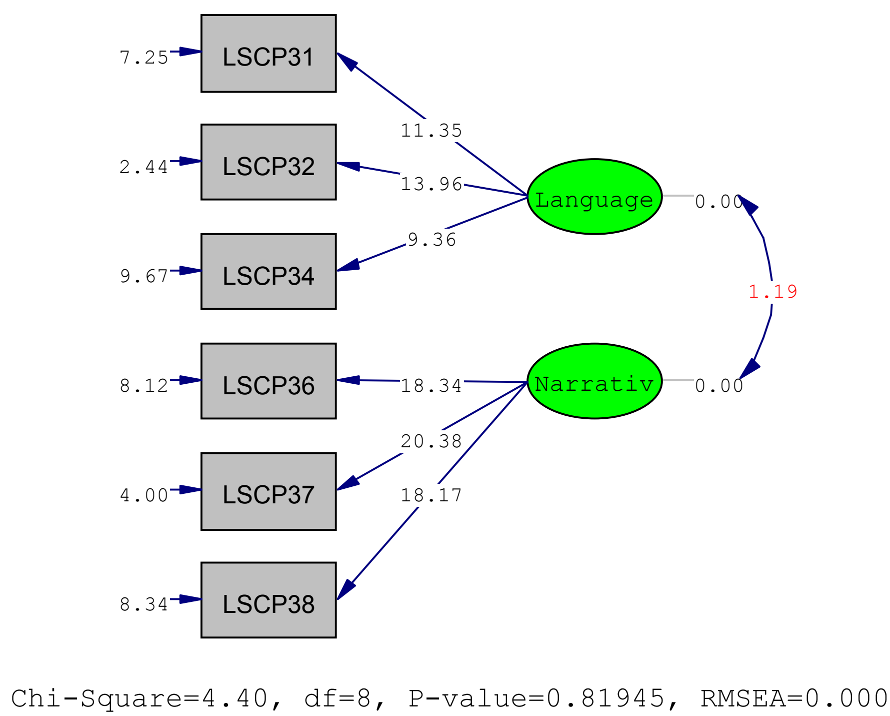


Table 6.2.1.6: Reliability, Convergent and Discriminant Validity of Community of Practice Scales

	Network Ties	Network Hierarchy	Appropriable Organization	Norms	Mutual Trust	Identification	Obligation	Shared Language	Narratives
Network Ties	AVE=0.60								
	α=0.81								
Network Hierarchy	*R=0.37***	AVE=0.56							
	χ^2=186	α=0.78							
Appropriable Organization	*R=0.32***	*r=0.13**	AVE=0.69						
	χ^2=212	χ^2=349	α=0.87						
Norms	*R=-0.43***	*r=-0.43***	*r=-0.16**	AVE=0.70					
	χ^2=178	χ^2=164	χ^2=709	α=0.90					
Mutual Trust	*r=-0.31***	*r=-0.44***	*r=-0.17***	*r=0.53***	AVE=0.72				
	χ^2=218	χ^2=168	χ^2=350	χ^2=609	α=0.91				
Identification	*r=0.57***	*r=0.40***	*r=0.20***	*r=0.52***	*r=0.58***	AVE=0.68			
	χ^2=145	χ^2=162	χ^2=663	χ^2=550	χ^2=486	α=0.90			
Obligation	*r=-0.21***	*r=-0.18***	*r=-0.04*	*r=0.33***	*r=0.21***	*r=0.36***	AVE=0.69		
	χ^2=249	χ^2=222	χ^2=349	χ^2=310	χ^2=343	χ^2=315	α=0.87		
Shared Language	*r=0.34***	*r=0.41***	*r=0.14**	*r=0.48***	*r=0.39***	*r=0.36***	*r=0.23***	AVE=0.57	
	χ^2=205	χ^2=174	χ^2=220	χ^2=153	χ^2=194	χ^2=191	χ^2=218	α=0.79	
Narratives	*r=0.24***	*r=-0.06*	*r=-0.10*	*r=0.22***	*r=0.12*	*r=0.37***	*r=0.24***	*r=0.06*	AVE=0.85
	χ^2=229	χ^2=207	χ^2=345	χ^2=730	χ^2=540	χ^2=545	χ^2=336	χ^2=227	α=0.94

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

χ^2> 10.22 for 1 d.f. is significant at p-value corrected for number of comparisons (0.05/36).

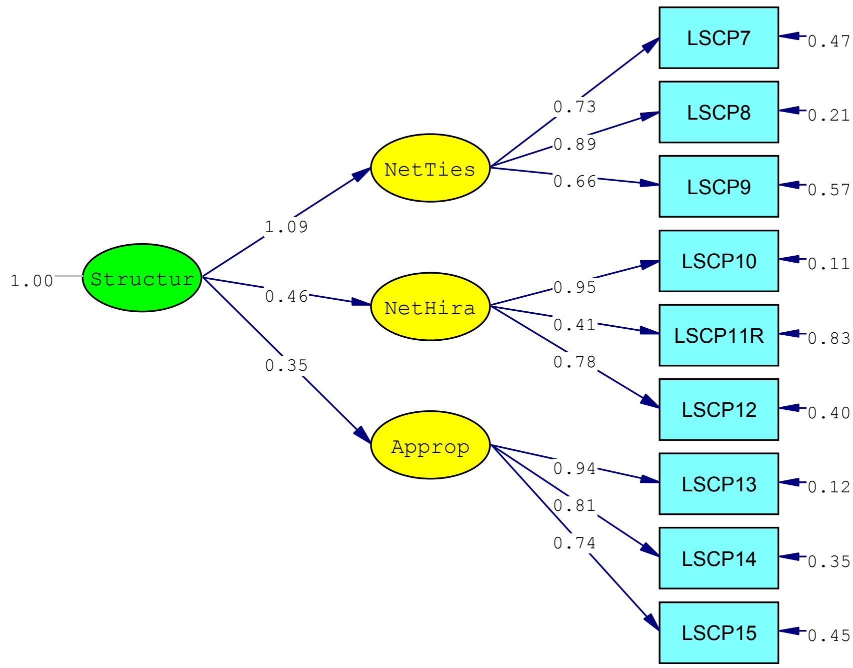
conjunction for the model-data fit. These fit statistics are shown in Table 6.2.1.7, and indicates reasonable to good fit for all three dimensions.

In order to test the proposed relationships that were hypothesized between second order constructs, existence of a second order factor was also evaluated. The fit statistics for both the correlated measurement model and second order factor model for each dimension of the community of practice are indicated in Table 6.2.1.7. The target coefficient index (March and Hocevar, 1985), which is the ratio of the chi-square of the first order correlated model to the second order model, is used to evidence the existence of a higher order model. The ratio can be interpreted as the percent of variation in the first order factors that is explained by the second order factor (Doll, Xia and Trokzadeh,

Table 6.2.1.7: Model Fit Statistics for the Correlated and Second Order Measurement Models.

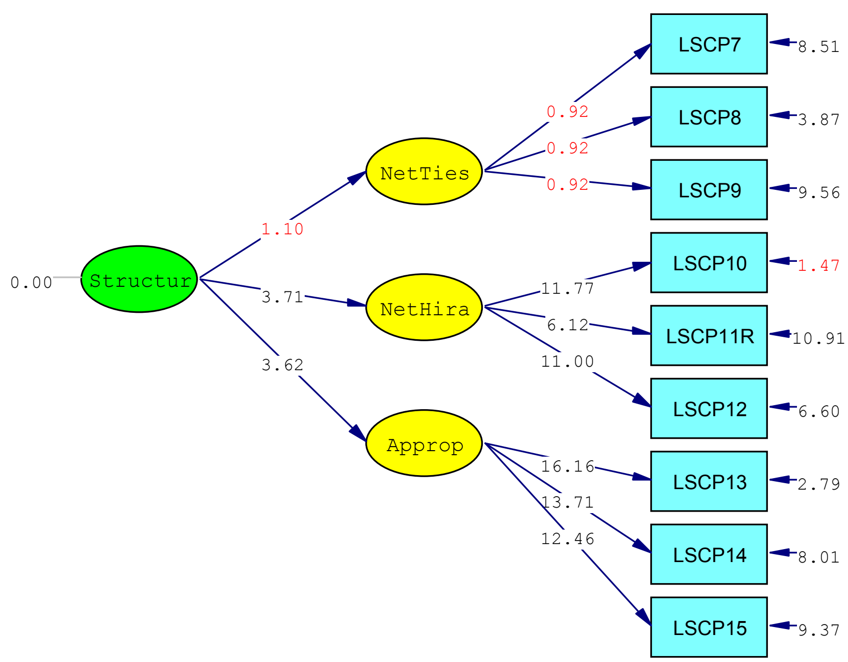
Construct	Chi-Square	DF	p-value	RMSEA	GFI	AGFI	NNFI	CFI	# of Items
WCH-CM	57.12	33	0.006	0.054	0.96	0.93	0.96	0.98	10
WCH-SM	57.12	33	0.006	0.054	0.96	0.93	0.96	0.98	10
COPSTR-CM	76.58	24	0.000	0.093	0.94	0.88	0.92	0.95	9
COPSTR-SM	76.58	24	0.000	0.093	0.94	0.88	0.92	0.95	9
COPREL-CM	186.72	84	0.000	0.070	0.91	0.87	0.95	0.96	15
COPREL-SM	194.78	86	0.000	0.071	0.91	0.87	0.95	0.96	15
COPCOG-CM	4.40	8	0.819	0.000	0.99	0.98	1.01	1.00	6
COPCOG-SM	Model is not identified								
EMP-CM	161.19	71	0.000	0.071	0.92	0.88	0.97	0.97	14
EMP-SM	163.84	73	0.000	0.070	0.91	0.88	0.97	0.97	14
ITS-CM	254.81	142	0.000	0.056	0.90	0.87	0.96	0.97	19
ITS-SM	295.98	147	0.000	0.064	0.89	0.86	0.96	0.96	19
KMP-CM	186.39	125	0.000	0.045	0.92	0.89	0.97	0.98	18
KMP-SM	225.42	130	0.000	0.054	0.91	0.88	0.96	0.97	18
TSK-CM	106.61	62	0.000	0.054	0.94	0.91	0.97	0.98	13
TSK-SM	106.61	62	0.000	0.054	0.94	0.91	0.97	0.98	13
PERF-CM	29.69	19	0.056	0.047	0.97	0.95	0.99	0.99	8
PERF-SM	Model is not identified								
CM= Correlate Model, SM= Second Order Model									

Figure 6.2.1.13: Standardized Solution for the Second Order Structural Dimension of CoP.



Chi-Square=76.58, df=24, P-value=0.00000, RMSEA=0.093

Figure 6.2.1.14: t-Values for the Second Order Structural Dimension of CoP.



Chi-Square=76.58, df=24, P-value=0.00000, RMSEA=0.093

Figure 6.2.1.15: Standardized Solution for the Second Order Relational Dimension of CoP.

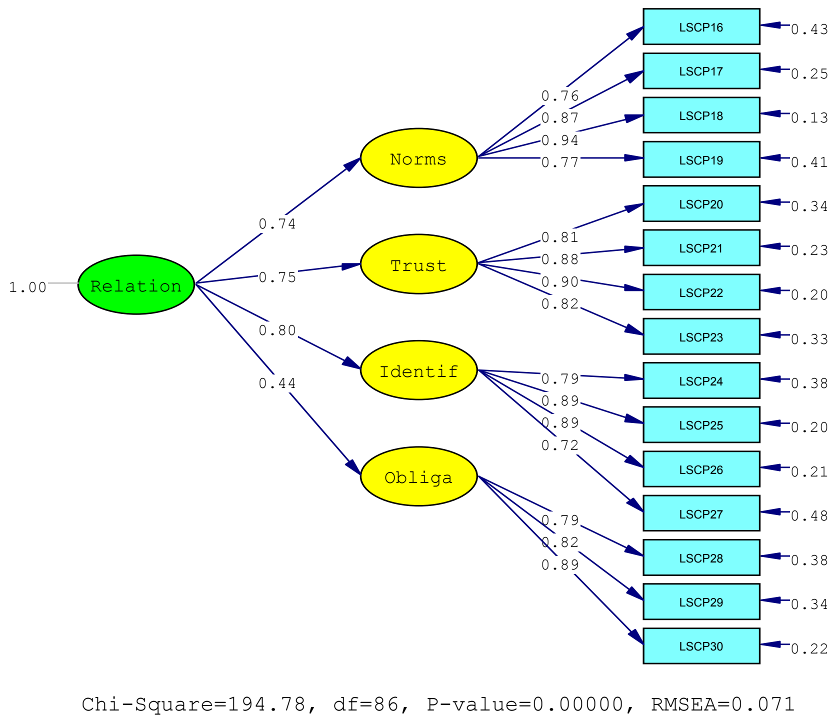
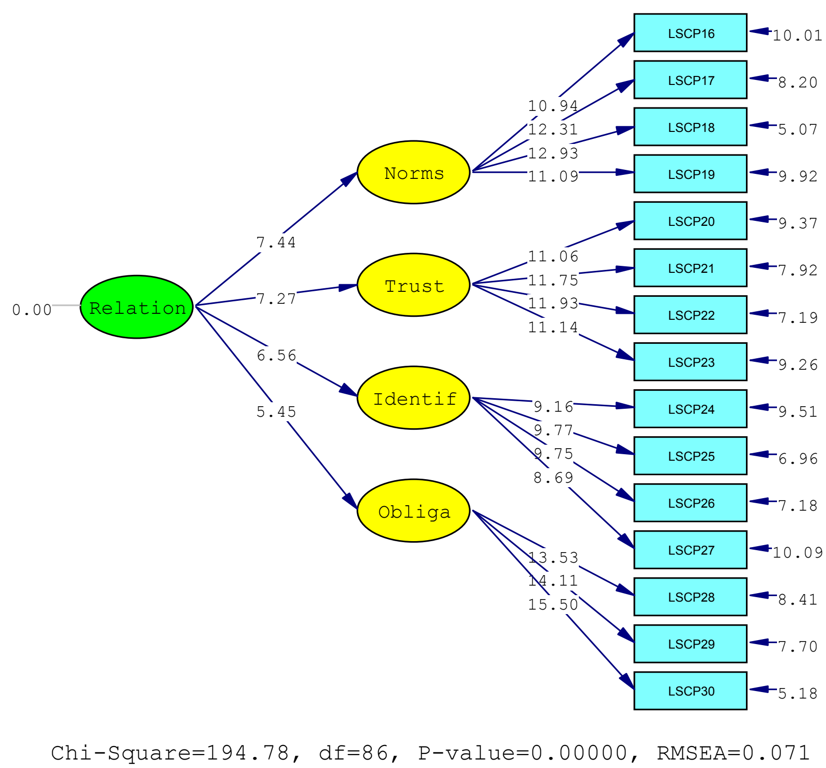


Figure 6.2.1.16: t-Values for the Second Order Relational Dimension of CoP.



1994). The results indicate that most of the variation in the first order constructs is explained by their respective second order constructs (Structural and Relational dimensions). The target coefficients for each of the constructs are: 100% for structural dimension and 95.8% for relational dimension. The standardized loadings and the t-values for the loadings in the second order measurement models are shown in Figures 6.2.1.13 to 6.2.1.16 for the two dimensions of community of practice. Cognitive dimension had only two factors and could not be modeled as a second order factor.

6.2.2 Work and Individual Characteristics

Since there were only two constructs in the work characteristics section after pilot, the items from work characteristics and individual characteristics were decided to be evaluated together in the large scale analysis. Further, these two aspects related to individuals' knowledge management practices are fairly independent of each other and are good constructs to evaluate the discriminatory ability of each. Slack, which is the third construct in work characteristic is a single item measure and will not be included in the analysis in this section. However, it will be used while the measurement model is evaluated in LISREL. The CITC scores for each construct are shown in Table 6.2.2.1. All the scales had CITC values greater than 0.60 for their respective items (lowest was 0.84 for LSIC12).

Each construct in this section was factor analyzed separately with their corresponding items that are retained after purification. All items for the respective scales loaded on a single factor and had a factor score above 0.60 indicating unidimensionality. To assess the convergent and discriminant validity, first the items were factor analyzed and then the measurement models of each construct were analyzed in a pair-wise fashion using LISREL.

Factor analysis results for the constructs in this section are shown in Table 6.2.2.2. Factor loadings below 0.30 are suppressed for easier interpretation of the factor

Table 6.2.2.1: CITC for Work Characteristics and Individual Characteristics

Construct	Label	Items	CITC
Cognitive Effort	LSWC1	My work required significant amount of reasoning	0.77
	LSWC2	My work required significant amount of knowledge	0.69
	LSWC3	My work involved intense thinking	0.80
	LSWC4	My work involved complex analysis	0.76
	LSWC5	My work was mentally challenging	0.79
Virtualness	LSWC6	My work involved work processes that had to be enacted through computers	0.78
	LSWC7	My work involved tasks that depended on computers	0.80
	LSWC8	My work would have been difficult to perform without computers	0.73
	LSWC9	My work processes were embedded in computers	0.76
	LSWC10	My work was mostly mediated by computers	0.64
Autonomy	LSIC1	I had autonomy in determining how I did my job	0.72
	LSIC2	I could decide on my own how to go about doing my work	0.85
	LSIC3	I had independence in how I did my job	0.88
	LSIC4	I had freedom in how I did my job	0.88
	LSIC5	I had choice in how I did my job	0.85
Self-Efficacy	LSIC6	I was confident about my ability to do my job	0.88
	LSIC7	I was self-assured about my capabilities to perform my work activities	0.87
	LSIC8	I had mastered the skills necessary to do my job	0.84
	LSIC9	I was confident about my knowledge for my tasks	0.88
Impact	LSIC10	I had impact on what happened in my department	0.82
	LSIC11	I had control over what happened in my department	0.79
	LSIC12	I had influence over what happened in my department	0.86
	LSIC13	I had impact over the outcomes of my job	0.70
Meaning	LSIC14	the work I did was important to me	0.89
	LSIC15	my job activities were personally meaningful to me	0.94
	LSIC16	the work I did was meaningful to me	0.95

Table 6.2.2.2: Factor Analysis of Work and Individual Characteristics Items

Pattern Matrix[a]

	Component					
	1	2	3	4	5	6
LSIC12	.908					
LSIC11	.902					
LSIC10	.830					
LSIC13	.639					
LSWC9		.872				
LSWC7		.870				
LSWC6		.848				
LSWC8		.813				
LSWC10		.774				
LSWC4			-.877			
LSWC3			-.871			
LSWC1			-.857			
LSWC5			-.821			
LSWC2			-.782			
LSIC4				.924		
LSIC3				.912		
LSIC5				.900		
LSIC2				.891		
LSIC1				.809		
LSIC9					-.931	
LSIC6					-.924	
LSIC8					-.914	
LSIC7					-.881	
LSIC15						.883
LSIC16						.869
LSIC14						.789

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 8 iterations.

Component Correlation Matrix

Component	1	2	3	4	5	6
1	1.000	-.058	-.361	.505	-.384	.430
2	-.058	1.000	-.169	-.090	-.015	-.058
3	-.361	-.169	1.000	-.294	.147	-.258
4	.505	-.090	-.294	1.000	-.424	.330
5	-.384	-.015	.147	-.424	1.000	-.350
6	.430	-.058	-.258	.330	-.350	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

structure. All the items corresponding to each construct loaded on their respective factors with a factor loading greater than 0.60 indicating some evidence for convergent validity. The lowest factor loading was 0.639 for LSIC13 in impact dimension of empowerment. There were no crossloadings greater than 0.30, indicating discriminant validity between the constructs in this section.

Measurement models for each construct with their respective items loading on the construct were constructed to evaluate the model-data fit. Item LSWC10 in virtualness, LSIC2 in autonomy and item LSIC9 in self-efficacy were eliminated due to high error correlations between other items in the same construct, resulting in 4 items for virtualness and autonomy and 3 items for self-efficacy. There were two error correlations between items in virtualness even after eliminating LSWC10, but they had relatively small modification indices (8.29). Upon examination of the items there were no justification to have an error correlation from a theoretical perspective and hence no action was taken.

Measurement models in this section indicated good fit. The p-values for chi-square were significant (<0.05) except for cognitive effort and meaning. The ratios of chi-square to degrees of freedom were: cognitive effort = 1.35, virtualness = 4.17, autonomy = 4.29, impact = 3.69, and indicated reasonable fit. Self-efficacy and meaning had only three items and had a perfect fit (chi-square= 0 and p-value=1) since they are saturated models. The model-data fit statistics for the all the constructs in this section are shown in Table 6.2.1.5.

Convergent and discriminant validity of the constructs in this section were further examined using structural equation modeling, by subjecting all constructs to a pair-wise comparison in LISREL. The results are shown in Table 6.2.2.3, with AVE, Pearson correlation between the constructs (r) and the reliabilities (α). The chi-square difference between the models when the construct correlations are set free and set to one ranges from 443 to 989 indicating good discriminant validity between the constructs. Correlation of the scales in this section rages from 0.01 to 0.59 and also suggesting good discriminant validity between the measures. AVE for the measures in this section ranges form 0.66 to 0.90, and indicates good convergent validity. Slack is a single item measure and only the correlation is reported in Table 6.2.2.3.

Next, two correlated measurement models with all the constructs within work characteristics and empowerment were tested separately. The Figures 6.2.2.1 to 6.2.2.4 show the standardized solution and t-values of the loadings for each correlated

Table 6.2.2.3: Reliability, Convergent and Discriminant Validity of Work Characteristics and Empowerment

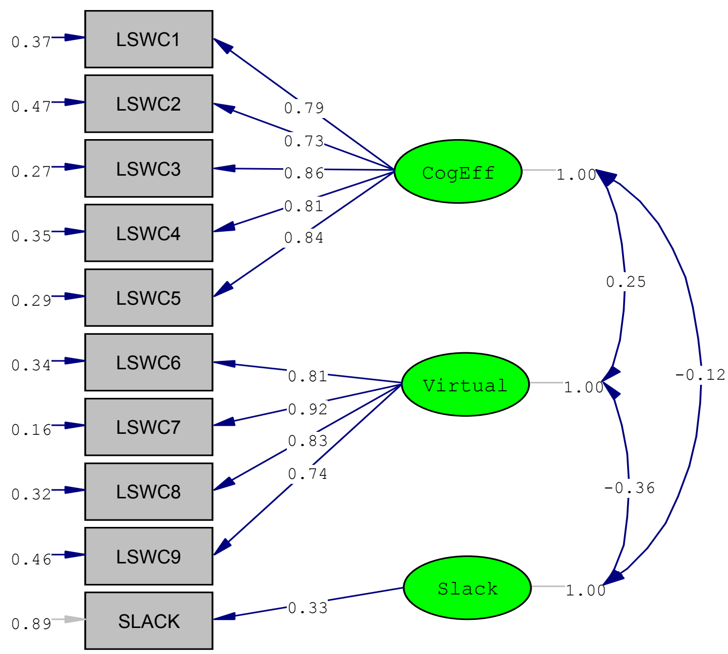
	Cognitive	Virtual	Autonomy	Self-efficacy	Impact	Meaning
Cognitive	AVE=0.66 α=0.91					
Virtual	*r=0.21*** χ^2= 693	AVE=0.68 α=0.89				
Autonomy	*r=0.30*** χ^2= 989	*r=-0.07* χ^2= 688	AVE=0.75 α=0.92			
Self-efficacy	*r=0.15** χ^2= 489	*r=0.03* χ^2= 496	*r=0.45*** χ^2= 460	AVE=0.81 α=0.93		
Impact	*r=0.39*** χ^2= 721	*r=-0.01* χ^2= 750	*r=0.55*** χ^2= 558	*r=0.43*** χ^2= 505	AVE=0.71 α=0.91	
Meaning	*r=-0.36*** χ^2= 963	*r=-0.07* χ^2= 607	*r=0.44*** χ^2= 785	*r=0.46*** χ^2= 443	*r=0.59*** χ^2= 589	AVE=0.90 α=0.97
Slack	*r=-0.03*	*r=-0.12**	*r=0.05*	*r=-0.10*	*r=0.06*	*r=-0.04*

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).
χ^2> 8.61 for 1 d.f. is significant at p-value corrected for number of comparisons (0.05/15).

measurement model. Since slack is a single item measure, its error variance was set to one in creating the measurement model. Though the modifications indices suggested few error correlations and crossloadings for the items in both the models, these modification indices were not severe. The largest modification index in work characteristics was 10.37 for a crossloading of LSWC1 to LSWC2, and for empowerment model it was 20.3 for an error correlation between items LSIC15 and LSIC16. Chi-square values for both models had a significant p-value (<0.05), but the ratios of chi-square to degrees of freedom indicate good fit and were: 1.73 for work characteristics and 2.27 for empowerment. Other fit statistics also indicated a good fit for both the measurement models and is shown in Table 6.2.1.7.

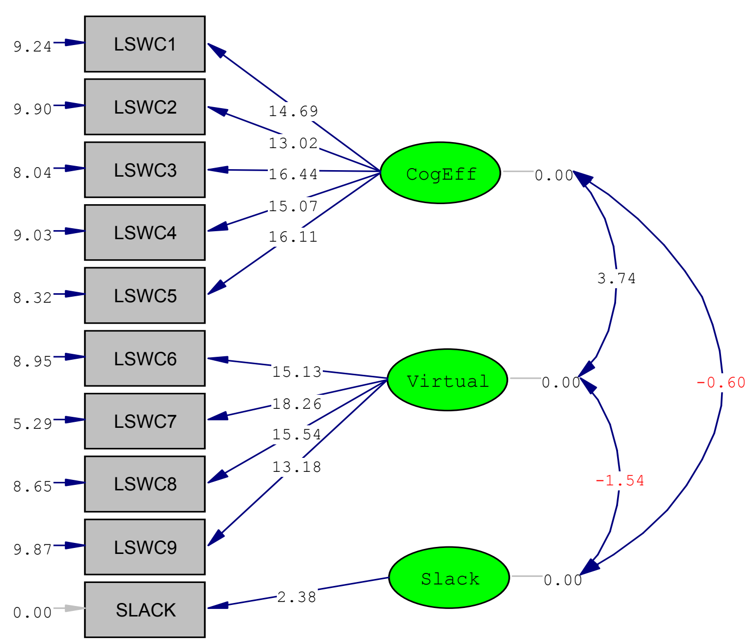
The plausibility of a second order factor for work characteristics and empowerment were evaluated using the target coefficient index. The fit statistics for both the correlated measurement model and second order factor model for work characteristics and empowerment are indicated in Table 6.2.1.7. The results indicate that most of the variation in the first order constructs is explained by their respective second order constructs. The target coefficients for the second order constructs are 100% for work characteristics and 98.4% for empowerment. The modification indices for the second order measurement model were similar to the modification indices in the correlated measurement model. The standardized loadings and the t-values for the loadings in the second order measurement models are shown in Figures 6.2.2.5 to 6.2.2.8. However, the loadings were not significant for the second order factor structure of work characteristics. The loadings for first order constructs to their observed variables for virtualness and slack were also not significant.

Figure 6.2.2.1: Standardized Solution for the Correlated Work Characteristics Measurement Model



Chi-Square=57.12, df=33, P-value=0.00569, RMSEA=0.054

Figure 6.2.2.2: t-Values for the Correlated Work Characteristics Measurement Model



Chi-Square=57.12, df=33, P-value=0.00569, RMSEA=0.054

Figure 6.2.2.3: Standardized Solution for the Correlated Measurement Model of Empowerment

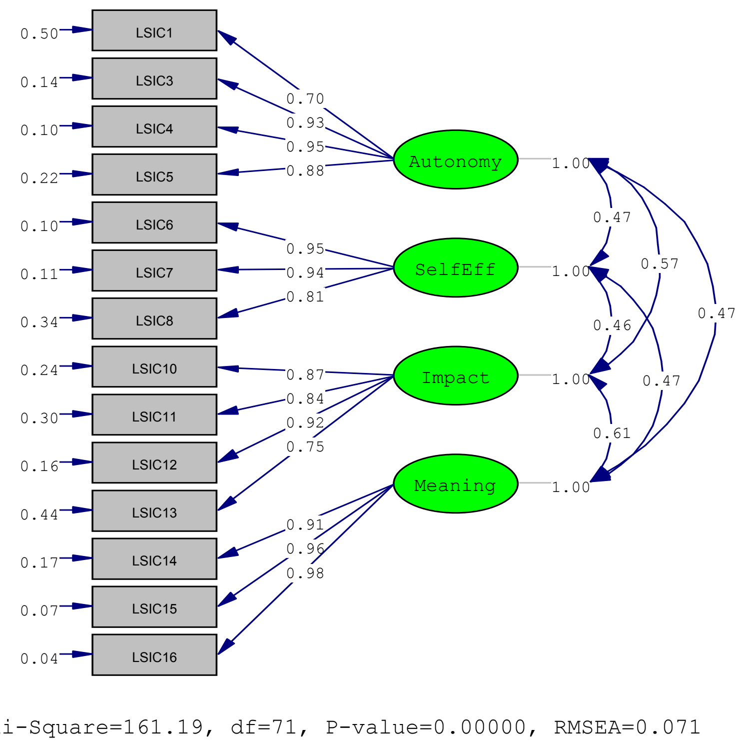


Figure 6.2.2.4: t-Values for the Correlated Measurement Model of Empowerment

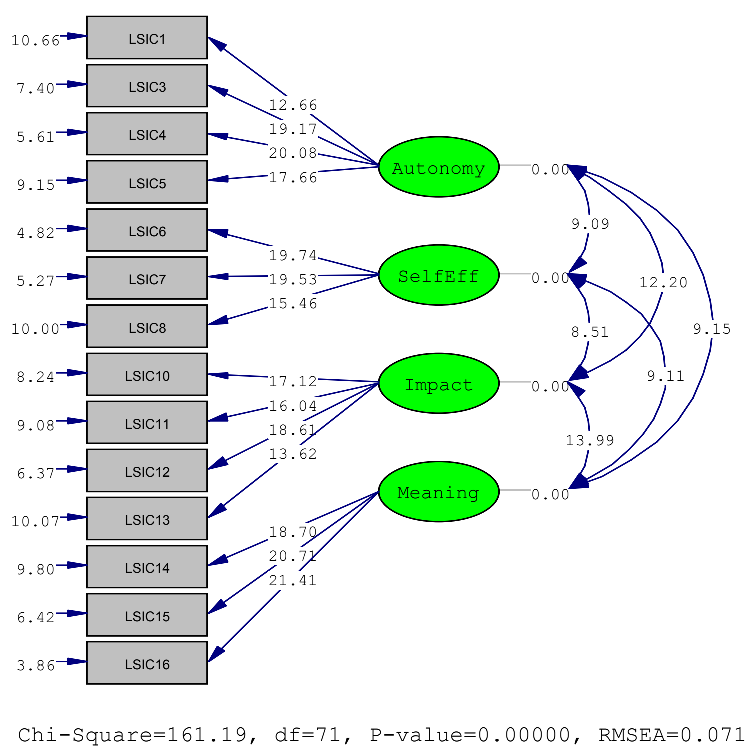


Figure 6.2.2.5: Standardized Solution for the Second Order Measurement Model of Work Characteristics

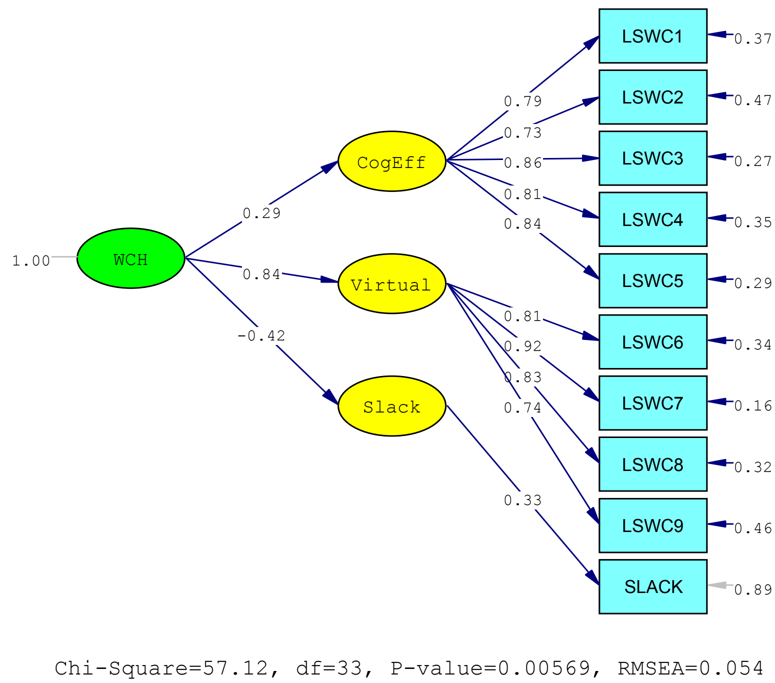


Figure 6.2.2.6: t-Values for the Second Order Measurement Model of Work Characteristics

