UNDERSTANDING CONTRIBUTION AND SEEKING BEHAVIOUR IN ELECTRONIC KNOWLEDGE REPOSITORIES

ATREYI KANKANHALLI

(*B.Tech., I.I.T., Delhi; M.S., R.P.I., NY*)

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SUMMARY

Although large amounts of investments are being made in knowledge management (KM) initiatives and there are well-publicized KM success stories, a significant number of organizations have difficulties with implementing KM efforts and knowledge management systems (KMS). Calls have been made to investigate social and technical factors responsible for the success or failure of KMS implementations.

With this motivation in mind, the objective of this study was to understand the factors that promote and inhibit knowledge sharing using Electronic Knowledge Repositories (EKR), a key form of KMS employed by organizations to support the codification strategy of KM. Two user perspectives: knowledge contributor and knowledge seeker were considered. Organizational knowledge leveraging through EKR would be possible only if both types of users are motivated to use EKR.

Survey of relevant literature was performed to identify potential factors that may promote or inhibit usage of EKR. Based on Social Exchange Theory and previous literature, individual cost and benefit factors were identified for knowledge contribution and knowledge seeking. In addition, based on the relational dimension of Social Capital Theory, organizational community factors were identified that may moderate the relationships between individual cost and benefit factors and usage of EKR. Once the two (knowledge contribution and knowledge seeking) models were formulated and operationalized, pilot studies were undertaken for the purpose of instrument validation.

Subsequently, a large-scale survey of knowledge professionals in public sector organizations was carried out to empirically validate the models. Public sector organizations were chosen since the majority of them are in the initial stages of KM implementation. Such organizations could provide an appropriate test-bed for and

benefit from the findings of our study as compared to organizations that have mature KMS in place e.g., the major consultancy firms.

In all ten organizations participated in the survey with a resultant sample of 150 contributor and 160 seeker responses. The survey data was analyzed to assess instrument validity and test the two models' hypotheses. Using multiple regression analysis and moderated multiple regression, the relative importance of the various cost, benefit, and moderating terms in influencing usage of EKR were determined.

The contribution model results indicate that enjoyment in helping others, economic rewards, and knowledge self-efficacy had significant effects on usage of EKR for knowledge contribution. Among social capital factors, pro-sharing norms moderated the relationship between reciprocity benefit and EKR usage, trust moderated the relationship between contribution effort and EKR usage, and identification moderated the relationship between economic rewards and usage.

The seeking model results indicate that perceived utility of results and seeker knowledge growth had significant effects on usage of EKR for knowledge seeking. Among social capital factors, identification moderated the relationship between future obligation and EKR usage while pro-sharing norms moderated the relationship between seeker knowledge growth and usage. The implications of these results are discussed to promote usage of EKR. Directions for future research stimulated by this study are presented.

This study contributes to theory building in the area of knowledge sharing and knowledge management, given the theoretical grounding, high construct validity of the measurement scales, strong research findings, and high explanatory power as compared to previous related studies.

Chapter 1

Introduction

How organizations create, store, transfer and reuse knowledge has been a subject of increasing interest in recent years (Alavi and Leidner 2001; Ruggles 1998). The terms "knowledge worker", "knowledge management (KM)" and "knowledge organization" have gained popularity (Choo 1998). Organizations are creating new positions such as Chief Knowledge Officer (CKO) to lead their KM initiatives. A recent IBM Institute for Knowledge Management study reports that 80% of the largest global organizations now have KM projects in place and over 25% have a CKO (Lawton 2001). According to analyst firm IDC, worldwide revenues for KM services will rise from $2.3 billion in 2000 to approximately $12.7 billion in 2005, reflecting an annual compound growth rate of 40.7% (IDC 2002). In addition to organizational interest in KM, increasing numbers of academic papers are being published on KM (Swan and Newell 2000). These developments reflect the growing significance of KM among scholars and practitioners.

A number of reasons have been cited for the emphasis on KM and the leveraging of knowledge resources. These include increased globalization, reduced time-to-market of products, increasing knowledge intensiveness of products and processes, and the need to leverage organizational expertise in tight labor markets (Alavi 2000). Such conditions require firms to focus their attention on efficient and effective creation, transfer, and reuse of knowledge in order to maintain competitive advantage. Therefore KM is now being

considered systematically, purposefully, and by leveraging information technology, often in global contexts. KM is becoming an important strategy for organizations.

Information technologies are considered as a key enabler for KM (Alavi and Leidner 2001). The class of technologies intended to support the management of knowledge resources is known as knowledge management systems (KMS). KMS include a variety of filtering, indexing, classifying, storage, retrieval, communication and collaboration technologies, to enable the sharing of organizational knowledge across time and space. A key form of KMS that focuses primarily on storing knowledge is electronic knowledge repositories (EKR). A typical EKR consists of a knowledge base, a cataloging system, document access control, a search and navigation capability, and a possible variety of advanced features such as email notification or commenting (Ackerman 1998). EKR may be used to store reports, presentations, articles, memos, and other forms of organizational knowledge (Lawton 2001). Documents are captured and catalogued to support likely future reuse e.g. existing consultant proposals being used to prepare new proposals (Davenport et al. 1998).

However, having sophisticated KMS does not guarantee success in KM initiatives (McDermott 1999; Cross and Baird 2000). Knowledge professionals must be willing to use KMS to share their knowledge. A recent study of 423 organizations reported that about 36% of KM initiatives failed due to lack of attention to adoption even when technological infrastructure was in place (KPMG 2000). Both social and technical barriers to usage of KMS have been listed and calls have been made to address both sets of issues together (McDermott 1999; Zack 1999) in order to be able to reap the benefits of KM that

have been experienced by some organizations (Davenport et al. 1998; O'Dell and Grayson 1998).

Motivated by such concerns, the purpose of this thesis is to shed light on the factors that support or inhibit individuals from using EKR (the most widely prevalent form of KMS (Davenport and Prusak 1998)) to share knowledge by employing a socio-technical perspective. A consequent goal is to use this understanding to suggest specific technological and organizational interventions that may facilitate knowledge sharing using EKR. Improving usage of EKR to share organizational knowledge could potentially lead to considerable gains in productivity due to effective reuse of knowledge (Gray 2000).

Any discussion of KM and KMS perforce starts with a discussion of the nature of knowledge and how it is distinguished from information (the distinction with data is more apparent). We begin this thesis with such a discussion, leading us on to formally define KM and KMS and eventually to the context of our study i.e. knowledge sharing using EKR.

1.1. Definitions

1.1.1. Knowledge

Distinguishing information and knowledge is important. There would be nothing new or interesting about KM if knowledge were not different from information (Fahey and Prusak 1998). Table 1.1. shows various definitions of data, information, and knowledge. A

commonly held view that has evolved over time is that data refers to raw numbers and facts, information is processed data in a context, and knowledge is authenticated information that is actionable (Alavi and Leidner 2001).

Table 1.1. Some Definitions of Data, Information and Knowledge

Author	Data	Information	Knowledge
(Wiig 1993)	---	Facts organized to describe a situation or condition	Truths and beliefs, perspectives and concepts, judgments and expectations, methodologies and know-how
(Nonaka and Takeuchi 1995)	---	A flow of meaningful messages	Commitments and beliefs created from these messages
(Ackoff 1997)	Symbols	Data that are processed to be useful	Application of data and information
(Davenport 1997)	Simple observations	Data with relevance and purpose	Valuable information from the human mind
(Alavi and Leidner 2001)	Raw numbers and facts	Processed data in context	Authenticated information that is actionable, justified belief that increases an entity's capacity for effective action

Data have no meaning outside the context in which they were collected. For example, the symbols, '8' and '10' can be perceived, but alone cannot be understood without the possibility of inaccurate interpretation. Lacking the context in which they were collected, one cannot accurately understand the symbols, even if one recognizes them (Nunamaker et al. 2001-2002). If one knows they were collected to record someone's age, one easily understands their meaning.

In understanding information, one understands relationships between data items in the context in which they are presented. Information is most useful when it is presented to

emphasize relationships (Nunamaker et al. 2001-2002). For example, a pie graph may represent age groups as percentages of total population.

Based on the ideas of Huber (1991) and Nonaka (1994), Alavi and Leidner (2001, pg. 109), define knowledge as follows:

"Knowledge is defined as a justified belief that increases an entity's capacity for effective action"

Knowledge requires understanding the patterns that emerge in information. Patterns act as archetypes or standards to which emerging information can be compared, from which inferences can be drawn and action taken. Knowledge may be about recurring relationships among information, or may be procedural, about how to successfully respond to the patterns discovered. Knowledge may provide answers to questions about how to perform order-specific and/or time-specific procedures (Nunamaker et al. 2001-2002).

Many authors (for example Ackoff (1997), Alter (1999), Bellinger et al. (2000), and Tuomi (2000)) consider it useful to think of knowledge as part of the following hierarchy: Data, Information, Knowledge, and Wisdom. While most authors argue that the hierarchy begins with data and moves to higher levels with more processing, Tuomi (2000) argues that the hierarchy, in fact, begins with knowledge which needs processing to be converted to information and further processing to be converted to data. Several authors (Stenmark 2002; Nunamaker et al. 2001-2002) logically suggest that the things we know lie on a continuum along which people can move in both directions, depending on their needs. Sometimes one begins with data, other times one begins with wisdom, and still other times one starts somewhere in between.

Arising from the above discussion about knowledge, what becomes apparent is that it is the *actionable* nature of knowledge that makes it of interest to organizations (Stenmark 2002). Since knowledge is by definition more actionable than data or information, organizations are interested to manage their knowledge resources.

1.1.2. Knowledge Management and Knowledge Management Systems

KM is defined as:

"*a systemic and organizationally specified process for acquiring, organizing and communicating both tacit and explicit knowledge of employees so that other employees may make use of it to be more effective and productive in their work*" (Alavi and Leidner 1999, pg.6).

KM involves the basic processes of creating, storing and retrieving, transferring and applying knowledge. The ultimate aim of KM is to avoid reinventing the wheel and leverage cumulative organizational knowledge for more informed decision-making, Examples of ways in which knowledge is leveraged include: transfer of best practices from one part of an organization to another part, codification of individual employee knowledge to protect against employee turnover, and bringing together knowledge from different sources to work on a specific project. A variety of tools are available to organizations to facilitate the leveraging of knowledge. These tools i.e. KMS, are defined as:

"A class of information systems applied to managing organizational knowledge. That is, they are IT-based systems developed to support and enhance the organizational processes

of knowledge creation, storage/retrieval, transfer, and application" (Alavi and Leidner 2001, pg.114).

Some of the common KMS technologies include intranets and extranets, search and retrieval tools, content management and collaboration tools, data warehousing and mining tools, and groupware and artificial intelligence tools like expert systems and knowledge-based systems.

Two models of KMS have been identified in information systems research (Alavi and Leidner 1999) both of which may be employed by organizations to fulfill different needs (Kankanhalli et al. forthcoming). These two models correspond to two different approaches to KM i.e. the codification approach and the personalization approach (Hansen et al. 1999) (Zack (1999) alternately labels these two models as integrative and interactive architectures respectively). The *repository* model of KMS associated with the *codification* approach focuses on the codification and storage of knowledge in knowledge bases. The purpose is to facilitate knowledge reuse by providing access to codified expertise. EKR to code and share best practices exemplify this strategy (Alavi and Leidner 2001).

The *network* model of KMS associated with the *personalization* approach attempts to link people to enable the transfer of knowledge. One way to do this is to provide pointers to location of expertise in the organization i.e. who knows what and how they can be contacted. This method is exemplified by knowledge directories, commonly called "yellow pages" (Alavi and Leidner 2001). Ruggles (1998) notes that in order to access the

knowledge in an organization that remains uncodified, mapping the internal expertise is useful.

A second way is to link people who are interested in similar topics. The term communities of practice (COP) has come into use to describe such flexible groups of professionals informally bound by common interests who interact to discuss topics related to these interests (Brown and Duguid 1991). KMS that provide a common electronic forum to support COP exemplify this approach (Alavi and Leidner 2001).

1.1.3. Electronic Knowledge Repository

The focus of our study is EKR, a common form of KMS implemented in organizations to support the codification strategy of KM (Grover and Davenport 2001). The reason for focusing on EKR is because they are by far the most prevalent form of KMS (Davenport and Prusak 1998) and yet study of their usage has not received much attention (see Section 1.4).

EKR have been defined as:

".. on-line computer-based storehouse of expertise, knowledge, experience, and documentation about a particular domain of expertise. In creating a knowledge repository, knowledge is collected, summarized, and integrated across sources" (Liebowitz and Beckman 1998).

EKR have also been called as organizational memory systems (OMS) (Ackerman 1994) or organizational memory information systems (OMIS) (Stein and Zwass 1995), the purpose of these systems being to leverage knowledge from the past to bear on present activities in order to increase organizational effectiveness (Markus 2001).

Davenport and Prusak (1998) found that 80% of the KM projects they reviewed involved some form of knowledge repository. Knowledge is codified and stored in a repository under the assumption that it will be useful to others in the organization, and that the costs of entering it into the repository are smaller than the benefits it generates (Alavi and Leidner 2001). Entering knowledge into a repository can free its contributor from having to deal individually with all the people who need access to it in addition to increasing the access of the knowledge. This opens up the possibility of achieving scale in knowledge reuse and thereby growing the business (Hansen et al. 1999). Accordingly knowledge repositories are intended to affect organizational efficiency by improving employees' ability to access other's codified knowledge across time and space.

EKR can be used to store various forms of organizational knowledge such as external knowledge (e.g. client or customer knowledge and competitive intelligence), structured internal knowledge (e.g. research reports, product specifications, marketing materials and methods) and informal internal knowledge (e.g. discussion knowledge bases of lessons learned) (Davenport and Prusak 1998).

1.2. Contributor's and Seeker's Perspectives on the Usage of EKR

The process of knowledge exchange through EKR involves people contributing content to populate the EKR and people seeking knowledge from EKR for reuse. Success of EKR requires that knowledge contributors must be willing to part with their knowledge and knowledge seekers must be willing to reuse other people's knowledge. A knowledge contributor typically logs into the system, fills out a form describing the contribution, and either attaches a document or pastes content into a text box. A knowledge seeker typically logs into the systems, types keywords to search for the required knowledge, and examines retrieved results. The distinction between contributors and seekers is conceptual in that the same individual can be a contributor or a seeker at different points of time. We now describe how the exchange process in EKR is different from other forms of KMS and direct knowledge sharing and therefore worthy of separate study. We also describe how this study attempts to address the gaps in previous related literature thereby providing additional justification for our study.

1.3. Comparison of EKR with other forms of KMS and direct sharing

Sharing knowledge through EKR has several unique characteristics to distinguish it from network forms of KMS and direct (face-to-face) sharing. First, the interaction with EKR may be impersonal. Seekers are usually aware of the identity of the contributor but are not likely to actually know the contributor. Contributors usually do not know the identity of the seeker unless the seeker initiates communication with the contributor. Would contributors be inclined to help people they don't know? Would seekers rely on knowledge from people they don't know? Second, contribution in EKR typically occurs

without any direct appeal or request for help by seekers. Would contributors be willing to contribute without knowing whether others will need their contributions?

Further, there is reason to believe that different forms of KMS and direct knowledge sharing will vary in terms of their costs and benefits to users (Gray 2000). Usage of EKR typically involves codification costs for knowledge contributors and retrieval costs for knowledge seekers. Contribution and seeking costs may be different for direct knowledge sharing where verbal communication is employed. They may also differ for network-based KM approaches (e.g. email or COP bulletin board) where knowledge is explicated as text but may not be indexed or categorized.

Outcomes of knowledge contribution and seeking, such as economic rewards and change in image, could vary for different forms of KMS and direct knowledge sharing. The assurance in email groups and electronic COP that all members of the group view responses posted to queries may not be true for EKR. It is even possible that a document contributed to a large repository may never be accessed or viewed. In EKR it may be difficult for users to identify the contributors as compared to electronic COP. Therefore change in image outcomes of knowledge contribution are likely to be different for different forms of KMS. Since knowledge contribution and seeking can be more easily monitored in EKR than in direct knowledge sharing, it may be easier to provide economic rewards for contributors to and seekers from EKR than for direct knowledge sharing.

1.4. Summary of Previous Related Work

A summary of related empirical studies on knowledge sharing in the IS and organizational behavior disciplines is provided in Table 1.2.

Study	Stakeholder	Technology	Context
Orlikowski (1993)	More emphasis on contributor	Lotus Notes groupware	Consulting Organization
Constant et al. (1994)	Contributor	None	Undergraduate and MBA students given organizational vignettes
Constant et al. (1996)	Contributor factors effect on usefulness of replies	Email distribution list	Tandem Computers
Goodman & Darr (1998)	Contributor and seeker	Repository + electronic COP	Office equipment distributor
Jarvenpaa & Staples (2000)	Contributor and seeker combined	All electronic media	1 University
Wasko & Faraj (2000)	More emphasis on contributor	Electronic COP	3 Usenet groups
Bock & Kim (2002)	Contributor	All electronic media	4 Public organizations

Table 1.2. Summary of Previous Related Studies

By reviewing the studies in Table 1.2., the following gaps in literature can be identified:

- Several studies consider knowledge sharing for all electronic media without focusing on a particular form of KMS (Bock and Kim 2002; Jarvenpaa and Staples 2000). Even when studies are situated in the context of a particular technology they may not refer specifically to the technology features and the consequences thereof (Constant et al. 1996; Orlikowski 1993). Exceptions are the case study by Wasko and Faraj (2000) that applies public goods theory to a Usenet group context and the case study by Goodman and Darr (1998) that briefly compares COP with EKR in an organization. Based on our previous discussion (see Section 1.3.), differences in antecedent factors of usage and the relative importance of antecedent factors can be expected for different forms

of KMS. Therefore for this study we focused on investigating usage of EKR, which are the most common form of KMS. Future work could extend this study to compare antecedents of usage across different forms of KMS.

- For knowledge sharing to take place, both types of participants (knowledge contributors and knowledge seekers) must be motivated. However, there are few studies on knowledge seekers (e.g., Goodman and Darr 1998) and the studies on contributors (e.g., Bock and Kim 2002; Constant et al. 1994) have mainly concentrated on the benefits (acting as motivators) rather than the costs of sharing. This is in spite of the fact that practitioner literature (e.g., O'Dell and Grayson 1998) and conceptual academic literature (e.g., Ba et al. 2001) suggest that costs are important in determining knowledge sharing behavior. Our study attempts to address these two gaps by investigating both seeker as well as contributor perspectives on knowledge sharing and by considering both costs (demotivators) and benefits (motivators) of EKR usage in order to obtain a better explanation of usage.
- Since previous studies have been mainly single case studies or surveys within one organization (except Bock and Kim 2002), there is a lack of theoretically grounded, empirically generalizable results regarding the phenomenon of interest. To address this limitation, our study aims to develop theoretically grounded models and empirically validate them using large-scale survey data from a number of organizations.

Therefore, the objective of our research is to develop socio-technical models of usage of EKR for knowledge contribution and knowledge seeking considering both cost and benefit factors as antecedents. Organizational community factors that provide the context in which usage takes place will also be examined.

1.5. Research Questions

With the motivations of the research in mind, we proceed to study the potential influences that determine usage of EKR. We are interested in investigating individual cost and benefit factors as well as organizational community factors. Emory (1980) suggests that a useful way to approach the research process is to view it as a four level hierarchy of questions. The process begins at the most general level with the *Management Question.* The main management question driving this study is, "How can organizations enhance the usage of EKR for sharing knowledge?"

Research information needs derive from the management question and lead to the *Research Question* that reflects the general purpose of the research. Based on our discussions till now, the research question that needs to be addressed is, "What are the major factors important to enhance usage of EKR for organizational knowledge sharing, and what is their relative significance?"

Once the research question has been defined, a third level of investigative questioning is pursued. These are specific questions that must be answered in order to address the research question. *Investigative Questions* are fractioned out of the research question and guide the details of the research effort, including the development of concepts, operational definitions, and measurement devices. In our study, related investigative questions include:

1. What individual factors are important in determining the usage of EKR for knowledge contribution?

2. What individual factors are important in determining the usage of EKR for knowledge seeking?
3. How do organizational community factors interact with the individual factors in influencing usage of EKR?
4. How can the potentially important factors be measured?

Measurement Questions are Emory's fourth level of questioning. These are the actual questions included in the survey instrument, posed to respondents, or against which observations are recorded.

1.6. Potential Contributions

This research seeks to benefit and contribute to both academic and practitioner arenas. For researchers, it can contribute to the existing literature on knowledge sharing and KM.

- Theoretically, it can provide a sound basis for gaining insight into the antecedent factors for knowledge seeking and knowledge contribution.
- It can help determine the relative importance of various antecedent factors for usage of EKR and the contextual (organizational community) conditions under which these factors are significant.
- Empirically, it will add to the limited studies done with EKR, thereby allowing future research on EKR to build upon the results of this study.
- The empirical study allows operationalization and validation of instruments for investigating knowledge sharing using EKR and potentially investigating other knowledge sharing contexts.

- It attempts to fill the gap in the knowledge sharing literature between the contributor and seeker perspectives and the benefit and cost perspectives by investigating both costs and benefits of knowledge contribution and knowledge seeking.
- It can serve to provide a basis for future research on comparing different forms of KMS and their usage for contributing and seeking knowledge.
- By drawing on a large sample from various organizations, the study aims to provide results that are generalizable across different organizational contexts.

To practitioners, this study may be useful in providing important insights into the use of EKR in organizations.

- It can highlight the critical factors that influence the usage of EKR. Introducing EKR into organizations can be a costly investment. Therefore, management must thoroughly understand the factors that influence the usage of EKR so that they can better utilize resources for the design and implementation of EKR and also provide organizational environments conducive for successful implementation.
- It can provide implications for technology designers of EKR to enhance usage of EKR for knowledge contribution and knowledge seeking.
- It can provide implications for knowledge contributors and seekers to enhance their usage of EKR.

1.7. Thesis Structure

In this opening chapter, we have highlighted the significance of knowledge in the new economy. The growing importance of KM and its supporting technologies, KMS, for organizations in the competitive marketplace was discussed. This was followed by definitions of important terms relevant to our study. We have also justified (both in terms of practical importance and the gaps in previous literature) the need to study and model the factors influencing the usage of the EKR from the contributor and seeker points of view. Therefore we propose a study to be carried out to develop models, operationalize the models, and empirically validate them to explain usage of EKR for knowledge contribution and knowledge seeking. The subsequent chapters of the thesis are organized as follows:

Chapter 2: A review of existing information systems, organizational behavior, and KM literature to identify theories and constructs that form the conceptual framework of the study.

Chapter 3: Presents the research models for knowledge contribution and knowledge seeking using EKR and the formulation of the hypotheses.

Chapter 4: Presents the research methodology that was adopted for the study. It includes the operationalization of independent and dependent variables for the two models and the description of instrument sorting procedures. It also describes the two pilot studies for instrument validation. Lastly, it presents the descriptive statistics of the field survey data.

Chapter 5: Presents the results of the analysis of the field survey data for the knowledge contribution model and for the knowledge seeking model.

Chapter 6: Presents the interpretation of results and implications of the study for theory, method, and practice for the two models.

Chapter 7: Summarizes the strengths and limitations of the study and discusses directions for future research.

Chapter 2

Literature Review

This chapter reviews a selection of literature relevant to our study. The literature review has four main objectives: (1) to introduce theory which could help to explain usage of EKR for contributing and seeking knowledge; (2) based on theory and prior research, to identify variables which are key to a better understanding of usage; (3) to serve as a source of explanation of phenomenon observed in model and hypothesis testing; and (4) to help position the current study with respect to prior and ongoing research in related fields (also done in Chapter 1).

This chapter provides a review of theories that can help to explain usage of EKR for contributing and seeking knowledge, mainly social exchange theory (SET) and social capital theory (SCT). The chapter starts with the justification of why SET and SCT are relevant to our study. The central concepts of SET including costs and benefits of exchange and the classification of costs are explained. Important costs for knowledge contributors and knowledge seekers are outlined. This is followed by a classification of benefits and a description of the important benefits for knowledge contributors and knowledge seekers. The subsequent sections describe SCT and its dimensions. The chapter ends with a description of the relational dimension social capital and how its components are relevant to our study.

2.1. Relevance of Social Exchange Theory

2.1.1. Knowledge Sharing as Social Exchange

SET is used to explain human behavior in social exchanges, which are different from economic exchanges (Blau 1964). First, the basic and most crucial distinction between the two types of exchanges is that in a social exchange the obligations are unspecified, whereas in an economic transaction (e.g. the sale of a product) there is an underlying formal contract that sets the exact quantities to be exchanged. Social exchange involves the principle that a person does another a favor and while there is a *general* expectation for *some* future return, there is no *clear* expectation of *exact* future return (Blau 1964). Second, social exchange assumes the existence of relatively long-term relationships of interest, whereas historically, classical microeconomic theories are developed on the assumption that exchanges take place between people on a one-off basis (Molm 1997). Knowledge sharing satisfies the first condition of social exchange in that the quantity and value of knowledge contributed cannot be specified and also the quantity and nature of return by knowledge seeker cannot be specified. Also knowledge sharing within an organization entails relatively long-term relationships that engender feelings of obligation and reciprocity, unlike in purely economic exchanges.

The original SET did not take into account knowledge as an exchange resource (Jarvenpaa and Staples 2000). However, researchers from the disciplines of IS and organizational behavior have started to view knowledge sharing through the lens of SET. Constant et al. (1994) employed some concepts from SET and social cognitive theory to study the factors that promote pro-social attitudes and encourage information and knowledge sharing in

technologically advanced organizations. Their theory goes beyond exchanges among friends and personal contacts to include organizationally remote strangers. Constant et al. found that pro-social attitudes mediate the relationship between rational self-interest and attitudes towards information sharing. Jarvenpaa and Staples (2000) extended Constant et al.'s ideas to study the use of electronic media for information sharing. They explored a wider range of antecedents than Constant et al. and found that organizational variables such as information culture and information ownership could predict use of collaborative media. Although both these studies drew a part of their reasoning from SET, they included a few benefit factors and no cost factors (that are a central concept of SET).

2.1.2. Social Exchange Theory versus Theories of IS Usage

Different models and frameworks have been developed to better understand IS usage behavior. Taylor and Todd (1995) identified two distinct directions in the research on IS usage. One of them investigates adoption and usage of information technology from a diffusion of innovation (DOI) perspective (Rogers 1983; Tornatzky and Klein 1982). The other line of research utilizes "intention-based" models that argue that behavioral intention predicts usage (Ajzen 1985). Antecedents of behavioral intention are then thoroughly explored further in these studies. We proceed to discuss why we chose to employ SET as a theoretical basis for our study rather than these theories of IS usage.

DOI theory focuses on characteristics of innovations as perceived by potential adopters, characteristics of individuals with reference to adoption behavior, and stages of adoption and diffusion of innovations (Rogers 1983). A number of different characteristics of innovations such as relative advantage, complexity, compatibility, observability, and

trialability are proposed as antecedents of adoption. In the context of our study, EKR cannot be considered as an entirely new innovation. Rather, EKR can be viewed as a combination of existing technologies e.g., codification, indexing, storage, and retrieval technologies, for which users may be familiar with the separate components. Therefore we did not feel that the characteristics of innovations and adopters as spelled out by DOI theory would be relevant to our study.

Two of the most popular and influential intention-based models are the Theory of Planned Behavior (TPB) (Ajzen 1985; Ajzen 1991) and the Technology Acceptance Model (TAM) (Davis 1989). TAM posits that two salient beliefs, Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), determine attitude towards using a technology. TPB posits that intention to use a technology depends on attitude towards the technology, subjective norms, and perceived behavioral controls. Both these theories take into account economic (e.g. PU) and cognitive (e.g. PEOU) considerations. However, social influences are only taken into account by subjective norms for TPB and constructs such as image and norms added to TAM (Venkatesh and Davis 2000). Concepts of obligation and reciprocity involved in longer-term relationships of knowledge sharing do not figure in TPB or TAM and its extensions.