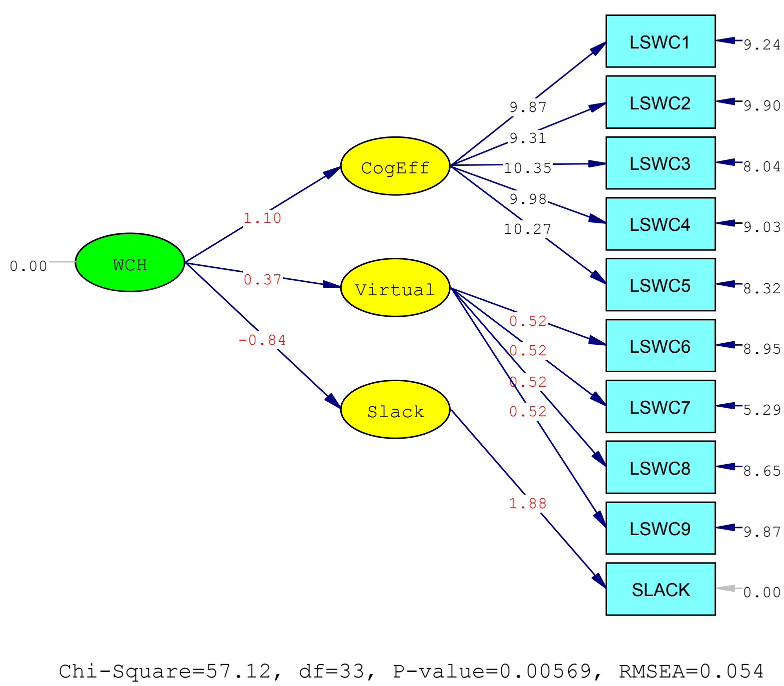
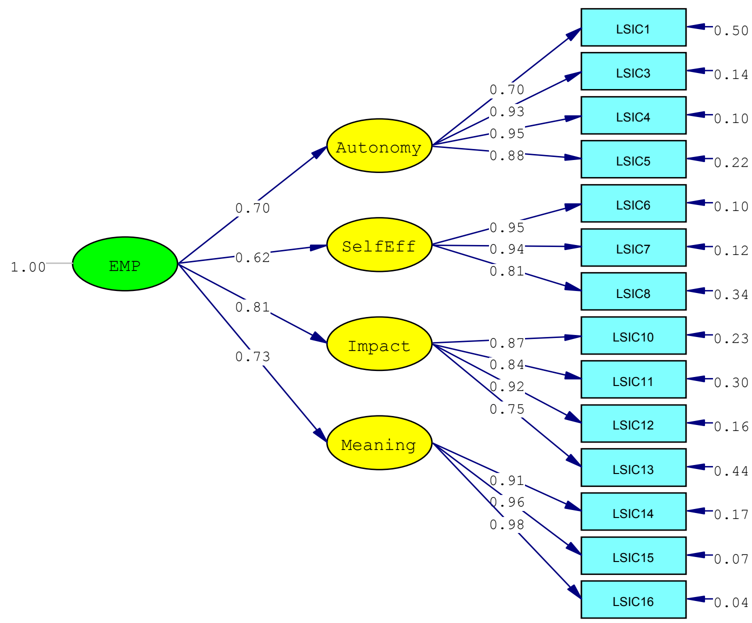
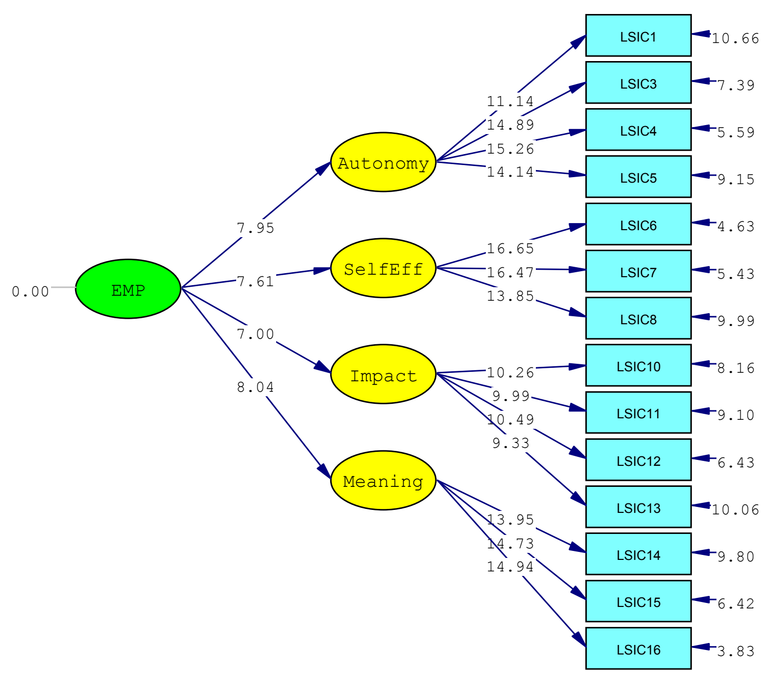


Figure 6.2.2.7: Standardized Solution for the Second Order Measurement Model of Empowerment



Chi-Square=163.84, df=73, P-value=0.00000, RMSEA=0.070

Figure 6.2.2.8: t-Values for the Second Order Measurement Model of Empowerment



Chi-Square=163.84, df=73, P-value=0.00000, RMSEA=0.070

6.2.3 Information Technology Support

The CITC scores for each construct in the IT support section is shown in Table 6.2.3.1. All the scales had CITC values greater than 0.60 for their respective items, except for LSIT10 and LSIT16 (both had a CITC score of 0.58, indicated in boldface). Since they are close to the 0.60 cut-off, all items are retained for further analysis. Each construct in this section was factor analyzed separately with their corresponding items that are retained after purification. All items for the respective scales loaded on a single factor and had a factor score above 0.60 indicating unidimensionality. To assess the convergent and discriminant validity, first the items were factor analyzed and then the measurement models of each construct were analyzed in a pair-wise fashion using LISREL.

Factor analysis of all items resulted in five factors, but items LSIT10 and LSIT16 had a factor loading less than 0.60 (0.476 and 0.464 respectively) and crossloaded with accumulate and stimulate respectively. Upon further examination these items were decided to be eliminated from further analysis. The resultant factor structure with rest of the items is shown in Table 6.2.3.2. Factor loadings below 0.30 are suppressed for easier interpretation of the factor structure. All the items corresponding to each construct loaded on their respective factors with a factor loading greater than 0.60 indicating some evidence for convergent validity. The lowest factor loading was 0.679 for LSIT7 in the accumulate dimension of IT support. There were no crossloadings greater than 0.30 at this point, indicating a certain level of discriminant validity between the constructs in this section.

Table 6.2.3.1: CITC for IT Support

Construct	Label	Items	CITC
Stimulate	LSIT1	generate new ideas	0.78
	LSIT2	think through problems	0.74
	LSIT3	generate new information	0.74
	LSIT4	stimulate my thinking	0.80
	LSIT5	create new knowledge	0.80
Accumulate	LSIT6	store needed information	0.74
	LSIT7	retain my knowledge	0.68
	LSIT8	store work related data	0.77
	LSIT9	retain required information	0.79
	LSIT10	store my ideas	**0.58**
Communicate	LSIT11	share my insights	0.84
	LSIT12	communicate what I know	0.90
	LSIT13	share my ideas	0.90
	LSIT14	communicate with other people	0.82
	LSIT15	transfer my knowledge	0.79
Informate	LSIT16	become more informed	**0.58**
	LSIT17	access needed information	0.75
	LSIT18	access information from others	0.77
	LSIT19	access required information	0.81
	LSIT20	access useful information	0.83
Automate	LSIT21	automate my work processes	0.74
	LSIT22	automate decision-making	0.73
	LSIT23	automate my work routines	0.89
	LSIT24	automate my tasks	0.90
	LSIT25	automate things I had to do	0.90

A confirmatory factor model of each construct with their respective items loading on the construct was constructed to evaluate the model-data fit. Items LSIT4, LSIT7, LSIT15 and LSIT22 were eliminated due to high error correlations and to keep the scales parsimonious, resulting in 4 items in each constructs in this section except for accumulate which had 3 items. Stimulate had multiple error correlations highest of which had a modification index of 15.86. There were two error correlation with a modification index of 8.32 in communicate. Rest of the constructs did not have any modifications.

Measurement models in this section indicated good fit. The p-values for chi-square were non-significant (>0.05) except for stimulate and communicate. The ratios of chi-square to degrees of freedom were: stimulate= 8.89, communicate= 4.18, informate= 0.90, automate= 3.09 and indicated reasonable fit except for stimulate. Accumulate had only three items and had a perfect fit (chi-square= 0 and p-value=1) since the model was saturated. The model-data fit statistics for the all the constructs in this section are shown in Table 6.2.1.5 and indicates good fit.

Convergent and discriminant validity of the constructs in this section were further examined using pair-wise measurement model comparison in LISREL. The results are shown in Table 6.2.3.3, with AVE, Pearson correlation between the constructs (*r*) and the reliabilities (α). The chi-square difference between the models with the construct correlations set to free and set to one ranges from 382 to 1001 indicating good discriminant validity between the constructs. Correlation of the scales in this section rages from 0.11 to 0.48 and also suggests good discriminant validity between the measures. AVE for the measures in this section ranges form 0.65 to 0.81, and indicates good convergent validity. The measures have good reliabilities ranging from 0.88 (for stimulate) to 0.94 (for communicate and automate).

A correlated measurement model with all constructs in IT support is developed to evaluate the model-data fit of the scales and to explore the possibility of a second order IT support construct. The Figures 6.2.3.1 and 6.2.3.2 show the standardized solution and t-values of the loadings for the correlated measurement model. The modifications indices suggested few error correlations and crossloadings in the correlated measurement model, but these modification indices are not very severe. The largest modification index is 18.6

Table 6.2.3.2: Factor Analysis of IT Support Items

Pattern Matrix[a]

	Component				
	1	2	3	4	5
LSIT4	.869				
LSIT5	.865				
LSIT1	.840				
LSIT2	.827				
LSIT3	.793				
LSIT24		.958			
LSIT25		.947			
LSIT23		.939			
LSIT21		.790			
LSIT22		.784			
LSIT8			.923		
LSIT6			.889		
LSIT9			.855		
LSIT7			.679		
LSIT12				.936	
LSIT13				.915	
LSIT11				.912	
LSIT14				.878	
LSIT15				.796	
LSIT19					-.895
LSIT20					-.841
LSIT17					-.816
LSIT18					-.805

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 9 iterations.

Component Correlation Matrix

Component	1	2	3	4	5
1	1.000	.332	.197	.388	-.321
2	.332	1.000	.279	.118	-.317
3	.197	.279	1.000	.291	-.421
4	.388	.118	.291	1.000	-.321
5	-.321	-.317	-.421	-.321	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

Table 6.2.3.3: Reliability, Convergent and Discriminant Validity of Information Technology Support

	Stimulate	Accumulate	Communicate	Informate	Automate
Stimulate	AVE=0.65 α=0.88				
Accumulate	*r=0.21*** χ^2= 619	AVE=0.76 α=0.91			
Communicate	*r=0.39*** χ^2= 550	*r=0.27*** χ^2=1001	AVE=0.81 α=0.94		
Informate	*r=0.42*** χ^2= 546	*r=0.48*** χ^2= 382	*r=0.40*** χ^2= 726	AVE=0.74 α=0.92	
Automate	*r=0.35*** χ^2= 572	*r=0.31*** χ^2= 440	*r=0.11* χ^2= 975	*r=0.37*** χ^2= 778	AVE=0.81 α=0.94

**Correlation is significant at the 0.01 level (2-tailed).
χ^2> 7.88 for 1 d.f. is significant at p-value corrected for number of comparisons (0.05/10).

for a crossloading of communication to LSIT18. Chi-square value had a significant p-value (<0.05), but the ratio of chi-square to degrees of freedom indicate good fit (1.79). Other fit statistics also indicated a adequate model-data fit (Table 6.2.1.7).

The target coefficient index is used to assess a second order IT support factor as proposed in the research model. The fit statistics for both the correlated measurement model and second order factor model are shown in Table 6.2.1.7. The results indicate that most of the variation in the first order constructs is explained by the second order construct. The target coefficient for the second order construct is 86.1%. Though there are some additional crossloadings in the second order model, the modification indices and their magnitudes are similar to the modification indices in the correlated measurement model. The standardized loadings and the t-values for the loadings in the second order measurement models are shown in Figures 6.2.3.3 and 6.2.3.4.

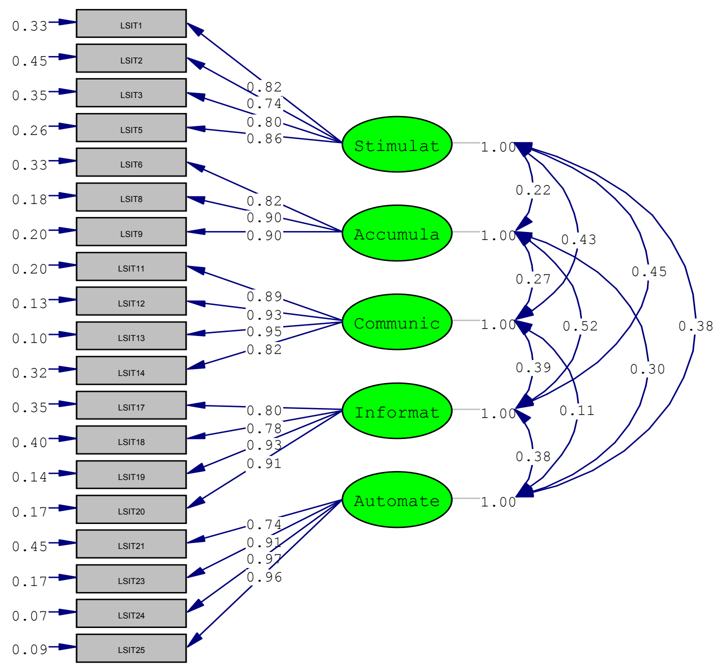
6.2.4 Knowledge Management Practices

Table 6.2.4.1 shows the CITC scores for each item for a particular construct in knowledge management practices. All the scales had CITC values greater than 0.60 for their respective items and all items were retained for further analysis. Each construct in this section was factor analyzed separately with their corresponding items. All items for the respective scales loaded on a single factor and had a factor score above 0.60 indicating unidimensionality.

Factor analysis of all items resulted in five factors. All the items loaded on their respective constructs with a factor loading greater than 0.60 indicating some evidence for convergent validity. The lowest factor loading was 0.717 for item LSKM3 in the knowledge creation dimension of knowledge management practices. There were no crossloadings greater than 0.30, indicating discriminant validity between the constructs in this section. Results of the factor analysis are shown in Table 6.2.4.2. LSKM23, LSKM24 were eliminated due to high error correlations and considering the parsimony of the scales, resulting in 4 items in each constructs in this section except for knowledge creation and knowledge application each of which had 3 items. Only knowledge capture had 2 error correlations between its items with a modification index of 17.70. A confirmatory factor model of each construct in this section is constructed to evaluate the model-data fit. Items LSKM2, LSKM5, LSKM10, LSKM11, LSKM17,

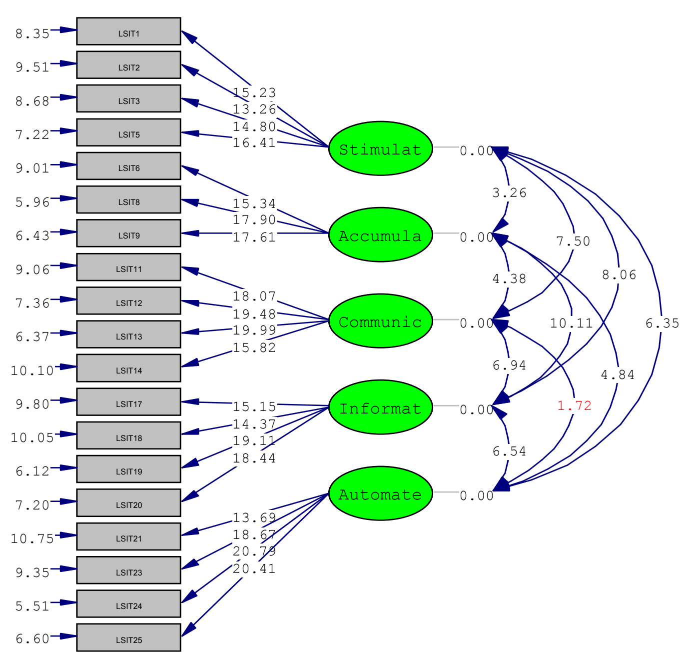
Based on the fit indices, measurement models in this section indicated good fit. The p-values for chi-square were non-significant (>0.05) except for knowledge capture. The ratios of chi-square to degrees of freedom were: knowledge capture= 9.09, knowledge sharing= 0.91 and knowledge access = 2.93, and indicated reasonable fit

Figure 6.2.3.1: Standardized Solution for the Correlated Measurement Model of Information Technology Support



Chi-Square=254.81, df=142, P-value=0.00000, RMSEA=0.056

Figure 6.2.3.2: t-Values for the Correlated Measurement Model of Information Technology Support



Chi-Square=254.81, df=142, P-value=0.00000, RMSEA=0.056

except for knowledge capture. Knowledge creation and knowledge application had only three items in each and had perfect fit (chi-square= 0 and p-value=1) since they were saturated models. The model-data fit statistics for the all the constructs in this section are shown in Table 6.2.1.5.

Pair-wise measurement model comparison was performed in LISREL to further assess the convergent and discriminant validity of the constructs in this section. The results are shown in Table 6.2.4.3, with AVE, Pearson correlation between the constructs (*r*) and the reliabilities (α). The chi-square difference between the models with construct correlations are set to free and set to one indicates good discriminant validity between the constructs, and ranges from 224 to 823. Correlation of the scales in this section rage from 0.22 to 0.50 and suggests that they measure fairly distinct aspect of knowledge management. AVE for the measures in this section ranges form 0.59 to 0.80, and indicates good convergent validity as well. The measures have good reliabilities (above 0.90) for all constructs except for knowledge creation (0.81).

A correlated measurement model with all constructs in the KM practices is developed to evaluate the model-data fit of the scales and to explore the possibility of a second order knowledge management practice construct. The Figures 6.2.4.1 and 6.2.4.2 show the solution with standardized loadings and t-values of the loadings for the correlated measurement model. The modifications indices suggested three error correlations and two crossloadings in the correlated measurement model, but these modification indices are not very severe. The largest modification index is 17.2 for correlated error between LSKM7 and LSKM8. Chi-square value had a significant p-value

Figure 6.2.3.3: Standardized Solution for the Second Order Measurement Model of Information Technology Support

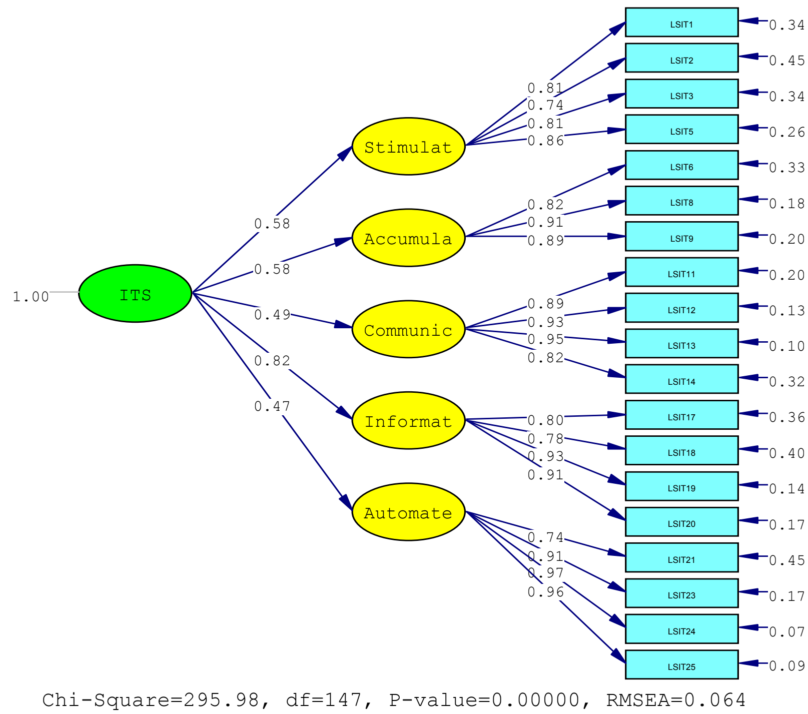


Figure 6.2.3.4: t-Values for the Second Order Measurement Model of Information Technology Support

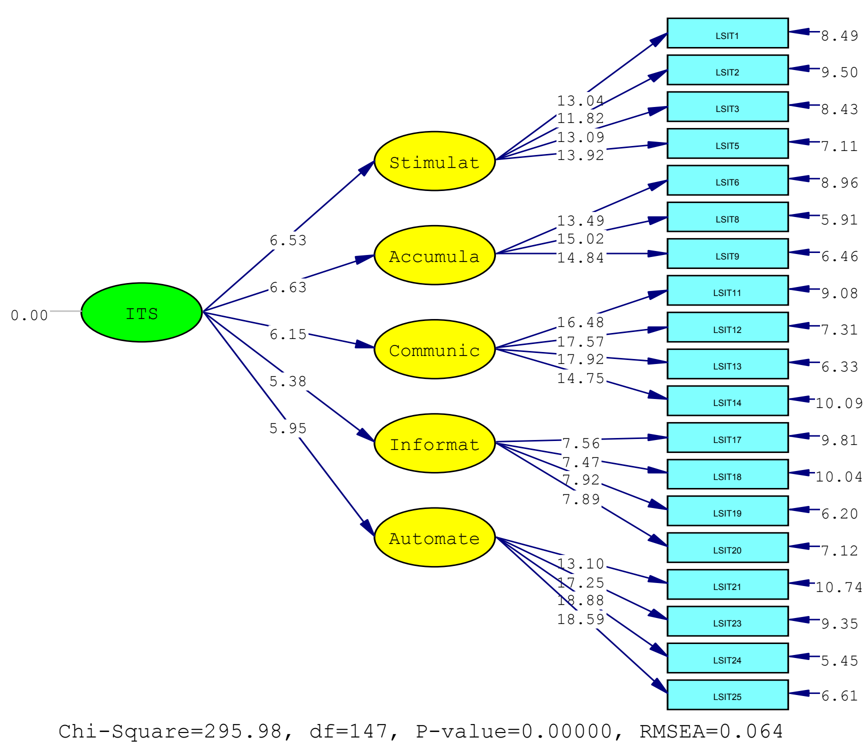


Table 6.2.4.1: CITC for Knowledge Management Practices

Construct	Label	Items	CITC
Create	LSKM1	created new thinking	0.69
	LSKM2	created new ways of doing things	0.76
	LSKM3	created new ways of interpreting situations	0.68
	LSKM4	created new ways of working	0.77
	LSKM5	created new work methods	0.76
Capture	LSKM6	stored important information	0.81
	LSKM7	stored information essential for my work	0.84
	LSKM8	stored information that I might need later	0.81
	LSKM9	stored pertinent information	0.87
	LSKM10	stored relevant information	0.82
Share	LSKM11	shared information with others	0.69
	LSKM12	shared my insights with others	0.84
	LSKM13	shared my know-how with others	0.85
	LSKM14	shared my knowledge with others	0.88
	LSKM15	shared my work-related knowledge with others	0.85
Access	LSKM16	retrieved information from various sources	0.76
	LSKM17	retrieved information relevant to my work	0.89
	LSKM18	retrieved information needed for my work	0.83
	LSKM19	retrieved data required for my work	0.81
	LSKM20	retrieved work-related information	0.82
Apply	LSKM21	applied my know-how	0.85
	LSKM22	applied my skills	0.84
	LSKM23	applied my insights	0.83
	LSKM24	applied my analytical skills	0.76
	LSKM25	applied my expertise	0.83

(<0.05), but the ratio of chi-square to degrees of freedom indicate good fit (1.49). Other fit statistics are shown in Table 6.2.1.7 and also indicate good fit.

The possibility of a second order knowledge management practices factor as proposed in the research model is evaluated using the target coefficient index. The fit statistics for both the correlated measurement model and second order factor model are shown in Table 6.2.1.7. The results indicate that most of the variation (target coefficient index = 83.6%) in the first order constructs is explained by the second order construct. A few additional error correlations and crossloadings were indicated in the second order

Table 6.2.4.2: Factor Analysis of Knowledge Management Items

Pattern Matrix[a]

	Component				
	1	2	3	4	5
LSKM22	.910				
LSKM25	.902				
LSKM21	.869				
LSKM23	.822				
LSKM24	.739				
LSKM6		-.914			
LSKM9		-.903			
LSKM8		-.884			
LSKM7		-.869			
LSKM10		-.854			
LSKM5			.921		
LSKM4			.920		
LSKM2			.816		
LSKM1			.722		
LSKM3			.717		
LSKM13				-.918	
LSKM14				-.914	
LSKM15				-.869	
LSKM12				-.857	
LSKM11				-.731	
LSKM17					.957
LSKM16					.890
LSKM19					.859
LSKM20					.853
LSKM18					.804

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

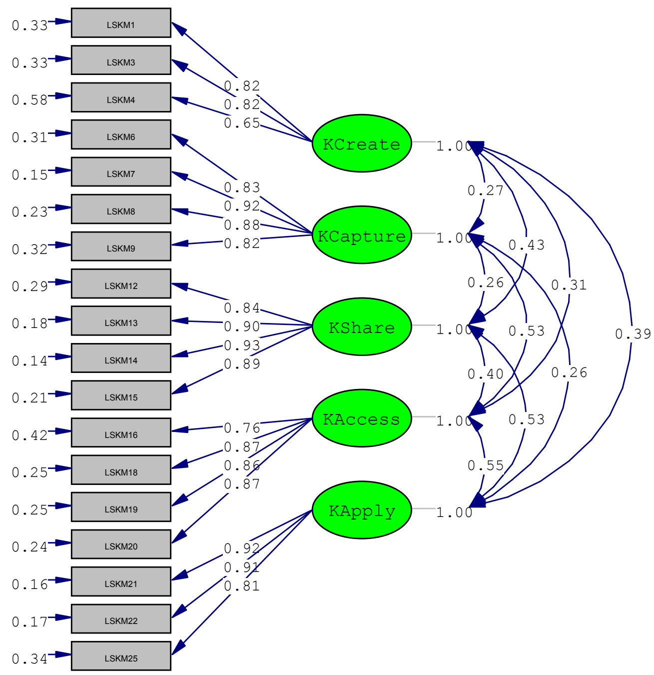
a. Rotation converged in 8 iterations.

Component Correlation Matrix

Component	1	2	3	4	5
1	1.000	-.236	.307	-.451	.467
2	-.236	1.000	-.210	.287	-.473
3	.307	-.210	1.000	-.330	.175
4	-.451	.287	-.330	1.000	-.364
5	.467	-.473	.175	-.364	1.000

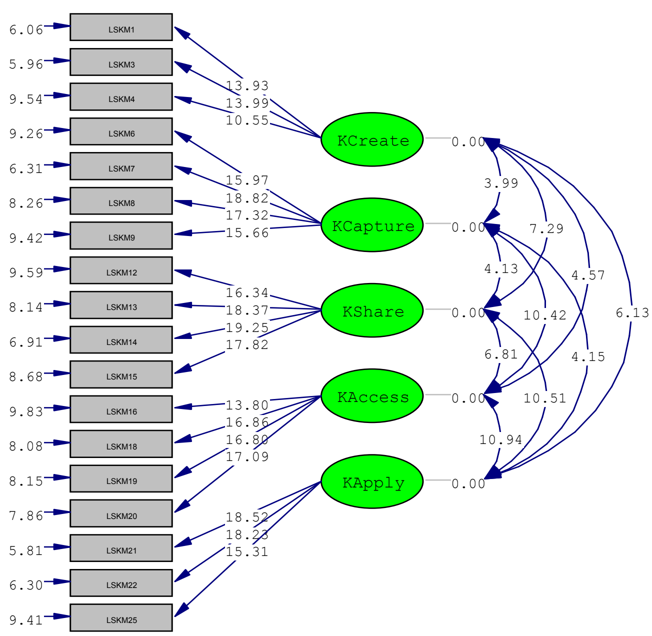
Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

Figure 6.2.4.1: Standardized Solution for the Correlated Measurement Model of Knowledge Management Practices



Chi-Square=188.39, df=125, P-value=0.00021, RMSEA=0.045

Figure 6.2.4.2: t-Values for the Correlated Measurement Model of Knowledge Management Practices



Chi-Square=188.39, df=125, P-value=0.00021, RMSEA=0.045

Table 6.2.4.3: Reliability, Convergent and Discriminant Validity of Knowledge Management Practices

	Create	Capture	Share	Access	Apply
Create	AVE=0.59 α=0.81				
Capture	*r=0.22*** χ^2= 246	AVE=0.75 α=0.92			
Share	*r=0.38*** χ^2= 224	*r=0.25*** χ^2= 823	AVE=0.80 α=0.94		
Access	*r=0.23*** χ^2= 247	*r=0.49*** χ^2= 647	*r=0.37*** χ^2= 702	AVE=0.71 α=0.91	
Apply	*r=0.33*** χ^2= 232	*r=0.24*** χ^2= 439	*r=0.49*** χ^2= 392	*r=0.50*** χ^2= 404	AVE=0.78 α=0.91
** Correlation is significant at the 0.01 level (2-tailed).					
χ^2> 7.88 for 1 d.f. is significant at p-value corrected for number of comparisons (0.05/10).					

model compared to the correlated measurement model and the largest modification index (26.8) was a two way path between knowledge access and knowledge capture. This is not surprising since such interrelationships between various knowledge management practices were suggested to exist in the theory section. But the focus of this research was to investigate to what degree the various work, individual and community of practice characteristics impacted the knowledge management practices of the individual, and how these practices contributed to the various performance and knowledge outcomes. Based on the target coefficient index and the various fit statistics compared to the correlated measurement model (Table 6.2.17) indicates that the first order constructs in knowledge management practices can be modeled as a second order construct reasonably well as initially proposed. The standardized loadings and the t-values for the loadings in the second order measurement models are shown in Figures 6.2.4.3 and 6.2.4.4.

Figure 6.2.4.3: Standardized Solution for the Second Order Measurement Model of Knowledge Management Practices

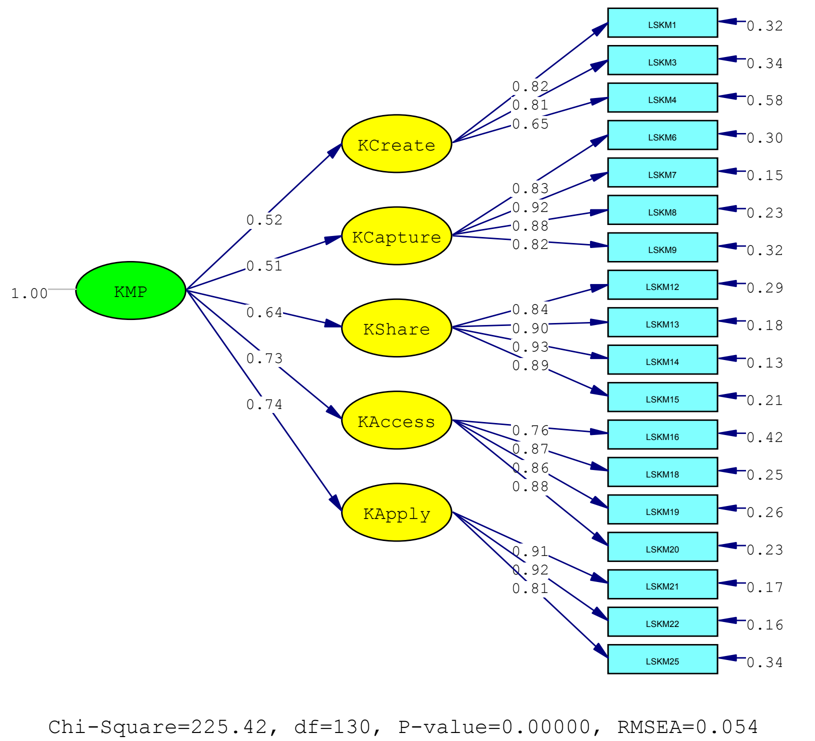
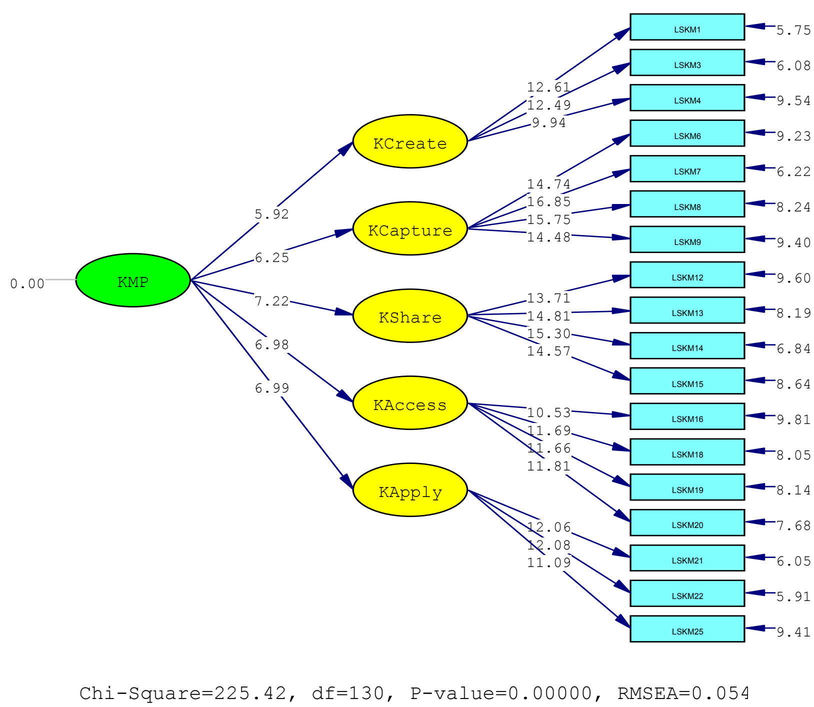


Figure 6.2.4.4: t-Values for the Second Order Measurement Model of Knowledge Management Practices



6.2.5 Task Knowledge

Table 6.2.5.1 shows the CITC scores for each item for a particular construct in knowledge management practices. All the scales had CITC values greater than 0.60 for their respective items and all items were retained for further analysis. Each construct in this section was factor analyzed separately with their corresponding items. All items for the respective scales loaded on a single factor and had a factor score above 0.60 indicating unidimensionality.

Exploratory factor analysis of items in this section resulted in three factors corresponding to the operational, conceptual and contextual knowledge. Two items in operational knowledge (LSTK4 and LSTK6) and one item in contextual knowledge (LSTK19) had factor loading less than 0.60. LSTK6 also had a crossloading of -0.396 with conceptual knowledge and was dropped upon further examination. After dropping this item, LSTK4, LSTK18 and LSTK19 were still below 0.60 (0.582, 0.586 and 0.530 respectively), but were close to the recommended value and were retained for further analysis. Rest of the items loaded on their respective constructs with a factor loading greater than 0.60 indicating some evidence for convergent validity. After eliminating LSTK6 there were no crossloadings greater than 0.30, indicating some evidence for discriminant validity between the constructs in this section. Results of the factor analysis are shown in Table 6.2.5.2.

A confirmatory factor model of each construct with their respective items loading on the construct was constructed to evaluate the model-data fit. Items LSTK2, LSTK12, LSTK14, LSTK15 and LSTK18 were eliminated due to high error correlations and to keep the scales parsimonious. The final scales had 4 items for operational knowledge, 4 items for conceptual knowledge and 5 items for contextual knowledge. Conceptual and contextual knowledge had two error correlations with the highest modification index of 12.18 and 10.22 respectively.

Table 6.2.5.1: CITC for Task Knowledge

Construct	Label	Items	CITC
Operational Knowledge	LSTK1	how to implement your work routines	0.74
	LSTK2	the procedures for doing your job	0.73
	LSTK3	the relevant know-how	0.71
	LSTK4	the technological developments in your area	**0.48**
	LSTK5	your job requirements	0.72
	LSTK6	what actions you need to take	0.66
Conceptual Knowledge	LSTK7	the reasons behind your actions	0.86
	LSTK8	the philosophy behind your actions	0.80
	LSTK9	the purpose of your actions	0.89
	LSTK10	the rationale behind your actions	0.87
Contextual Knowledge	LSTK11	whom to go to for the necessary resources	0.67
	LSTK12	who could help when you get stuck	0.65
	LSTK13	who were the most knowledgeable people at work	0.74
	LSTK14	where to find the required information	0.77
	LSTK15	where the necessary things were available	0.73
	LSTK16	where you could get the required resources	0.74
	LSTK17	when different things had to be done	0.71
	LSTK18	when to get more information	0.70
	LSTK19	when to share information	0.63

All three measurement models in this section indicated good fit. The p-values for chi-square were significant (<0.05) except for operational knowledge. The ratios of chi-square to degrees of freedom were: operational knowledge = 1.61, conceptual knowledge= 6.14, contextual knowledge= 3.31. The model-data fit statistics for the all the three constructs are shown in Table 6.2.1.5 and indicates good fit.

Table 6.2.5.2: Factor Analysis of Task Knowledge Items

Pattern Matrix[a]

	Component		
	1	2	3
LSTK14	.895		
LSTK15	.842		
LSTK16	.830		
LSTK13	.830		
LSTK12	.785		
LSTK17	.647		
LSTK11	.606		
LSTK18	.586		
LSTK19	.530		
LSTK9		-.919	
LSTK7		-.905	
LSTK10		-.899	
LSTK8		-.879	
LSTK2			.932
LSTK1			.878
LSTK3			.779
LSTK5			.688
LSTK4			.582

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.
a. Rotation converged in 4 iterations.

Component Correlation Matrix

Component	1	2	3
1	1.000	-.462	.574
2	-.462	1.000	-.450
3	.574	-.450	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

Convergent and discriminant validity of the constructs in this section were analyzed together with the performance outcome constructs using pair-wise measurement model comparison in LISREL. The results are shown in Table 6.2.5.3, with AVE, Pearson correlation between the constructs (r) and the reliabilities (α). The chi-square difference between the models with the construct correlations set to free and set to one ranges from 110 to 955 indicating good discriminant validity between the constructs. Correlation of the scales in this section rages from 0.20 to 0.56 and also suggests good discriminant validity between the measures. AVE for the measures ranges form 0.52 to 0.80, and indicates good convergent validity. The measures have adequate reliabilities and range from 0.81 (operational knowledge) to 0.94 (conceptual knowledge). A full correlated measurement model with all constructs in task knowledge is developed to evaluate the model-data fit of the scales and to explore the possibility of a second order construct. The Figures 6.2.5.1 and 6.2.5.2 show the standardized solution and t-values of the loadings for the correlated measurement model. The modifications indices suggested three error correlations but did not have any crossloadings. The modification indices were small with the highest being 11.26. Chi-square value had a significant p-value (<0.05),

Table 6.2.5.3: Reliability, Convergent and Discriminant Validity of Information Technology Support

	Operational Knowledge	Conceptual Knowledge	Contextual Knowledge	Individual Performance	Creative Performance
Operational Knowledge	AVE=0.52 α=0.81				
Conceptual Knowledge	*r=0.56*** χ^2= 174	AVE=0.80 α=0.94			
Contextual Knowledge	*r=0.62*** χ^2= 110	*r=0.56*** χ^2= 388	AVE=0.53 α=0.85		
Individual Performance	*r=0.43*** χ^2= 286	*r=0.23*** χ^2= 519	*r=0.28*** χ^2= 622	AVE=0.61 α=0.86	
Creative Performance	*r=0.20*** χ^2= 339	*r=0.27*** χ^2= 955	*r=0.23*** χ^2= 640	*r=0.37*** χ^2= 488	AVE=0.72 α=0.91

** Correlation is significant at the 0.01 level (2-tailed).

χ^2> 7.88 for 1 d.f. is significant at p-value corrected for number of comparisons (0.05/10).

Figure 6.2.5.1: Standardized Solution for the Correlated Measurement Model of Task Knowledge

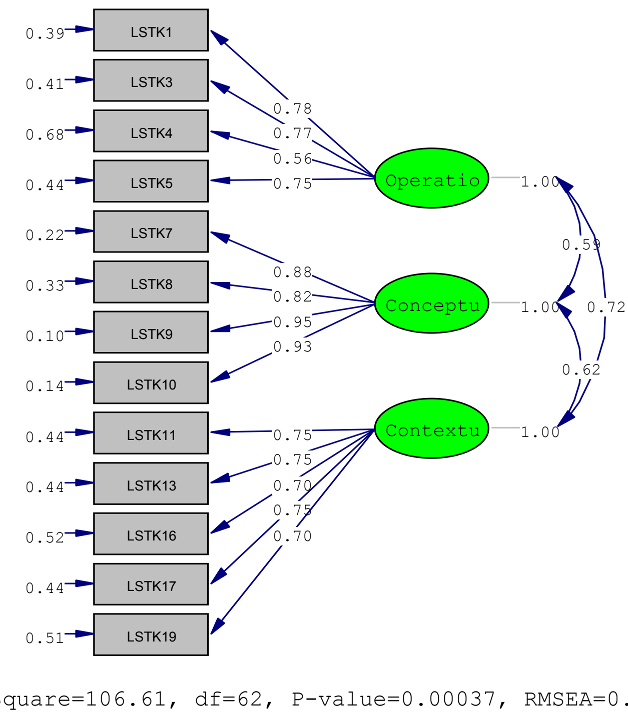


Figure 6.2.5.2: t-Values for the Correlated Measurement Model of Task Knowledge

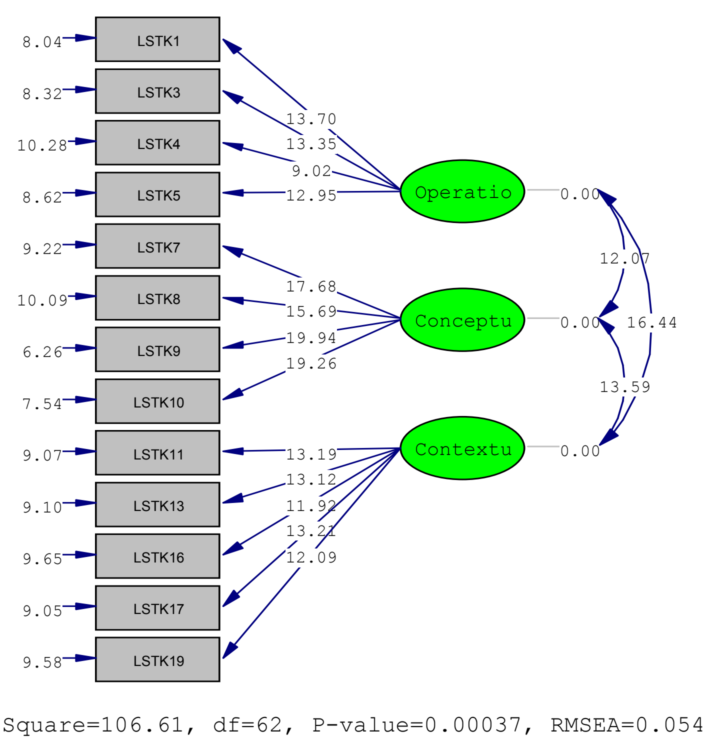


Figure 6.2.5.3: Standardized Solution for the Second Order Measurement Model of Task Knowledge

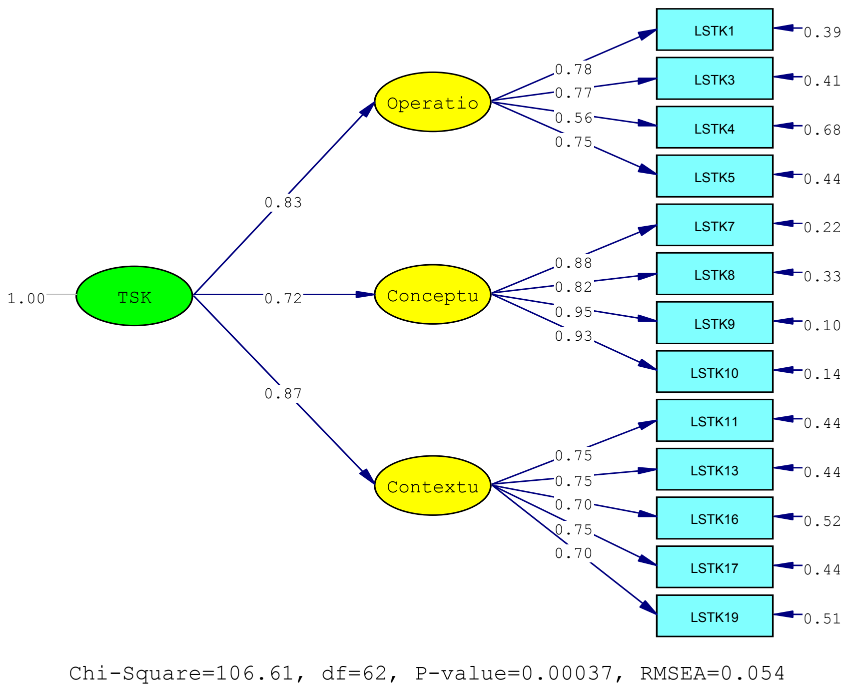
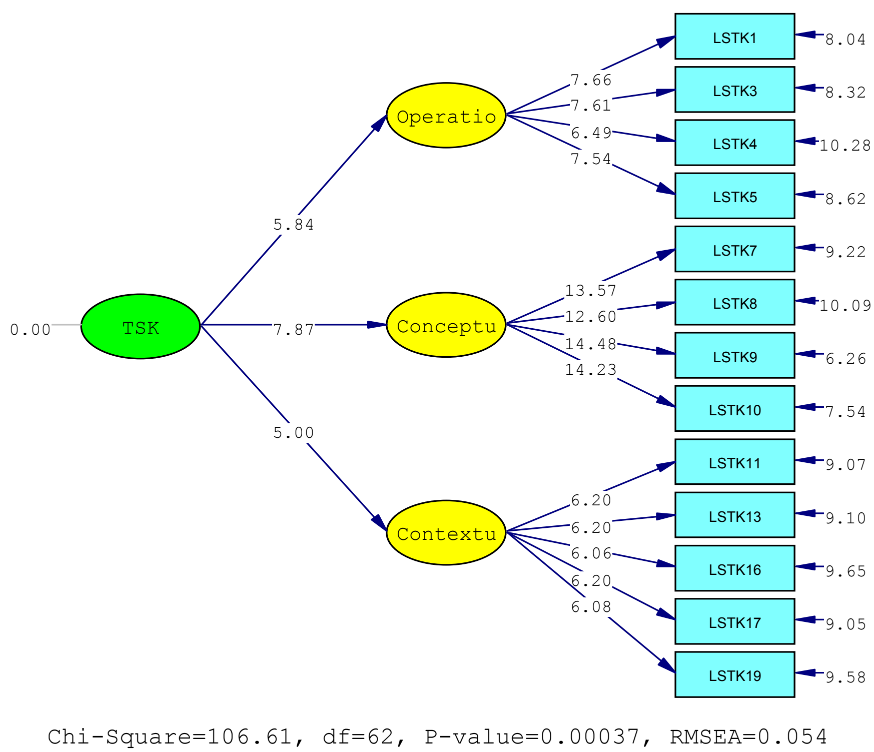


Figure 6.2.5.4: t-Values for the Second Order Measurement Model of Task Knowledge



but the ratio of chi-square to degrees of freedom indicate good fit (1.72). Other fit statistics also indicated good model-data fit (Table 6.2.1.7).

The target coefficient index is used to evaluate second order task knowledge factor. The fit statistics for both the correlated measurement model and second order factor model are shown in Table 6.2.1.7. The results indicate that the variation in the first order constructs is explained by the second order construct. The target coefficient for the second order construct is 100%. The modification indices and their magnitudes are identical to that in the correlated measurement model. The standardized loadings and the t-values for the loadings in the second order measurement models are shown in Figures 6.2.5.3 and 6.2.5.4.

6.2.6 Performance Outcomes

Both the constructs in this section had CITC values greater than 0.60 for their respective items and all items were retained for further analysis (Table 6.2.6.1). Both the constructs were factor analyzed separately with their corresponding items. All items for the respective scales loaded on a single factor and had a factor score above 0.60 indicating unidimensionality.

Factor analysis of items in this section resulted in two clean factors. All the items loaded on their respective constructs with a factor loading greater than 0.60 indicating some evidence for convergent validity. The lowest factor loading was 0.771 for item LSIO3. There were no crossloadings greater than 0.30, indicating discriminant validity between the constructs in this section. Results of the factor analysis are shown in Table 6.2.5.2.

Table 6.2.6.1: CITC for Performance Outcomes

Construct	Label	Items	CITC
Individual Performance	LSIO1	I was very efficient at my work	0.67
	LSIO2	I was very effective in my work	0.74
	LSIO3	My work was of very high quality	0.73
	LSIO4	I easily met my goals	0.61
	LSIO5	I usually finished my tasks within the expected time limit	0.65
Creative Performance	LSIO6	I had generated creative ideas	0.77
	LSIO7	I was the first to use certain ideas in my kind of work	0.79
	LSIO8	ideas that I implemented were the first use of such ideas in my department	0.81
	LSIO9	my work was original and practical	0.85
	LSIO10	my work was creative	0.83

Table 6.2.6.2: Factor Analysis for Performance Outcome Items

Pattern Matrix[a]

	Component	
	1	2
LSIO10	.914	
LSIO9	.901	
LSIO8	.874	
LSIO7	.858	
LSIO6	.837	
LSIO5		.816
LSIO2		.801
LSIO1		.800
LSIO4		.783
LSIO3		.771

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 4 iterations.

Component Correlation Matrix

Component	1	2
1	1.000	.322
2	.322	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

A confirmatory factor model of each construct with their respective items loading on the construct was constructed to evaluate the model-data fit. Items LSIO5 and LSIO8 were eliminated due to high error correlations. The final scales had 4 items for both the constructs. Creative performance had two error correlations with modification index 11.86. Measurement models for both the constructs had good fit. The p-value was non-significant (>0.05) only for individual performance. The ratios of chi-square to degrees of freedom were 0.40 for individual performance and 6.00 for creative performance. The absolute and relative fit indices were good for both the models and are shown in Table 6.2.1.5. Convergent and discriminant validity of the constructs in this section were analyzed together with the task knowledge constructs in the previous section. Correlation of the scales in this section rages from 0.20 to 0.43 and suggests good discriminant validity between the measures. AVE for individual and creative performance was 0.61 and 0.72 respectively. The reliabilities of both the constructs was 0.86 (individual performance) and 0.91 (creative performance).

A correlated measurement model with both the constructs is developed to evaluate the model-data fit of the scales and to explore the possibility of a second order construct. The Figures 6.2.6.1 and 6.2.6.2 show the standardized solution and t-values of the loadings for the correlated measurement model. The modifications indices suggested two error correlations but did not have any crossloadings. The highest modification index was for error correlation between items LSIO6 and LSIO9 (15.22). Chi-square was non-significant (p-value >0.05) and the ratio of chi-square to degrees of freedom indicate good fit (1.56). Other fit statistics also indicated excellent model-data fit (Table 6.2.1.7). Performance had only two factors and could not be modeled as a second order factor.

Figure 6.2.6.1: Standardized Solution for the Correlated Measurement Model of Performance Outcomes

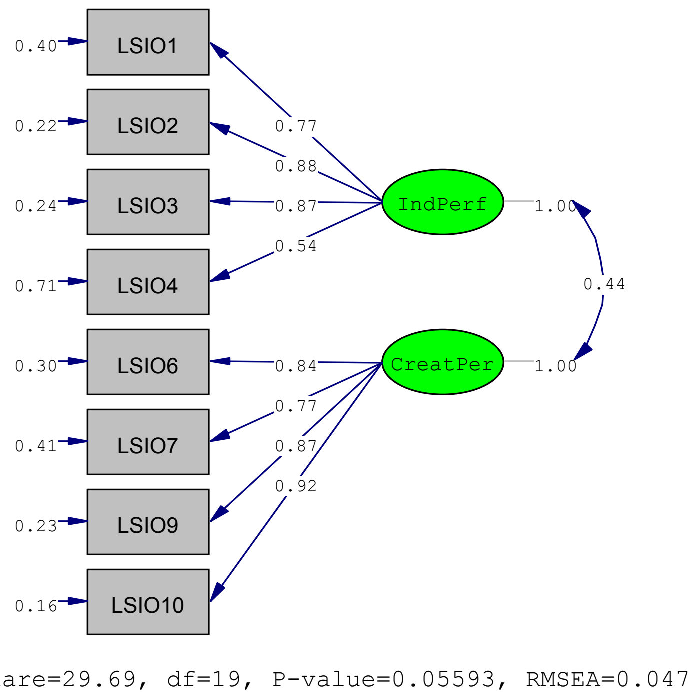
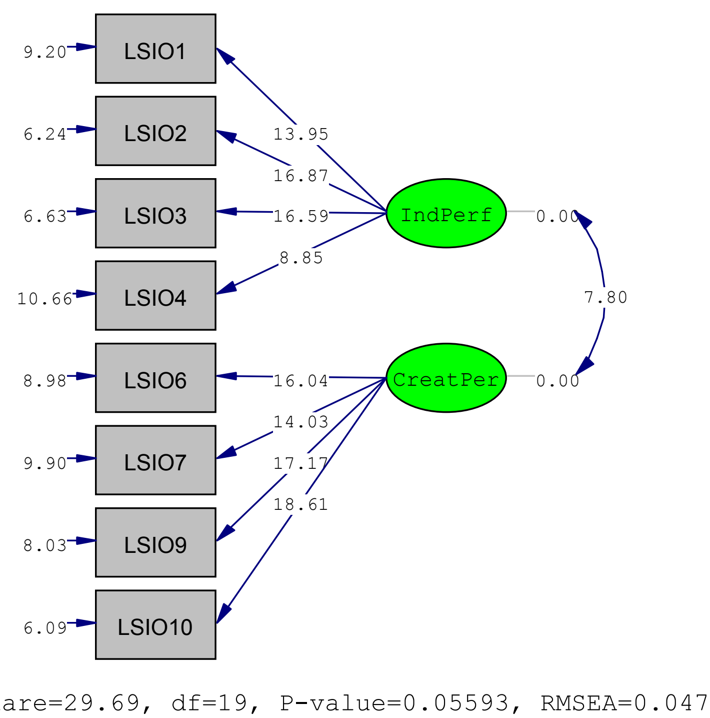


Figure 6.2.6.2: t-Values for the Correlated Measurement Model of Performance Outcomes



6.2.7 Summary of Measurement Results

In the final instrument, community of practice had 30 measurement items measuring nine scales within the three dimensions. Though norm and identification scales had significant p-values (<0.05) for the chi-squares, other fit indices were excellent. The scales had good discriminatory ability with other scales in this section and the reliabilities were good except for network hierarchy and shared language which had acceptable levels of alpha at 0.78 and 0.79 respectively. The measurement models were evaluated based on the fit statistics for the individual models for each constructs and based on correlated measurement models with all constructs in each section. The second order models for each of the three dimensions had good model-data fit statistics though their chi-square values were significant at p-value less than 0.01 except for cognitive dimension for which it was non significant.

The work characteristics had 10 measurement items in the final model of which slack was a single item measure. The rest of the nine items were distributed between cognitive effort (5) and virtualness (4). The discriminant validity of these scales were evaluated together with the empowerment scales and showed good discriminatory power the chi-square difference ranged from 443 to 989. The empowerment scales had a total of 15 items between the four scales. All scales in this section had good model data fit statistics. Only self-efficacy had a chi-square that was significant (p-value<0.01). The correlated measurement model for both the work characteristics and empowerment also had good model data fit statistics. The reliabilities of the scales in this section were also good and ranged from 0.89 to 0.97. The second order factor for work characteristics did not have significant factor loading indicating that the three factors cannot be modeled as a reflective second order construct. Hence to test the hypothesis involving work characteristics, the three first order constructs were decided to be tested with them directly impacting the knowledge management practices.

The IT support, knowledge management practices, task knowledge and performance outcome instruments had 19, 18, 13 and 8 items respectively. The reliabilities of these scales ranged form 0.80 to 0.94 with most scales having reliabilities above 0.90. The model-data fit statistics were reasonable to good for the final scales and for correlated measurement models. Each of the scales in this section also demonstrated good discrimination with other scales in each section. The fit statistics of second order factor models were comparable to the correlated measurement models indicating that each of these scales can be efficiently used as part of their respective second order construct.

6.3 Hypotheses Testing and Structural Model

The hypotheses specified in this research posit relationship between second order constructs of work characteristics, structural dimension of community of practice, relational dimension of community of practice, cognitive dimension of community of practice and empowerment to knowledge management practices, and from knowledge management practices to the task knowledge and performance outcomes of the individual. Based on the results of the measurement model there were satisfactory evidence that the proposed constructs formed second order factors.

In order to test the substantive hypotheses a two step approach was adopted. First, using summated scales of each latent variable, individual hypotheses were separately tested between the second order constructs (partial aggregated model) (Bagozzi and Heatherton, 1994). The results of this analysis were used to accept or reject the hypotheses based on the significance of the Beta coefficients of the relationships. In order to evaluate the significance of the Beta coefficients a reasonable model to data fit was necessary, and is evidenced based on the various fit statistics. A t-value greater than 1.96 is considered to be significant at $p<0.05$ and t-value greater than 2.33 is significant at $p<0.01$. T-value is the ratio of the estimated parameter to its standard error.

In the second step, selecting only those constructs which had a significant relationship in the analysis conducted in the first step, a comprehensive structural model was developed to validate whether those relationships where significant in a nomological network of the constructs in this study. Since same dataset is being used in the measurement model and to test the hypotheses, the results should be interpreted with caution when these relationships have to be generalized to other samples.

6.3.1 Results of Hypotheses Testing

A correlation matrix with the summated scales of all second order factors is involved in hypothesis testing is shown in Table 6.3.1.1. Correlations range from 0.03 between cognitive dimension of community of practice and task knowledge to o.0.53 between cognitive and relational dimensions of community of practice. Correlation between the constructs involved in the hypotheses seem to have a strong correlation ($p>0.01$) except for the community of practice dimensions. The correlation table provides a preliminary indication of the strength of the relationships between each construct and the statistical significance of these relationships.

As mentioned earlier, each hypothesis is tested individually using LISREL model and a final model is developed to validate these relationships based on the initial testing. The three second order community of practice dimensions, (i.e., Structural, Relational and Cognitive dimensions) are tested in a single model since they all relate to a single theme of individuals' community of practice. Similarly, the three first order constructs in work characteristics (Cognitive effort, Virtualness of work and Slack time available) failed to significantly load on a single second order factor, the three first order constructs will be tested to assess the impact of each of these aspects of individual's work on their knowledge management practice.

Table 6.3.1.1: Descriptive Statistics and Correlation of Second Order Constructs.

Variables	Mean	SD	1	2	3	4	5	6	7	8
1. COP_STRU	3.51	0.66	1							
2. COP_RELA	3.73	0.60	0.50**	1						
3. COP_COGN	3.61	0.60	0.26**	0.53**	1					
4. WCHAR	2.95	0.55	0.05	0.20**	0.10	1				
5. EMP	5.71	0.88	0.23**	0.28**	0.13*	0.16*	1			
6. ITS	3.61	0.66	0.14*	0.24**	0.19**	0.18**	0.26**	1		
7. KMP	3.92	0.56	0.13*	0.21**	0.14*	0.24**	0.39**	0.49**	1	
8. TK	4.07	0.59	0.21**	0.21**	0.03	0.10	0.42**	0.23**	0.50**	1
9. PERFORM	5.45	0.86	0.14*	0.20**	0.14*	0.23**	0.35**	0.15*	0.50**	0.38**
** Correlation is significant at the 0.01 level (2-tailed).										
* Correlation is significant at the 0.05 level (2-tailed).										

Since different aspects of work characteristics failed to form a single second order factor, a structural model with two first order factors, cognitive effort and virtualness of work, together with the single item slack was created to test the hypothesis H1. All three aspects of the work characteristics were hypothesized to impact individual's knowledge management practices positively. Figures 6.3.1.1 and 6.3.1.2 shows the standardized

Figure 6.3.1.1: Standardized Solution for the Structural Model of H1

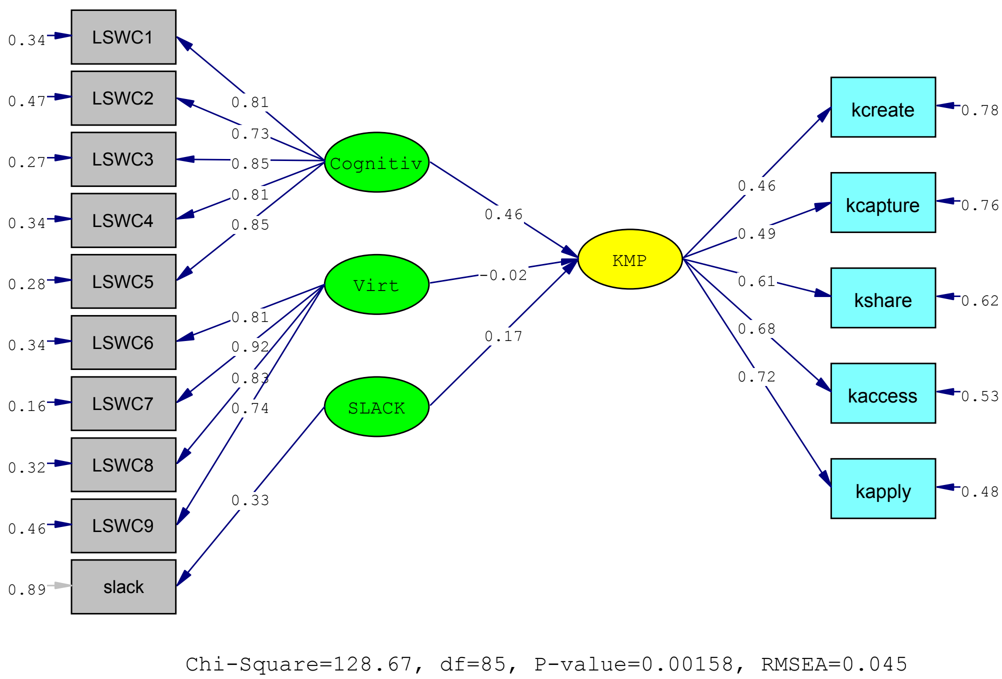


Figure 6.3.1.2: t-Values for the Structural Model of H1

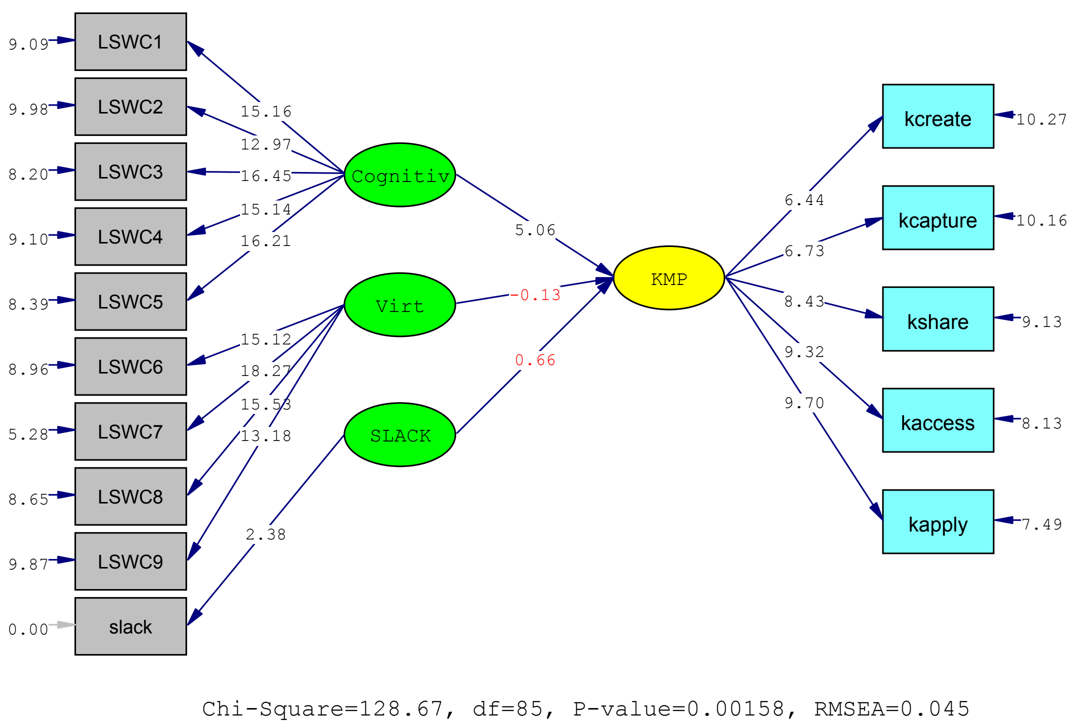


Table 6.3.1.2: Model-Data Fit Statistics of Structural Models

Hypotheses	Chi-Square	DF	p-value	RMSEA	GFI	AGFI	NNFI	CFI	Standardized Structural Coefficient	t-Value	# of Items
H1- Using First Order Factors (3 Constructs)	128.67	85	0.002	0.045	0.94	0.91	0.97	0.97	**Cognitive=0.46**	**5.06**	15
									Virtualness=0.02	-0.13	
									Slack=0.17	0.66	
H2a	231.72	71	0.000	0.095	0.88	0.83	0.79	0.83	-0.14	0.28	8
H2b	231.72	71	0.000	0.095	0.88	0.83	0.79	0.83	0.36	0.75	9
H2c	231.72	71	0.000	0.095	0.88	0.83	0.79	0.83	0.04	0.55	7
H3	69.46	26	0.000	0.082	0.94	0.90	0.89	0.92	**0.55**	**6.15**	9
H4	215.68	34	0.000	0.146	0.85	0.76	0.67	0.75	**0.68**	**6.31**	10
H5	76.15	13	0.000	0.139	0.92	0.83	0.73	0.83	**0.72**	**4.38**	7
H6	51.31	19	0.000	0.082	0.95	0.91	0.91	0.97	**0.69**	**6.93**	8
Bolded standardized coefficients are significant at p-values<0.01											

loadings and t-values of the structural model. The largest modification index was 23.53 for an error correlation between access and capture summated scales. The fit statistics of the model is shown in Table 6.3.1.2. The chi-square for the overall model fit is significant ($p<0.01$), but the comparative and absolute fit statistics suggests a good model-data fit. Only cognitive effort had a significant effect on the knowledge management practices ($\gamma=0.46$, t-value=5.06). Hypothesis H1 was only partially supported since there were no significant direct impact of virtualness of work and slack time on the individuals' knowledge management practices.