Also, neither TAM nor TPB explicitly include the concept of costs that are central to SET and appear to be significant in the context of knowledge sharing. Costs as demotivators could be conceptualized as antecedents of PU and PEOU in applications of TAM. However this is rarely done (exceptions being the computer anxiety or avoidance construct (Venkatesh 2000; Moore and Benbasat 1995) and the implementation gap construct (Chau 1996)) since PU and PEOU are phrased in a positive manner and

therefore the tendency is to think of positive antecedents for these constructs. Costs could be included in TPB as antecedents of perceived behavioral control or as negative outcome evaluations (as antecedents to attitude) but here too the bias is towards positive antecedents (exceptions being the lack of knowledge, difficulty of use, fear of obsolescence, and high cost constructs in Venkatesh and Brown's study (2001)). Even if we are to choose TPB to explain usage of EKR (TAM are TPB are almost equally good in predicting usage but the decomposed TPB provides better description of antecedents for implementation of IS (Taylor and Todd 1995)), the large number of mandatory constructs in TPB does not allow us to explore the richness of antecedents which we are able to do using SET. SET, similar to rational choice theories (Elster 1986), links evaluation of costs and benefits directly to motivation and action (i.e. has less intervening constructs than the intention based models).

Several researchers have suggested that increasing the benefits and reducing the costs for contributing and seeking is important to encourage knowledge sharing using KMS (Goodman and Darr 1998; Markus 2001; Wasko and Faraj 2000). This corresponds with the premise of SET that people in an exchange behave in a manner that allows them to minimize their costs and maximize their benefits (Thibaut and Kelley 1986). Considering that knowledge sharing maps closer to social exchange than economic exchange and that SET directly takes into account the costs and benefits of exchange, we apply this theory to explain the usage of EKR for contributing and seeking knowledge. Further, SET is similar to rational choice theories (weighting of benefits versus costs) employed to explain a variety of behaviours (Elster 1986) but has the advantage of including concepts of obligation and reciprocity pertaining to carry over effects from one transaction to another in long term relationships.

2.2. Relevance of Social Capital Theory

It is acknowledged that the organizational and social context affects contributors and seekers motivation to exchange knowledge (Constant et al. 1996; Goodman and Darr 1998; Jarvenpaa and Staples 2000; Orlikowski 1993). There is also evidence that individuals superimpose a social context even in inanimate interactions with computers (Nass et al. 1999) (therefore such superimposition can be expected in interactions with EKR as well). While SET mainly considers individual actors in social exchanges, SCT emphasizes the resources embedded within networks of human relationships (Nahapiet and Ghoshal 1998). Social capital consists of both the network and the assets that may be mobilized through the network (Bordieu 1986). The theory posits that social capital facilitates the development of human capital by affecting the conditions necessary for knowledge exchange and combination to occur. Therefore we expect that SCT constructs would moderate the relationships between SET constructs and usage of EKR for knowledge sharing (i.e. determine the conditions under which these relationships are significant).

Particularly the relational dimension of social capital consisting of trust, norms, obligation, and identification, has been suggested to influence the motivation to combine and exchange knowledge (Nahapiet and Ghoshal 1998). Other dimensions of social capital are likely to influence access to exchange partners, anticipation of exchange value, and combination capability (see Figure 2.1.). Since obligation is conceptualized at an individual level through SET in our study, we employ the other three constructs from the relational dimension of SCT (i.e. trust, pro-sharing norms and identification) to reflect the organizational community context within which knowledge sharing occurs and study their

moderating impact on the relationship between cost and benefit factors and usage of EKR for knowledge contribution or seeking.

2.3. Social Exchange Theory

Similar to rational choice theories (Elster 1986), SET posits that individuals evaluate alternative courses of action so that they obtain the greatest benefit at lowest cost from any transaction (Hall 2001). The principle for predicting behavior can be expressed as (Molm 1997):

Behavior (Profits) = Rewards of interaction – Costs of interaction

However in social exchanges, unlike economic exchanges, the value of costs and rewards (benefits) are difficult to quantify.

Although SET started off by examining interdependence and power in dyads (Emerson 1962) and later networks (Cook et al. 1983), it has been extended in different directions by researchers over the years. Kelley and Thibaut (1977) used game-theoretic principles to develop their theory of interdependence based on SET. Molm (1997), Kollock (1994) and other researchers further elaborated on the different types of ties and types of dependence in social exchanges. In organizational contexts, SET has been applied to explain power, brokerage, reciprocity, and inequality in different contexts such as collaboration networks (Ahuja 2000), market competition (Podolny 1993), and workplace mobility (Podolny and Baron 1977). SET has also been applied to problems of inter-organizational trust (Gulati and Gargiulo 1999), generalized trust and collective dilemmas (Yamagishi and Cook

1993). Our research follows along this last stream of SET research that looks at why individuals may share resources without an exact expectation of return.

There are various forms of SET, but they all rely on the central concepts of actors, resources, structures and processes associated with their own assumptions as summarized in Table 2.1. In the terminology of Table 2.1., our actors are individual employees of organizations who may use EKR to contribute or seek knowledge, resources that we are investigating are the costs and benefits of using EKR to contribute or seek knowledge, and the structural context is a generalized exchange (Fulk et al. 1996) where the EKR serves as intermediary between the knowledge contributor and seeker. A contributor may also be a seeker and vice versa. The process is an exchange network (Molm 1997) where more than one connected exchange relation exists.

There are a several features of SET that make it appealing. First, the actor in SET can be a rational actor (according to micro-economic theory) or an operant actor (according to behavioral psychology). SET does not require the actor to be purely selfish or hedonistic. Therefore it allows for a more natural and realistic modeling of human actors. Second, SET agrees with motivational theories such as expectancy theory (Vroom 1964) and rational choice theories (Elster 1986) that have been successful in predicting human behavior in saying that actors behave according to the expectation of outcomes (positive or negative) that they will receive by performing a behavior.

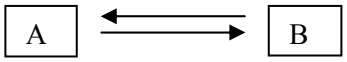
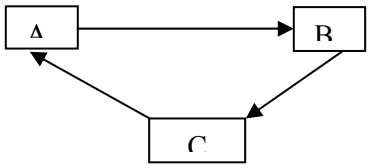
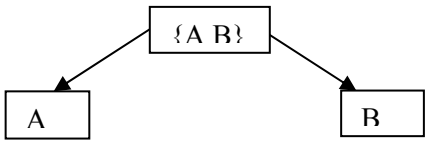
Concept	Assumption
Exchange	Mutual giving and receiving of valued outcomes by 2 actors
Actors	• Behave in ways that *increase* outcomes that they *positively* value (**benefits**) and *decrease* outcomes that they *negatively* value **(costs)** • Can be individuals or corporate groups such as a company acting as a single unit • Can be specific entities (such as a friend) or interchangeable occupants of structural positions (such as the CEO of Accenture)
Resources	• Act as the currency of exchange • Include *tangible goods and services* (such as money, gifts, or assistance), *intangible goods* (such as status, approval, or companionship) and *psychological gratification* (such as self-esteem and satisfaction) • When given to another the exchange resource is known as a **Cost** • When received or produced as a result of an exchange, the exchange resource is known as **Outcome**. Outcome can have a *positive* value (called reward, reinforcement, utility, or **benefit**) or *negative* value (called **cost**, punishment, disutility, or loss)
Structures	• Dependent relationships that support the exchange • Different types of exchange: ➢ **Direct Exchange** (two actors are dependent on one another)  ➢ **Generalized Exchange** (more than two actors and reciprocal dependence is indirect)  ➢ **Productive Exchange** (both actors must participate in order to benefit) 
Processes	• Describe how the interaction takes place within the exchange structure. • Three types of processes: ➢ **Exchange transaction**: When someone provides an occasion to initiate exchange (exchange opportunity) and the initiation is reciprocated. ➢ **Exchange relation**: An ongoing series of transactions between the same two actors. ➢ **Exchange network**: A set of two or more connected exchange relations.

Table 2.1. Concepts and Assumptions of SET (Derived from Molm 1997*)*

We now proceed to identify and describe the costs and benefits of knowledge contribution and knowledge seeking in EKR. These costs and benefits may not be unique to EKR users (i.e., some may also apply to other knowledge sharing situations) but they are identified as potentially relevant for EKR users. Furthermore, these costs and benefits are likely to vary for usage of different forms of KMS and direct sharing, as discussed in Section 1.3.

2.4. Classification of Costs

In SET, costs can be seen as negative outcomes resulting from the exchange process or resources to be given to exchange partners (refer to Table 2.1.). Costs have been classified in various ways in the economics and accounting disciplines. Common classifications include, fixed vs. variable costs, tangible vs. intangible costs, direct vs. indirect costs, marginal costs, sunk costs, as well as other methods of classification for specific applications. We have borrowed from the classification by Molm (1997) who conceptualized the costs incurred in social exchange as opportunity costs, investment costs, the actual loss of a material resource, or costs intrinsic to behavior itself.

The opportunity costs of exchange refer to "reward foregone" from alternative partners or behavior not chosen. Investments costs are costs associated with acquiring a certain kind of resource (e.g. cost of learning a skill). When a material is exchanged, the actors incur the actual loss of resource that is physically transferred. Finally, there are costs intrinsic to the performance of the exchange behavior such as fatigue and unpleasantness. Based on this framework of costs, we outline the costs of knowledge contribution to and knowledge seeking from EKR.

2.5. Contribution Costs

The opportunity cost of contributing knowledge is likely to depend on the time taken to contribute. If more time is taken up for knowledge contribution to EKR, this precludes the performance of any other alternative behavior during this time and the corresponding rewards or benefits accruing from that behavior. When a potential knowledge contributor needs to learn to use the EKR, this can be considered as an investment cost. Considering that EKR is typically not a new technology for most users and the main contribution effort goes towards codification, we did not consider learning cost separately.

When a knowledge contributor parts with his or her knowledge, he or she may perceive a loss of power associated with the knowledge he or she has shared. This can be considered as an actual loss of resource during the knowledge contribution. The time and effort required to contribute knowledge to EKR may also be thought of as an intrinsic cost for knowledge contributors (apart from being an opportunity cost). The costs perceived by a potential contributor, supported by previous literature, are further elaborated below.

2.5.1. Loss of Knowledge Power

It has been observed that employees may regard their knowledge as a source of power within the organization (Orlikowski 1993). Employees' knowledge and expertise can reflect on their value and influence in the organization. Since knowledge is perceived as a source of power, the possessors of knowledge may fear losing their power or their unique value if others know what they know (Davenport and Prusak 1998; Gray 2001; Thibaut and Kelley 1986). Potential knowledge contributors may keep themselves out of a

knowledge exchange if they feel they benefit more by hoarding their knowledge than by sharing it (Davenport and Prusak 1998). Thus loss of knowledge power may be considered as a cost by knowledge contributors.

2.5.2. Contribution effort

The act of knowledge contribution to EKR involves formulating or codifying the knowledge. This can entail costs to the contributor as an expense of time and effort (Ba et al. 2001; Constant et al. 1996; Markus 2001). Orlikowski (1993) observed a situation where consultants avoided knowledge contribution due to high opportunity cost. They were unwilling to use a Lotus notes based knowledge sharing system as this would have required them to incur "non-chargeable" hours or to give up their personal time. Apart from the codification cost (particularly for more tacit forms of knowledge), there are additional costs of indexing the knowledge or creating the metadata for storage into EKR. Additional requests for clarification and assistance accompanying knowledge contribution can also increase the contribution effort (Goodman and Darr 1998).

2.6. Seeking Costs

We use the same framework employed for contribution cost classification to classify seeking costs. The opportunity cost of seeking knowledge from EKR depends on the availability of the required knowledge via any other lower cost means. The opportunity cost for seekers is therefore likely to depend on the time taken to search for the requisite knowledge from EKR. As for the case of knowledge contributors, we did not separately consider the investment cost for knowledge seekers to learn to use the EKR. The time and

effort required to seek knowledge from EKR may be thought of as an intrinsic cost for knowledge seekers in addition to being an opportunity cost.

According to SET, recipients of knowledge may experience an obligation cost. Blau (1964) notes that an individual who supplies rewarding services to another obligates him. To discharge this obligation, the second person must furnish benefits to the first in turn. Till the obligation is discharged, obligation cost will be incurred. Obligation cost is a negative outcome knowledge professionals may perceive of seeking knowledge from EKR. Although seekers may not be identified by contributors, seeking from EKR is observable and seekers know it is observable. Therefore they may experience a generalized form of obligation i.e., not to the specific contributor but to the community of users at large. The costs perceived by a seeker, supported by previous literature, are further elaborated below.

2.6.1. Seeker Effort

Knowledge seeking from EKR involves formulating a query and searching (refining the query) till satisfactory results are obtained or the seeker decides to give up search. Knowledge seeking can entail costs to the seeker as an expense of time and effort (Goodman and Darr 1998; Constant et al. 1996; Markus 2001). Information retrieval and IS literature reveal various parameters that increase or decrease search cost and affect system usage (Klein 1998). These include individual characteristics, system parameters and task characteristics. We can anticipate that these factors will impact the effort involved in seeking knowledge from EKR. However for the purpose of this study, we are not interested to study the effects of these factors on seeker effort but rather to investigate

how seeker effort relates to EKR usage. We conceptualize seeker effort in terms of the perception of time taken to formulate and refine the query and evaluate the search results.

2.6.2. Future Obligation

A condition of social exchange is that individuals must release their debts or discharge their obligations for having received help in the past, in the interest of continuing to receive help in the future. If they do not do so they may meet with sanctions from the community e.g., denial of help (Blau 1964). Thus knowledge seekers may feel an obligation to repay back in the future if they seek (receive help) now (Constant et al. 1996; Kollock 1999; Wasko and Faraj 2000). We refer to this cost, that seeking from EKR will entail the need to repay back in the future, as future obligation. Obligation in such generalized exchange situations is diffuse and unspecified in nature i.e., the mode of repayment is not fixed to an individual or time period.

2.7. Classification of Benefits

According to SET, rewards or benefits are produced by providing outcomes of positive value (Molm 1997). Below we discuss several concepts related to classifying benefits. The purpose of classifying benefits (as also for classifying costs) is to ensure that all types of benefits are considered and also to potentially be able to infer conclusions about the influence of different types of benefits on EKR usage. Benefits can be considered as motivators since a person may be moved towards a behavior by the expectation of positive outcome by performance of the behavior. An important way to classify motivators is to distinguish between intrinsic versus extrinsic motivation. Another classification that we

present here is the distinction between hedonic, utilitarian, and social outcomes. This classification has been employed in the IS literature to explain personal computer adoption in homes (Venkatesh and Brown 2001).