Hypotheses H2a, H2b, H2c are all tested simultaneously to assess the level of impact the different dimensions (structural, relational and cognitive) of community of practice in which the individual interacts have on their knowledge management practices. Summated scales of each first order factor were used to reflect the three second order dimensions of the community of practice. Figures 6.3.1.3 and 6.3.1.4 shows the standardized loadings and t-values of the structural model respectively. The chi-square statistic was significant at p-value < 0.01. The model data fit indices suggest a barely acceptable level of fit (Table 6.3.1.2). The largest modification indices for the model were 22.5 for an error correlation between access and capture, and 22.4 for an error correlation between identification and network ties.

None of the substantive relationship between the three dimensions of community of practice to the individuals' knowledge management practices had a significant structural coefficient. Based on the non-significant t-values there was no evidence to support any of the three hypotheses (H2a, H2b, H2c) related to community of practice. It is possible that the different aspects of the community of practice impact the behavioral manifestations through a more elementary aspect such as their perceptions and expectancies. Further, the approach used in this research in measuring the various aspects of an individual's community of practice was based on individuals own perception of their community. While it is important how the individual perceives the community in which he/she interacts in terms of how it may impact the individual, it may reflect the objective characteristics of the community to only a limited extent.

A model to test the substantive relationship between empowerment and knowledge management practices is developed to test hypothesis H3. Again, the summated scales for the first order factors in both the constructs are used to test the relationship. The standardized loadings and the t-values are shown in Figure 6.3.1.5 and 6.3.1.6. All loadings were significant ($p<0.05$). The model had reasonable fit upon examination of the various absolute and comparative fit indices (Table 6.3.1.2). The structural coefficient from empowerment to knowledge management practices was 0.55 (γ) and was also significant with a t-value of 6.16. The largest modification index in this model was 26.4 for an error correlation between knowledge access and knowledge capture. There was evidence in support of hypothesis H3, indicating that individuals' psychological empowerment had a significant impact on their knowledge management practices.

The Table 6.3.1.2 shows the fit statistics for the model involving information technology support and knowledge management practices to test the hypothesis H4. The model had a poor model-data fit. The largest modification index was 50.2 for an error correlation between accumulate indicator of information technology support and knowledge capture of knowledge management practices. The structural coefficient from

Figure 6.3.1.3: Standardized Solution for the Structural Model of H2a, H2b, H2c

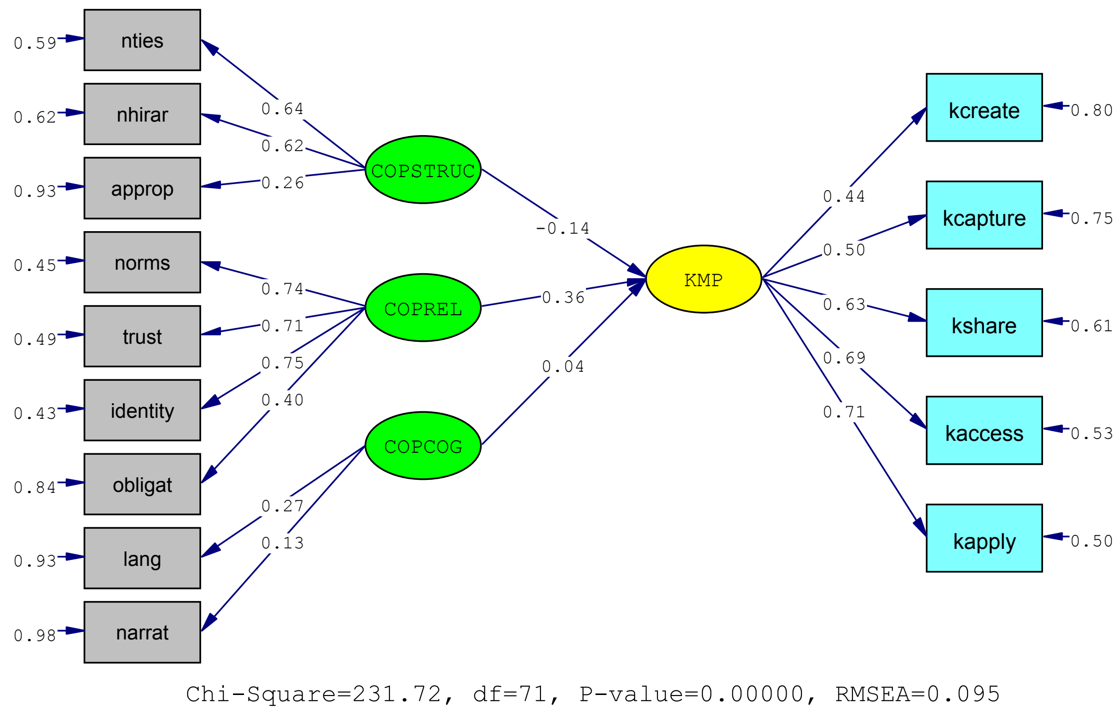
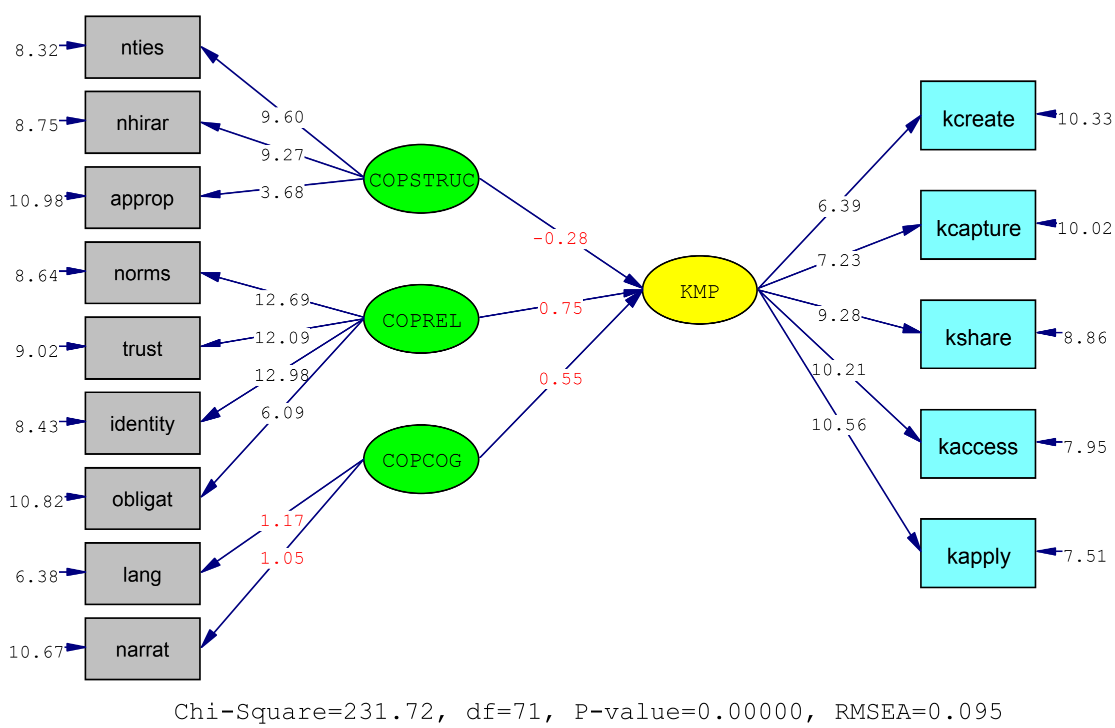


Figure 6.3.1.4: t-Values for the Structural Model of H2a, H2b, H2c



empowerment to knowledge management practices was 0.68 and was significant (t-value= 6.31). All other loadings were significant as well ($p<0.05$). The Figures 6.3.1.7 and 6.3.1.8 show the standardized loading and t-values respectively. The data supports hypothesis H4 as evidenced by the significant structural coefficient.

Similar to the previous models, hypotheses H5 and H6 were tested using separate structural models for each hypothesis. The Figures 6.3.1.9 and 6.3.1.10 shows the standardized solution for the structural model and the t-values of those loadings to test the relationship between the knowledge management practices and the performance outcomes. Performance outcomes consist of two summated items for individual performance and creative performance. The Figures 6.3.1.11 and 6.3.1.12 show the standardized solution and t-values for the model to test H6. This model had good model-data fit and had only two error correlation between the items, largest of which was 29.5 between knowledge access and knowledge capture. The fit statistics are shown in Table 6.3.1.2 for both the models. The fit statistics for the model testing H5 had marginal fit. The largest modification index in this model was an error correlation of 31.6 between knowledge creation and creative performance. The structural coefficients in both the models were significant based on their t-values. The relationship between knowledge management practices and performance outcome had a structural coefficient = 0.72 (t-value= 4.38), and the structural coefficient between knowledge management practices and task knowledge was 0.69 (t-value=6.93). Both H5 and H6 were supported by the data.

The next step involved testing these hypotheses that were supported by the data simultaneously in a comprehensive structural model. None of the three dimension of

Figure 6.3.1.5: Standardized Solution for the Structural Model of H3

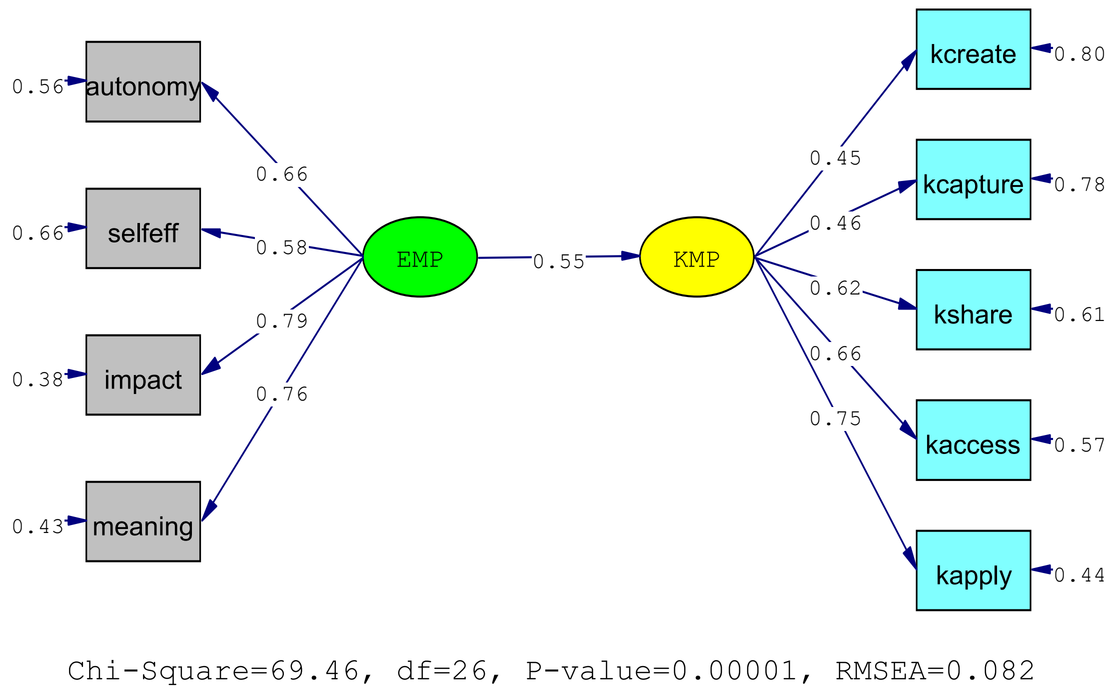


Figure 6.3.1.6: t-Values for the Structural Model of H3

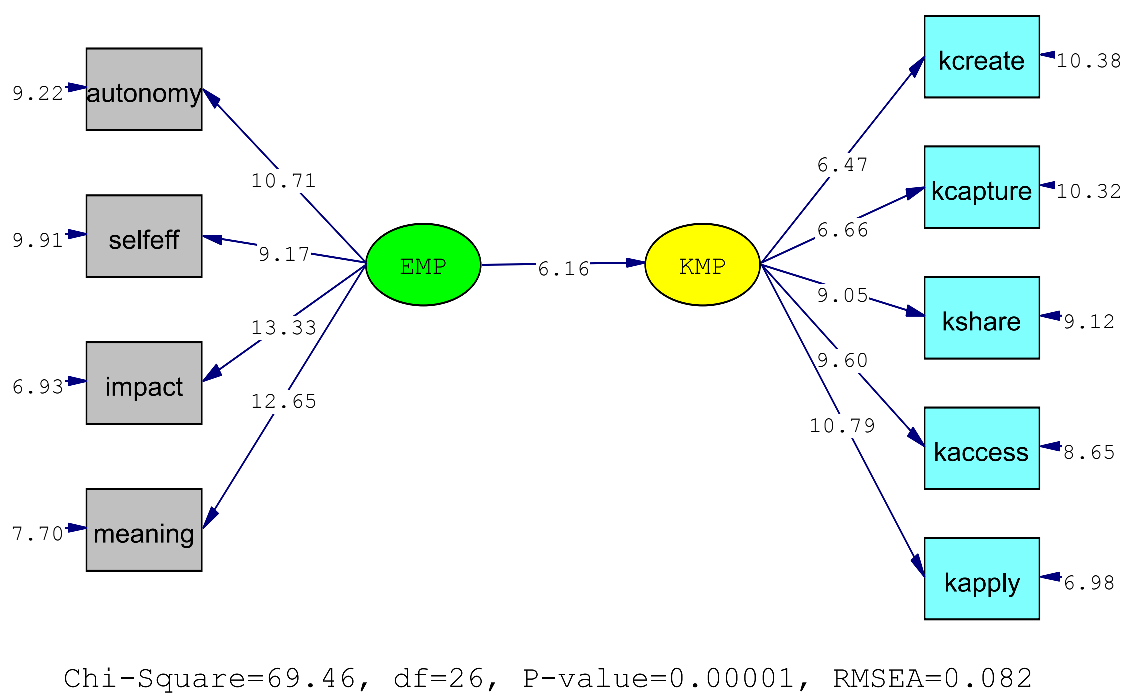


Figure 6.3.1.7: Standardized Solution for the Structural Model of H4

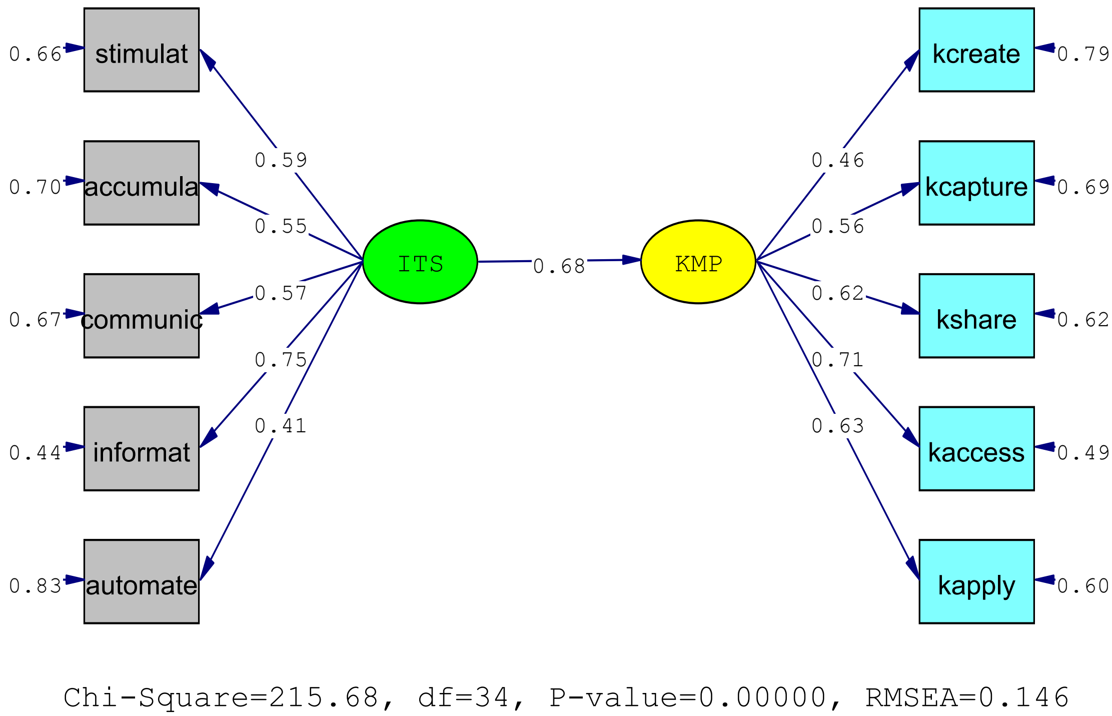


Figure 6.3.1.8: t-Values for the Structural Model of H4

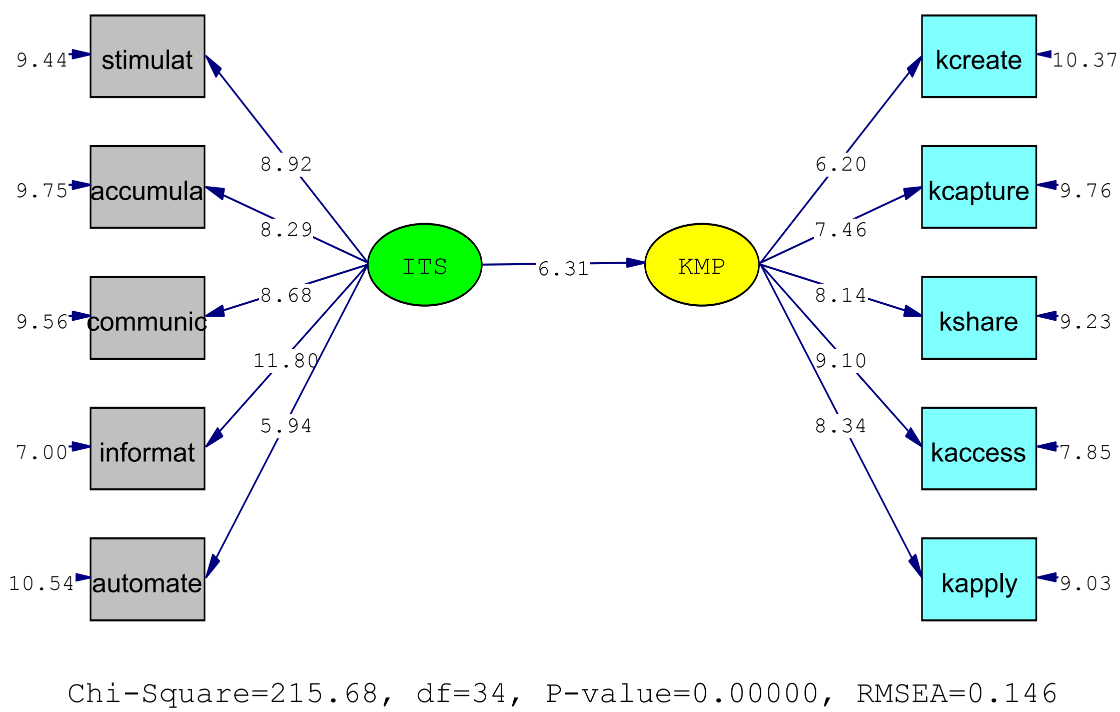


Figure 6.3.1.9: Standardized Solution for the Structural Model of H5

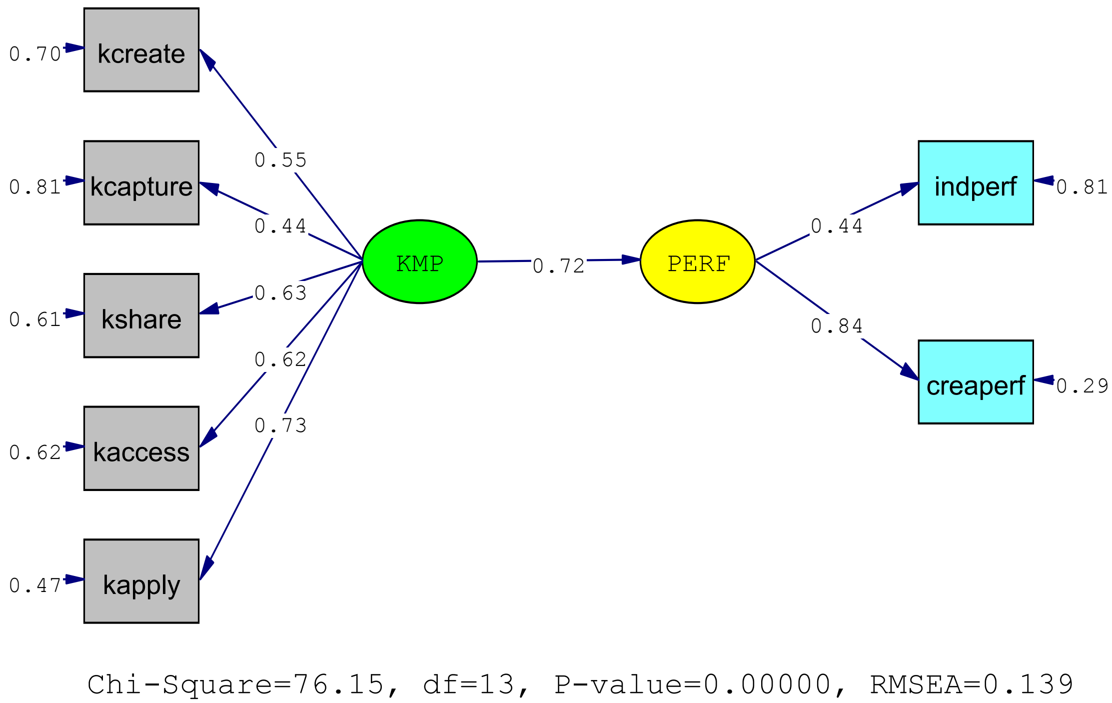


Figure 6.3.1.10: t-Values for the Structural Model of H5

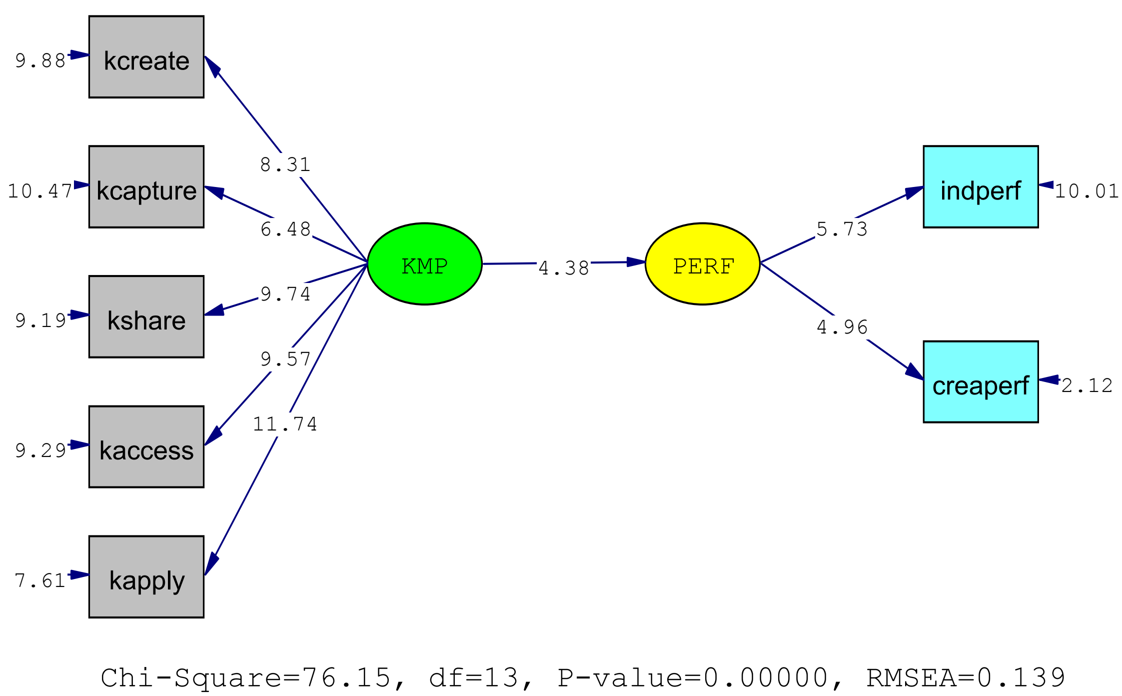


Figure 6.3.1.11: Standardized Solution for the Structural Model of H6

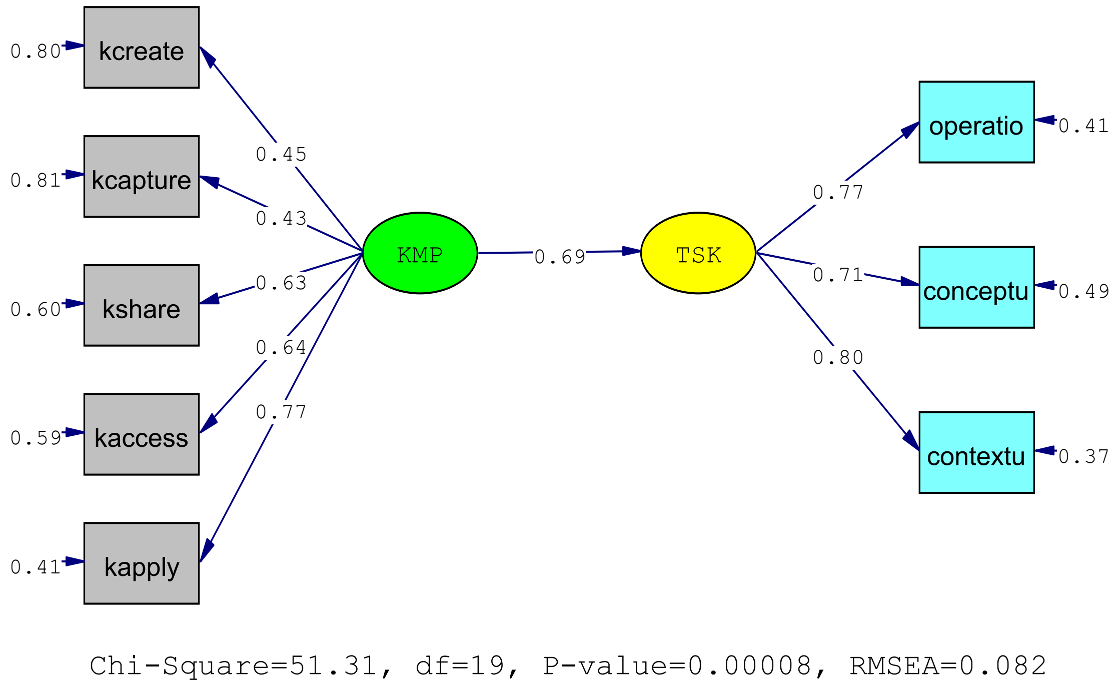
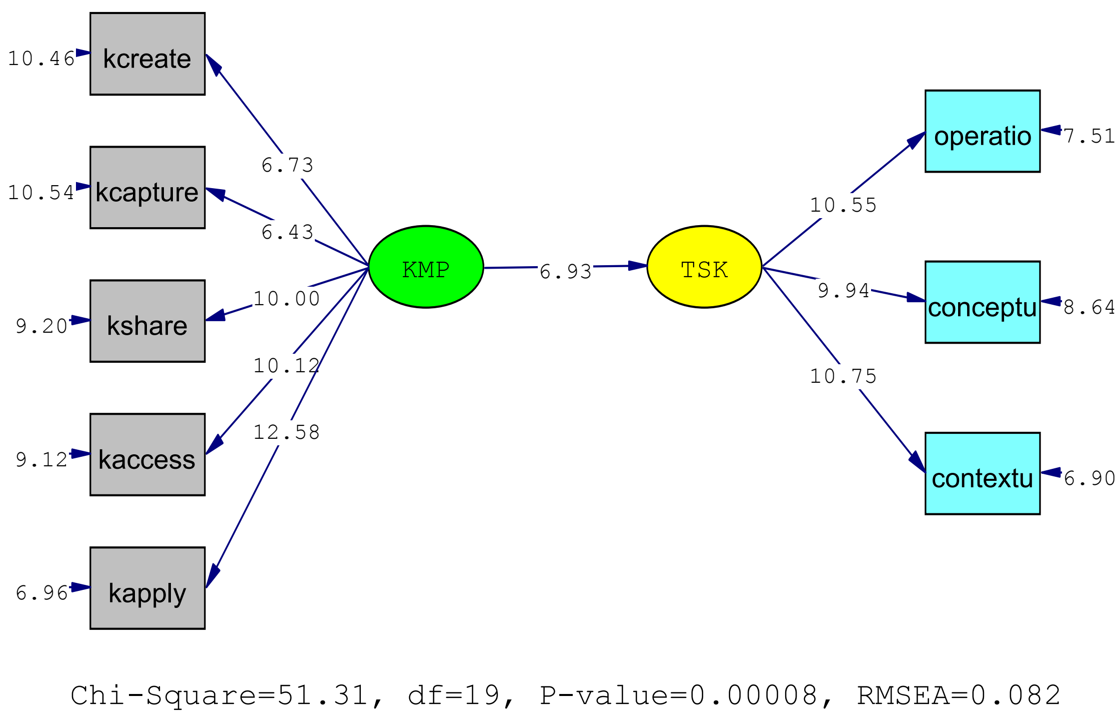


Figure 6.3.1.12: t-Values for the Structural Model of H6



community of practice had a significant impact on individuals' knowledge management practices. Hence, all three dimensions of community of practice were excluded in the comprehensive structural model. Hypothesis H1, which posited positive relationship between work characteristics and individual's knowledge management practices was partially supported because, only one aspect of the individual's work (the level of cognitive effort needed for the work), had a significant impact on their knowledge management practices. Therefore, this aspect of work characteristic was included in the overall structural model.

Figures 6.3.1.13 and 6.3.1.14 show the standardized solution and t-values for the comprehensive structural model. Several modification indices were observable in the model, largest of which was 53.9 for an error correlation between accumulate and knowledge capture. The chi-square statistic for the overall model is 666.77 (d.f.=244, p-value<0.000). Other fit statistics for the model were, RMSEA=0.083, GFI=0.82, AGFI=0.78, NNFI=0.82 and CFI=0.84, indicating marginal model-data fit. Though the structural coefficients between cognitive effort, empowerment and IT support to knowledge management practices were lower compared to the coefficients in their respective individual model, they were statistically significant (p-value<0.05). All the hypotheses that were supported in the earlier individual model were also supported in the comprehensive model. Table 6.3.1.1 and Figure 6.3.1.15 shows the hypotheses that are supported, partially supported and not supported by the data after the large scale analysis.