2.7.1. Extrinsic versus Intrinsic Motivation

Motivation theory suggests that there are two main classes of motivators: extrinsic and intrinsic (Deci and Ryan 1980; Vallerand 1997). Extrinsic motivation pertains to a means-end relationship where the motivator is not an end in itself but serves as a means to an end. Extrinsic motivation comes from external sources and the rewards (e.g., money) serve as a means to other ends (e.g., purchasing a desired product). Intrinsic motivation is the pleasure and satisfaction derived from a specific behavior. Intrinsic motivation comes from within the individual and is sought as an end in itself e.g. appreciating a beautiful painting. A significant body of research has established extrinsic and intrinsic motivation as primary drivers of behavior in several domains (Vallerand 1997), including technology adoption and usage (Davis et al. 1992; Venkatesh and Speier 1999; Venkatesh and Brown 2001) and knowledge sharing (Osterloh and Frey 2000).

2.7.2. Utilitarian, Hedonic, and Social Outcomes

Several researchers in consumer behavior (Babin et al. 1994; Batra and Ahtola 1990; Dhar and Wertenbrooh 2000) have suggested that consumer value could be assessed on two important dimensions: utilitarian value and hedonic value. Utilitarian value results from the conscious pursuit of an intended goal. It is characterized by an emphasis on utility,

rationality, and task-relatedness. In the IS literature, utilitarian outcomes are related to use-productivity contingency constructs such as relative advantage and perceived usefulness that have emerged as the strongest predictors of IS adoption and usage (Igbaria et al. 1997; Davis 1989). For example, the utilitarian outcomes of personal computer adoption at home include application for personal use, utility for children, and utility for work-related use (Venkatesh and Brown 2001).

Consumer behavior research describes hedonic value as the pleasure derived from the consumption, or use, of a product (Babin et al. 1994; Hirschman and Holbrook 1982). Hedonic value is more subjective than utilitarian value and includes feelings of fun, pleasure, and excitement. It is mainly affective in nature. In the IS literature hedonic outcomes that have been studied include perceived enjoyment as an antecedent of IS usage (Venkatesh 2000) and applications for fun (e.g. computer games and music) as an antecedent of PC adoption (Venkatesh and Brown 2001).

A third type of outcome is social outcomes (Tauber 1972; McCracken 1988; Fisher and Price 1992). As opposed to utilitarian and hedonic outcomes that only involve one-self, social outcomes need others to be realized. Social outcomes can be extrinsic or intrinsic in nature. Examples of extrinsic social outcomes include gain in status or image while an intrinsic social outcome is altruism. Among social outcomes, image has been well studied in the IS usage literature (Karahanna et al. 1999; Moore and Benbasat 1991; Venkatesh and Davis 2000).

The second classification is related to the first classification in that utilitarian outcomes are related to extrinsic motivation while hedonistic outcomes are related to intrinsic motivation (Venkatesh and Brown 2001). Social outcomes can be either extrinsic or intrinsic motivators but depend on others to be realized. Since the second classification can be subsumed under the first, we used the first classification (extrinsic versus intrinsic benefits) to enumerate and classify the positive outcomes of EKR usage for knowledge contribution and knowledge seeking.

2.8. Contribution Benefits

In Table 2.2. below we classify the potential benefits perceived by knowledge contributors to EKR. These rewards have been identified based on SET and KM literature.

Extrinsic	***Intrinsic***
• **Economic Rewards** • **Image** • **Reciprocity Benefit**	• **Knowledge Self-Efficacy** • **Enjoyment in helping others**

Table 2.2. Typology of Contribution Benefits

The benefits are classified as extrinsic versus intrinsic. The extrinsic outcomes include economic rewards, image, and reciprocity benefit. The intrinsic benefits include knowledge self-efficacy and enjoyment in helping others. Each of these benefits is elaborated below.

2.8.1. Economic Reward

The most explicit or tangible reward systems for knowledge sharing are those that involve economic incentives such as increased pay, bonuses, job security, or career advancement (Ba et al. 2001; Beer and Nohria 2000; Hall 2001). Economic incentives act as extrinsic motivators because they serve as a means to other ends such as a better lifestyle. The American Productivity Quality Center's website provides examples of reward schemes for knowledge sharing in organizations (APQC 2001). Several consulting companies have made knowledge sharing one of the basic criteria of employees' performance evaluation (Davenport and Prusak 1998). There are also instances where longer term or more secure job prospects are awarded to employees who contribute knowledge more (Hall 2001).

2.8.2. Image

In most businesses today, the importance of reputation is increasing as the old social contracts between firm and worker based on length of service and loyalty erode (Ba et al. 2001; Davenport et al. 1998). Knowledge contributors may want to show off and let others know that they are knowledgeable people with valuable expertise (Ba et al. 2001). As an expression of self and of self-consistency, sharing expertise could have the personal benefit of earning respect from others (Constant et al. 1994) and a better reputation (Constant et al. 1996).

Providing high quality knowledge and impressive technical details in one's writings can work towards increasing one's prestige in the workplace (Kollock 1999). At the same time any errors or omissions in contributions could result in a negative image or reduction of

status. Either way, the nature of online sharing allows contributions to be visible to a larger community and the corresponding effects on image to be stronger for EKR contribution than for the case of direct knowledge sharing (Kollock 1999).

2.8.3. Reciprocity Benefit

A motivational mechanism in operation for contributions to discretionary databases is reciprocity (Connolly and Thorn 1990). Reciprocity is a central concept in SET (Blau 1964). It can act as a potential benefit for knowledge contributors in that a person who contributes may expect that he or she will receive useful help in return when he or she needs it (Connolly and Thorn 1990; Davenport and Prusak 1998; Kollock 1999). Unlike the case of direct reciprocity where people expect to receive future help from the same individuals they helped before, previous research (Wasko and Faraj 2000) suggests that people who share their knowledge in online communities may believe in generalized reciprocity in the context of generalized exchange. In generalized reciprocity, help given to one person may be reciprocated by someone else (not necessarily by the original recipient of help) (Ekeh 1974).

2.8.4. Knowledge Self-efficacy

Self-efficacy is defined as, "People's judgment of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with the judgments of what one can do with whatever skills one possesses" (Bandura 1986, pg. 391). As an expression of self and self-consistency, sharing expertise can have a potential benefit of increasing self-efficacy

(Constant et al. 1994). We refer to self-efficacy with respect to job-related expertise as knowledge self-efficacy. An individual's judgment of his or her capabilities to contribute knowledge beneficial to the organizational performance can act as a self-motivational force (Bock and Kim 2002). In this sense, knowledge self-efficacy is related to the concept of instrumentality where employees may believe that *their* knowledge could help solve important problems (Constant et al. 1996) and improve organizational efficiency, learning, innovation and flexibility (Ba et al. 2001).

2.8.5. Enjoyment in Helping Others

This benefit is derived from the concept of altruism. Altruism is defined as, "An aspect of human motivation that is present to the degree that the individual derives intrinsic satisfaction or psychic rewards from attempting to optimize the intrinsic satisfaction of one or more other persons without conscious expectation of participating in an exchange relationship whereby those "others" would be obligated to make similar or related satisfaction optimization in efforts in return" (Smith 1981). Altruism makes one who practices it "feel good" i.e. receive psychic rewards for him or herself. Given that there is no absolute altruism, no absolute lack of concern for self in the net motivation for any act, there can only be relative altruism (Smith 1981). A point to note here is that if there was pure altruism then there would be no expectation of reciprocity.

Knowledge contributors may be motivated in part by some degree of altruism based on a natural impulse to help others (Davenport and Prusak 1998). Previous research shows that knowledge providers may gain pleasure by demonstrating their own altruistic and pro-

social behavior (Wasko and Faraj 2000). They may wish for good outcomes not only for themselves but also for other employees (Ba et al. 2001). Similar observations are made by Constant and colleagues (1994; 1996).

2.9. Seeking Benefits

A classification of the potential benefits experienced by knowledge seekers from EKR is shown in Table 2.3. For knowledge seekers the need and motivation to use EKR is usually more obvious than for knowledge contributors. An important extrinsic motivator may be the utility of results from EKR (synonymous to the perceived usefulness construct of TAM). As for the case of knowledge contributors, economic rewards may serve as extrinsic motivators for knowledge seekers. An intrinsic reward for seekers is knowledge growth. Now we will discuss each of these benefits in detail.

Extrinsic	*Intrinsic*
• **Economic Rewards** • **Perceived Utility of Results**	• **Knowledge Growth**

Table 2.3. Typology of Seeker Benefits

2.9.1. Economic Reward

As in the case of economic rewards for knowledge contributors, economic rewards may be offered to knowledge seekers to overcome barriers to knowledge reuse (Ba et al. 2001). These rewards could include monetary rewards such as salary increment, bonus, stock options, one-time cash awards, career advancement (which may also be linked to monetary rewards), and job security (e.g. becoming stakeholders in top management or having sustained relationships with clients and customers) (Hall 2001). The main rationale

for organizations to use economic rewards to motivate knowledge seekers is to counteract the costs of seeking (see Section 2.6.) and thereby allow economic reuse of organizational knowledge.

2.9.2. Perceived Utility of Results

A major motivation for knowledge seekers appears to be the usefulness of results obtained from EKR (Goodman and Darr 1998). Kankanhalli et al. (2001) report that perceived output quality serves as an important antecedent of seeker usage of EKR. EKR output that is of high quality i.e. current, relevant to their job, and accurate, can motivate seekers since it allows them to accomplish their task more effectively. Constant et al (1996) employ usefulness of reply as the indicator of how beneficial seekers find electronic ties. Wasko and Faraj (2000) report that a tangible return for knowledge seekers in Usenet groups is the usefulness or value of the responses. The usefulness is likely to be related to the relevance, accuracy, and timeliness of the answer (Markus 2001; Wasko and Faraj 2000).

2.9.3. Knowledge Growth

An intrinsic benefit of knowledge seeking is knowledge growth (Hall 2001). Seekers like to benefit from other's experience as a substitute for their own personal experience (Wasko and Faraj 2000). Knowledge growth can be seen as a benefit separate from utility of results in that people may search EKR for the sake of learning something new or satisfying their curiosity about a topic. The learning and knowledge acquisition that may

take place as a result of knowledge seeking can lead to the intrinsic satisfaction of becoming more knowledgeable (Wasko and Faraj 2000).

2.10. Social Capital Theory

2.10.1. General Concept

Social capital is defined as, "the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit" (Nahapiet and Ghoshal 1998, pg. 243). Whereas physical capital refers to physical objects and human capital refers to the properties of individuals, social capital refers to connections among individuals (social networks) and the value that arises from them. Social capital thus consists of both the network and the assets that may be mobilized through the network (Bordieu 1986).

The term social capital first appeared in community studies as a basis for cooperation and collective action for communities (Jacobs 1965). It also appeared in the context of family relationships supporting an individual (Loury 1977). Increasingly the concept is been studied for its impact on the development of human capital (Coleman 1988; Loury 1987) and consequently on the economic performance of firms (Baker 2000), geographic regions (Putnam 1995) and countries (Fukuyama 1995). Some of the benefits of social capital claimed for organizations include (Cohen and Prusak 2001): better knowledge sharing, lower transaction costs both within the organization and with external partners, low

turnover rates that reduce severance costs and hiring and training expenses, and greater coherence of action due to organizational stability and shared understanding.

2.10.2. Social Capital Dimensions

Three dimensions of social capital are outlined in the literature (Nahapiet and Ghoshal 1998): structural, cognitive, and relational. All the dimensions are logically different but related to each other (see Figure 2.1.).

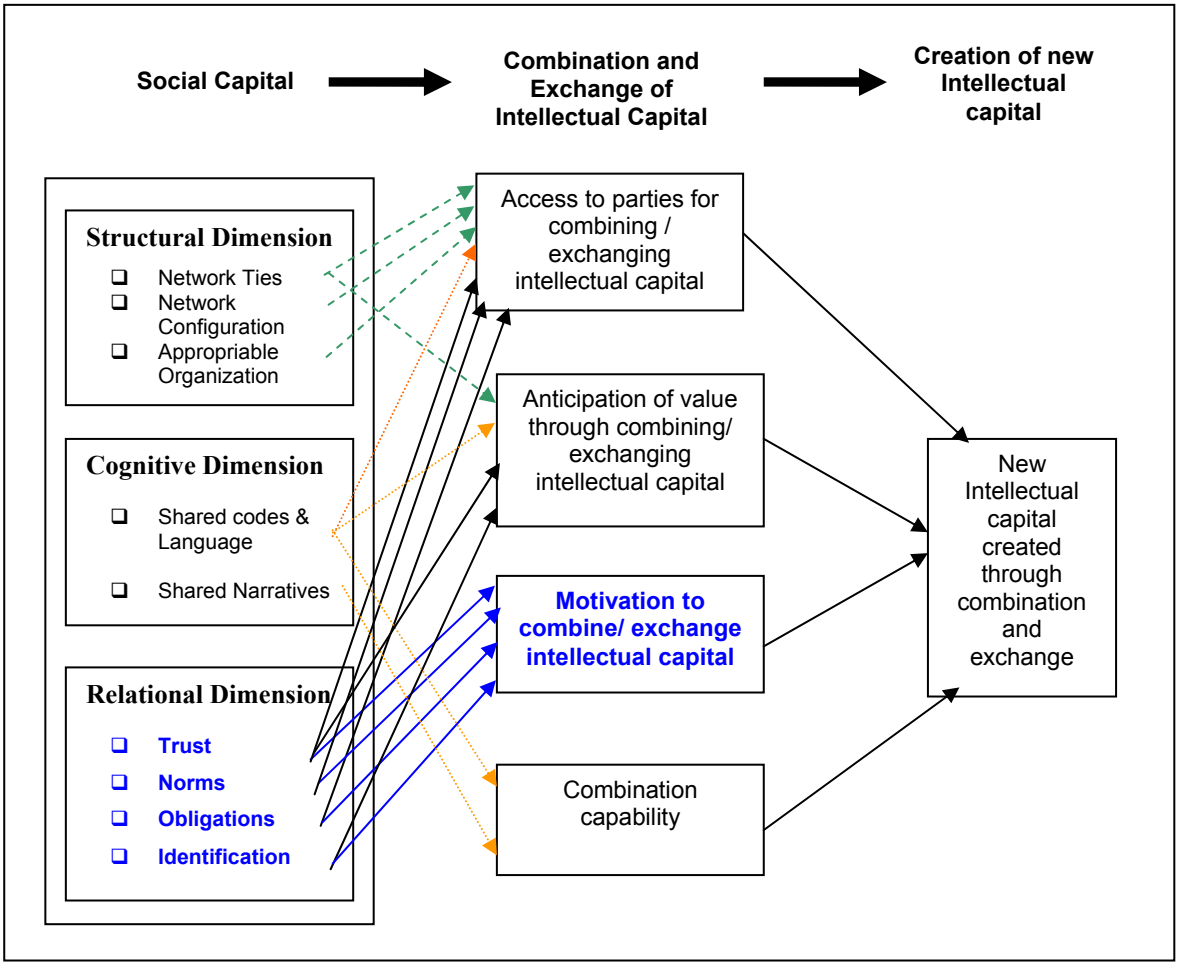


Figure 2.1. Social Capital in the Creation of Intellectual Capital

(Nahapiet and Ghoshal 1998, pg. 251)

The structural dimension of social capital refers to the overall pattern of connections between actors. It deals with the properties of the social system and the network of relations as a whole. It is about whom people can reach through the network and how they can be reached (Nahapiet and Ghoshal 1998). The cognitive dimension refers to the cognitive resources providing shared representations, interpretations, and systems of meaning among parties (Nahapiet and Ghoshal 1998). Examples of these resources including shared language and codes, and shared narratives.

The relationship between social capital and intellectual capital highlights the significance of the relational dimension of social capital (Nahapiet and Ghoshal 1998; Szulanski 1996). The term "relational embeddedness" describes the personal relationships that people have developed with others through a history of interactions. This concept focuses on the particular relations that people have such as respect and friendship that influence their behavior. It is through these ongoing personal relationships that people fulfill social motives such as sociability, approval and prestige. The key facets of this dimension are trust, norms, obligation, and identification (Nahapiet and Ghoshal 1998).

2.10.3. Social Capital and Knowledge Sharing

Before applying SCT to the context of knowledge sharing through EKR we need to clarify two issues: (1) the appropriateness of SCT to online organizational communities (e.g. users of EKR), and (2) overlapping concepts in SET and SCT. Regarding the first issue, the relational dimension of SCT originally referred to networks of personal relationships fostered through a history of face-to-face interactions. However, several researchers (e.g. (Cohen and Prusak 2001) and (Baker 2000)) have extended the concept to include online

interactions as well as face-to-face interactions. They suggest that people interacting online can develop feelings of connectedness and support and add value to each other. Several virtual community researchers (e.g., Rheingold 2000) also point to the development of social ties when online interactions are sustained long enough. Based on such reasoning, our use of SCT is in the context of EKR user communities that consist of open (where people may enter or leave at any time (Yamagishi and Cook 1993)) electronic networks of weak ties.

Regarding the second issue, it can be seen that there is an overlap of two concepts between SET and the relational dimension of SCT i.e. obligation and reciprocity. Which theory do we chose to explain these concepts, SET or SCT? In our study we conceptualized reciprocity as an individual level benefit of knowledge contribution and obligation as an individual level cost of knowledge seeking based on SET since we felt that these concepts would operate at the individual level of exchange. However the interpretation of these constructs in SCT as features of the community (i.e. norms of reciprocity and obligation) is not likely to conflict with our SET based interpretation since majority of individuals' perceptions of obligation and reciprocity are likely to agree with community level norms of these concepts.

Organizational social capital can provide individuals with a rationale for deferring their immediate individual interests in favor of longer-term group and organizational goals (Leana and Van Buren 1999). In the KM literature, a few researchers have suggested similar ideas without explicitly referring to SCT or applying its concepts. Jarvenpaa and Staples (2000) extended the work by Constant et al. (1994) in support of this view. They

claim that the stronger the influence of the social and organizational context, the less likely people's behavior is driven strictly by task or personal determinants of information and knowledge sharing and more likely by social and organizational determinants. In line with these observations, we conceptualized three components of the relational dimension of social capital (trust, pro-sharing norms, and identification) as moderators that govern the conditions under which the individual cost and benefit factors would impact EKR usage for knowledge contribution and seeking. Each of these three components is discussed below.

2.10.4. Generalized trust

Trust is a concept that has become widely popular and attracted attention from a variety of disciplines. A definition of trust employed in the social capital literature (Nahapiet and Ghoshal 1998) is "the belief that the results of somebody's intended action will be appropriate from our point of view" (Mistzal 1996, pg. 9-10). According to Mishra (1996), trust is multidimensional and indicates willingness to be vulnerable to other people arising from the confidence and belief in their: (1) good intent and concern, (2) competence and capability, (3) reliability, and (4) perceived openness. McKnight and colleagues (1998) term the first three of these trusting beliefs as benevolence belief, competence belief, and honesty and predictability belief respectively and note that these are the most common trust beliefs cited in the literature. In our study, the perceived openness belief is subsumed under pro-sharing norms and therefore is not included as a constituent of trust.

SCT employs a perception of generalized trust that is different from trust in a specific individual. In his discussion of social capital, Putnam (1993) describes this kind of impersonal or indirect trust that does not rest with the knowledge of a particular individual but rests on behavior that is generalized to a social unit as a whole. An individual may be trusted without the other party having much personal knowledge of or interaction with him or her. This type of trust is deemed appropriate within the context of sharing knowledge through EKR where knowledge contributors or seekers may not know their knowledge exchange partner, but can place their generalized trust on the group of people who are users of EKR.

Trust has been viewed as a key aspect of organizational context and as an antecedent of cooperation (Tsai and Ghoshal 1998). Trust may improve the effectiveness of knowledge exchange by reducing both transaction costs (i.e. by replacing contracts with handshakes) and agency risks (i.e. by replacing the fear of avoidance of obligation and mis-interpretation with mutual confidence) (Adler 2001). Without trust, knowledge initiatives may fail regardless of how thoroughly they are supported by technology and rhetoric (Davenport and Prusak 1998). For example, consultants at Ernst and Young declined to contribute knowledge to EKR because they were concerned that their contributions would not be used appropriately (Markus 2001).

2.10.5. Pro-Sharing Norms

According to Coleman (1990), a norm represents a degree of consensus in the social system. A norm exists when the socially defined right to control an action is held by the

community and not by the actor (Coleman 1990). Previous KM literature shows that pro-sharing norms that can enhance the exchange of intellectual capital are norms of teamwork (Starbuck 1992), collaboration and sharing (Goodman and Darr 1998; Jarvenpaa and Staples 2000; Orlikowski 1993), willingness to value and respond to diversity, openness to criticism, and tolerance for failure (Leonard-Barton 1995).

Norms of cooperation and collaboration may have significant influence on exchange processes (Nahapiet and Ghoshal 1998) by enhancing the motivation to engage in the exchange of knowledge. Conversely, previous studies found that the reluctance to use KM technology for knowledge sharing was sometimes caused by incompatibility between collaborative nature of the technology and the individualistic and competitive nature of the organizational culture (Orlikowski 1993). In organizations that value individual expertise over knowledge sharing i.e. lack pro-sharing norms, there may be less motivation to exchange problems and solutions, thus making knowledge transfer difficult (Goodman and Darr 1998; Orlikowski 1993).

Norms of willingness to respond to diversity, openness to criticism, and tolerance for failure can be crucial to promote knowledge sharing. In environments that allow risk taking or experimentation, there is "greater openness to the potential for value creation through exchange" (Nahapiet and Ghoshal 1998). One of the reasons cited for organizational members not to share knowledge is because they are afraid that they may be penalized for errors or divergent views expressed during knowledge sharing (Davenport and Prusak 1998).

2.10.6. Identification

Identification is defined as "a process of internal and external persuasion by which the interests of an individual merge with the interests of an organization resulting in the creation of identification based on that interest" (Johnson et al. 1999). Three components of identification have been identified: similarity of values, membership, and loyalty towards one's organization (Patchen 1970). Similarity has been defined as mutually perceived joint goals and interests with the other members in the organization. Membership is defined as the degree to which one's self-concept is linked to the organization, while loyalty refers to the employee's support and defense of the organization. Cheney and Christensen (2000) note that organizational identification has been linked to a variety of organizational phenomena such as motivation and organizational effectiveness. Individual outcomes associated with greater identification include enhancement of a feeling of belonging and security (Wiener and Vardi 1980).

Identification has been found to be positively related to pro-social behaviors (O'Reilly and Chatman 1986). Identification with a group can enhance the concern for collective processes and outcomes. Because of the attachment or commitment one has to the group, one may contribute to the group because that is what is best for the group (Johnson et al. 1999). Nahapiet and Ghoshal (1998) suggest that identification with the organization heavily influences communications and exchanges among people. It can act as a resource influencing both the anticipation of value to be achieved through combination and exchange and the motivation to combine and exchange knowledge (see Figure 2.1.). Faced with a request for help, those who have high identification would be concerned with issues

such as how much their help is needed, how useful they can be to others, and how their advice might solve organization problems (Constant et al. 1996).

With the identification of theories and constructs from prior literature that are relevant to our study in this chapter, we proceed to develop models to explain and predict the usage of EKR for knowledge contribution and knowledge seeking.

Chapter 3

Research Models and Hypotheses

This chapter describes the research models and hypotheses for the usage of EKR for contributing and seeking knowledge. We first describe the model for knowledge contribution followed by its direct and moderating hypotheses. The second half of the chapter describes the model for knowledge seeking along with its direct and moderating hypotheses.

3.1. Research Model for Knowledge Contribution

The research model to explain usage of EKR for contributing knowledge is depicted in Figure 3.1. The constructs from SET and SCT that may affect usage of EKR to contribute knowledge are integrated in the research model. All independent variables are derived from SET and KM literature and grouped as individual factors. The dependent variable is the usage of EKR for contributing knowledge. Relationships between certain independent variables and the dependent variable are hypothesized to be moderated by specific social capital factors. A more detailed description of the different factors is provided in the following sections.

3.1.1. Individual Factors

Previous studies have emphasized the importance of individual factors in determining knowledge sharing behavior (Constant et al. 1994; Markus 2001; Orlikowski 1993). Based on our synthesis of literature, the costs of using EKR to contribute knowledge (loss of knowledge power and contribution effort) and the benefits of using EKR to contribute

knowledge (economic reward, image, reciprocity benefit, knowledge self-efficacy, and enjoyment in helping others) are specified as individual variables in the research model.

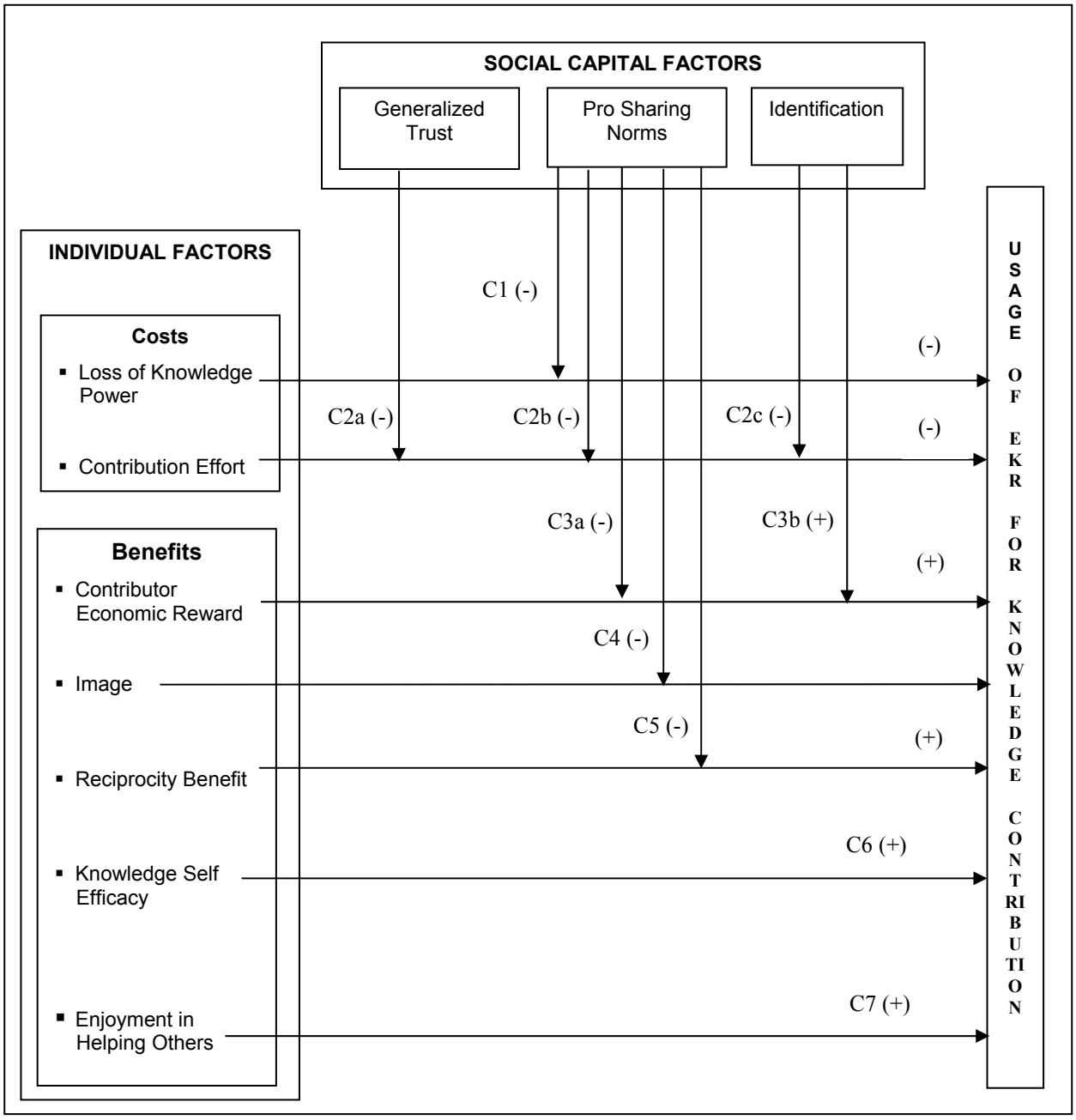


Figure 3.1. Research Model for Usage of EKR for Knowledge Contribution

3.1.2. Social Capital Factors

Studies have highlighted the importance of social capital factors in influencing the leveraging of organizational knowledge resources (Cohen and Prusak 2001; Nahapiet and Ghoshal 1998). Based on our review of previous research, we identified three components of the relational dimension of social capital (i.e. generalized trust, pro-sharing norms, and identification) as the factors that may moderate the relationships between individual factors and usage of EKR for knowledge contribution. Each social capital factor was considered in combination with each individual factor to ensure if a moderating effect was likely or not.