Figure 6.3.1.13: Standardized Solution for the Comprehensive Structural Model

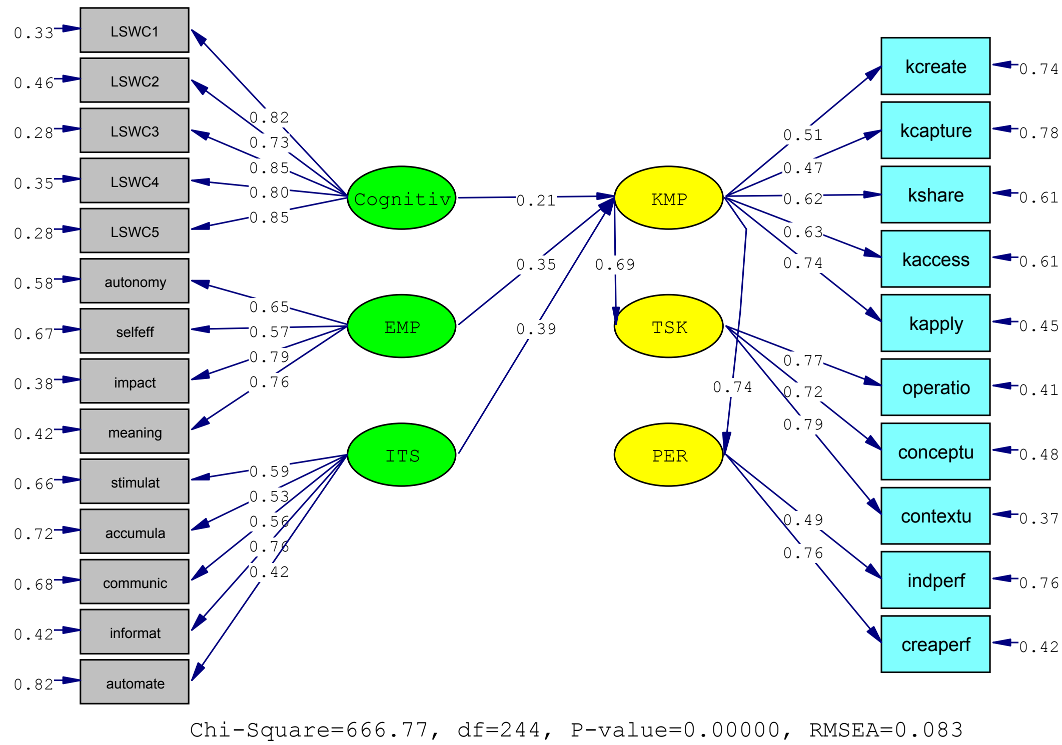


Figure 6.3.1.14: t-Values for the Comprehensive Structural Model

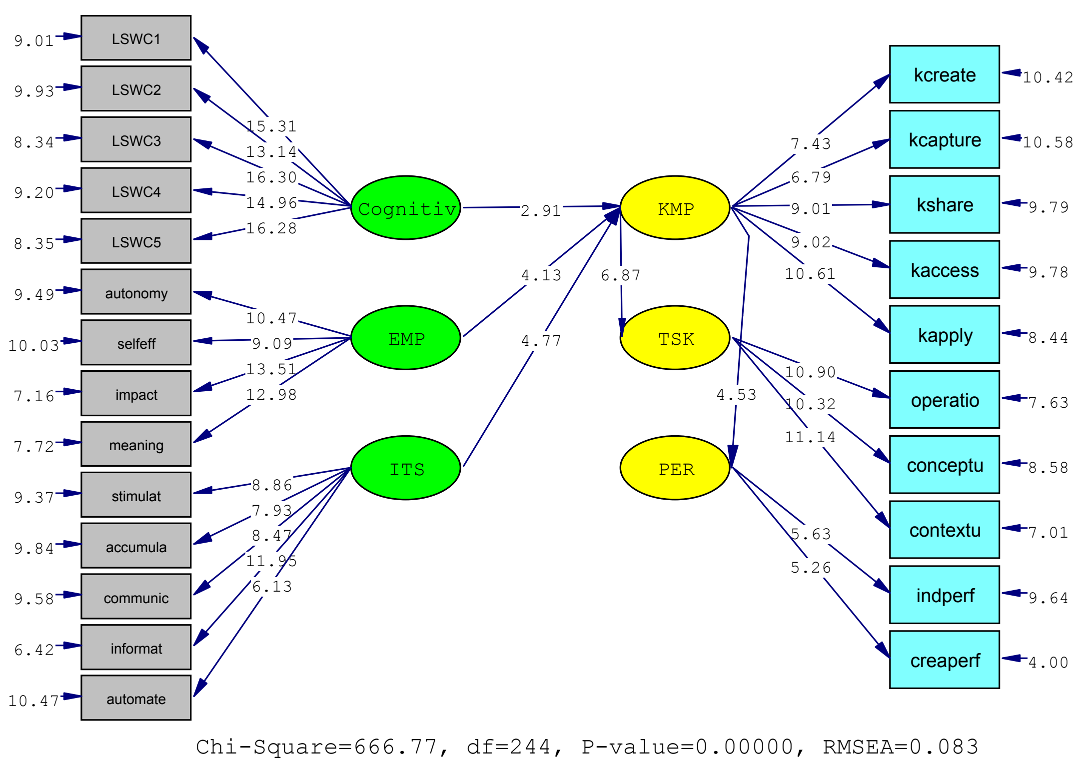


Figure 6.3.1.15: Detailed Research Model after Large Scale Analysis

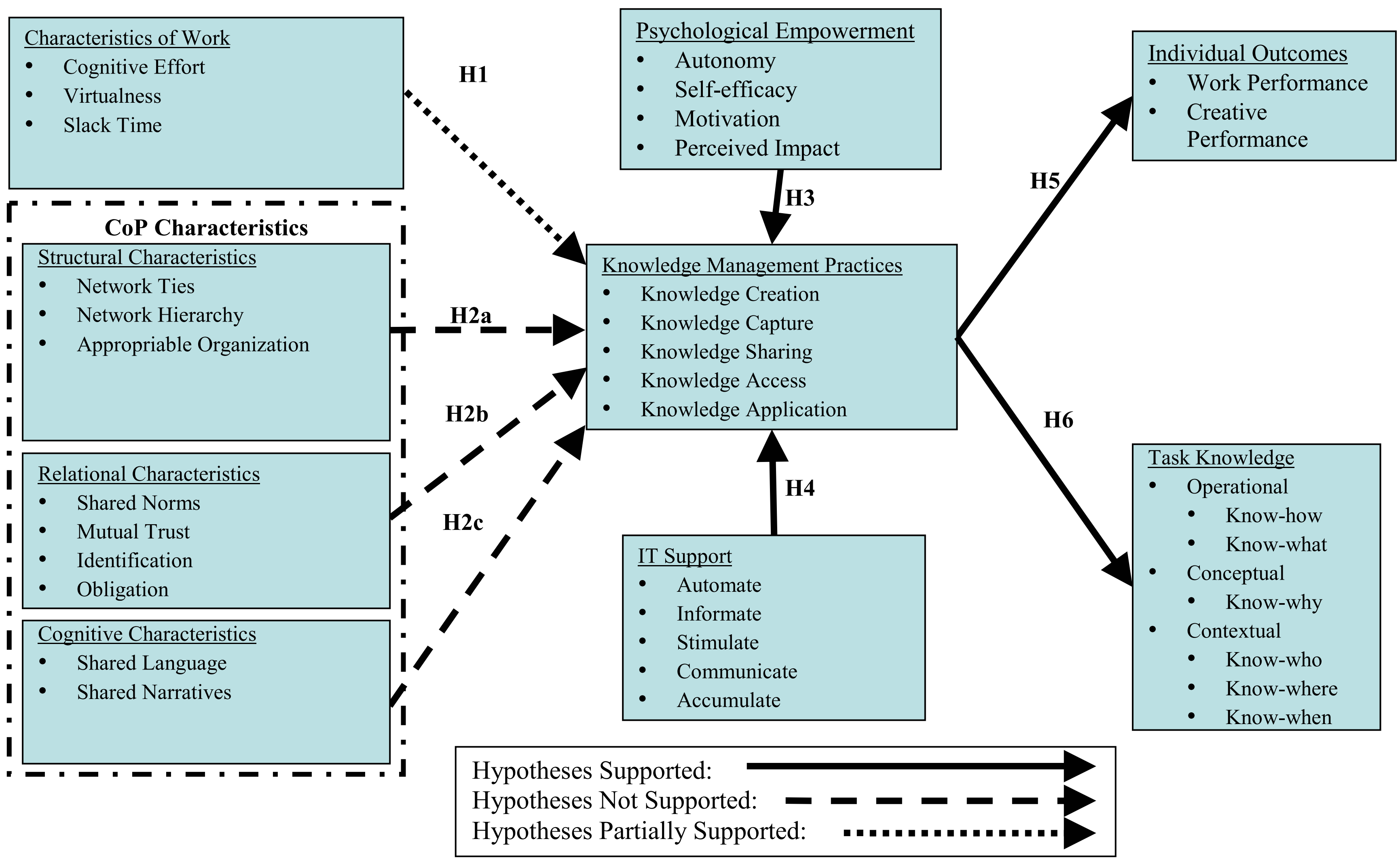


Table 6.3.1.3: Test Results of Hypotheses Based on the Comprehensive Model

Hypotheses	Standardized Structural Coefficients and (t-values)		
	Individual Model	Comprehensive Model	Status of Null
H1a (CognitEff-KMP)	**0.46 (5.06)**	**0.21 (2.91)**	Rejected
H1b (Virtual-KMP)	0.02 (-0.13)	NA	Not Rejected
H1c (Slack-KMP)	0.17 (0.66)	NA	Not Rejected
H2a (STR-KMP)	-0.14 (-0.28)	NA	Not Rejected
H2b (REL-KMP)	0.36 (0.75)	NA	Not Rejected
H2c (COG-KMP)	0.04 (0.55)	NA	Not Rejected
H3 (EMP-KMP)	**0.55 (6.16)**	**0.35 (4.13)**	Rejected
H4 (ITS-KMP)	**0.68 (6.31)**	**0.39 (4.77)**	Rejected
H5 (KMP-PER)	**0.72 (4.38)**	**0.74 (4.53)**	Rejected
H6 (KMP-TSK)	**0.69 (6.93)**	**0.69 (6.87)**	Rejected

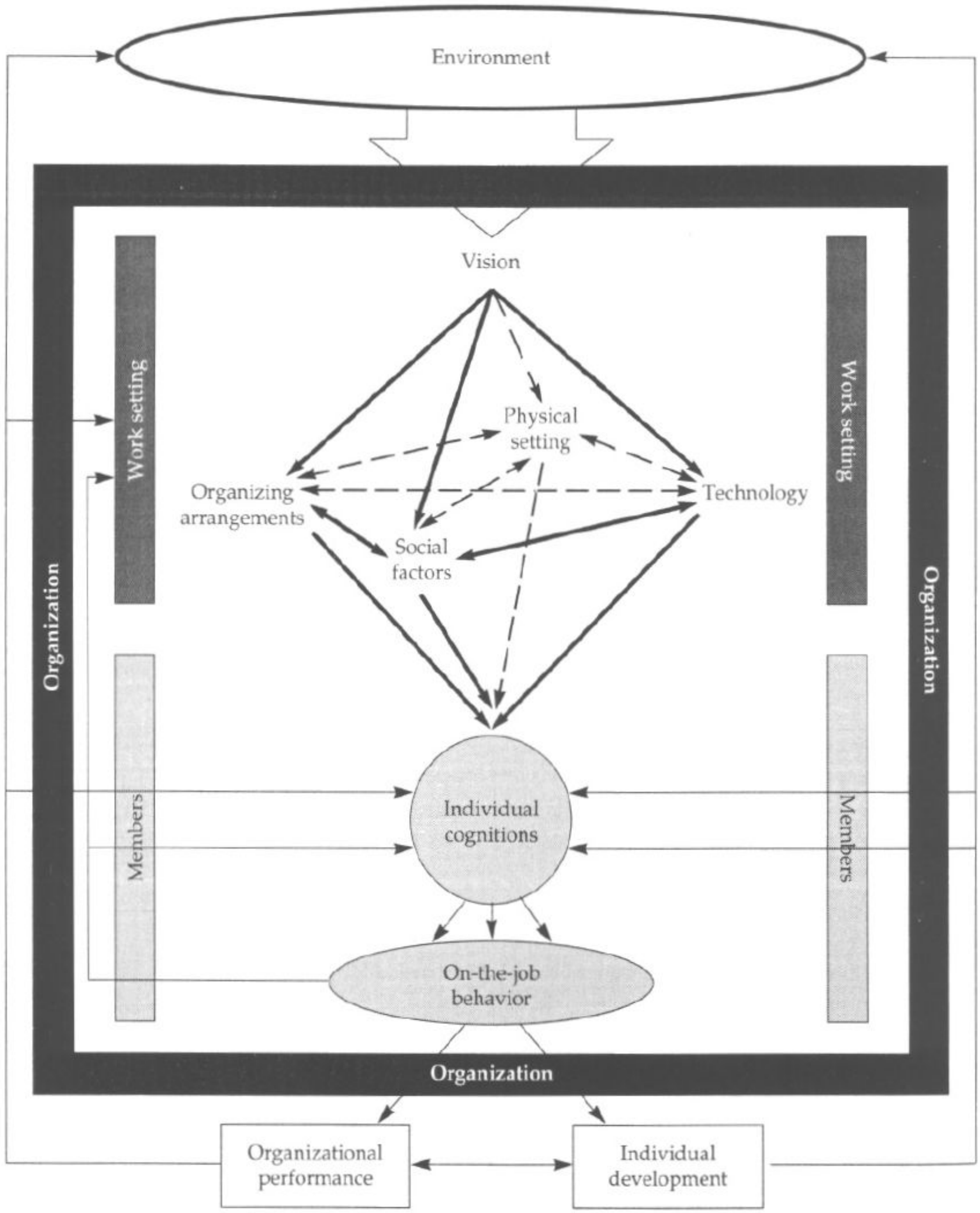
6.3.2 Alternate Structural Model

Since, none of the three dimensions of the characteristics of community of practice, and virtualness and slack did not have an significant impact on knowledge management practices. Whether these aspects of community of practice and work characteristics impacted knowledge management indirectly need to be investigated through competing alternative models. Relationships proposed in the alternative model needs to be logically plausible and should be developed in the light of existing theories. Porras and Robertson (1992) and Robertson, Roberts and Porras (1993) had used a meta-analytic approach and proposed a comprehensive theoretical model involving similar variables in the context of organizational development (OD). The model is mainly used to understand OD interventions and is partly based on Bandura’s (1977, 1986) social cognitive theory (Porras and Bradford, 2004). The common element of both the theories is the emphasis on human behavior as an interaction between environmental, cognitive and behavioral variables. These theories are also similar to Vygotsky's (1978) sociocultural theory and Lave and Wenger's (1990) situated learning theory in that they all consider the interaction of context/culture, activity and cognition but emphasize on different aspects and different purposes.

This research uses Porras and Robertson's (1992) frame work to develop an alternate model since it provides explicit links between the variables in question and is more close to the context of application (Figures 6.3.2.1). Specifically, they consider various interrelated organizational work setting (Including, Social, Physical, Technological and Organizational) factors affecting individual cognitions which in turn impact the individual behaviors, and subsequently affecting individual development and organizational performance. The social factors in their model are similar to the three dimensions of community of practice characteristics in this study. These social factors are expected to impact the individual behavior thorough their cognitions.

The only individual cognition measured in this study is the individuals' empowerment. However, common language and codes, and narratives did not form a single second order factor and had to be used as first order constructs. Further, all of these social characteristics need not have same level of impact on empowerment. Based on the inter-correlation between the constructs within community of practice, it was evident that many of these factors were interrelated as suggested by Nahaphiet and Ghoshal (1998). The relational dimension comprising of shared norms, trust, identification and obligation seemed to be most closely related to individual cognition. Both, structural dimension and the cognitive dimension contributed to what extent the community members developed

Figure 6.3.2.1: Change-based Organizational Framework (Porras and Robertson, 1992)



these positive norms, trust, identification and obligation. Logically also it made sense to model network ties, a flat hierarchy and appropriable organization as contributing to the shared norms, trust, identification and obligation within a community. A common language would help communicate effectively with other community members and hence help develop closer ties, access a broader range of individuals and thus help in reducing hierarchy, and will help to easily communicate with people they know if they share a common language. On the other hand, use of narrative communication may contribute to the relational aspect of the community of practice.

Based on Porras and Robertson's (1992) model, technology also impacts the social factors. In this research we are considering Information Technology support as the specific technologies that support the five knowledge management practice. Since these are classification of the technology that may have a wide impact, in addition to the direct impact on knowledge management practices, we also model its indirect effect thru enhanced empowerment because of the availability of these systems in the alternate model. Further, these technologies can impact the structural dimension of the community of practice, by helping to connect with other members and thus building stronger network ties, effectively flattening the hierarchy if one exists, and helping to be in touch with people they already know by other means.

Similarly, information technology supported knowledge work implies work that may be constantly emerging and requiring continual non-routine interaction with the system. Such a work settings may imply that the work is also cognitively challenging. In order to test these effects virtualness of work is suggested to impact cognitive effort required for the work. Slack however did not have a meaningful impact with either knowledge management practices or empowerment and was not included in the alternate model. The alternate model also indicated a large modification index for a path between empowerment and cognitive effort. It is possible that cognitively empowered workers by virtue of being highly autonomous, motivated and feeling greater meaning for their work may actively participate and show greater interest in their work, leading them to feel that their work is cognitively more enriching than their counter parts who may not feel highly empowered. In order to validate this post hoc hypothesis a direct relationship between empowerment and cognitive effort was also considered in the alternate model.

Figures 6.3.2.2 and 6.3.2.3 indicate the standardized solution and t-values for the alternate structural model. Several modification indices were observable in the model, largest of which was 53.6 for an error correlation between accumulate and knowledge capture. The chi-square statistic for the overall model is 1454.39 (d.f.=761, p-value<0.000). Other fit statistics for the model were, RMSEA=0.060, GFI=0.78, AGFI=0.75, NNFI=0.86 and CFI=0.87, indicating marginal model-data fit. Fit statistics for the alternate model is slightly better than the earlier comprehensive model. All the relationships proposed in the alternate model were statistically significant (p-value<0.05). All the hypotheses that were supported in the comprehensive model were also supported in the alternate mode. The structural coefficients and the t-values of these relationships and the newly proposed relationships are shown in Table 6.3.2.1.

Figure 6.3.2.2: Standardized Solution for the Alternate Structural Model

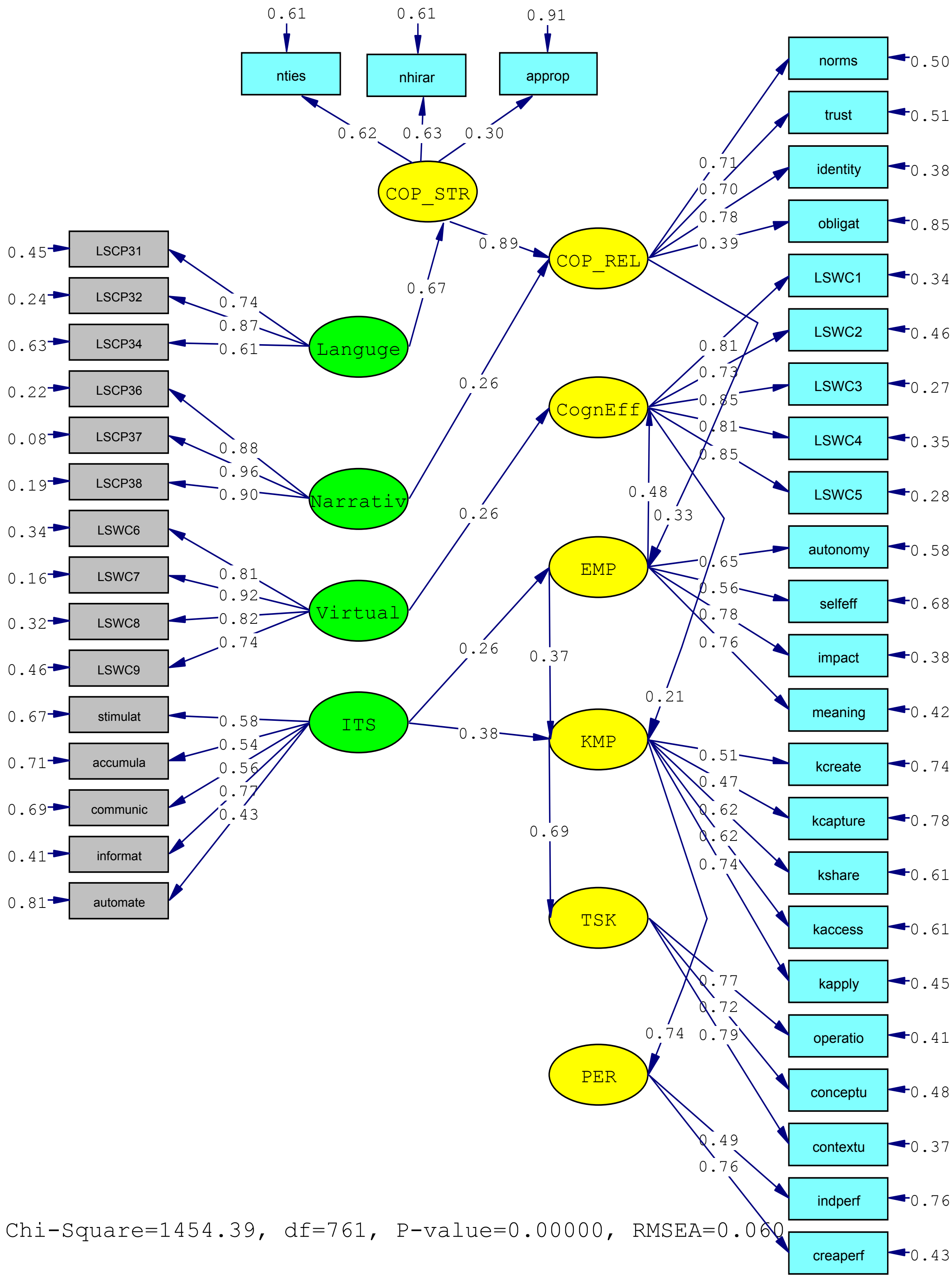


Figure 6.3.2.3: t-Values for the Alternate Structural Model

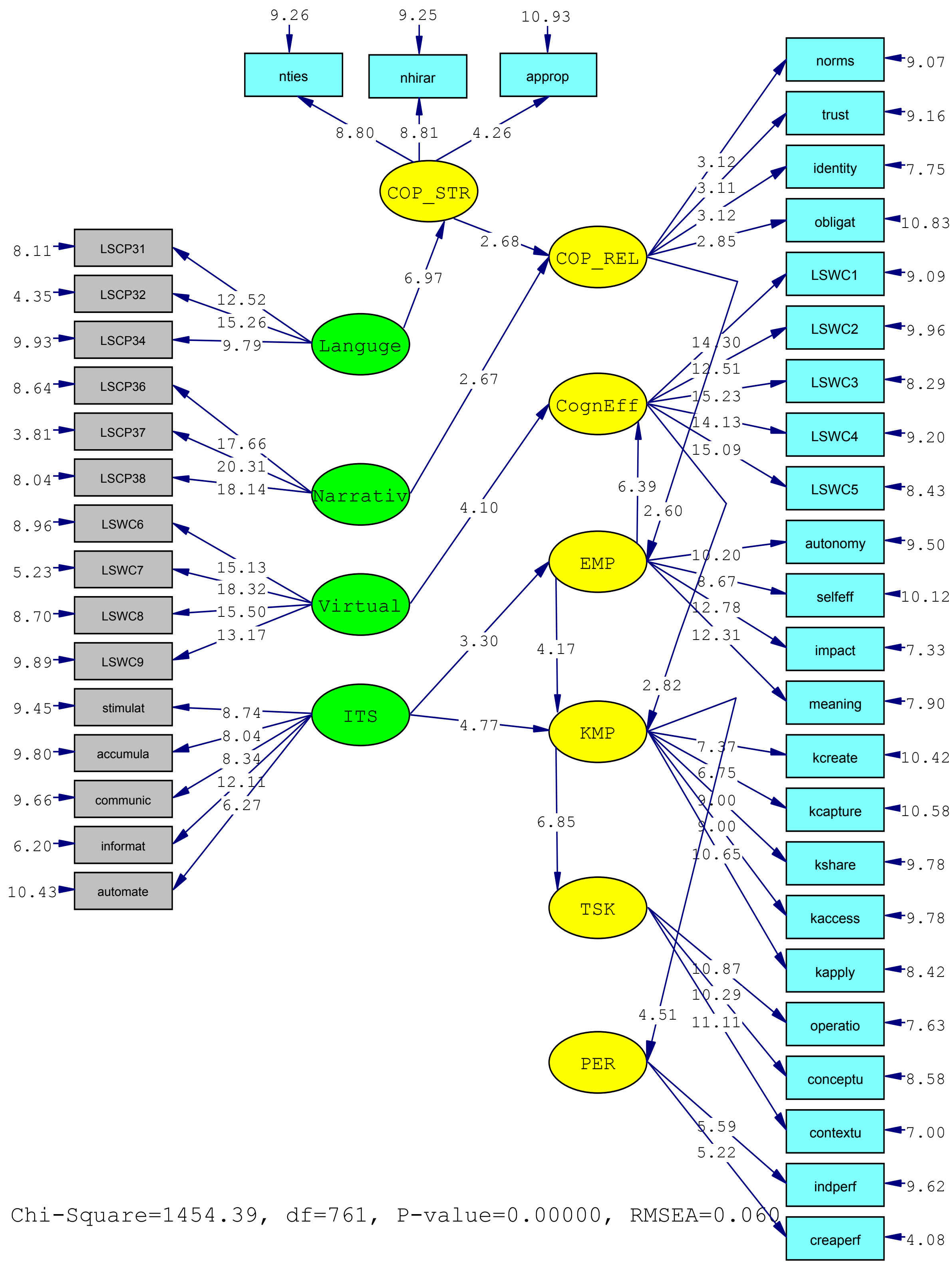


Table 6.3.2.1: Test Results of Hypotheses Based on the Alternative Model

Hypotheses	Standardized Structural Coefficients and (t-values)		
	Alternate Model		
	Direct Effect	**Indirect Effect**	**Total Effect**
H1a (CognitEff-KMP)	**0.21 (2.82)**	NA	**0.21**
H1b (Virtual-KMP)	NA	0.05	0.05
H1c (Slack-KMP)	NA	NA	NA
H2a (STR-KMP)	NA	0.14	0.14
H2b (REL-KMP)	NA	0.16	0.16
H2c (COG-KMP)	NA	0.13	0.13
H3 (EMP-KMP)	**0.37 (4.17)**	0.10	**0.47**
H4 (ITS-KMP)	**0.38 (4.77)**	0.12	**0.5**
H5 (KMP-PER)	**0.74 (4.51)**	NA	**0.74**
H6 (KMP-TSK)	**0.69 (6.85)**	NA	**0.69**
Virtual-CognitEff	**0.26 (4.10)**	NA	**0.26**
Language-STR	**0.67 (6.97)**	NA	**0.67**
Narrative-REL	**0.26 (2.67)**	NA	**0.26**
STR-REL	**0.89 (2.68)**	NA	**0.89**
REL-EMP	**0.33 (2.60)**	NA	**0.33**
ITS-EMP	**0.26 (3.30)**	NA	**0.26**
EMP-CognitEff	**0.48 (6.39)**	NA	**0.48**

6.3.3 Summary of Hypotheses Testing

Based on the results from measurement model evaluation, summated scales of first order latent variables were used to test the structural model. Evaluation of hypotheses was based on a two step procedure where individual hypotheses were tested for their plausibility based on individual structural models. In the next stage, all constructs for which the hypotheses were supported in the first stage were used to develop a comprehensive structural model to evaluate the simultaneous effect of the proposed relationships. Results of hypotheses testing using structural equation modeling in LISREL indicate that there is no evidence to support some of the proposed hypotheses whereas there is no evidence to reject others (Table 6.3.1.1).

Specifically, the hypotheses H2a, H2b and H2c were rejected in the first stage itself indicating that all three dimensions of community of practice did not have a significant impact on individuals' knowledge management practices. A preliminary analysis to explore whether the three dimensions had any significant impact on the first order factors within the knowledge management practices measure also indicated no significant relationship.

Since the first order constructs of work characteristics failed to form a second order construct, hypotheses H1 which posited that the work characteristics involving greater cognitive effort, greater virtualness of work and availability of more slack time will have a significant positive impact on the individual's knowledge management practices was tested by modeling the three first order constructs directly impacting knowledge management practices. This enables us to test the partial impact of each of these aspects of work characteristics on knowledge management practices. Accordingly, H1 was split into H1a, H1b, and H1c corresponding to the impact of cognitive effort, virtualness of work and slack time on knowledge management practices respectively. Only H1a was supported indicating that cognitive effort required for one's work has a positive impact on engaging in the various knowledge management practices. Virtualness of work and availability of slack time did not have a significant impact on individual's knowledge management practices.

All other hypotheses were supported by the data suggesting that both individual's empowerment and various IT support available had a significant impact on the extent to which the individual engages in the various knowledge management practices. The data also supports the fact that engaging in the various knowledge management practices as conceptualized in this research significantly contributes to the task knowledge and the various performance outcomes of the individuals.

The hypotheses that were supported in the comprehensive model were also supported in the alternate model. These relationships were also strengthened by other indirect effects for some of the hypotheses as seen in the alternate model (Figure 6.3.2.2). the alternate model also supports other relationships that were not originally hypothesized and extends our understanding of the knowledge management behaviors in the light of other theories not originally considered. Results indicate that the relational dimension of community of practice characteristics impacts knowledge management behaviors through individuals' cognitive empowerment. This is consistent with other theories which posit that social factors influence individual behaviors through their cognitions (Porras and Robertson, 1992).

The structural and cognitive dimensions of community of practice as proposed by Nahapiet and Ghoshal (1998) did not have a direct impact on individual behaviors, rather, the cognitive characteristic of the extent of shared language and codes impacted knowledge management practices through its impact on the structural dimension of the community of practice. Similarly, the cognitive characteristic of the extent of use of narrative in the community impacted knowledge management practices through its impact on the relational dimension. Likewise, rather than structural characteristic having a direct impact on knowledge management practice, its effect was mediated by the relational dimension and the individuals' cognitive empowerment.

Based on the alternative model, IT support not only have a direct impact on the individuals' knowledge management practices but also affects their behavior by having an impact on their cognitive empowerment, similar to the impact of certain technologies on individual cognitions as suggested by Porras and Robertson (1992). Interestingly, virtualness of one's work and the level of their cognitive empowerment positively impact the individuals' perception of cognitive effort needed for their work and their subsequent involvement in the various knowledge management practices. A summary of all the direct and indirect relationships in the alternate model is shown in Table 6.3.2.1. Chapter seven discusses the results, limitations of the current study and practical and theoretical implications, and provides recommendations for future research.

CHAPTER 7: SUMMARY, IMPLICATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

7.1 Summary of Findings and Discussion

Most of the literature on knowledge management to date has been primarily theoretical, particularly in the conceptualization of knowledge and knowledge management. The few empirical studies that exist have primarily focused on service based industries or knowledge management in the context of consulting firms and software development. This research provides a large scale empirical investigation of knowledge and knowledge management and the various factors that impact knowledge management at an individual level of analysis focusing on its importance in manufacturing sector. The study uses a sample of 252 knowledge workers from various manufacturing and related industries to test the theoretically conceptualized model involving individuals' knowledge management practices and the various factors that affects these behaviors and the outcomes of those behaviors.

Specifically, the study tests relationships between knowledge workers' community of practice, work characteristics, psychological empowerment and information technology support on their knowledge management practices, and the subsequent impact of their knowledge management practices on their task knowledge and performance outcomes. The research contributes to the body of knowledge management literature in a number of ways.

First, this research provides a comprehensive theoretical model of knowledge management at an individual level and has integrated the various conceptualizations of knowledge management. This theoretical model can be used as a basis for identifying other factors that may be important in how individuals manage their knowledge in a world where knowledge is increasingly gaining importance for their own and their organization's competitiveness. The theoretical model also provides a framework to link the concept of knowledge management at various levels of abstraction.

Second, the study provides valid and reliable new measurement instruments for knowledge management practices and task knowledge at an individual level, and of IT support from a knowledge management perspective. Measures for the three dimensions of the characteristics of community of practice are also operationalized and tested based on Nahapiet and Ghoshal's (1998) conceptualization. This study also provides measures of work characteristics such as cognitive effort and virtualness of work. Existing measures of empowerment, creative performance and work performance are also validated in this study. Valid and reliable measures in the knowledge management field can greatly extend the theory development and empirical testing that is limited this field.

Third, the substantive relationships tested in this research identify important factors that affect individuals' knowledge management practices and their subsequent performance outcomes. Specifically, individual's empowerment, IT support available and the cognitive effort involved in their work were found to have a significant impact on their knowledge management practices. Their knowledge management practices also had a significant impact on their task knowledge and their performance outcomes. The three dimensions of their community of practice (structural, relational and cognitive) were found not to have a significant direct impact on individuals' knowledge management practices. Rather, the cognitive and structural aspects of the community of practice impacted the relational dimension, which in turn impacted the knowledge management practices indirectly by affecting individuals' psychological empowerment. The finding is consistent with other similar theories of individual behaviors which emphasize interaction between the environmental, cognitive and behavioral variables such as social cognitive theory (Bandura, 1977, 1986, 1989; Porras and Robertson, 1992).

However, alternative explanations exist and needs to be explored to validate the above claim. For example, further investigation needs to be conducted to ensure that indirect relationship of community of practice characteristics on knowledge management practices is not because of the way community of practice characteristics are measured in this research. Since this study was conducted at the individual level of analysis, the different aspects of an individual's community of practice were measured using perceptual questions aimed at the individual. Though the individual may be the best person to answer the different aspect of their own community of practice, the objective characteristics of the community of practice may not have been captured adequately by such a method. It is possible that such objective characteristics of the community of practice may still constrain or promote certain behaviors related to managing their knowledge based on strict behaviorist theories which supports a direct, unidirectional effect of stimulus to response (Skinner, 1938, 1953; Thorndike, 1932; Watson, 1930).

Another, possible reason may be due to the fact that when individual's are involved in more than one community it may have been difficult to focus on the characteristics of a particular community though the questions were directed to do that. Further, when they are involved in many communities as indicated by the sample in this study, it may be difficult to separate the effect of one community from the other. However, based on the reliability, and convergent and discriminant validity tests, the findings suggest that individuals were able to distinctly discern the different aspects of the community of practice as measured in this study. The results suggest that rather than various characteristics of community of practice directly affecting the individual knowledge management practices, they impact these behaviors through a more fundamental aspect of the individual such as their perceptions and cognitions.

The results related to the community of practice may also be due to the individuals' perception of the peculiar characteristics of their community. For example, more than 50 percent of the individuals in this sample indicated that they were part of three or more communities during the period. Similarly, more than 50 percent of the respondents also indicated that their primary community was their work group. To what extent do they use multiple communities simultaneously to access various knowledge needed for their task and whether a particular community can be conceptualized as a knowledge community from such a perspective also needs to be explored further. A similar investigation could be performed by exploring the differences in effect between individuals who have greater identity with the particular community in question compared to those who did not identify with their community as strongly.