3.2. Research Hypotheses for Knowledge Contribution

Hypotheses about the relationships between constructs are presented in this section together with the reasoning supporting them.

3.2.1. Loss of Knowledge Power

By contributing some part of their unique knowledge to an EKR, employees give up sole claim to the benefits stemming from that knowledge (Gray 2001). All else remaining equal, the knowledge contributor thus retains less proprietary knowledge upon which to argue his or her unique value to the firm. This in turn may reduce the employee's power position in relation to his or her employer, making him or her more replaceable. Hickson et al (1971) argue that uniqueness is a key aspect of organizational power as the lower the substitutability of the activities of the individual, the greater is his or her power. The same arguments are echoed by a number of researchers in economics (Williamson 1975) and organization strategy (Mintzberg 1973; Pfeffer 1992). The KM literature reports the loss

of power due to contribution of unique knowledge as a barrier to knowledge sharing (Davenport and Prusak 1998; Orlikowski 1993).

Reasoning based on SCT, we expect the negative relationship between loss of knowledge power and EKR usage for knowledge contribution to be moderated by pro-sharing norms. Pro-sharing norms as a component of the relational dimension of social capital consist of norms of cooperation and collaboration, norms of responding to diversity, and norms of openness to conflicting views. When norms of cooperation and collaboration prevail, the barriers to knowledge transfer witnessed in cultures that value personal technical expertise and knowledge creation are weakened (Jarvenpaa and Staples 2000). If other employees are seen to be sharing their knowledge then the deterrent effect of the loss of knowledge power (which is relative to other employees) on EKR usage is likely to be less for any contributor. Therefore, we hypothesize,

C1: The negative relationship between loss of knowledge power and usage of EKR for knowledge contribution will be weaker under conditions of high pro-sharing norms.

3.2.2. Contribution effort

The act of codifying knowledge and entering it into an EKR serves as an expense of time and effort to knowledge contributors (Ba et al. 2001; Constant et al. 1996; Goodman and Darr 1998; Markus 2001). When time demands for knowledge contribution are large, they can deter knowledge sharing (O'Dell and Grayson 1998; Orlikowski 1993). Effort is analogous to the perceived ease of use (PEOU) construct which has been observed as a significant predictor of technology adoption (Agarwal 2000). However, there may be various contextual factors that influence this deterrent effect. Reasoning based on SCT, we

expect the negative relationship between contribution effort and usage of EKR for knowledge sharing to be moderated by generalized trust. High trust implies belief in the good intent and concern of others, which from the point of view of knowledge contributors may mean that knowledge recipients will give them credit for knowledge contributed. Therefore, in a high trust atmosphere, knowledge contributors may be prepared to put in more effort towards knowledge contribution since they may perceive that appropriate credit will be given to them. Thus we hypothesize,

C2a: The negative relationship between contribution effort and usage of EKR for knowledge contribution will be weaker under conditions of high generalized trust.

In the presence of high pro-sharing norms, it can be expected that the majority of employees will collaborate and cooperate with each other. If a knowledge contributor perceives that other colleagues are contributing knowledge and that is the sanctioned behavior of the community, he or she may be motivated to contribute despite the effort required to contribute. Therefore, we expect the deterrent effect of contribution effort to be reduced under conditions of high pro-sharing norms. We hypothesize,

C2b: The negative relationship between contribution effort and usage of EKR for knowledge contribution will be weaker under conditions of high pro-sharing norms.

Under conditions of high organizational identification, individuals would choose the behavior which best promotes the perceived interests of the organization (Johnson et al. 1999). When employees experience high levels of alignment (similarity of values) and membership with the organization, they may be motivated to contribute knowledge regardless of the effort they need to expend for contribution. Therefore, we postulate,

C2c: The negative relationship between contribution effort and usage of EKR for knowledge contribution will be weaker under conditions of high identification.

3.2.3. Contributor Economic Reward

In order to overcome the costs of contribution, organizations may need to create various reward mechanisms to encourage employees to share their knowledge. Tangible rewards may include money, promotions, and substantial gifts (Beer and Nohria 2000; Hall 2001). These could be tied to formal measures of knowledge contribution and performance appraisal. In a number of consulting firms and other organizations, extrinsic rewards have been found to promote contribution to shared knowledge repositories (Markus 2001). However, the positive relationship between economic rewards and usage of EKR for contributing knowledge is likely to be moderated by contextual factors.

SCT suggests that collaboration and cooperation norms may provide significant influence that can ensure the motivation to exchange knowledge (Nahapiet and Ghoshal 1998). If such norms by themselves provide substantial motivation for knowledge contributors, the need for extraneous benefits such as economic rewards may be less in high pro-sharing norm environments. Thus, we postulate,

C3a: The positive relationship between contributor economic rewards and usage of EKR for knowledge contribution will be weaker under conditions of high pro-sharing norms.

Contrary to the effect of pro-sharing norms, when identification is high, the effect of economic rewards on knowledge contribution to EKR is likely to be stronger. In other words, conditions of strong identification with the organization can reinforce the positive effect of economic incentives as people feel more inclined to contribute. Thus, we postulate,

C3b: The positive relationship between contributor economic reward and usage of EKR for knowledge contribution will be stronger under conditions of high identification.

3.2.4. Image

An important reward for contributing knowledge could be an enhancement in the reputation or status of the knowledge provider (Hall 2001; Kollock 1999). Employees have been found to share their best practice because of a desire to be recognized by their peers as key contributors or experts (O'Dell and Grayson 1998). To the extent that the contribution is visible to the organizational community and they gain respect for their knowledge, people are likely to contribute their knowledge to EKR. In the presence of high pro-sharing norms however, the need for extrinsic benefits like enhanced image is likely to be reduced. On the other hand, knowledge contributors may experience a reduction in their image if there are any mistakes or errors in their contribution to EKR. In such situations, the presence of strong pro-sharing norms that imply tolerance for failures and mistakes could alleviate the problem. Hence, we postulate,

C4: The relationship (positive or negative) between image and usage of EKR for knowledge contribution will be weaker under conditions of high pro-sharing norms.

3.2.5. Reciprocity Benefit

A person may be motivated to contribute knowledge to the group in the expectation that he or she will receive useful help in return in the future (Connolly and Thorn 1990; Davenport and Prusak 1998; Kollock 1999). This motivation is caused by anticipated reciprocity. In a generalized exchange, those who help others are likely to be taken care of by the community. In fact, researchers have observed that people who regularly helped others in a virtual community seemed to receive help more quickly when they asked for it (Rheingold 2000).

Reasoning from SCT, we expect that when norms of collaboration and cooperation are strong then the need for others to reciprocate knowledge contributions may be reduced. Since norms of knowledge sharing already exist, the need for direct reciprocation may not exist since people may help each other anyway. Thus, we hypothesize,

C5: The positive relationship between reciprocity benefit and usage of EKR for knowledge contribution will be weaker under conditions of high pro-sharing norms.

3.2.6. Knowledge Self Efficacy

People may want to contribute their knowledge because of a sense of self-efficacy, that they are able to make a difference to their environment or organization (Kollock 1999; Wasko and Faraj 2000). Likewise, if individuals feel that they lack knowledge that is useful to their organization, they may decline from using EKR to contribute knowledge since their contribution would not have a beneficial impact for others in the organization. We do not expect the effect of knowledge self-efficacy on EKR usage to be moderated by

social capital factors since the benefit is likely to be a strong enough motivation on its own. Thus, we postulate,

C6: Knowledge self-efficacy is positively related to usage of EKR for knowledge contribution.

3.2.7. Enjoyment in Helping Others

Review of previous research shows that a reason why individuals may like to share their knowledge is because they enjoy helping people (Constant et al. 1994; Constant et al. 1996) or gain pleasure by demonstrating their own altruistic and pro-social behavior (Wasko and Faraj 2000). We do not expect the effect of enjoyment in helping others on EKR usage to be moderated by social capital factors since this benefit is likely to be an intrinsic reward independent of such conditions. Therefore, we postulate,

C7: Enjoyment in helping others is positively related to usage of EKR for knowledge contribution.

3.3. Research Model for Knowledge Seeking

The research model to explain usage of EKR for knowledge seeking is depicted in Figure 3.2. The elements of SET and SCT that may affect usage of EKR to seek knowledge are integrated in the research model. As in the case of the knowledge contribution model, all independent variables are derived from SET and KM literature and grouped as individual factors. The dependent variable is the usage of EKR for knowledge seeking. Relationships between the independent variables and the dependent variable are hypothesized to be moderated by social capital factors. A more detailed description of the different factors is provided in the following sections

3.3.1. Individual Factors

Previous studies have emphasized the importance of individual factors in determining knowledge seeking behavior (Goodman and Darr 1998; Markus 2001). Based on our literature review, the costs of using EKR to seek knowledge (seeker effort and future obligation) and the benefits of using EKR to seek knowledge (economic reward, perceived utility of results, and knowledge growth) are specified as individual variables in the research model.

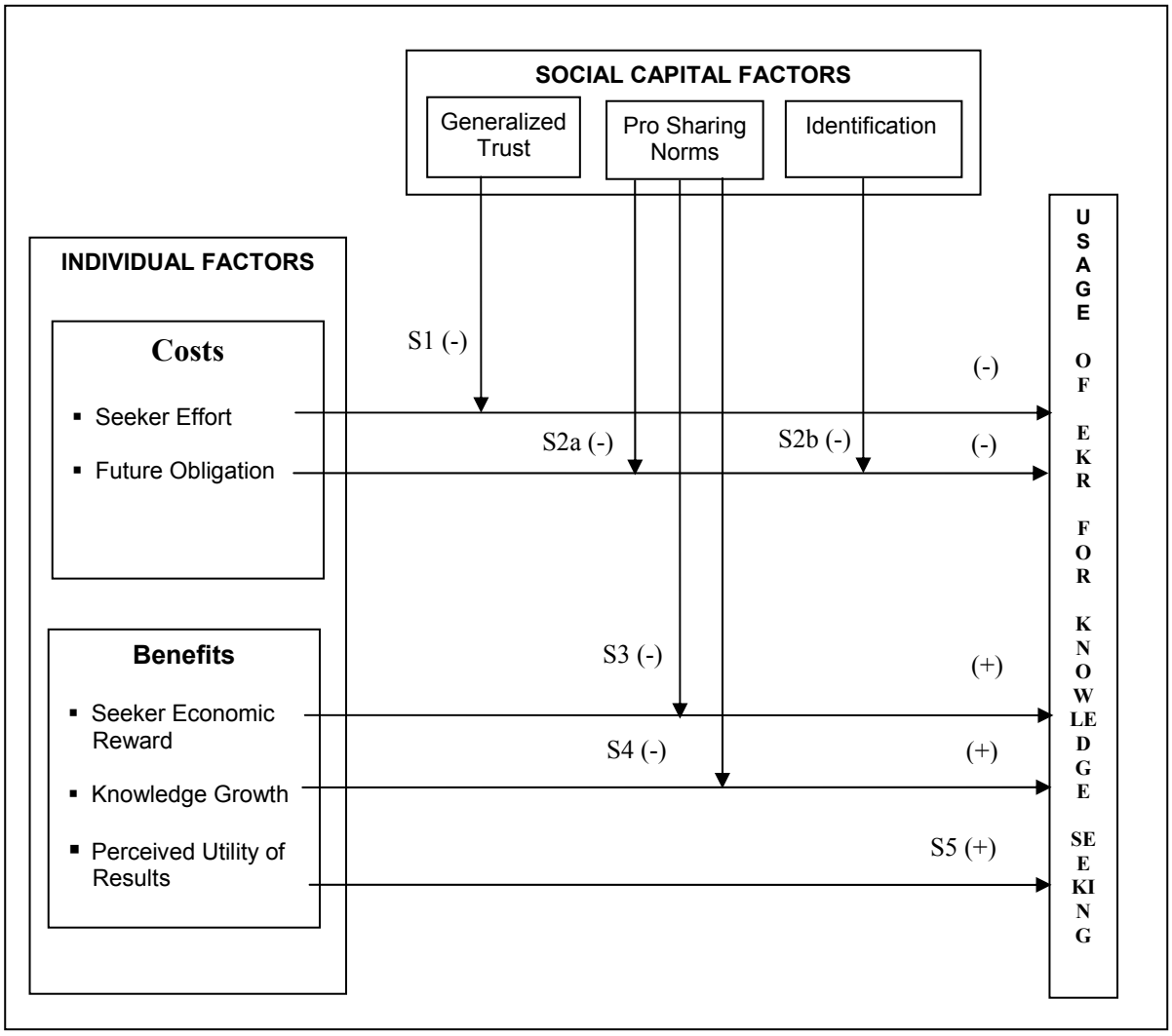


Figure 3.2. Research Model for Usage of EKR for Knowledge Seeking

3.3.2. Social Capital Factors

Studies have highlighted the importance of social capital factors in promoting knowledge sharing (Cohen and Prusak 2001; Nahapiet and Ghoshal 1998). Based on our review of previous research, the elements of the relational dimension of social capital (i.e. generalized trust, pro-sharing norms, and identification) are identified as the factors that may moderate the relationships between individual factors and usage of EKR for knowledge seeking. Each social capital factor was considered in combination with each individual factor to ensure if a moderating effect was likely or not.

3.4. Research Hypotheses for Knowledge Seeking

Hypotheses about the relationships between constructs are presented in this section together with the reasoning supporting them.

3.4.1. Seeker Effort

The act of seeking knowledge from EKR requires expenditure of time and effort for knowledge seekers (Goodman and Darr 1998; Markus 2001). If the time needed to search the EKR and find adequate results is substantial, it can deter knowledge seeking. Effort is analogous to the perceived ease of use (PEOU) construct which has been observed as a significant predictor of technology adoption (Agarwal 2000). Additionally, we expect the relationship between seeker effort and usage of EKR for knowledge seeking to be moderated by generalized trust. Trust involves belief in the good intent and concern of others, belief in their competence and capability, and belief in their reliability. From a knowledge seeker's perspective, high trust implies the belief that contributors to EKR would be competent and consistently put their high quality knowledge into the system. Therefore with high levels of trust and corresponding belief that EKR knowledge will be

of good quality, the deterrent effect of seeker effort on usage of EKR may be reduced. We hypothesize that,

S1: The negative relationship between seeker effort and usage of EKR for knowledge seeking will be weaker under conditions of high generalized trust.

3.4.2. Future Obligation

When a seeker obtains knowledge from EKR, he or she may feel the need to repay back in the future. Seeking knowledge incurs obligation for seekers that they may have to discharge in the future (Constant et al. 1996; Wasko and Faraj 2000). This cost of incurring obligation can act as a deterrent to knowledge seekers. As described before, pro-sharing norms include norms of cooperation and collaboration. When norms of cooperation and collaboration prevail, the barriers to knowledge transfer seen in cultures that value personal technical expertise and knowledge creation are weakened (Jarvenpaa and Staples 2000). Under strong norms of collaboration and cooperation, the negative effect of future obligation on usage of EKR for knowledge seeking may not be so strong since seekers are anyway willing to share their knowledge as needed. Hence we hypothesize,

S2a: The negative relationship between future obligation and usage of EKR for knowledge seeking will be weaker under conditions of high pro-sharing norms.

Under conditions of high organizational identification people would choose the behavior which best promotes the perceived interests of the organization (Johnson et al. 1999). Due to feelings of affiliation and membership with the organization, they may be motivated to contribute knowledge as and when required. Therefore under high identification conditions knowledge seekers may not strongly feel a cost of having to repay back in future for seeking now since they are anyway willing to contribute their knowledge as required. Hence, we postulate,

S2b: The negative relationship between future obligation and usage of EKR for knowledge seeking will be weaker under conditions of high identification.

3.4.3. Seeker Economic Reward

Analogous to contributor economic rewards, economic rewards for knowledge seeking may act as extrinsic motivators for knowledge seekers. Incentives such as salary increase, bonus, cash awards, and career advancement could be implemented to encourage people to reuse knowledge and overcome the barriers to seeking (Ba et al. 2001; Hall 2001). However, since conditions of strong pro-sharing norms may provide significant influence that can ensure the motivation to exchange knowledge (Nahapiet and Ghoshal 1998), the need for extraneous benefits such as economic rewards may be less in high pro-sharing norm environments. Thus, we postulate,

S3: The positive relationship between seeker economic rewards and usage of EKR for knowledge seeking will be weaker under conditions of high pro-sharing norms.

3.4.4. Knowledge Growth

People are likely to benefit from the experiences of others when they seek knowledge from EKR. This can serve as a positive motivator for knowledge seekers who want to quickly acquire knowledge and substitute others experience for their own (Hall 2001; Wasko and Faraj 2000). However the relationship between knowledge growth and EKR usage for knowledge seeking is likely to be moderated by pro-sharing norms. If a knowledge seeker perceives that other colleagues are seeking knowledge from EKR and that is the sanctioned behavior of the community, he or she may be motivated to seek even

if knowledge growth may not take place. Therefore, we expect the motivating effect of knowledge growth on EKR usage for knowledge seeking to be reduced under conditions of high pro-sharing norms. Thus, we postulate,

S4: The positive relationship between knowledge growth and usage of EKR for knowledge seeking will be weaker under conditions of high pro-sharing norms.

3.4.5. Perceived Utility of Results

Perceived utility of results can act as a strong motivator for people to seek knowledge from EKR. If seekers perceive that the results they obtain from EKR are useful for their job i.e. can improve their job performance, they are likely to be motivated to use EKR (Goodman and Darr 1998; Wasko and Faraj 2000). This construct is analogous to the perceived usefulness (PU) construct which has been observed as a significant predictor of technology adoption (Agarwal 2000).We do not expect the relationship between perceived utility of results and EKR usage for seeking knowledge to be moderated by social capital factors. This is because the motivation to seek knowledge from EKR due to utility of results is likely to be strong by itself. Therefore we postulate,

S5: Perceived utility of results is positively related to usage of EKR for knowledge seeking.

Chapter 4

Research Methodology

This chapter presents the survey methodology employed in the study and the descriptive statistics of the field study samples. Since several of the constructs in the research models have been adapted to our context and a large number of construct measures have been self-developed, going through a systematic procedure for instrument development was felt needed. This chapter begins with a discussion about survey methodology followed by a description of the framework of survey instrument development. As a part of this framework, operationalization of the independent and dependent variables of the two models, steps and results of conceptual validation using sorting procedures, and pilot survey results are discussed. The main aim of this exercise is to obtain a set of valid and reliable measures that will enable us to collect data and empirically test our models to explain the usage of EKR for knowledge contribution and for knowledge seeking. Lastly the descriptive statistics of the field study samples are presented.

4.1. Survey methodology

A survey is a way of going from observations to theory validation. The usual objective for IS researchers using this approach is to determine the relationship between constructs as a way of making sense of behavior surrounding and involving IS. Survey research can be coupled with a number of methods for analyzing data ranging from the reporting of simple scale means, the use of analysis of variance of results in different conditions, through regression analysis and the analysis of paths between constructs, to the use of second generation structural equation modeling techniques such as LISREL and PLS. As a part of

a panel discussion on this subject (Newsted et al. 1996), Lee noted that in positivist research, surveys are particularly useful in determining the actual values of variables under study, and the strengths of relationships among them. Further, responses can be generalized to other members of the population studied and often to other similar populations. Surveys can be reused easily, and provide an objective way of comparing responses over different groups, times, and places. All the above advantages apart from the compelling reason of being able to test specific theoretical propositions in an objective fashion justify our choice of survey research methodology. However we need to be aware of the limitations that surveys are just a snapshot of behavior at one place and time (Fowler 1993). Further they do not provide as rich or "thick" descriptions of a situation as a case study nor do they provide as strong evidence for causality between surveyed constructs as a well designed experiment.

4.1.1. Survey Process

Once a theoretical foundation has been built (e.g. theoretical model and hypotheses formulated), the activities of the survey process can be considered. Malhotra and Grover (1998) provide a detailed checklist to be followed in the development and use of an instrument. Significant among these steps are:

1. Determination of the unit of analysis (e.g., the individual, group, or organization)
2. Creation and use of multi-item scales
3. Pre-testing and use of pilot data
4. Assessment of both construct and content validity
5. Assessment of reliability
6. Random sampling from a defined sample frame

7. Determination of an appropriate response rate and evaluation of non-response bias
8. Assessment of whether significant correlations imply real causal relations

In our study, the unit of analysis is the individual organizational employee. We want to explain and predict the behavior of individual employees with regard to their usage of EKR for knowledge contribution and knowledge seeking. The next section describes in more detail the framework used for survey instrument development that includes steps 2-5 i.e., the creation of multi-item scales, pre-testing, and assessment of reliability and validity. The results of step 2 and step 3 using pilot data are described in subsequent sub-sections. Steps 6 and 7 are also dealt with in later sections of this chapter while steps 4, 5 and 8 using field data are described in Chapter 5.

4.2. Framework for Survey Instrument Development

Churchill (1979) presented a sequence of steps (starting from specifying the domain of the construct till assessing the validity of the instrument) that can be followed for development of better measures for constructs. Moore and Benbasat (1991) described in detail the card sorting procedure for conceptual validation of instruments applied to the development of instruments to measure individual's various perceptions in adopting IT innovation. We incorporated Moore and Benbasat's conceptual construct validation procedure within step 3 of Churchill's framework. The resultant framework is shown in Figure 4.1.

The validity and reliability of measures is very important as it determines the quality of the interpretation that one can make from the data collected. Lack of validated measures

raises fears that no single finding in the study can be trusted. Moreover, the attention to instrumentation issues brings clarity to the formulation and interpretation of the research issue (Straub 1989).

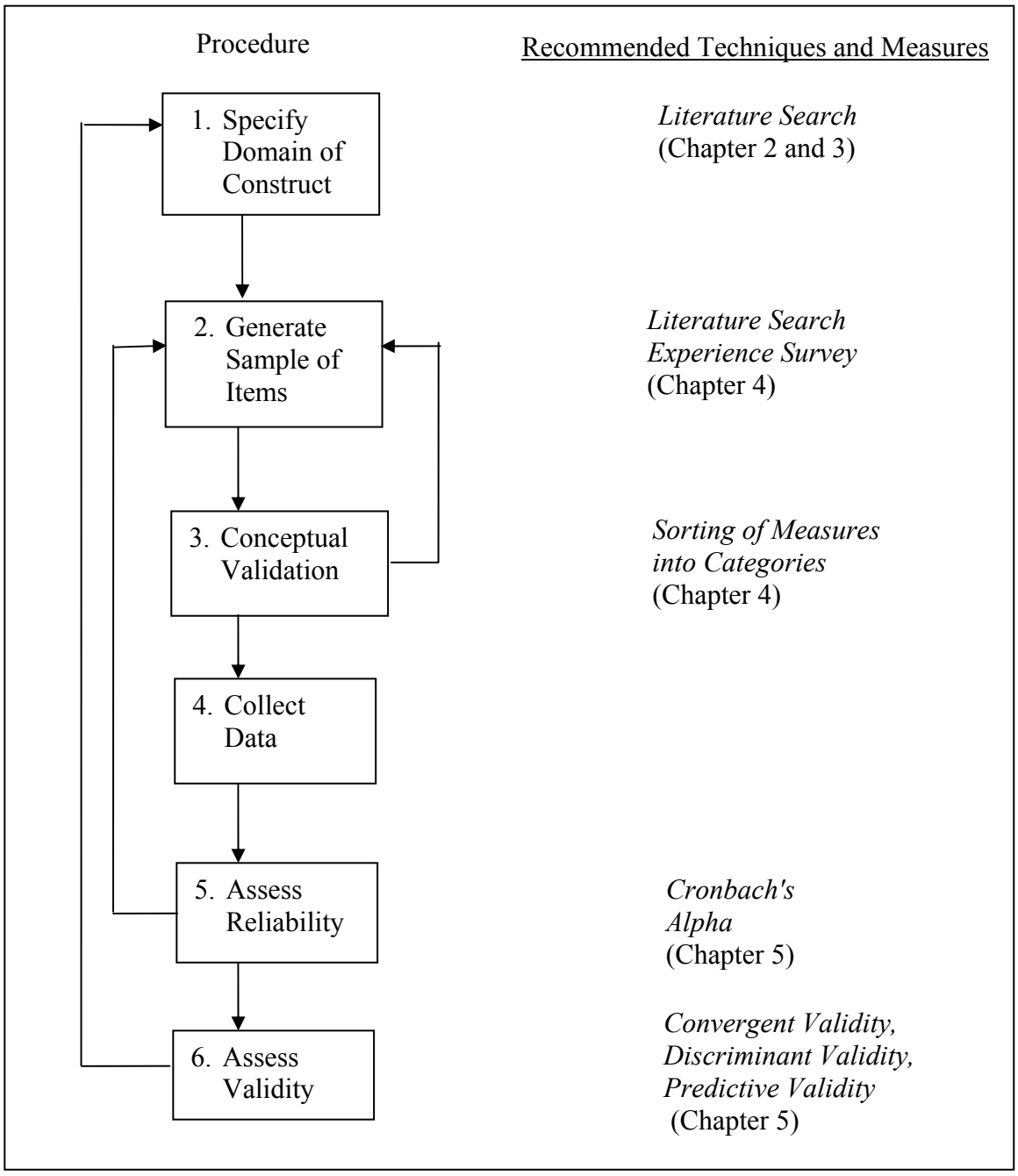


Figure 4.1. Instrument Development Framework

A measure is ***valid*** when the differences in observed score from the data collected reflect true differences in the characteristics one is attempting to measure and nothing else. A measure is ***reliable*** to the extent that independent but comparable measures of the same construct of a given object agree. A measure can be reliable but not valid; however, a measure cannot be valid if it is not reliable. In other words, reliability is a necessary but not sufficient condition for validity (Dooley 2001; Salkind 2000).

In the first step of instrument development, the domain of the construct is specified. In order to specify the domain, the conceptual specification of the construct (i.e. what is to be included in and what is to be excluded from the domain) is decided. This step is achieved by consulting all related literature to draw the boundaries of the construct.

In the second step of instrument development, items that capture the domain of the construct are generated. Here, measures that have been validated in previous studies are adopted as far as possible. The purpose of doing this is to enhance the validity of measures and facilitate comparison of results across studies (Stone 1978). However, for certain constructs, appropriate measures may not exist in the previous literature. In such situations, the measures are generated from previous case studies, interviews or experience surveys, and based on the definitions of the constructs. These first two steps help to ensure content validity.

The next step in instrument development is conceptual validation. This step aims to assess the ***conceptual validity*** of the constructs (i.e. how well the constructs and relationships at the operational level reflect the constructs and relationships at the conceptual level) and to

identify any items that may be ambiguous or confusing in their wording or framing (Moore and Benbasat 1991). The method employed is to present all measures to a set of judges to see if they can understand the items and assign the same meaning to them (i.e. according to their constructs) as is intended. Kappa scores (Cohen 1960) and item placement ratios (Moore and Benbasat 1991) are used to assess the reliability and conceptual validity of constructs in the sorting procedure.

After data collection, reliability of constructs is assessed. Cronbach alpha is used to assess reliability because of its simplicity and being the lowest bound to reliability (Carmines and Zeller 1979).

In the sixth step of instrument development, the construct validity of measures is assessed. Specifying the domain of the construct, generating items that exhaust the domain, and the purification of the scale can only produce measures that are reliable and content valid. However, these steps may or may not ensure the construct validity of the measure. It is important for the measure to have ***construct validity*** because it examines the extent to which a scale measures a theoretical variable of interest (Cronbach and Meehl 1955). Construct validity asks whether the measures chosen are true constructs describing the events or merely artifacts of the methodology itself (Campbell and Fiske 1959). Construct validity is assessed by demonstrating the convergent and discriminant validity of the measures. ***Convergent validity*** refers to the degree of agreement between the multiple measures of a construct whereas ***discriminant validity*** looks at the extent to which measures of different constructs are distinct from each other (Campbell and Fiske 1959). Finally, we assess the predictive validity of the instruments. Measures are said to possess

predictive validity when they behave as expected in relation to other constructs based on some theoretical bases (Churchill 1979). In other words, predictive validity can be assessed by testing the model hypotheses.

We now describe the outcome of the first two steps of Figure 4.1. i.e., the items generated for each construct. All questions are anchored on a seven point scale from strongly disagree (1) to strongly agree (7).