This research also found empirical support indicating that virtual work- the work that is mostly mediated or embedded within computers- require greater thought and reflection making it more cognitively demanding. Virtualness of work being an environmental variable did not have a direct effect on individuals' knowledge management practices. Rather, it contributed to the knowledge management practices by making the work setting more cognitively demanding.

Information technologies that specifically supported the various knowledge management practices not only had a direct impact on those practices but also impacted the individuals' knowledge management practice behavior by contributing to their empowerment feelings. That is, the IT systems that were available for these individuals not only helped them manage their knowledge effectively (by creating, capturing, sharing, accessing and applying their knowledge) but also helped them feel that they were better empowered based on their feeling that they could better achieve their work goals (self-efficacy), feeling of having greater control of their work situation (autonomy), deriving greater meaning from their work (meaning) and feeling that they could significantly contribute to their work (impact), which in turn again contributed to how effectively they engage in the various knowledge management practices.

Interestingly, individuals' empowerment not only had a direct impact on their knowledge management practices but also affected these practices by making them feel that their work required greater cognitive effort. This may be because individuals who see greater meaning in what they do and feel that their actions have greater impact may actively become engaged in their work with not just their body but with their mind too, and hence may perceive their work to be more cognitively engaging. In the next section the practical and theoretical implications of the findings of this research are discussed.

7.2 Practical and Theoretical Implications

The findings of this research have several practical and theoretical implications. First, the results of the study indicate that knowledge management practices can be viewed as a set of at least five distinct enduring behaviors by which individuals manage their knowledge. This research provides valid and reliable measures which managers can use as a valuable tool to assess and benchmark the various knowledge management practices of their employees with that of their best work force. Knowledge worker productivity is an important issue in the light of increasing amount of such work in the current economy. The knowledge management practice as measured in this research is found to significantly impact the task knowledge and the performance outcomes of such workers. Organizations should be able to use these measures to assess impact of the various knowledge management initiatives and technologies in improving the knowledge management practices of their individuals and subsequently their performance outcomes. The insights form these studies can be used to develop the right type of initiatives and to efficiently allocate limited organizational resources. In addition these measurement instruments can be used in a wide range of situations to identify the specific factors that are important in that work setting.

This research also found that information technology tools used in knowledge work can be viewed from a knowledge management perspective corresponding to the five practices conceptualized and operationalized in this research and supporting these practices as technologies that stimulate, accumulate, communicate, informate and automate. These conceptualizations are similar to Dutta et al.'s (1997) conceptualization of information systems but extends it to include the full range of knowledge management practices. The results indicate that all the five technologies jointly affect to what extent knowledge workers can mange their knowledge. Managers need explicitly to consider how the different technologies available for their workers contribute to these five aspects of IT support.

The IT support framework will help managers to evaluate the various IT tools from these five perspectives and integrate or supplement with additional tools or develop specific components to achieve the level of support needed in each of these areas. However, they need to be cautious in blindly pursuing initiatives to provide the highest level of support in all the five areas since certain work situations may require greater support in some aspects than in others. Future research needs to investigate this aspect more thoroughly to gain further insight. For instance, in areas such as new product development, knowledge creation may have a more critical role than other knowledge management practices and hence the technologies that stimulate may be subsequently more important.

However, all five knowledge management practices are interrelated as are the IT tools that support these practices. How particular aspects of these practices suffer due to the lack of support in other areas have to be investigated in future research. Future research also needs to investigate any differences between a single integrated IT tool supporting all five areas of knowledge management as opposed to multiple tools supporting these areas separately. The results of such an investigation will have significant impact on system development.

Knowledge workers' psychological empowerment was found to play a significant role in impacting their knowledge management practices. The results suggest that empowered individuals tend to engage in the various knowledge management practices more extensively. Further, the community of practice characteristics, especially the relational dimension, and IT support available also impacted knowledge management practices through their empowerment feelings. As work becomes emergent and more cognitively demanding, managers need to explicitly consider this aspect of knowledge worker behavior and promote conditions that enhance their empowerment. This is especially significant since individuals' psychological empowerment have been found to impact a wide range of behaviors. Various aspects of IT users' empowerment have also been found to impact how effectively they use such systems (Deng, Doll, Dothang, 2004), and is doubly important when these knowledge workers have to use the information technology tools that are available to manage their knowledge effectively.

As work becomes more knowledge based in organizations, individuals need to reflect and analyze greater amount of information to make effective decisions. This research confirms the fact that such cognitively demanding work prompts the individuals to mange their knowledge more extensively. Further, as end-user computing environments become more pervasive (Torkzadeh, Koufteros, Doll, 2005), the results of the current study suggest that they demand greater cognitive effort. When assessing performance outcomes of knowledge workers managers need to consider the cognitive effort required in their work in conjunction with other support factors that help individuals to manage their knowledge in such environments.

The new measures developed in this research can contribute to the development of theory in the field of knowledge management by enabling researchers to test other individual, organizational and contextual variables that may impact individual's knowledge management practices. The results of this study support some aspects of the originally proposed model from the perspective of behavioral based theories (Bandura, 1963; Skinner, 1938; Thorndike, 1932; Watson, 1930) where the environmental factors are posited to directly impact the individual behaviors and subsequently their outcomes. A post hoc analysis using alternate model also render support for relationships that impact individual behavior through their cognitions, supporting some aspects of cognitive theories such as social cognitive theory (Bandura, 1986, 1989), activity theory (Engestrom, 1987, 1999; Blackler, 1993; Vygotsky, 1978) and situated learning theory (Lave and Wenger, 1990), which posit that environmental affect individual behaviors through their cognitions.

The results of the current study suggest that knowledge management practices can be conceptualized as at least five fairly distinct sustained behavioral manifestations dealing with individual's knowledge (knowledge creation, capture, sharing, access and application). Identifying these practices as core behavioral process by which individual manage their knowledge, and providing operational measures that are valid and reliable for these processes will help in further identifying the critical factors that impact and are impacted by these core processes in the current knowledge economy. Though the measures and relationships tested in this research needs to be replicated and validated in other scenarios they provide preliminary evidence for theory building in this field.

From a behavioral perspective, current research finds that information technologies specific to the particular knowledge management practices (or sustained behaviors) and extent of cognitive effort required in the work impact individuals knowledge management practices. Whereas other external factors such as their community of practice characteristics impact their knowledge management behaviors through their psychological empowerment supporting the cognitive theoretical perspective. The relationship of IT support to knowledge management practices is also supported by this perspective by having an indirect relationship through empowerment.

The results contribute to both behavioral and cognitive theories by finding empirical evidence for relationship between the constituent variables in the context of knowledge management at individual level. The results also validate several similar relationships proposed by Porras and Robertson (1992) in their framework used to analyze organizational change/development based on social cognitive theory (see Figure 6.3.2.1)

7.3 Recommendations, Limitations and Future Research Directions

The focus of the current study was in developing a valid and reliable measure of individual knowledge management practices and in identifying and testing its specific antecedents and consequents among knowledge workers in a manufacturing context. The results suggest that the measures developed are valid and reliable, and supports many of the proposed hypotheses. Significant relationships were found between individual's empowerment, IT support available, and cognitive effort involved in work with their knowledge management practice, which subsequently had a significant impact on their task knowledge and performance outcome. However, the data obtained from the sample in this study suggests that there was no significant relationship between the various characteristics of community of practice and individuals' knowledge management practices.

However, the findings of this research are based on a single sample of knowledge workers drawn mainly from various manufacturing contexts. An immediate recommendation for future direction is to retest the measurement and structural model in a similar demographic sample.

An important limitation of this research is that an email campaign using an open access database was used to collect the data needed for this research. Accordingly, the traditional response rate based on the number of requests send out was very small compared to other similar studies. Several factors were identified earlier in the results section for the response rate obtained. However, the model needs to be tested in a more targeted group such as by obtaining access to a large manufacturing company which employees a large number of knowledge workers whose work processes are embedded or enabled by information technology.

Another possible avenue of future research is to test the model in various work settings or in special work functions such as in software development, accounting, customer service, etc. Given the generic nature of the measures this would be relatively easy to implement if the sample target population is accessible. This should provide a better test of the invariance of the measurement and structural model and may help identify the specific differences in such groups.

Recent studies have indicated that “with the growth of end user computing environments and flexible technology, the ultimate question for use of technology by individuals and organizations may be more related to how the technology impacts work than how technology is designed or used.” (Torkzadeh, Koufteros, Doll, 2005, p. 116). Future research needs to consider such impacts caused by the information systems and individuals knowledge management practices, and whether the IT support available to them on the dimensions considered in this research impacts such outcomes apart from their performance outcomes and task knowledge.

Future research could test the model in higher levels of abstraction to investigate for example, whether the knowledge management practices as operationalized in this research holds true in a group or an organizational level of analysis. Different contextual variables and the outcome measures may have to be used in such contexts. It should be valuable and interesting to know what factors would be important in group and organizational levels to successfully manage knowledge that is accessible to these levels of abstraction.

This research also provides a framework for analyzing information systems from a knowledge management perspective. This framework could be used to further study how the different information technologies support the various dimensions of IT support as conceptualized in this research. Managers should be able to use this framework to analyze the right combination of IT tools that are needed and equip the knowledge workers for the knowledge based 21^{st} century.

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Appendix-A: Pretest Survey

A Survey of Individual Knowledge Management in Computer Intensive Manufacturing Environment

General Overview, Disclosure and Instructions

1. This survey is part of a research to understand the different ways individuals manage their knowledge in a computer intensive manufacturing environment, and to understand the different technological and work related factors that influence such activities, and its outcomes.

2. All responses to this survey will be kept with utmost confidentiality. Only anonymous opinions and aggregate results will be used, and may be reported in scholarly journals and conferences.

3. Most questions in this survey require you to choose an alternative that best fit your views on the particular topic. There are no correct or incorrect answers and we are interested only in you perceptions. The estimated completion time for this questionnaire is expected to be approximately 45 minutes.

4. Please complete all questions in this survey. Incomplete questionnaire can create serious problems for data analysis and responses may become unusable for research purposes.

5. All questions in this survey require you to respond in relation to a particular **assignment or project that you have completed most recently** preferably as a team, irrespective of its success or failure. If your work did not involve working on a particular assignment or project please answer the questions in this survey based on **your work in the past six (6) months**.

6. If you can identify a particular assignment or project, please list the following details regarding the assignment or project that you will be referring to for completing this survey:

Name of the assignment/project: ____
Date this assignment/project was completed: ________________________________ (MM/DD/YY)
Duration of this assignment/project (in number of months): ___________________________ Month(s)

7. By returning the completed survey you agree to voluntarily participate in this study. If you would like to receive a free copy of the summary of the survey results, please provide your name and address at the end of this questionnaire or attach your business card.

In this research by **knowledge** we mean any knowledge/information that you have in relation to the above mentioned assignment/project or your work, or any knowledge/information that you think or feel is relevant to this or similar task in the future.

Thank you for your cooperation and valuable assistance in this research.

If you have any questions regarding this survey please feel free to contact the following persons.

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Section A: Characteristics of Work

In this section we would like to know something about the nature of your work during the assignment/project that you mentioned at the beginning of this survey. Please circle the number that corresponds to the extent to which the following activities were part of your work.

1= None or To a very little extent 2= To a little extent 3= To a moderate extent 4= To a great extent 5= To a very great extent

The assignment/project I mentioned at the beginning of this survey…

A1. involved doing repetitive tasks	1	2	3	4	5
A2. involved doing similar tasks	1	2	3	4	5
A3. involved doing same kind of tasks	1	2	3	4	5
A4. involved doing same things in a cycle	1	2	3	4	5
A5. involved doing same things over and over again	1	2	3	4	5
A6. involved doing a large variety of tasks (R)	1	2	3	4	5
A7. was routine	1	2	3	4	5
A8. had routine tasks	1	2	3	4	5
A9. had routine duties	1	2	3	4	5
A10.had standard tasks	1	2	3	4	5
A11.had predetermined requirements	1	2	3	4	5
A12.had predictable requirements	1	2	3	4	5
A13.required doing things in a sequential manner	1	2	3	4	5
A14.involved doing sequential tasks	1	2	3	4	5
A15.involved doing things in a given order	1	2	3	4	5
A16.involved doing tasks one at a time	1	2	3	4	5
A17.involved doing things one by one	1	2	3	4	5
A18.had tasks that were not very ordered (R)	1	2	3	4	5
A19.involved working in groups	1	2	3	4	5
A20.had activities that had to be done in a group	1	2	3	4	5
A21.had activities that required me to interact with many others	1	2	3	4	5
A22.had tasks that were dependent on the whole group	1	2	3	4	5
A23.had tasks that could mostly be done individually (R)	1	2	3	4	5
A24.involved doing things solely by myself (R)	1	2	3	4	5
A25.had goals that kept changing	1	2	3	4	5
A26.had tasks with several objectives	1	2	3	4	5
A27.had goals that were changeable	1	2	3	4	5
A28.had goals that were constantly changing	1	2	3	4	5
A29.had goals that were fixed (R)	1	2	3	4	5
A30.had tasks with fixed objectives (R)	1	2	3	4	5
A31.provided freedom of choice in how the work had to be performed	1	2	3	4	5
A32.provided choice in how the work had to be planned	1	2	3	4	5
A33.provided choice in the work activities	1	2	3	4	5
A34.required me to decide how things were to be done	1	2	3	4	5
A35.required me to decide when the work had to be performed	1	2	3	4	5
A36.required me to decide what was to be done	1	2	3	4	5
A37.required me to decide where the work had to be performed	1	2	3	4	5

1= None or To a very little extent	2= To a little extent	3= To a moderate extent	4= To a great extent	5= To a very great extent

The assignment/project I mentioned at the beginning of this survey…

A38.required me to think	1	2	3	4	5
A39.required me to use my reasoning	1	2	3	4	5
A40.required my thoughtful judgment	1	2	3	4	5
A41.required me to use cognitive effort	1	2	3	4	5
A42.required involved thinking	1	2	3	4	5
A43.was intellectually challenging	1	2	3	4	5
A44.required me to use my knowledge	1	2	3	4	5
A45.was mentally challenging	1	2	3	4	5
A46.involved using computers	1	2	3	4	5
A47.involved tasks that depended on computers	1	2	3	4	5
A48.would have been difficult to perform without computers	1	2	3	4	5
A49.had processes embedded in computers	1	2	3	4	5
A50.had work embedded in computers	1	2	3	4	5

During the assignment/project I mentioned at the beginning of this survey…

A51.I had time to think about what I was doing	1	2	3	4	5
A52.I had time to think about the work I did	1	2	3	4	5
A53.I had time to reflect on my work	1	2	3	4	5
A54.I had time to reflect on what I did	1	2	3	4	5
A55.I had time to analyze what I did	1	2	3	4	5
A56.I had time above and beyond what was needed as a minimum to get things done	1	2	3	4	5
A57.provided me time to do productive tasks that was not directly related to my work outcome	1	2	3	4	5
A58.provided me time to organize information related to what I was doing	1	2	3	4	5
A59.I had slack time	1	2	3	4	5
A60.we were always rushed to get things done (R)	1	2	3	4	5
A61.we were always hurried in our job (R)	1	2	3	4	5

A62.About what percentage of your working time was available for you to do things **not directly related** to the productivity of the task at hand? ____________%

Section B: Information Technology Support

In this section we would like to know to what extent information technologies you used for the assignment/project have helped you to become more knowledgeable in your job, and to what extent they have helped you to manage what you know.

Please list all the applications/software that you regularly used for the assignment/project you mentioned at the beginning of this survey:

1. ____________	6. ____________	11. ____________
2. ____________	7. ____________	12. ____________
3. ____________	8. ____________	13. ____________
4. ____________	9. ____________	14. ____________
5. ____________	10. ____________	15. ____________

Please circle the number that corresponds to the extent to which the above technologies have helped you in each of the activities mentioned below.

1= None or To a very little extent	2= To a little extent	3= To a moderate extent	4= To a great extent	5= To a very great extent

During the assignment/project I mentioned at the beginning of the survey the above applications have helped me…

B1.	come up with new ideas	1	2	3	4	5
B2.	think through problems	1	2	3	4	5
B3.	gain new insights	1	2	3	4	5
B4.	gain new knowledge	1	2	3	4	5
B5.	combine new information	1	2	3	4	5
B6.	stimulate my thinking	1	2	3	4	5
B7.	create new knowledge	1	2	3	4	5
B8.	store knowledge I created	1	2	3	4	5
B9.	store information I needed	1	2	3	4	5
B10.	organize my knowledge	1	2	3	4	5
B11.	accumulate my knowledge	1	2	3	4	5
B12.	memorize required information	1	2	3	4	5
B13.	retain new ideas	1	2	3	4	5
B14.	create new routines	1	2	3	4	5
B15.	capture my knowledge	1	2	3	4	5
B16.	share my insights	1	2	3	4	5
B17.	share my best practices	1	2	3	4	5
B18.	communicate what I knew	1	2	3	4	5
B19.	share my ideas	1	2	3	4	5
B20.	communicate information that I had	1	2	3	4	5
B21.	communicate with other people	1	2	3	4	5
B22.	transfer my knowledge	1	2	3	4	5
B23.	transfer my skills	1	2	3	4	5
B24.	become more informed	1	2	3	4	5
B25.	access needed information	1	2	3	4	5
B26.	access what others knew	1	2	3	4	5
B27.	access relevant company data	1	2	3	4	5
B28.	access work related information	1	2	3	4	5
B29.	access information form company databases	1	2	3	4	5
B30.	remember needed information	1	2	3	4	5
B31.	get quick help	1	2	3	4	5
B32.	automate my work processes	1	2	3	4	5
B33.	embed my knowledge into my work routines	1	2	3	4	5
B34.	implement my ideas	1	2	3	4	5
B35.	apply my knowledge at work	1	2	3	4	5
B36.	use my knowledge for my work	1	2	3	4	5
B37.	incorporate my knowledge into work processes	1	2	3	4	5

Section C: Characteristics of Communities of Practice

A community of practice is <u>any group formal or informal from which you seek, share or build your job related knowledge,</u> it could be your own work group, or a specific community within or outside your organization that is related to your field of work.

In this section we would like to know about the characteristics of the community of practice in which you interacted. Please answer the following questions in relation to the community of practice in which you **<u>interacted the most</u>** during the assignment/project you mentioned at the beginning of this survey.

C1. Was this community same as your work group?	_____Yes _____No
C2. Was this primarily an online (Internet/Intranet) community?	_____Yes _____No
C3. Approximately what percent of your interaction with the community was online?	_____________%
C4. For how long were you part of this community by the end of the project/assignment you mentioned?	____Year(s) and ____Month(s)
C5. Approximately how many members were there at that time in this community?	__________
C6. Approximately how many members did you interact with in this community?	__________
C7. Approximately how many members did you interact with very regularly in this community?	______
C8. Did you interact with the same people most of the time?........................	_____Yes _____No

Please circle the number that corresponds to the extent to which you agree or disagree with each of the statements in relation to the community of practice in which you **<u>interacted the most</u>** during the assignment/project you mentioned at the beginning of this survey.

1= Strongly disagree	2= Disagree	3= Neither disagree nor agree	4= Agree	5= Strongly agree

In the community I interacted…

C9.	People had very strong network ties	1	2	3	4	5
C10.	People had very strong relations	1	2	3	4	5
C11.	People's relations with each other were very close	1	2	3	4	5
C12.	People's relations with each other were very frequent	1	2	3	4	5
C13.	People had very weak network ties..	1	2	3	4	5
C14.	People had very weak relations..	1	2	3	4	5
C15.	People's relations with each other were very distant........................	1	2	3	4	5
C16.	People's relations with each other were very infrequent	1	2	3	4	5
C17.	people knew many members..	1	2	3	4	5
C18.	I knew many members	1	2	3	4	5
C19.	people interacted with many members	1	2	3	4	5
C20.	I interacted with many members..	1	2	3	4	5
C21.	network of information was very rich..	1	2	3	4	5
C22.	people had many contacts	1	2	3	4	5
C23.	we knew lots of members	1	2	3	4	5
C24.	we knew people with lots of different information..........................	1	2	3	4	5
C25.	people had a great variety of information	1	2	3	4	5
C26.	people had a great variety of interests..	1	2	3	4	5
C27.	people were very diverse	1	2	3	4	5

1= Strongly disagree	2= Disagree	3= Neither disagree nor agree	4= Agree	5= Strongly agree

In the community I interacted…

C28. people connected with others very easily	1	2	3	4	5
C29. people had very loose ties with others	1	2	3	4	5
C30. people could very easily form loose ties	1	2	3	4	5
C31. people made connections very easily	1	2	3	4	5
C32. it was very easy to network with others	1	2	3	4	5
C33. it was very easy to get information from others	1	2	3	4	5
C34. people were very easily able to become part of it	1	2	3	4	5
C35. new people were always joining	1	2	3	4	5
C36. people could access anybody very easily	1	2	3	4	5
C37. there were many levels of people who were not directly accessible	1	2	3	4	5
C38. we had many levels of hierarchy	1	2	3	4	5
C39. we had to go through certain people to access information certain others had	1	2	3	4	5
C40. there were many different levels of access	1	2	3	4	5
C41. people could access other directly	1	2	3	4	5
C42. Most people who interacted knew each other before	1	2	3	4	5
C43. People who interacted with each other were mostly friends	1	2	3	4	5
C44. Most people who interacted were acquaintances of each other	1	2	3	4	5
C45. Most people who interacted were already known to each other by other means	1	2	3	4	5
C46. Most people who interacted with each other kept in touch outside the community also	1	2	3	4	5
C47. people I interacted the most were known to me before	1	2	3	4	5
C48. people I interacted the most were my friends too	1	2	3	4	5
C49. I had regular contact outside the community with the people I interacted	1	2	3	4	5
C50. to be open to other's ideas was a very widely held norm	1	2	3	4	5
C51. to be open to criticism was a very widely held norm	1	2	3	4	5
C52. members shared a need to be open to new ideas	1	2	3	4	5
C53. to be cooperative was a very widely held norm	1	2	3	4	5
C54. teamwork was a very widely held norm	1	2	3	4	5
C55. people expected you to be cooperative	1	2	3	4	5
C56. people expected each other to have an open mind	1	2	3	4	5
C57. people expected each other to share what you know	1	2	3	4	5
C58. there was a great deal of shared expectation to value diversity	1	2	3	4	5
C59. there was a great deal of shared expectation to be cooperative	1	2	3	4	5
C60. there was a great deal of shared expectation to be open to criticism	1	2	3	4	5
C61. there was a great deal of shared expectation to be open to each other	1	2	3	4	5
C62. members trusted each other enough to share all relevant information	1	2	3	4	5
C63. members were willing to share sensitive information	1	2	3	4	5
C64. members trusted each other	1	2	3	4	5
C65. members shared the belief that all members were acting in good faith	1	2	3	4	5
C66. members shared a belief that all members were honest	1	2	3	4	5
C67. members were confident they could trust each other	1	2	3	4	5
C68. members relied on each other for the truthfulness of the information shared	1	2	3	4	5
C69. members trusted each other to share accurate information	1	2	3	4	5
C70. members trusted each other enough to share sensitive information	1	2	3	4	5

1= Strongly disagree	2= Disagree	3= Neither disagree nor agree	4= Agree	5= Strongly agree

In the community I interacted…

C71. People had a very strong sense of belonging to the community	1	2	3	4	5
C72. Members identified a great deal with each other as one community	1	2	3	4	5
C73. We felt as one community to a great deal	1	2	3	4	5
C74. Members were proud to be part of the community to a great deal	1	2	3	4	5
C75. Members were concerned about other's well being to a great deal	1	2	3	4	5
C76. Members were concerned about community's well being to a great deal	1	2	3	4	5
C77. There was a great deal of camaraderie between members	1	2	3	4	5
C78. People generally felt obliged to help back	1	2	3	4	5
C79. People expected others to help when they helped	1	2	3	4	5
C80. People generally felt obliged to share their knowledge	1	2	3	4	5
C81. People expected others to share their knowledge when they shared it themselves	1	2	3	4	5
C82. People expected favors to be returned	1	2	3	4	5
C83. People expected other to return help	1	2	3	4	5
C84. People helped when others requested help	1	2	3	4	5
C85. People shared what they knew when someone need it	1	2	3	4	5
C86. we had a short hand language to express ideas	1	2	3	4	5
C87. members had a common shared language	1	2	3	4	5
C88. it helped to have a common language to share ideas	1	2	3	4	5
C89. people used their own technical words	1	2	3	4	5
C90. the terms used by people were known to most of us	1	2	3	4	5
C91. we had our own special words to communicate ideas	1	2	3	4	5
C92. members used specific technical words	1	2	3	4	5
C93. we had special communication codes	1	2	3	4	5
C94. we had specific codes to share ideas	1	2	3	4	5
C95. we used specific technical terms frequently	1	2	3	4	5
C96. people used lots of stories to share their knowledge	1	2	3	4	5
C97. members used a great deal of stories to communicate ideas	1	2	3	4	5
C98. stories were considered very valuable	1	2	3	4	5
C99. there were great deal of stories to learn from	1	2	3	4	5
C100. people used a great deal of myths	1	2	3	4	5
C101. people used a great deal of tales	1	2	3	4	5
C102. there were a great deal of narratives shared	1	2	3	4	5
C103. people communicated a great deal using narratives	1	2	3	4	5
C104. members knew similar kind of stories	1	2	3	4	5
C105. members shared similar tales	1	2	3	4	5
C106. members used common narratives	1	2	3	4	5
C107. members had a common knowledge base	1	2	3	4	5
C108. most members worked on similar projects	1	2	3	4	5
C109. most members had similar work experience	1	2	3	4	5
C110. members were all mostly in the same field	1	2	3	4	5
C111. most members shared similar interests	1	2	3	4	5
C112. most members shared similar type of knowledge	1	2	3	4	5
C113. members were from many different areas (R)	1	2	3	4	5
C114. there were a wide variety of people (R)	1	2	3	4	5

1= Strongly disagree	2= Disagree	3= Neither disagree nor agree	4= Agree	5= Strongly agree

The knowledge shared within the community was…

C115.	mostly complex type of knowledge	1	2	3	4	5
C116.	mostly rich in content	1	2	3	4	5
C117.	mostly rich in context	1	2	3	4	5
C118.	mostly complicated	1	2	3	4	5
C119.	very involved type of knowledge	1	2	3	4	5
C120.	very intricate type of knowledge	1	2	3	4	5
C121.	very difficult to articulate	1	2	3	4	5
C122.	mostly simple type of knowledge (R)	1	2	3	4	5

Section D: Individual Characteristics

In this section we would like to know more about your perceptions and feelings about your job during the assignment/project that you mentioned at the beginning of this survey. Please circle the number that corresponds to the extent to which you perceived each of the aspects mentioned below.

1= None or To a very little extent	2= To a little extent	3= To a moderate extent	4= To a great extent	5= To a very great extent

During the assignment/project I mentioned …

D1.	I had significant autonomy in determining how I did my job	1	2	3	4	5
D2.	I could decide on my own how to go about doing my work	1	2	3	4	5
D3.	I had considerable opportunity for independence in how I did my job	1	2	3	4	5
D4.	I had considerable freedom in how I did my job	1	2	3	4	5
D5.	I had a great deal of choice in how I did my job	1	2	3	4	5
D6.	I was confident about my ability to do my job	1	2	3	4	5
D7.	I was self-assured about my capabilities to perform my work activities	1	2	3	4	5
D8.	I had mastered the skills necessary for my job	1	2	3	4	5
D9.	I believed I had the required knowledge to do my job well	1	2	3	4	5
D10.	I was confident about my knowledge for my tasks	1	2	3	4	5
D11.	I believed I could do my job very efficiently	1	2	3	4	5
D12.	My impact on what happens in my department was large	1	2	3	4	5
D13.	I had a great deal of control over what happened in my department	1	2	3	4	5
D14.	I had significant influence over what happened in my department	1	2	3	4	5
D15.	The work I did was very important to me	1	2	3	4	5
D16.	My job activities were personally meaningful to me	1	2	3	4	5
D17.	The work I did was meaningful to me	1	2	3	4	5
D18.	I usually felt joyful at work	1	2	3	4	5
D19.	I usually felt pleasant at work	1	2	3	4	5
D20.	I usually felt pleasurable at work	1	2	3	4	5
D21.	I usually liked my work	1	2	3	4	5
D22.	I usually loved what I was doing	1	2	3	4	5
D23.	I usually felt unpleasant at work (R)	1	2	3	4	5
D24.	I usually felt painful at what I was doing (R)	1	2	3	4	5
D25.	I usually hated my work (R)	1	2	3	4	5
D26.	I usually didn't like what I was doing (R)	1	2	3	4	5

1= None or To a very little extent	2= To a little extent	3= To a moderate extent	4= To a great extent	5= To a very great extent

During the assignment/project I mentioned …

D27.	I usually felt excited at work	1	2	3	4	5
D28.	I usually felt active at work	1	2	3	4	5
D29.	I usually felt energetic at work	1	2	3	4	5
D30.	I usually felt enthusiastic at work	1	2	3	4	5
D31.	I usually felt happy at work	1	2	3	4	5
D32.	I usually felt upbeat at work	1	2	3	4	5
D33.	I usually felt intellectually stimulated	1	2	3	4	5
D34.	I was usually calm at work (R)	1	2	3	4	5
D35.	I usually felt depressed at work (R)	1	2	3	4	5
D36.	I usually felt boring at work (R)	1	2	3	4	5
D37.	I usually felt tiring at work (R)	1	2	3	4	5
D38.	I was usually attentive at work	1	2	3	4	5
D39.	I was usually focused at work	1	2	3	4	5
D40.	I usually felt tensed at work	1	2	3	4	5
D41.	I usually felt hopeful of situations at work	1	2	3	4	5
D42.	I usually could see things with clarity at work	1	2	3	4	5
D43.	I usually felt distracted at work (R)	1	2	3	4	5
D44.	I had a casual feeling at work (R)	1	2	3	4	5
D45.	I usually felt relaxed at work (R)	1	2	3	4	5
D46.	I usually had a carefree feeling at work (R)	1	2	3	4	5

Section E: Knowledge Management Practices

In this section we would like to know the different activities you engaged in related to managing your knowledge during the assignment/project that you mentioned. Please circle the number that corresponds to the extent to which you have engaged in each of the activities.

1= None or To a very little extent	2= To a little extent	3= To a moderate extent	4= To a great extent	5= To a very great extent

During the assignment/project I mentioned …

E1.	I have come up with new ideas	1	2	3	4	5
E2.	I have created new knowledge with information I gained elsewhere	1	2	3	4	5
E3.	I have gained new knowledge by observing others working	1	2	3	4	5
E4.	I have gained new knowledge by interacting with others	1	2	3	4	5
E5.	I have gained new knowledge by expressing what I know	1	2	3	4	5
E6.	I have gained new knowledge by applying my knowledge	1	2	3	4	5
E7.	I have gained new knowledge by using my knowledge	1	2	3	4	5
E8.	I have gained new knowledge by organizing information that I collected	1	2	3	4	5
E9.	I have gained new knowledge by combining information that I collected	1	2	3	4	5
E10.	I have created new knowledge	1	2	3	4	5

1= None or To a very little extent	2= To a little extent	3= To a moderate extent	4= To a great extent	5= To a very great extent

During the assignment/project I mentioned …

E11.	I have stored new knowledge that I created	1	2	3	4	5
E12.	I have stored new information whenever I received it	1	2	3	4	5
E13.	I have stored new information that I used	1	2	3	4	5
E14.	I have retained information in computers/files/or my memory	1	2	3	4	5
E15.	I have retained my new ideas in computers/files/or my memory	1	2	3	4	5
E16.	I have incorporated new knowledge into my work processes	1	2	3	4	5
E17.	I have incorporated new knowledge into my organization's routines	1	2	3	4	5
E18.	I have shared new insights that I have gained	1	2	3	4	5
E19.	I have shared my best practices	1	2	3	4	5
E20.	I have shared my knowledge with my colleagues	1	2	3	4	5
E21.	I have shared the information that I stored for my own purposes	1	2	3	4	5
E22.	I have shared the information at others request	1	2	3	4	5
E23.	I have shared my knowledge when I feel there is a need for it	1	2	3	4	5
E24.	I have shared the information that I use	1	2	3	4	5
E25.	I have shared the information that I have gained from elsewhere	1	2	3	4	5
E26.	I have accessed needed information with ease	1	2	3	4	5
E27.	I have accessed what my colleagues know with ease	1	2	3	4	5
E28.	I have accessed information from our company's database, intranet, etc.	1	2	3	4	5
E29.	I have retrieved information that I have stored	1	2	3	4	5
E30.	I was able to remember the needed information	1	2	3	4	5
E31.	I got help from other people without hesitation	1	2	3	4	5
E32.	I have used the new knowledge that I created	1	2	3	4	5
E33.	I have used the information I have taken from others	1	2	3	4	5
E34.	I have implemented my ideas in my job	1	2	3	4	5
E35.	I have applied my knowledge in my job	1	2	3	4	5
E36.	I have tried to apply in my work any new information I received	1	2	3	4	5
E37.	I have implemented the best practices that I developed	1	2	3	4	5

Section F: Task Related Knowledge

In this section we are interested in the extent of various aspects your knowledge **during the final phase** of the assignment/project that you mentioned at the beginning of this survey. Please circle the number that corresponds to the extent to which you knew the different aspects indicated below.

1= None or To a very little extent	2= To a little extent	3= To a moderate extent	4= To a great extent	5= To a very great extent

Towards the end of the assignment/project I mentioned I knew…

F1.	how the different tasks were to be done	1	2	3	4	5
F2.	how to implement different components of the assignment/project	1	2	3	4	5
F3.	how to execute the different tasks	1	2	3	4	5
F4.	the procedures for doing my task	1	2	3	4	5
F5.	the relevant know-how	1	2	3	4	5
F6.	the applications that I used	1	2	3	4	5

1= None or To a very little extent	2= To a little extent	3= To a moderate extent	4= To a great extent	5= To a very great extent

Towards the end of the assignment/project I knew…

F7.	what information was needed for each task	1	2	3	4	5
F8.	what each task was about	1	2	3	4	5
F9.	what needed to be accomplished	1	2	3	4	5
F10.	what was expected of me	1	2	3	4	5
F11.	what others knew	1	2	3	4	5
F12.	the functional requirements	1	2	3	4	5
F13.	the information requirements	1	2	3	4	5
F14.	why we did the tasks the way we did	1	2	3	4	5
F15.	why it was important to do the tasks in a certain way	1	2	3	4	5
F16.	the reasons for doing what we did	1	2	3	4	5
F17.	the philosophy behind my actions	1	2	3	4	5
F18.	the purpose of my actions	1	2	3	4	5
F19.	significance of my tasks	1	2	3	4	5
F20.	who my customers were	1	2	3	4	5
F21.	who my stakeholders were	1	2	3	4	5
F22.	who could do what	1	2	3	4	5
F23.	other's capabilities	1	2	3	4	5
F24.	who had the relevant expertise	1	2	3	4	5
F25.	who had the required information	1	2	3	4	5
F26.	where to find the relevant information	1	2	3	4	5
F27.	where I needed to do specific tasks	1	2	3	4	5
F28.	where the activities were performed	1	2	3	4	5
F29.	where I could find someone when I needed them	1	2	3	4	5
F30.	where to find help if needed	1	2	3	4	5
F31.	exactly when things needed to be done	1	2	3	4	5
F32.	when the tasks were due	1	2	3	4	5
F33.	the timing of different tasks	1	2	3	4	5
F34.	when each action was needed	1	2	3	4	5
F35.	when I would be able to do particular tasks	1	2	3	4	5

Section G: Individual Outcomes

In this section we would like to know more about your job outcomes for the assignment/project you mentioned at the beginning of this survey. Please circle the number that corresponds to the extent to which you agree or disagree with the different aspects of your work outcomes.

1= Strongly disagree	2= Disagree	3= Slightly disagree	4= Neither disagree nor agree	5= Slightly agree	6= Agree	7= Strongly agree

Towards the end of the assignment/project I mentioned…

G1.	I was very efficient at my work	1	2	3	4	5	6	7
G2.	I accomplished my tasks within the allocated resource	1	2	3	4	5	6	7
G3.	I accomplished a great deal of work	1	2	3	4	5	6	7

1= Strongly disagree	2= Disagree	3= Slightly disagree	4= Neither disagree nor agree	5= Slightly agree	6= Agree	7= Strongly agree

Towards the end of the assignment/project I mentioned…

G4.	I was very effective at interacting with others	1	2	3	4	5	6	7
G5.	My work was of very high quality	1	2	3	4	5	6	7
G6.	I easily met my goals	1	2	3	4	5	6	7
G7.	I usually finished my tasks within the expected time limit	1	2	3	4	5	6	7
G8.	I usually met my goals as quickly as possible	1	2	3	4	5	6	7
G9.	I could have done my tasks faster with the same quality	1	2	3	4	5	6	7
G10.	Generally speaking, I was very satisfied with my job	1	2	3	4	5	6	7
G11.	I was very satisfied with my work outcomes	1	2	3	4	5	6	7
G12.	I was very satisfied with the results of my work	1	2	3	4	5	6	7
G13.	I was generally very satisfied with the kind of work I did	1	2	3	4	5	6	7
G14.	I frequently thought of quitting my job	1	2	3	4	5	6	7
G15.	I was very frustrated with my job	1	2	3	4	5	6	7
G16.	I was very satisfied with my personal growth	1	2	3	4	5	6	7
G17.	I was very satisfied with my personal development	1	2	3	4	5	6	7
G18.	I was very satisfied with my learning opportunities	1	2	3	4	5	6	7
G19.	I was very satisfied with my growth opportunities	1	2	3	4	5	6	7
G20.	I was very satisfied with my accomplishments	1	2	3	4	5	6	7
G21.	I was very satisfied with my independence in thought	1	2	3	4	5	6	7
G22.	I was very satisfied with my independence in action	1	2	3	4	5	6	7
G23.	I was very satisfied with the amount of challenge	1	2	3	4	5	6	7

Please circle the number corresponding to the degree to which you engaged in the following activities.

1= Not at all	2= To a low degree	3= To a slightly low degree	4= To a moderate degree	5= To a slightly high degree	6= To a high degree	7= To an exceptional degree

During the assignment/project I mentioned at the beginning of this survey…

G24.	I searched out new technologies, processes, techniques, and/or product ideas	1	2	3	4	5	6	7
G25.	I had generated creative ideas	1	2	3	4	5	6	7
G26.	I had promoted and championed ideas to others	1	2	3	4	5	6	7
G27.	I had investigated and secured funds needed to implement new ideas	1	2	3	4	5	6	7
G28.	I had developed plans and schedules for the implementation of new ideas	1	2	3	4	5	6	7
G29.	I was innovative	1	2	3	4	5	6	7
G30.	I had created innovative work processes	1	2	3	4	5	6	7
G31.	I had developed and implemented innovative ideas	1	2	3	4	5	6	7
G32.	I had developed innovative ideas, built support for it and implemented it	1	2	3	4	5	6	7
G33.	My work was original and practical	1	2	3	4	5	6	7
G34.	My work was adaptive and practical	1	2	3	4	5	6	7
G35.	My work was creative	1	2	3	4	5	6	7
G36.	My ideas were novel and useful	1	2	3	4	5	6	7
G37.	My work outcomes were creative	1	2	3	4	5	6	7

Section H: Team Outcomes

In this section we are interested in your perception of your team's performance outcomes for the assignment/project you mentioned at the beginning of this survey. Please circle the number corresponding to the degree to which your team performed on the following aspects.

1= Not at all	2= To a low degree	3= To a slightly low degree	4= To a moderate degree	5= To a slightly high degree	6= To a high degree	7= To an exceptional degree

During the assignment/project I mentioned at the beginning of this survey …

H1.	My team was flexible in performing a given task	1	2	3	4	5	6	7
H2.	My team was flexible in how we did our job	1	2	3	4	5	6	7
H3.	My team was flexible to changes in deadlines	1	2	3	4	5	6	7
H4.	My team was flexible in working with other teams	1	2	3	4	5	6	7
H5.	My team was flexible in general	1	2	3	4	5	6	7
H6.	My team was versatile	1	2	3	4	5	6	7
H7.	Even when the work responsibilities were uncertain my team was efficient	1	2	3	4	5	6	7
H8.	My team members were capable of taking different roles	1	2	3	4	5	6	7
H9.	My team was adaptable to new situations	1	2	3	4	5	6	7
H10.	My team was adaptable to new types of work	1	2	3	4	5	6	7
H11.	My team was adaptable to new tasks without complaint	1	2	3	4	5	6	7
H12.	My team was adaptable to new responsibilities	1	2	3	4	5	6	7
H13.	My team was adaptable to changes in work environments	1	2	3	4	5	6	7
H14.	My team was successful in different contexts	1	2	3	4	5	6	7
H15.	My team could successfully cope with different situations	1	2	3	4	5	6	7
H16.	My team was easily able to change its structure to new requirements	1	2	3	4	5	6	7
H17.	My team easily aligned itself to different work environments	1	2	3	4	5	6	7
H18.	My team looked for new technologies, processes, techniques, and/or product ideas	1	2	3	4	5	6	7
H19.	My team generated creative ideas	1	2	3	4	5	6	7
H20.	My team promoted and championed ideas in our organization	1	2	3	4	5	6	7
H21.	My team investigated and secured funds needed to implement new ideas	1	2	3	4	5	6	7
H22.	My team developed plans and schedules for implementing new ideas	1	2	3	4	5	6	7
H23.	My team was innovative	1	2	3	4	5	6	7

Please circle the number corresponding to the level of performance of your team for the assignment/project you mentioned at the beginning of this survey.

1= Extremely low	2= Low	3= Slightly low	4= Moderate	5= Slightly high	6= High	7= Extremely high

For the assignment/project you mentioned at the beginning of this survey how would you rate the following aspects of your team…

H24.	The efficiency of team operations	1	2	3	4	5	6	7
H25.	The team's adherence to budgets	1	2	3	4	5	6	7
H26.	The amount of work the team produced	1	2	3	4	5	6	7
H27.	Effectiveness of the team's interactions with people outside the team	1	2	3	4	5	6	7
H28.	The quality of work the team produced	1	2	3	4	5	6	7
H29.	The team's ability to meet the goals of the project	1	2	3	4	5	6	7
H30.	The team's adherence to schedules	1	2	3	4	5	6	7
H31.	The team could have done its work faster with the same level of quality	1	2	3	4	5	6	7
H32.	The team met the goals as quickly as possible	1	2	3	4	5	6	7

Section I: General Information

Please provide the following background information for statistical purposes in this section:

I1. Name of the organization:____

I2. Name of the department: ____

I3. Your Title: ____

I4. Please indicate the type of your company (e.g. automotive, electronics, banking, etc.):____________

I5. How long have you been working in the current organization? ______Month(s) ______Year(s)

I6. How long have you been working in the current or similar position? ______Month(s) ______Year(s)

I7. Please indicate the highest degree you have completed:

☐ High School ☐ Associate ☐ Undergraduate ☐ Master ☐ Doctorate

I8. I learned to use most of the software applications I regularly use through:

☐ formal training ☐ on-the-job training ☐ experimenting with it ☐ the help of my colleagues ☐ using similar software ☐ using other types of software

I9. Most of the software applications I regularly use is installed on: ☐ Standalone PC ☐ Networked PC

☐ Standalone Workstation ☐ Networked Workstation ☐ Midrange computer ☐ Mainframe ☐ Other___________________

I10. Please indicate your age (in years)? ______

I11. Please indicate your gender? ☐ Female ☐ Male

I12. Does your organization have any knowledge management initiatives? ☐ Yes ☐ No

I13. If yes, are you involved in it in any way? ☐ Yes ☐ No

I14. If your organization has a knowledge management initiative, how long ago did it start?

______Month(s) ______Year(s) ☐ Not Applicable

I15. How important do you think your knowledge is for your department?

☐ Very low ☐ Low ☐ Moderate ☐ High ☐ Very High

Thank you very much for your time and assistance in completing this questionnaire.

If you wish to receive a free copy of the summary of this surveys results, please provide your name and address in the space below or attach your business card.

Name: ____

Company: ____

Address: ____

____

____

Telephone: ____

Fax: ____

Email: ____

Appendix-B: Pretest Comments

(***Note:*** *Number in the parenthesis at the end of the comment indicates the rater number.)*

General Comments:

- Randomize items within each subsection in a more engaging format. (more meaningful clusters of 3-4 constructs). (1)
- Reorient the overall flow of the questionnaire in a more interesting format by changing the placement of the main sections (suggested: CoP, Work Characteristics, Empowerment, IT Support, KM, Task Knowledge, Outcomes) (1)
- Capture information overload
- Need for knowledge/KM?

Cover Sheet:

- Make the cover sheet more respondent friendly.
- Shorten the general overview, disclosure and instructions to reflect what is most essential only.
- The sentences are too wordy.
- Long sentences can be made into bulleted points.

Section A: Work Characteristics

Overall comments:

- Modify instruction- "please circle the number that best describes your work." (1)
- Not necessary to mention "The assignment/project/work…" when it is mentioned in the section instruction. Simplify to use "My work..". (1)

Range- Repetitiveness A1-A6:

- A6: delete reverse item (1)
- A6: large variety doesn't necessarily mean it is not repetitive (4)

Range- Routineness A7-A12:
A7: does not fit with the scale properly (4)
A8-A9: use "known tasks" instead of "routine tasks" (4)
A8-A9: represents "repetitiveness" dimension also (4)

Range- Sequence dependence A13-A18:

- Items do not capture "dependency"
- A13: Modify (eg. I have to do things in a specific sequence) (1)
- A15: Use a more unambiguous term for "in a given order" (eg., "in a particular order") (4)
- A18: delete reverse item (1)
- A18: use "need not be ordered" instead of "were not very ordered" (4)

Range-Group dependence A19-A24:

- A23: delete reverse item (1)
- A23: Modify- "… could mostly be done by myself" (5)
- A24: delete reverse item (1)

Structure A25-A30:

- A25: had **work** goals.. (5)
- A26: Modify (eg. My work involved changing trade offs) (1)

Discretion A31-A37:

- Prefix with "**The way work was setup..**" for all items. (1)
- Use different synonyms for "**performed**". (1)
- A34-A37: preferable do not use "**required**". (1)

Cognitive effort A38-A45:

- Raise bar of all items in this section. (eg. Modify it as **required considerable thought** or **intense thinking**) (1)
- A41: Delete- too complicated (3)
- A42: use "complex analysis" instead of "involved thinking" (1)

Virtualness A46-A50:

- Possibly add more items (1)
- Use "virtualness" in items (eg.:
    - my work is virtual rather than real
    - had work processes that was performed automatically by the computers
    - I enact my work processes through computers) (1)
- A46: delete item (1)

Slack time A51-A62:

- Use "**reflective thought**" in items (1)
- A62: Modify (eg., what % of time was available for reflection and exchange of ideas) (1)
- A57-A58: Not clear, what provided? (use "I had time…" rather than "provided me time…" (4)
- A62: Not clear

<u>Section B: IT Support</u>

- Limit to 3 most commonly used applications (1)
- Modify prefix with "these applications" or "the above applications" (1)
- Modify prefix with "…helped me **to**…" (4)
- Highlight "**above applications**" (4)
- B5: "generate new information" rather than "combine new information" (4)
- B6: Delete (3)
- B14: Modify to "create new **work** routines" (4)

- B20: Delete (3)
- B32-B37: Modify (3)

<u>Section C: Community of Practice</u>

- Change title to “Community of Practice” from “Communities of Practice”
- Change the response format for each constructs with proper scales (1)
- Modify prefix to: “In my community of practice…” from “In the community I interacted…” (1)
- C3: rephrase question- not clear (4)
- C6 & C7: restructure the sentence to “Approximately **with** how many…” (4)
- May include a brief description in the cover page to select a project in which there was a significant amount of community interaction. (4)
- Add a “Don’t Know” category. (4)

Structural- Network ties C9-C16:

- Scale: Degree (1)
- Use interpersonal tie as an alternate for network ties (1)
- C11, C12, C15, C16: Use “**interaction**” instead of “relations” (4)

Structural- Network Configuration- Density C17-C27:

- Scale: Degree (1)
- Items represent two concepts- C17-C20 represents number and C21-C27 represents richness (1)
- C21: Modify- “**The** network of…” (1)
- C17-18: Delete- not required (3)
- C22-23: “we” means who? (4)
- Use either “I” or “we” if possible instead of both (4)

Structural- Network Configuration- Connectivity C28-C35:

- Scale: Time(1)
- C29: Delete (1)
- C30: Delete (1)
- C30: Probably better measured in a reverse direction (eg., It was not as difficult to disconnect with others) (4)
- C34: Modify (eg., people could easily join..) (1)

Structural- Network Configuration- Hierarchy C36-C41:

- Scale: Degree (1)
- C41: Modify- people could access other **people** (5)

Structural- Appropriable organization C42-C49:

- Scale: Extent (1)
- Use items without “interact” (1)
- C45: Modify (eg., Most people knew each other) (1)
- C47-C49: grammatical error- redundant “I interacted” in sentence (4)

Relational- Shared Norms C50-C61:
- Scale: Degree (1)
- Use “expected” rather than “norm”. (eg., people were expected to be open to others ideas, people were expected to be cooperative) (1)
- C58-C61: Delete (1)
- C56: Delete (3)

Relational- Mutual Trust C62-C70:
- Scale: Degree (1)
- C62: delete “enough” (4)
- C69: Modify- “members trusted each other to **provide reliable** information” (4)

Relational- Identification C71-C77:
- Scale: Degree (1)
- C71: Modify (1)
- C73: Modify- “We strongly felt as one community” (4)
- C74-C76: Modify- “members were very…” (4)

Relational- Obligation C78-C85:
- Scale: Time (1)
- C78: Modify- “…obliged to help each other” (1)
- C81: Modify- delete “…it themselves” (4)
- C82: Modify- “…people are expected to return favors” or “exchange favors” (1)
- C83: Modify- “…people are expected to return help” (1)
- C83: Modify- “people expected other**s** to help **in return**” (4)
- C84: Modify- “….when others requested **to** help” (4)
- C80, C84, C85- Delete (1)

Cognitive- Shared languages and codes C86-C95:
- Scale: Degree (1)
- Use “common” instead of “specific” (1)
- C88: Modify- “people shared a common language” (1)
- C91-C95- Delete (1)

Cognitive- Shared narratives C96-C106:
- Scale: Time (1)
- Take implied intend out of the items (1)
- C99: Modify- “learned a great deal from stories” (1)
- C100, C103-C106- Delete (1)
- C103: Delete (3)
- Use an alternate word for “narratives” (1)

Cognitive- Shared knowledge base C107-C114:
- Scale: Extent (1)

- Modify C109, C110 (1)
- Delete C111, C113, C114 (1)
- C113: "…from many different backgrounds" (5)

Cognitive- Complexity of knowledge C115-C122:

- Scale: Degree (1)
- C115: Modify- delete "…type of knowledge" (4)
- C116: delete (5)
- Delete C122 (1)

<u>Section D: Empowerment</u>

- Original scale is "strongly agree" to "strongly disagree" but empowerment can be more meaningfully viewed as the "extent" to which one feel empowered in the workplace than to agree or disagree with one is empowered or not.
- Original scale is 7 point likert hence the 7 point response is maintained in spite of the fact that it is in between the 5 point response sections (the shortcoming of this may be minimized when implementing it as a web based questionnaire where this whole section can be on a different page).
- D11-D13 (Impact dimension): The original instrument uses middle managers as the respondent hence their impact in their department might be relevant but among knowledge workers this level of impact may not be appropriate. Hence 3 more items (D14-D16) is added to capture the impact that the respondent feels in relation to hi/her "job outcomes".
- Items in this section need to be modified to reflect the "extent" response format. (1)

<u>Section E: Knowledge Management</u>

- Capture and Storage might be slightly different-Capture is more proactive, Storage is more reactive (4)
- E1: Modify- "I have come…" to "I came…" (4)
- E31: Help for what? (3)

<u>Section F: Task Knowledge</u>

- Items too low bar- fix by adding "..to what extent did you **achieve full knowledge** of…" to the prefix of the items (1)
- Modify instruction (4)
- Move Know-what before Know-how (5)
- Scale in this section is confusing- preferably select a different scale (eg., strongly agree/disagree) (4)
- F20-F25: "Who" refers to whom is not clear (4)
- F23: "other **people's** capabilities" (4)
- F29: Delete- what is the significance of "where"? is it the same for all questions? (3)

Section G: Individual Outcomes

G3: Delete (3)
G3: Modify- "…great deal of work **with the available resources**"
G6: Delete (3)
G4-G6: not clearly related to effectiveness.
G37: Delete- Not clear (3)
G37: Modify- "my work contributions were creative"
Innovation G24-G32:

- Items could be modified to reflect first use of an idea by an individual (1)

Section H: Team Outcomes

H5: Delete- Not clear (3)

Section I: General Information

- Item for whether public or private organization (8)
- Item to capture the size of the organization (8)
- Item to measure the Country of the respondent, if it is going to be a global database?
- I3: Use preset categories to indicate level (eg., Manager, Professional, Supervisor)
- I4: Use standard industry categories based on code (1)
- I7: Modify- "undergraduate" to "bachelors" (1)
- I8: Add "Check all that apply" (1) (4)
- I9: Modify- "..I regularly use **are** installed on" (1)
- I10: Use age categories <25, 25-35, 35-45, 45-55, >55 (1)

Appendix-C: Pilot Survey

Knowledge Management Survey

The purpose of this survey is to improve our understanding of how individuals create, share, and use their knowledge in the workplace. Knowledge workers gain and share most of their work related knowledge within certain communities in which they interact. These could be formal or informal communities within or outside an organization and are often referred to as your community of practice. The questions in this survey ask about your perceptions about your community of practice, your work settings, and your knowledge management practices.

All questions in this survey require you to respond in relation to a particular **assignment or project that you have completed most recently** preferably as a team, irrespective of its success or failure. If your work did not involve working on a particular assignment or project please answer the questions in this survey based on **your work in the past six (6) months**. Please provide the following details if you will be referring to a particular assignment or project for completing this survey:

Name of the assignment/project: ____
Date this assignment/project was completed: ________________________________ (MM/DD/YY)
Duration of this assignment/project (in number of months): ___________________________ Month(s)

OR

☐ I will be referring to the last six months of my work to respond to this survey. (please check if using this option)

Most questions in this survey require you to choose an alternative that best fit your views on the particular topic. There are no correct or incorrect answers; we are interested in your perceptions. The estimated completion time for this questionnaire is expected to be approximately 30 minutes. **All responses to this survey will be confidential**. Only aggregate results will be reported in scholarly journals. Please try to complete all questions on this survey.

Thank you for your cooperation and valuable assistance in this research.

If you have any questions regarding this survey please feel free to contact the following persons.

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COMMUNITY OF PRACTICE

A community of practice is referred to here as <u>any group formal or informal from which you seek, share or build your job related knowledge</u>, it could be your own work group, or a specific community within or outside your organization that is related to your field of work.

Please answer the following questions in relation to the community of practice in which you **<u>interacted the most</u>** during the assignment/project/work you mentioned.

CP1	Was this community same as your work team?	Yes	No
CP2	Was this primarily an online (Internet/Intranet) community?	Yes	No
CP3	About what percent of your interaction in this community was online?		%
CP4	Approximately how many members were there in this community at the time of your interaction?		
CP5	Approximately with how many members did you interact in this community?		
CP6	With how many members did you interact **very regularly** in this community?		
CP7	Did you interact with the same people most of the time?	Yes	No
CP8	For how long were you part of this community?	Months Years	

In this section we would like to know about the type of network that existed in your community of practice. Please select a number that corresponds to the extent to which you agree or disagree with each of the statements in relation to the community of practice in which you **<u>interacted the most</u>** during the assignment/project/work you mentioned.

1=Strongly Disagree 2=Disagree 3=Neither Disagree nor Agree 4=Agree 5=Strongly Agree

In my community of practice...

CP9	members had strong interpersonal ties	1	2	3	4	5
CP10	members were closely connected to each other	1	2	3	4	5
CP11	members interacted very close to each other	1	2	3	4	5
CP12	members interacted frequently with other members	1	2	3	4	5
CP13	members maintained a great deal of distance with each other	1	2	3	4	5
CP14	members interacted with many members	1	2	3	4	5
CP15	the network of people was very dense	1	2	3	4	5
CP16	members could easily stop interacting with others if needed	1	2	3	4	5
CP17	it was easy to network with others	1	2	3	4	5
CP18	members could access anybody easily	1	2	3	4	5
CP19	we had many levels of hierarchy	1	2	3	4	5

In this section we would like to know about the social norms that existed in your community of practice. Please select a number that corresponds to the extent to which you agree or disagree with each of the statements in relation to the community of practice in which you **interacted the most** during the assignment/project/work you mentioned.

1=Strongly Disagree 2=Disagree 3=Neither Disagree nor Agree 4=Agree 5=Strongly Agree

In my community of practice...

CP20	most members knew each other before they joined this community	1	2	3	4	5
CP21	members were mostly friends	1	2	3	4	5
CP22	most members were acquaintances of each other	1	2	3	4	5
CP23	most members kept in touch outside the community	1	2	3	4	5
CP24	most members I interacted with were known to me before I joined this community	1	2	3	4	5
CP25	members were expected to be open to criticism	1	2	3	4	5
CP26	members were expected to have a team spirit	1	2	3	4	5
CP27	members were expected to be cooperative	1	2	3	4	5
CP28	members were expected to have an open mind	1	2	3	4	5
CP29	members were expected to share what they knew	1	2	3	4	5

In this section we would like to know about the level of trust, identification, and obligation the community members have in your community of practice. Please select a number that corresponds to the extent to which you agree or disagree with each of the statements in relation to the community of practice in which you **interacted the most** during the assignment/project/work you mentioned.

1=Strongly Disagree 2=Disagree 3=Neither Disagree nor Agree 4=Agree 5=Strongly Agree

In my community of practice...

CP30	members trusted each other enough to share all relevant information	1	2	3	4	5
CP31	members believed that all members were acting in good faith	1	2	3	4	5
CP32	members were confident they could trust each other	1	2	3	4	5
CP33	members relied on each other for the truthfulness of the information shared	1	2	3	4	5
CP34	members trusted each other enough to share sensitive information	1	2	3	4	5
CP35	members had a strong sense of belonging to the community	1	2	3	4	5
CP36	members identified with each other as one community	1	2	3	4	5
CP37	members were proud to be part of the community	1	2	3	4	5
CP38	members were concerned about other's well being	1	2	3	4	5
CP39	members were concerned about community's well being	1	2	3	4	5
CP40	members generally felt obliged to help each other	1	2	3	4	5
CP41	members expected others to help them when they helped	1	2	3	4	5
CP42	members expected others to share their knowledge when they themselves shared	1	2	3	4	5
CP43	members were expected to return favors	1	2	3	4	5
CP44	members expected others to help in return	1	2	3	4	5

In this section we would like to know about the kind of information the community members share in your community of practice. Please select a number that corresponds to the extent to which you agree or disagree with each of the statements in relation to the community of practice in which you **interacted the most** during the assignment/project/work you mentioned.

1=Strongly Disagree 2=Disagree 3=Neither Disagree nor Agree 4=Agree 5=Strongly Agree

In my community of practice...

CP45	members used a common language	1	2	3	4	5
CP46	a common language was used to share ideas	1	2	3	4	5
CP47	the terms used by members were known to most of us	1	2	3	4	5
CP48	we had our own common words to communicate ideas	1	2	3	4	5
CP49	members used technical terms common among us	1	2	3	4	5
CP50	members used stories to share their knowledge	1	2	3	4	5
CP51	members used stories to communicate subtle ideas	1	2	3	4	5
CP52	stories and narratives were used to communicate rich sets of ideas	1	2	3	4	5
CP53	stories and metaphors were used to create and preserve rich meaning	1	2	3	4	5
CP54	stories and narratives were used to share hard to communicate ideas	1	2	3	4	5
CP55	most members had a common knowledge base	1	2	3	4	5
CP56	the knowledge shared was mostly complex	1	2	3	4	5

WORK CHARACTERISTICS

In this section we would like to know about the nature of your work **during the assignment/project/ work** that you mentioned at the beginning of this survey. Please select a number that best describes your work for the following questions.

1=None or To a very little extent **2**=To a little extent **3**=To a moderate extent **4**=To a great extent **5**=To a very great extent

WC1	My work involved doing repetitive tasks	1	2	3	4	5
WC2	My work involved routine duties	1	2	3	4	5
WC3	My work involved doing things in a sequential manner	1	2	3	4	5
WC4	My work involved tasks that were dependent on the whole group	1	2	3	4	5
WC5	My work had goals that were constantly changing	1	2	3	4	5
WC6	My work required considerable thought	1	2	3	4	5
WC7	My work required significant amount of reasoning	1	2	3	4	5
WC8	My work required significant amount of knowledge	1	2	3	4	5
WC9	My work involved intense thinking	1	2	3	4	5
WC10	My work involved complex analysis	1	2	3	4	5

WC11	My work was mentally challenging	1	2	3	4	5
WC12	My work involved work processes that had to be enacted through computers	1	2	3	4	5
WC13	My work involved tasks that depended on computers	1	2	3	4	5
WC14	My work would have been difficult to perform without computers	1	2	3	4	5
WC15	My work had processes embedded in computers	1	2	3	4	5
WC16	My work was virtual rather than real	1	2	3	4	5
WC17	My work was mostly mediated by computers	1	2	3	4	5
WC18	I felt overwhelmed by the amount of information that I had to process	1	2	3	4	5
WC19	I felt that I needed more knowledge to do my tasks effectively	1	2	3	4	5
WC20	I felt that I needed to manage my knowledge more effectively	1	2	3	4	5
WC21	During the assignment/project/work about what percentage of your working time was available for reflection and exchange of ideas?	%				

EMPOWERMENT

In this section we would like to know your perceptions about your job **during the assignment/project/work** that you mentioned at the beginning of this survey. Please select a number that corresponds to the extent of your perceptions for the following questions..

1=None or To a very little extent **2**=To a little extent **3**=To a moderate extent **4**=To a great extent **5**=To a very great extent

During the assignment/project/work...

IC1	I had autonomy in determining how I did my job	1	2	3	4	5
IC2	I could decide on my own how to go about doing my work	1	2	3	4	5
IC3	I had opportunity for independence in how I did my job	1	2	3	4	5
IC4	I had freedom in how I did my job	1	2	3	4	5
IC5	I had choice in how I did my job	1	2	3	4	5
IC6	I was confident about my ability to do my job	1	2	3	4	5
IC7	I was self-assured about my capabilities to perform my work activities	1	2	3	4	5
IC8	I had mastered the skills necessary to do my job	1	2	3	4	5
IC9	I had the required knowledge to do my job well	1	2	3	4	5
IC10	I was confident about my knowledge for my tasks	1	2	3	4	5
IC11	I had impact on what happened in my department	1	2	3	4	5
IC12	I had control over what happened in my department	1	2	3	4	5
IC13	I had influence over what happened in my department	1	2	3	4	5
IC14	I had impact over the strategic outcomes of my job	1	2	3	4	5
IC15	I had impact over the administrative job outcomes	1	2	3	4	5
IC16	I had impact over the operational job outcomes	1	2	3	4	5
IC17	the work I did was important to me	1	2	3	4	5
IC18	my job activities were personally meaningful to me	1	2	3	4	5
IC19	the work I did was meaningful to me	1	2	3	4	5

INFORMATION TECHNOLOGY SUPPORT

In this section we would like to know to what extent information technologies you used **during the assignment/project/work** have helped you to become more knowledgeable in your job, and to what extent they have helped you to manage what you know.

Please list the applications/software that you used most frequently during the assignment/project/work you mentioned at the beginning of this survey. List up to three (3) applications/software in the order of their use.

1. ________ 2. ________ 3. ________

Please select a number that corresponds to the extent to which the above applications have helped you stimulate your thought, to become more informed, and to capture your knowledge **during the assignment/project/work**.

1=None or To a very little extent **2**=To a little extent **3**=To a moderate extent **4**=To a great extent **5**=To a very great extent

The above applications have helped me...

IT1	come up with new ideas	1	2	3	4	5
IT2	think through problems	1	2	3	4	5
IT3	gain new knowledge	1	2	3	4	5
IT4	generate new information	1	2	3	4	5
IT5	stimulate my thinking	1	2	3	4	5
IT6	create new knowledge	1	2	3	4	5
IT7	store knowledge that I created	1	2	3	4	5
IT8	capture the required information	1	2	3	4	5
IT9	organize my knowledge	1	2	3	4	5
IT10	capture my know-how	1	2	3	4	5
IT11	retain the required information in my mind	1	2	3	4	5
IT12	store my ideas	1	2	3	4	5
IT13	share my insights	1	2	3	4	5
IT14	share my know-how	1	2	3	4	5
IT15	communicate what I know	1	2	3	4	5
IT16	share my ideas	1	2	3	4	5
IT17	communicate with other people	1	2	3	4	5
IT18	transfer my knowledge	1	2	3	4	5

Please select a number that corresponds to the extent to which the above applications have helped you automate your work processes, and share your knowledge with others **during the assignment/project/work**.

1=None or To a very little extent **2**=To a little extent **3**=To a moderate extent **4**=To a great extent **5**=To a very great extent

The above applications have helped me...

IT19	become more informed	1	2	3	4	5
IT20	access needed information	1	2	3	4	5
IT21	access other's knowledge	1	2	3	4	5
IT22	access relevant company data	1	2	3	4	5
IT23	to retrieve information form various sources	1	2	3	4	5
IT24	remember the required information	1	2	3	4	5
IT25	automate my work processes	1	2	3	4	5
IT26	automate my decision-making process	1	2	3	4	5
IT27	implement my ideas	1	2	3	4	5
IT28	apply my knowledge at work	1	2	3	4	5
IT29	automate things I had to do	1	2	3	4	5
IT30	automate my problem-solving tasks	1	2	3	4	5

KNOWLEDGE MANAGEMENT PRACTICES

In this section we would like to know to what extent you were able to access information from various sources**,** create new knowledge, and retain that information **during the assignment/project/work** that you mentioned. Please select a number that corresponds to the extent to which you have engaged in each of the following activities.

1=None or To a very little extent **2**=To a little extent **3**=To a moderate extent **4**=To a great extent **5**=To a very great extent

During the assignment/project/work...

KM1	I have created new knowledge by observing others working	1	2	3	4	5
KM2	I have created new knowledge by interacting with others	1	2	3	4	5
KM3	I have created new knowledge by expressing what I knew	1	2	3	4	5
KM4	I have created new knowledge by applying my knowledge	1	2	3	4	5
KM5	I have created new knowledge by combining information that I collected	1	2	3	4	5
KM6	I have often created new knowledge	1	2	3	4	5
KM7	I have stored new knowledge that I created	1	2	3	4	5
KM8	I have stored new information whenever I received it	1	2	3	4	5
KM9	I have stored new information whenever I used it	1	2	3	4	5
KM10	I have retained information in computers/files/or my memory	1	2	3	4	5
KM11	I have retained my new ideas in computers/files/or my memory	1	2	3	4	5

KM12	I have incorporated new knowledge into my work processes	1	2	3	4	5
KM13	I have shared new insights that I have gained	1	2	3	4	5
KM14	I have shared my best practices	1	2	3	4	5
KM15	I have shared the information that I stored for my own purposes	1	2	3	4	5
KM16	I have shared the information at others request	1	2	3	4	5
KM17	I have shared the information that I used	1	2	3	4	5
KM18	I have shared the information that I have gained from elsewhere	1	2	3	4	5

In this section we would like to know to what extent you were able to share what you know, and apply your knowledge fully **during the assignment/project/work** that you mentioned. Please select a number that corresponds to the extent to which you have engaged in each of the following activities.

1=None or To a very little extent **2**=To a little extent **3**=To a moderate extent **4**=To a great extent **5**=To a very great extent

During the assignment/project/work...

KM19	I have accessed needed information with ease	1	2	3	4	5
KM20	I have accessed what my colleagues knew	1	2	3	4	5
KM21	I have accessed information from our company's database, intranet, etc.	1	2	3	4	5
KM22	I have retrieved information that I have stored	1	2	3	4	5
KM23	I was able to recall the required information with ease	1	2	3	4	5
KM24	I could remember things easily	1	2	3	4	5
KM25	I have used the new knowledge that I created	1	2	3	4	5
KM26	I have used the information I have taken from others	1	2	3	4	5
KM27	I have implemented my ideas in my job	1	2	3	4	5
KM28	I have applied my knowledge in my job	1	2	3	4	5
KM29	I have applied new information I received in my work	1	2	3	4	5
KM30	I have implemented the best practices that I developed	1	2	3	4	5

TASK RELATED KNOWLEDGE

In this section we would like to know **by the end of the assignment/project/work** to what extent you were knowledgeable about what was to be done, how to perform those tasks, and why it had to be done so. Please select a number that corresponds to the extent to which you knew the following aspects of your work.

1=None or To a very little extent **2**=To a little extent **3**=To a moderate extent **4**=To a great extent **5**=To a very great extent

Towards the end of the assignment/project/work to what extent did you achieve full knowledge of...

TK1	how to perform the different aspects of your job	1	2	3	4	5
TK2	how to implement your work routines	1	2	3	4	5
TK3	the procedures for doing your job	1	2	3	4	5
TK4	the relevant know-how	1	2	3	4	5
TK5	how to use the relevant software	1	2	3	4	5
TK6	what information was needed for each task	1	2	3	4	5
TK7	what tasks needed to be accomplished	1	2	3	4	5
TK8	what was expected of you	1	2	3	4	5
TK9	what the functional requirements were	1	2	3	4	5
TK10	what information was needed	1	2	3	4	5
TK11	why you were doing things the way you did them	1	2	3	4	5
TK12	the reason(s) for doing what you did	1	2	3	4	5
TK13	the philosophy behind your actions	1	2	3	4	5
TK14	the purpose of your actions	1	2	3	4	5
TK15	the rationale behind your actions	1	2	3	4	5

In this section we would like to know **by the end of the assignment/project/work** to what extent you were knowledgeable about the people connected to your work, finding various resources, and time related issues of your work. Please select a number that corresponds to the extent to which you knew the following aspects of your work.

1=None or To a very little extent **2**=To a little extent **3**=To a moderate extent **4**=To a great extent **5**=To a very great extent

Towards the end of the assignment/project/work to what extent did you achieve full knowledge regarding...

TK16	who your immediate customers were	1	2	3	4	5
TK17	whom to go to for the necessary resources	1	2	3	4	5
TK18	who could get things done	1	2	3	4	5
TK19	who had the relevant expertise	1	2	3	4	5
TK20	who had the required information	1	2	3	4	5
TK21	where to find the relevant information	1	2	3	4	5
TK22	where the necessary things were available	1	2	3	4	5
TK23	where to perform all your activities	1	2	3	4	5
TK24	where to find people when you needed them	1	2	3	4	5
TK25	where to find help when needed	1	2	3	4	5
TK26	exactly when things needed to be done	1	2	3	4	5
TK27	when to gather more information	1	2	3	4	5
TK28	the timing of different tasks	1	2	3	4	5
TK29	when to pursue a particular problem	1	2	3	4	5
TK30	when you needed to do particular tasks	1	2	3	4	5

PERFORMANCE OUTCOMES

In this section we would like to know more about your job outcomes for the assignment/project/work you mentioned at the beginning of this survey. Please select a number that corresponds to the extent to which you agree or disagree with the following aspects of your work outcomes.

1=Strongly disagree **2**=Disagree **3**=Slightly disagree **4**=Neither **5**=Slightly agree **6**=Agree **7**=Strongly agree

Towards the end of the assignment/project/work...

IO1	I was very efficient at my work	1	2	3	4	5	6	7
IO2	I accomplished my tasks within the allocated resource	1	2	3	4	5	6	7
IO3	I accomplished a great deal of work with the available resources	1	2	3	4	5	6	7
IO4	I was very effective at interacting with others	1	2	3	4	5	6	7
IO5	My work was of very high quality	1	2	3	4	5	6	7
IO6	I easily met my goals	1	2	3	4	5	6	7
IO7	I usually finished my tasks within the expected time limit	1	2	3	4	5	6	7
IO8	I usually met my goals as quickly as possible	1	2	3	4	5	6	7
IO9	I could have done my tasks faster with the same level of quality compared to the beginning of the project	1	2	3	4	5	6	7
IO10	Generally speaking, I was satisfied with my job	1	2	3	4	5	6	7
IO11	I was satisfied with my work outcomes	1	2	3	4	5	6	7
IO12	I was generally satisfied with the kind of work I did	1	2	3	4	5	6	7
IO13	I was satisfied with my personal growth	1	2	3	4	5	6	7
IO14	I was satisfied with my growth opportunities	1	2	3	4	5	6	7
IO15	I was satisfied with my accomplishments	1	2	3	4	5	6	7

In this section we would like to know the degree of your innovativeness allowed by your work, and the degree to which your work outcomes were creative. Please select a number that corresponds to the degree to which you engaged in the following activities.

1=Not at all **2**=To a low degree **3**=To a slightly low degree **4**=To a moderate degree **5**=To a slightly high degree **6**=To a high degree **7**=To an exceptionally high degree

During the assignment/project/work...

IO16	I searched out new technologies, processes, techniques, and/or product ideas	1	2	3	4	5	6	7
IO17	I had generated creative ideas	1	2	3	4	5	6	7
IO18	I had promoted my ideas to others	1	2	3	4	5	6	7
IO19	I had investigated and secured funds needed to implement new ideas	1	2	3	4	5	6	7
IO20	I had developed plans and schedules for the implementation of new ideas	1	2	3	4	5	6	7

IO21	I was innovative	1	2	3	4	5	6	7
IO22	I had developed innovative ideas, built support for it and implemented it	1	2	3	4	5	6	7
IO23	I was the first to use certain ideas in my kind of work	1	2	3	4	5	6	7
IO24	ideas that I implemented were the first use of such ideas in my department	1	2	3	4	5	6	7
IO25	ideas that I implemented were the first use of such ideas in this type of work	1	2	3	4	5	6	7
IO26	my work was original and practical	1	2	3	4	5	6	7
IO27	my work was adaptive and practical	1	2	3	4	5	6	7
IO28	my work was creative	1	2	3	4	5	6	7
IO29	my ideas were novel and useful	1	2	3	4	5	6	7

TEAM OUTCOMES

In this section we are interested in your perception of your team's performance outcomes for the assignment/project/work you mentioned at the beginning of this survey.

TO1A	How many members were there in your team?	
TO1B	About what percent of involvement did you have in this team compared to all other team members?	%

Please select the number corresponding to the level of performance of your team for the assignment/project/work you mentioned at the beginning of this survey.

1=Extremely low	**2**=Low	**3**=Slightly low	**4**=Moderate high	**5**=Slightly high	**6**=High	**7**=Extremely

For the assignment/project/work you mentioned at the beginning of this survey how would you rate the following aspects of your team…

TO1	The efficiency of team operations	1	2	3	4	5	6	7
TO2	The team's adherence to budgets	1	2	3	4	5	6	7
TO3	The amount of work the team produced	1	2	3	4	5	6	7
TO4	Effectiveness of the team's interactions with people outside the team	1	2	3	4	5	6	7
TO5	The quality of work the team produced	1	2	3	4	5	6	7
TO6	The team's ability to meet the goals of the project	1	2	3	4	5	6	7
TO7	The team's adherence to schedules	1	2	3	4	5	6	7
TO8	The team could have done its work faster with the same level of quality	1	2	3	4	5	6	7
TO9	The team met the goals as quickly as possible	1	2	3	4	5	6	7

SECTION I: GENERAL INFORMATION

Please provide the following background information for statistical purposes in this section.

ORGANIZATIONAL DETAILS:			
GI1	Please indicate the primary business of your company:		
GI2	Number of employees in your organization/division:		
GI3	Type of your organization:		
GI4	How old is your organization/division?		
GI5	Does your organization have any knowledge management initiatives/program?	Yes	No
	GI5A: If yes, how long has it been since the initiative/program started?	____Months	____Years
	GI5B: Are you involved in the initiative/program in any way?	Yes	No
WORK DETAILS:			
GI6	What business function are you most closely associated to?		
GI7	How long have you been working in the current organization?	____Months	____Years
GI8	Please indicate your current position:		
GI9	How long have you been working in the current or similar position?	____Months	____Years
GI10	How important do you think your knowledge is for your department?		
GI11	Country in which you are currently working:		
PERSONAL DETAILS:			
GI12	Highest degree you have completed:		
GI13	Please indicate your age category:		
GI14	Please indicate your gender:	Female	Male

Appendix-D: Knowledge Management Practices Re-Pilot

The purpose of this survey is to understand the different activities people perform in managing their knowledge for a particular task. All questions in this survey require you to think about your knowledge and the activities related to a particular task (such as, the knowledge and activities related to a **particular course** that you are taking this semester).

Please indicate the name of the course you have taken this semester, which you will be referring to respond to the questions in this survey: ____(Example: INFS-4510, BUAD-2070, etc.)

In this section we would like to know to what extent you have engaged in activities by which you created new knowledge, have stored what you know, and have shared your knowledge **related to the above course**. Please circle a number that corresponds to the extent to which you have engaged in each of the following activities.

1= None or To a very little extent 2= To a little extent 3= To a moderate extent 4= To a great extent 5= To a very great extent

During this semester, for the above mentioned course I have...

A1.	created new skills	1	2	3	4	5
A2.	stored important information	1	2	3	4	5
A3.	shared techniques relevant to this course	1	2	3	4	5
A4.	created new insights	1	2	3	4	5
A5.	stored data related to this course	1	2	3	4	5
A6.	created new knowledge	1	2	3	4	5
A7.	shared my know-how with others	1	2	3	4	5
A8.	created new knowledge relevant to this course	1	2	3	4	5
A9.	stored information needed for this course	1	2	3	4	5
A10.	created new ways of interpreting situations	1	2	3	4	5
A11.	stored appropriate information	1	2	3	4	5
A12.	shared information with others	1	2	3	4	5
A13.	stored information that I might need later	1	2	3	4	5
A14.	shared information my team-mates needed	1	2	3	4	5
A15.	created new ways of working	1	2	3	4	5
A16.	shared my expertise with others	1	2	3	4	5
A17.	stored pertinent information	1	2	3	4	5
A18.	shared my knowledge with others	1	2	3	4	5
A19.	created new thinking	1	2	3	4	5
A20.	stored relevant information	1	2	3	4	5
A21.	created new work methods	1	2	3	4	5
A22.	shared my insights with others	1	2	3	4	5
A23.	created new ideas	1	2	3	4	5
A24.	stored information essential for this course	1	2	3	4	5
A25.	created new ways of doing things	1	2	3	4	5
A26.	shared the course-related knowledge with other students	1	2	3	4	5

In this section we would like to know to what extent you were engaged in activities where you have searched out for new knowledge, and have applied what you know **in the above mentioned course**. Please circle a number that corresponds to the extent to which you have engaged in each of the following activities.

1= None or To a very little extent 2= To a little extent 3= To a moderate extent 4= To a great extent 5= To a very great extent

During this semester, for the above mentioned course I have...

A27.	retrieved documents essential to this course	1	2	3	4	5
A28.	applied my knowledge	1	2	3	4	5
A29.	retrieved course-related information	1	2	3	4	5
A30.	applied my expertise	1	2	3	4	5
A31.	retrieved information from external sources	1	2	3	4	5
A32.	applied my intuitive thinking skills	1	2	3	4	5
A33.	retrieved data required for my course work	1	2	3	4	5
A34.	applied my know-how	1	2	3	4	5
A35.	retrieved information relevant to my course work	1	2	3	4	5
A36.	applied my analytical skills	1	2	3	4	5
A37.	retrieved required information from various sources	1	2	3	4	5
A38.	applied my intuitive judgment	1	2	3	4	5
A39.	retrieved information needed for my course work	1	2	3	4	5
A40.	applied my insights	1	2	3	4	5

Appendix-E: Large Scale Cover Letter

Dear ________,

This email is to request your participation to complete a survey to understand how key individuals whose knowledge is highly important for the competitiveness of their organization manage their knowledge, and what factors are important in such a context. This research is conducted at The University of Toledo and is part of a Ph.D. dissertation.

You will **not** be asked to disclose any company confidential information. We are interested in your individual perceptions. Once you complete the survey you will be able to request the **summary of your results in comparison to other respondents**. You will also be able to compare them with the best benchmarks in the industry. This will help you gain insight to many factors that impact your knowledge and performance in today's economy, and will help you understand the specific characteristics that are important for your work. In addition, **five (5)** individuals chosen randomly from the first 200 respondents who complete the survey will receive **$100US each**. Details are available on the website.

There are three ways to complete the questionnaire:

1. Complete the survey online (preferred method) by creating a username and password using the Access Code "**KMS**" at this website: http://www.wjdoll.utoledo.edu/kms/kms/default.asp
2. Download a hard copy (http://www.wjdoll.utoledo.edu/kms/Docs/KM-questionnaire.pdf), and fax it to xxx-xxx-xxxx, or
3. You can request for a printed copy and a self-addressed stamped envelope by replying to this email with your postal information.

YOUR RESPONSES WILL BE KEPT STRICTLY CONFIDENTIAL AND ONLY AGGREGATE RESULTS MAY BE REPORTED IN ACADEMIC OR BUSINESS JOURNALS.

If you choose not to participate in this survey please reply with "kmsmnRemove4" in the subject.

We think you'll find this survey interesting and its results useful to you! Thank you very much for your kind cooperation and valuable time.

Best regards,

Shan
=================

Shahnawaz Muhammed
College of Business and Administration
The University of Toledo.
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Appendix-F: Large Scale Questionnaire

Knowledge Management Survey

The purpose of this survey is to improve our understanding of how individuals create, share, and use their knowledge in the workplace. Knowledge workers gain and share most of their work related knowledge within certain communities in which they interact. These could be formal or informal communities within or outside an organization and are often referred to as your community of practice. The questions in this survey ask about your perceptions about your community of practice, your work settings, and your knowledge management practices.

All questions in this survey require you to respond in relation to a particular **assignment or project that you have completed most recently** preferably as a team, irrespective of its success or failure. If your work did not involve working on a particular assignment or project, please answer the questions in this survey based on **your work in the past six (6) months**. Please provide the following details if you will be referring to a particular assignment or project for completing this survey:

Name of the assignment/project: ____
Date this assignment/project was completed: ________________________________ (MM/DD/YY)
Duration of this assignment/project (in number of months): _________________________ Month(s)

OR

☐ I will be referring to the last six months of my work to respond to this survey. (Please check if using this option)

Most questions in this survey require you to choose an alternative that best fit your views on the particular topic. There are no correct or incorrect answers; we are interested in your perceptions. The estimated completion time for this questionnaire is expected to be approximately 30 minutes. **All responses to this survey will be confidential**. Only aggregate results will be reported in scholarly journals. Please try to complete all questions on this survey.

Thank you for your cooperation and valuable assistance in this research.

If you have any questions regarding this survey please feel free to contact the following persons.

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ABOUT YOUR COMMUNITY OF PRACTICE

A community of practice is referred to here as <u>any formal or informal group from which you seek, share or build your job related knowledge</u>, it could be your own work group, or a specific community within or outside your organization that is related to your field of work.

Please answer the following questions in relation to the community of practice in which you **<u>interacted the most</u>** during the assignment/project/work you mentioned.

A1.	Was this community the same as your work team?	Yes	No
A2.	Was this primarily an online (Internet/Intranet) community?		
A3.	About what percent of your interaction in this community was online?		_____%
A4.	Approximately how many members were there in this community?		
A5.	For how long were you part of this community?	___Months	___Yrs
A6.	How many communities were you part of during this time?		______

In this section we would like to know about the type of network that existed in your community of practice. Please select a number that corresponds to the extent to which you agree or disagree with each of the following statements in relation to the community of practice in which you **<u>interacted the most</u>** during the assignment/project/work you mentioned.

1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

In my community of practice...

A7.	members knew other members closely	1	2	3	4	5
A8.	members interacted very close to each other	1	2	3	4	5
A9.	members interacted frequently with other members	1	2	3	4	5
A10.	members could directly access any other member	1	2	3	4	5
A11.	there were many levels of membership	1	2	3	4	5
A12.	there were many levels of hierarchy	1	2	3	4	5
A13.	most members knew each other before they joined this community	1	2	3	4	5
A14.	most members were acquaintances of each other	1	2	3	4	5
A15.	most members I interacted with were known to me before I joined this community	1	2	3	4	5

In this section we would like to know about the social norms and the level of trust that existed in your community of practice. Please select a number that corresponds to the extent to which you agree or disagree with each of the following statements in relation to the community of practice in which you **<u>interacted the most</u>** during the assignment/project/work you mentioned.

1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

In my community of practice...

A16.	members were expected to have team spirit	1	2	3	4	5
A17.	members were expected to be cooperative	1	2	3	4	5
A18.	members were expected to have an open mind	1	2	3	4	5
A19.	members were expected to share what they knew	1	2	3	4	5
A20.	members trusted each other enough to share all relevant information	1	2	3	4	5
A21.	members believed that all members were acting in good faith	1	2	3	4	5
A22.	members were confident they could trust each other	1	2	3	4	5
A23.	members relied on each other for the truthfulness of the information shared	1	2	3	4	5

In this section we would like to know about the level of identification and obligation the members have in your community of practice. Please select a number that corresponds to the extent to which you agree or disagree with each of the following statements in relation to the community of practice in which you **interacted the most** during the assignment/project/work you mentioned.

1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

In my community of practice...

A24.	members had a strong sense of belonging to the community	1	2	3	4	5
A25.	members identified with each other as one community	1	2	3	4	5
A26.	members felt as one community	1	2	3	4	5
A27.	members cared for other members' well being	1	2	3	4	5
A28.	members expected others to help them when they helped	1	2	3	4	5
A29.	members were expected to return favors	1	2	3	4	5
A30.	members expected others to help in return	1	2	3	4	5

In this section we would like to know about the kind of information the community members share in your community of practice. Please select a number that corresponds to the extent to which you agree or disagree with each of the following statements in relation to the community of practice in which you **interacted the most** during the assignment/project/work you mentioned.

1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

In my community of practice...

A31.	members used a common language	1	2	3	4	5
A32.	the terms used by members were known to most of us	1	2	3	4	5
A33.	we had our own common words to communicate ideas	1	2	3	4	5
A34.	members used technical terms common among us	1	2	3	4	5
A35.	members used stories to communicate subtle ideas	1	2	3	4	5
A36.	stories and narratives were used to communicate rich sets of ideas	1	2	3	4	5
A37.	stories and metaphors were used to create and preserve rich meaning	1	2	3	4	5
A38.	stories and narratives were used to share hard to communicate ideas	1	2	3	4	5

ABOUT YOUR WORKING ENVIRONMENT

In this section we would like to know about the nature of your work **during the assignment/project/ work** that you mentioned at the beginning of this survey. Please select a number that best describes your work for the following questions.

1=None or To a very little extent **2**=To a little extent **3**=To a moderate extent **4**=To a great extent **5**=To a very great extent

B1.	My work required significant amount of reasoning	1	2	3	4	5
B2.	My work required significant amount of knowledge	1	2	3	4	5
B3.	My work involved intense thinking	1	2	3	4	5
B4.	My work involved complex analysis	1	2	3	4	5

B5.	My work was mentally challenging	1	2	3	4	5
B6.	My work involved work processes that had to be enacted through computers	1	2	3	4	5
B7.	My work involved tasks that depended on computers	1	2	3	4	5
B8.	My work would have been difficult to perform without computers	1	2	3	4	5
B9.	My work processes were embedded in computers	1	2	3	4	5
B10.	My work was mostly mediated by computers	1	2	3	4	5

B11.	During this time about what percentage of your working time was available for reflection and exchange of ideas?	__________%

ABOUT EMPOWERMENT

In this section we would like to know your perceptions about your job **during the assignment/project/work** that you mentioned at the beginning of this survey. Please select a number that corresponds to the extent of your perceptions for the following questions.

1=Not at all	**2**=To a very little extent	**3**=To a little extent	**4**=To a moderate extent	**5**=To a great extent	**6**=To a very great extent	**7**=To an exceptionally great extent

During the assignment/project/work...

C1.	I had autonomy in determining how I did my job	1	2	3	4	5	6	7
C2.	I could decide on my own how to go about doing my work	1	2	3	4	5	6	7
C3.	I had independence in how I did my job	1	2	3	4	5	6	7
C4.	I had freedom in how I did my job	1	2	3	4	5	6	7
C5.	I had choice in how I did my job	1	2	3	4	5	6	7
C6.	I was confident about my ability to do my job	1	2	3	4	5	6	7
C7.	I was self-assured about my capabilities to perform my work activities	1	2	3	4	5	6	7
C8.	I had mastered the skills necessary to do my job	1	2	3	4	5	6	7
C9.	I was confident about my knowledge for my tasks	1	2	3	4	5	6	7
C10.	I had impact on what happened in my department	1	2	3	4	5	6	7
C11.	I had control over what happened in my department	1	2	3	4	5	6	7
C12.	I had influence over what happened in my department	1	2	3	4	5	6	7
C13.	I had impact over the outcomes of my job	1	2	3	4	5	6	7
C14.	the work I did was important to me	1	2	3	4	5	6	7
C15.	my job activities were personally meaningful to me	1	2	3	4	5	6	7
C16.	the work I did was meaningful to me	1	2	3	4	5	6	7

ABOUT THE INFORMATION TECHNOLOGY SUPPORT AVAILABLE

In this section we would like to know to what extent the information technologies you used **during the assignment/project/work** have helped you to become more knowledgeable in your job, and to what extent they have helped you to manage what you know during that time.

Please list the applications/software that you used **most frequently** during the assignment/project/work you mentioned at the beginning of this survey. List up to three (3) applications/software in the order of their use.

1.______________________	2.______________________	3.______________________

Please select a number that corresponds to the extent to which the above applications have helped you stimulate your thought, to become more informed, and to capture your knowledge **during the assignment/project/work**.

1=None or To a very little extent **2**=To a little extent **3**=To a moderate extent **4**=To a great extent **5**=To a very great extent

The above applications were helpful in...

D1.	generating new ideas	1	2	3	4	5
D2.	thinking through problems	1	2	3	4	5
D3.	generating new information	1	2	3	4	5
D4.	stimulating my thinking	1	2	3	4	5
D5.	creating new knowledge	1	2	3	4	5
D6.	storing needed information	1	2	3	4	5
D7.	retaining my knowledge	1	2	3	4	5
D8.	storing work related data	1	2	3	4	5
D9.	retaining required information	1	2	3	4	5
D10.	storing my ideas	1	2	3	4	5
D11.	sharing my insights	1	2	3	4	5
D12.	communicating what I know	1	2	3	4	5
D13.	sharing my ideas	1	2	3	4	5
D14.	communicating with other people	1	2	3	4	5
D15.	transferring my knowledge	1	2	3	4	5

Please select a number that corresponds to the extent to which the above applications have helped you automate your work processes, and share your knowledge with others **during the assignment/project/work**.

1=None or To a very little extent **2**=To a little extent **3**=To a moderate extent **4**=To a great extent **5**=To a very great extent

The above applications were helpful in...

D16.	becoming more informed	1	2	3	4	5
D17.	accessing needed information	1	2	3	4	5
D18.	accessing information from others	1	2	3	4	5
D19.	accessing required information	1	2	3	4	5
D20.	accessing useful information	1	2	3	4	5
D21.	automating my work processes	1	2	3	4	5

D22.	automating decision-making	1	2	3	4	5
D23.	automating my work routines	1	2	3	4	5
D24.	automating my tasks	1	2	3	4	5
D25.	automating things I had to do	1	2	3	4	5

ABOUT YOUR KNOWLEDGE MANAGEMENT PRACTICES

In this section we would like to know to what extent you have engaged in activities by which you created new knowledge, have stored what you know, and have shared your knowledge related to your work. Please select a number that corresponds to the extent to which you have engaged in each of the following activities **during the assignment/project/work** that you mentioned.

1=None or To a very little extent **2**=To a little extent **3**=To a moderate extent **4**=To a great extent **5**=To a very great extent

During the assignment/project/work, I have...

E1	created new thinking	1	2	3	4	5
E2	created new ways of doing things	1	2	3	4	5
E3	created new ways of interpreting situations	1	2	3	4	5
E4	created new ways of working	1	2	3	4	5
E5	created new work methods	1	2	3	4	5
E6	stored important information	1	2	3	4	5
E7	stored information essential for my work	1	2	3	4	5
E8	stored information that I might need later	1	2	3	4	5
E9	stored pertinent information	1	2	3	4	5
E10	stored relevant information	1	2	3	4	5
E11	shared information with others	1	2	3	4	5
E12	shared my insights with others	1	2	3	4	5
E13	shared my know-how with others	1	2	3	4	5
E14	shared my knowledge with others	1	2	3	4	5
E15	shared my work-related knowledge with others	1	2	3	4	5

In this section we would like to know to what extent you were engaged in activities where you have searched out for new knowledge, and have applied what you know **during the assignment/project/work** that you mentioned. Please select a number that corresponds to the extent to which you have engaged in each of the following activities.

1=None or To a very little extent **2**=To a little extent **3**=To a moderate extent **4**=To a great extent **5**=To a very great extent

During the assignment/project/work, I have...

E16	retrieved information from various sources	1	2	3	4	5
E17	retrieved information relevant to my work	1	2	3	4	5
E18	retrieved information critical for my work	1	2	3	4	5
E19	retrieved data required for my work	1	2	3	4	5
E20	retrieved work-related information	1	2	3	4	5
E21	applied my know-how	1	2	3	4	5

E22	applied my skills	1	2	3	4	5
E23	applied my insights	1	2	3	4	5
E24	applied my analytical skills	1	2	3	4	5
E25	applied my expertise	1	2	3	4	5

ABOUT YOUR TASK RELATED KNOWLEDGE

In this section we would like to know **by the end of the assignment/project/work** to what extent you had FULL knowledge about what was to be done, how to perform those tasks, and why it had to be done so. Please select a number that corresponds to the extent to which you had FULL knowledge of the following aspects of your work.

1=None or To a very little extent **2**=To a little extent **3**=To a moderate extent **4**=To a great extent **5**=To a very great extent

Towards the end of the assignment/project/work to what extent did you have FULL knowledge of...

F1.	how to implement your work routines	1	2	3	4	5
F2.	the procedures for doing your job	1	2	3	4	5
F3.	the relevant know-how	1	2	3	4	5
F4.	the technological developments in your area	1	2	3	4	5
F5.	your job requirements	1	2	3	4	5
F6.	what actions you need to take	1	2	3	4	5
F7.	the reasons behind your actions	1	2	3	4	5
F8.	the philosophy behind your actions	1	2	3	4	5
F9.	the purpose of your actions	1	2	3	4	5
F10.	the rationale behind your actions	1	2	3	4	5

In this section we would like to know **by the end of the assignment/project/work** to what extent you had FULL knowledge about the people related to your work, where to get the required resources, and time related issues of your work. Please select a number that corresponds to the extent to which you had FULL knowledge the following aspects of your work.

1=None or To a very little extent **2**=To a little extent **3**=To a moderate extent **4**=To a great extent **5**=To a very great extent

Towards the end of the assignment/project/work to what extent did you have FULL knowledge regarding...

F11.	whom to go to for the necessary resources	1	2	3	4	5
F12.	who could help when you get stuck	1	2	3	4	5
F13.	who were the most knowledgeable people at work	1	2	3	4	5
F14.	where to find the required information	1	2	3	4	5
F15.	where the necessary things were available	1	2	3	4	5
F16.	where you could get the required resources	1	2	3	4	5
F17.	when different things had to be done	1	2	3	4	5
F18.	when to get more information	1	2	3	4	5
F19.	when to share information	1	2	3	4	5

ABOUT THE OUTCOMES OF YOUR JOB

In this section we would like to know more about your job outcomes for the assignment/project/work you mentioned. Please select a number that corresponds to the extent to which you agree or disagree with the following aspects of your work outcomes.

1=Strongly disagree **2**=Disagree **3**=Slightly disagree **4**=Neutral **5**=Slightly agree **6**=Agree **7**=Strongly agree

Towards the end of the assignment/project/work compared to other people in similar position...

G1.	I was very efficient at my work	1	2	3	4	5	6	7
G2.	I was very effective in my work	1	2	3	4	5	6	7
G3.	My work was of very high quality	1	2	3	4	5	6	7
G4.	I easily met my goals	1	2	3	4	5	6	7
G5.	I usually finished my tasks within the expected time limit	1	2	3	4	5	6	7

In this section we would like to know the degree to which your work outcomes were creative. Please select a number that corresponds to the degree to which you engaged in the following activities.

1=Not at all	**2**=To a low degree	**3**=To a slightly low degree	**4**=To a moderate degree	**5**=To a slightly high degree	**6**=To a high degree	**7**=To an exceptionally high degree

During the assignment/project/work compared to other people in similar position...

G6.	I had generated creative ideas	1	2	3	4	5	6	7
G7.	I was the first to use certain ideas in my kind of work	1	2	3	4	5	6	7
G8.	ideas that I implemented were the first use of such ideas in my department	1	2	3	4	5	6	7
G9.	my work was original and practical	1	2	3	4	5	6	7
G10.	my work was creative	1	2	3	4	5	6	7

GENERAL INFORMATION

Please provide the following background information for statistical purposes in this section.

ORGANIZATIONAL DETAILS:

GI1 Please indicate the primary business of your organization (With 2002 NACIS Code if available): ____

GI2 Number of employees in your organization/division (Check one):
☐ Less than 50 ☐ 50-100 ☐ 101- 500 ☐ 501- 1000 ☐ 1001-5000 ☐ Over 5000

GI3 Type of your organization (Check one):
☐ Private ☐ Public ☐ Non-Profit ☐ Government ☐ Other

GI4 How old is your organization/division? (Check one)
☐ Less than 2 years ☐ 2 -5 years ☐ 6 -10 years ☐ 11- 25 years ☐ Over 25

GI5 Does your organization have any knowledge management initiatives/program? ☐ Yes ☐ No

	GI5A: If yes, how long has it been since the initiative/program started?	____Months	____Years

WORK DETAILS:			
GI6	What business function are you most closely associated to? (Manufacturing, Operations, Accounting, etc.) ____		
GI7	How long have you been working in the current organization?	____Months	____Years
GI8	Please indicate your current position (Check one): ☐ Operational ☐ Professional ☐ Supervisory ☐ Middle Management ☐ Top Management		
GI9	How long have you been working in the current or similar position?	____Months	____Years
PERSONAL DETAILS:			
GI10	Highest degree you have completed (Check one): ☐ High School ☐ Associate ☐ Bachelors ☐ Master ☐ Doctorate		
GI11	Please indicate your age category (Check one): ☐ Less than 26 ☐ 26-35 ☐ 36-45 ☐ 46-55 ☐ 56-65 ☐ Over 65		
GI12	Please indicate your gender:	☐ Female	☐ Male

Thank you very much for your time and assistance in completing this questionnaire.

CONTACT INFORMATION:

If you wish to receive a free copy of the summary of this surveys results, please provide your name and address in the space below or attach your business card.

Name: ____

Company: ____

Address: ____
____
____

Telephone: ____________________________ **Fax:**

Email: ____