4.3. Operationalization of Contribution Model Variables

4.3.1. Loss of Knowledge Power (LOKP)

People may be reluctant to share their knowledge for fear of losing the uniqueness of their expertise that makes them stand out and for losing their power in the organization that originates from the possession of unique knowledge (Orlikowski 1993). By sharing knowledge, the possessor may lose his or her unique value relative to what others know (Thibaut and Kelley 1986). Since no existing instrument could be found for the loss of knowledge power construct, the items were generated based on the descriptions of the construct in previous studies (Orlikowski 1993; Thibaut and Kelley 1986). All the items were negatively worded to reflect the perceived cost from the knowledge contributor perspective (refer to Appendix A, Table A.1.1).

4.3.2. Contribution Effort (CEFF)

Formulating and delivering solutions takes time and energy (Constant et al. 1994; Goodman and Darr 1998; Orlikowski 1993) and the potential knowledge contributor may

expect that there will be additional cost due to follow-up clarification and requests for assistance (Goodman and Darr 1998). As there is no existing instrument to measure contribution effort we abstracted from previous case studies (Goodman and Darr 1998; Orlikowski 1993) to generate items for this construct. The contribution effort cost was operationalized as the perceived time and effort required to codify and enter knowledge into EKR and to follow up on queries resulting from the sharing of knowledge. All questions were negatively worded to reflect the perceived cost from the knowledge contributor perspective (refer to Table A.1.2).

4.3.3. Contributor Economic Reward (CREW)

Review of literature shows that economic incentives that motivate people to share their knowledge include pay, bonuses in the forms of cash or stock options (Beer and Nohria 2000; Hall 2001), better work assignment, career advancement and job security (Davenport and Prusak 1998; Hargadon 1998; Kalman 1999). For the economic reward instrument, one item was adopted from Kalman (1999) and slightly reworded to suit our context. The other four items were self-developed by taking into account the components of economic reward from the previous literature (Davenport and Prusak 1998; Hall 2001; Hargadon 1998). The respondents were asked questions about their expectation of different types of economic rewards as a result of knowledge contribution using EKR. All the items were worded in comparison to respondents' colleagues to capture the relative or outcome based nature of individual incentives (refer to Table A.1.3).

4.3.4. Image (IMAG)

Previous research has operationalized image as an enhancement of one's status within the organization (Moore and Benbasat 1991). Moore and Benbasat developed five items to measure image with acceptable reliability and validity. Two items out of these five were adopted since all the items were of the same nature. Three additional items were operationalized in terms of recognition by others, respect from colleagues, and praise from superiors (Green 1989; Kalman 1999) (refer to Table A.1.4).

4.3.5. Reciprocity Benefit (RECB)

This construct reflects the expectation of benefit due to the reciprocity principle that may operate during knowledge exchange. When sharing their knowledge in online communities, people may not necessarily expect to receive future help from the same individual that they have helped in the past, but possibly from somebody else in the community (Kollock 1999; Wasko and Faraj 2000). Since we could not find any existing instruments for this construct we derived the two items from the description of the concept in previous literature (Wasko and Faraj 2000; Yamagishi and Cook 1993) and situated the items in the context of our study (refer to Table A.1.5).

4.3.6. Knowledge Self-Efficacy (KSEF)

All four items to measure this construct were adapted from Kalman's (1999) information self-efficacy instrument. This concept describes a person's belief in their ability to provide worthwhile knowledge to the organization. The items were reworded to suit our context. As in the original instrument, two items are positively worded while the other two are negatively worded (refer to Table A.1.6).

4.3.7. Enjoyment in Helping Others (EHLP)

Knowledge contributors may be motivated by some degree of altruism or a desire to help others (Davenport and Prusak 1998). People gain pleasure or enjoyment by demonstrating their own altruistic and pro-social behavior and by seeing the positive effect of their help on others (Wasko and Faraj 2000). Thus the four items for this construct were operationalized in terms of enjoyment or pleasure in helping others (refer to Table A.1.7).

4.3.8. Usage of EKR for Knowledge Contribution (CUSG)

The dependent variable for the knowledge contribution model is the usage of EKR for knowledge contribution. IS studies have typically measured usage in terms of the frequency of use of information systems (Davis 1989; Jarvenpaa and Staples 2000). Frequency of use has been noted to provide a better indicator of the extensiveness of usage than measures of time spent with the system (Igbaria et al. 1996). One item for frequency of use was measured on a six-point scale ranging from 1 ("daily") to 6 ("less than once in 6 months"). Two other measures were subjective measures of frequency (refer to Table A.1.8).

These indicators are typical of the kinds of self-reported measures often used to operationalize system use and acceptance, particularly in cases where objective use and acceptance metrics are not available. Self-reported usage should not be regarded as a precise measure of actual usage, although previous research suggests it is appropriate as a relative measure (Straub et al. 1995).

4.4. Operationalization of Seeking Model Variables

4.4.1. Seeker Effort (SEFF)

The time and effort required for seeking knowledge from EKR can act as a deterrent for knowledge seekers. Since we could not find pre-existing instruments for measuring knowledge seeker effort, we operationalized this construct based on case study comments (Goodman and Darr 1998) and descriptions of the concept (Constant et al. 1996; Markus 2001). The four items are enumerated in Table A.1.9.

4.4.2. Future Obligation (FOBL)

When a seeker obtains knowledge from EKR, he or she may feel the need to repay back in the future. Therefore seeking knowledge from EKR incurs obligation for seekers that they may have to discharge in the future. In the absence of pre-existing instruments, the four items for this construct were self developed based on descriptions of this concept (Wasko and Faraj 2000) in previous literature (refer to Table A.1.10).

4.4.3. Seeker Economic reward (SREW)

The economic reward for knowledge seekers was operationalized with five items with analogous wording to the contributor economic reward items. These items took into account the different components of economic reward i.e. better work assignment, promotion, higher salary, higher bonus, and job security. The respondents were asked questions about their expectation of different types of economic rewards as a result of knowledge seeking using EKR (refer to Table A.1.11).

4.4.4. Perceived Utility of Results (PUOR)

The perceived utility of results obtained from EKR for a seeker are likely to depend on several dimensions of EKR output i.e. reliability, accuracy, relevance, and timeliness (Markus 2001; Wasko and Faraj 2000). Therefore, the seven items for this construct reflect these dimensions i.e. two for reliability, one for accuracy, one for relevance, and three for timeliness. The items are enumerated in Table A.1.12.

4.4.5. Seeker Knowledge Growth (SKGW)

Since no previous instrument was found for this construct, the four items for seeker knowledge growth were derived based on previous case studies (Goodman & Darr 1998; Wasko and Faraj 2000) and incentives literature (Green 1989). The four items reflect increase in knowledge, increase in competency, and strengthening of concepts (refer to Table A.1.13).

4.4.6. Usage of EKR for Knowledge Seeking (SUSG)

The dependent variable for the knowledge seeking model is the usage of EKR for seeking knowledge. As mentioned before, a common measure of IS usage has been in terms of the frequency of use of the information system (Davis 1989; Jarvenpaa and Staples 2000). Similar to the usage of EKR for knowledge contribution we have operationalized the usage construct for seeking knowledge as frequency of use in all the three items (refer to Table A.1.14).

4.5. Operationalization of Common Variables

The three social capital variables are common to both knowledge contribution and knowledge seeking models. The operationalization of these three variables is described in the following sections.

4.5.1. Generalized Trust (GTRU)

All items for this construct were based on Mishra's (1996) dimensions of trust that were described by Nahapiet and Ghoshal (1998) as part of the relational component of social capital. According to Mishra (1996), trust has four aspects: belief in the good intent and concern of exchange partners, belief in their competence and capability, belief in their reliability, and belief in their perceived openness. The belief in perceived openness was found to overlap with a similar belief in the pro-sharing norm construct, and therefore not included in this construct. The remaining three beliefs correspond to the most commonly known set of beliefs in trust literature (McKnight et al. 1998). The four items for this construct were operationalized in the context of knowledge sharing (both contributing and seeking) through EKR (refer to Table A.1.15).

4.5.2. Pro-sharing Norms (PSNM)

Previous literature reports that pro-sharing norms that can enhance the exchange of knowledge or intellectual capital are norms of teamwork (Starbuck 1992), norms of collaboration and cooperation (Goodman and Darr 1998; Jarvenpaa and Staples 2000; Orlikowski 1993), norms of willingness to value diversity, openness to criticism, and

tolerance for failure (Leonard-Barton 1995). The six items measuring this construct were operationalized in terms of these dimensions (refer to Table A.1.16).

4.5.3. Identification (IDEN)

Items to measure the identification construct were borrowed from Cheney (1983). These measures have been cited as the most widely used for assessment of organizational identification (Johnson et al. 1999). There are three dimensions inherent in the construct i.e. similarity, membership and loyalty (Patchen 1970). The original organizational identification instrument contains twenty-five items pertaining to these dimensions. For this study, we selected (based on high factor loadings from (Johnson et al. 1999)) three items to reflect loyalty (IDEN1-3), three items to reflect similarity (IDEN4-6), and three items to represent membership (IDEN7-9) (refer to Table A.1.17).

4.6. Conceptual Validation

At the end of the item generation step, the knowledge contribution survey instrument consisted of 51 items and the knowledge seeking survey instrument contained 46 items. The conceptual validation procedure for our study was adopted from Moore and Benbasat (1991). It was carried out in two stages i.e. unstructured sorting (without construct category labels) in round one and structured sorting (with construct category labels) in round two. For each sorting round, a different set of four judges was used. All seventeen constructs in the two models were validated through the sorting process.

Two measurements were made to assess the level of conceptual reliability and validity. First, the judges' level of agreement was measured using Cohen's Kappa (Cohen 1960).

This measure was computed for all pairs of judges. No general threshold exists with respect to required scores but scores greater than 0.65 are considered acceptable (Jarvenpaa 1989). Second, both reliability and validity of the constructs were assessed through the item placement hit ratio. The higher the percentage of items placed in the targeted constructs, the higher the reliability level. This measure is also an indicator of construct validity. If an item is consistently placed within a particular category, then it is considered to demonstrate convergent validity with the target construct and discriminant validity with the other constructs.

We now present the results of conceptual validation for the knowledge contribution model (rounds 1 and 2) followed by the knowledge seeking model (rounds 1 and 2).

Contribution Model Round 1 (Unstructured Sorting)

In round one, four sets of identical cards were created. Each set contained all the items that were printed, one each, on white index cards. The cards were then shuffled in random order for presentation to the four judges. The judges then sorted the cards into different categories and gave their own labels for the categories, independent from the other judges. This procedure minimizes the potential of "interpretational confounding", which may occur during the assignment of empirical meaning to unobserved variables (Burt 1976). Prior to sorting the cards, judges were briefed with an introduction of what EKR is and the aim of the sorting exercise. Judges were encouraged to ask as many questions as they felt necessary at this stage. Following this, a trial sort was demonstrated to ensure that the judges understood the idea of sorting the items based on categories that best reflect the underlying constructs.

Round 1 sorting results were generally favorable with minor exceptions. In round one, the Kappa score averaged 0.76 (see Table 4.1) and the overall placement ratio of items within the target constructs was 0.87 (see Table 4.2). Based on the labels for the categories provided by the judges (refer to Appendix A.2.1.), Judge 2 confused the loss of knowledge power construct with the image construct, so LOKP1 and LOKP2 were reworded to emphasize the difference between the two constructs. For the contribution effort construct, Judge 1 created separate constructs for the time and effort and for the follow-up cost, so CEFF4 and CEFF5 were reworded to reflect time and effort.

	Round 1 Raw Agreement	**Round 1 Cohen's Kappa**	**Round 2 Raw Agreement**	**Round 2 Cohen's Kappa**
Judges 1 and 2	0.64	0.60	1.00	1.00
Judges 1 and 3	0.78	0.76	1.00	1.00
Judges 1 and 4	0.80	0.78	0.94	0.93
Judges 2 and 3	0.78	0.76	1.00	1.00
Judges 2 and 4	0.78	0.76	0.94	0.93
Judges 3 and 4	0.90	0.90	0.94	0.93
Average	**0.78**	**0.76**	**0.97**	**0.97**

Table 4.1. Contribution Model Inter Judge Agreement

Table 4.2. Contribution Model Hit Rate Round 1

Target Category	Actual Category												Total Qs	Hit Rate (%)
	LOKP	CEFF	CREW	IMAG	RECB	KSEF	EHLP	GTRU	PSNM	IDEN	CUSG	Other		
LOKP	12			2								2	16	75
CEFF		15									1	4	20	75
CREW			20										20	100
IMAG			2	14					1			3	20	70
RECB					6							2	8	75
KSEF						14		1				1	16	87.50
EHLP							16						16	100
GTRU								16					16	100
PSNM								1	20			3	24	83.33
IDEN									1	31		4	36	86.11
CUSG											12		12	100
Average														86.54

Judge 2 and Judge 3 were confused with the "comparison to others" wording of the items in the contributor economic reward construct. Thus, in order not to confuse with the main intention of the construct the words "compared to others" were deleted from the items' wording. IMAG5 and PSNM3 were dropped because they were confused with tangible benefits (e.g. economic rewards) and generalized trust respectively. Two judges commented that they were not comfortable with items IDEN3 and IDEN5, thus these items were dropped. A few other items were also identified by the judges to be confusing or ambiguous and were therefore reworded. The final list of items for the second round of sorting is included in Appendix A.2.2.

Contribution Model Round 2 (Structured Sorting)

Four new judges in the second round were asked to sort the refined items from round 1 based on the construct definitions that were provided. A "Do Not Fit" category (marked as NF in Table 4.3.) was also included to ensure that judges did not force fit any item into a particular category. Prior to the sorting of cards, introduction of what an EKR is, the aim of the sorting exercise, and sorting demo were described.

Sorting results in the second round were very positive. In this round, the Kappa score averaged 0.97 (see Table 4.1.*)* and the overall placement ratio of items within the target constructs was 0.99 (see Table 4.3.). One of the judges put two IMAG items under the "Do Not Fit" category. However, in his comments, he stated that IMAG3 and IMAG4 could be placed under the image construct. A few other items were also identified by the judges to be confusing or ambiguous and therefore were reworded. The final list of items for the knowledge contribution survey is included in Appendix B.1.

Target Category	Actual Category												Total Qs	Hit Rate (%)
	LOKP	CEFF	CREW	IMAG	RECB	KSEF	EHLP	GTRU	PSNM	IDEN	CUSG	NF		
LOKP	16												16	100
CEFF		20											20	100
CREW			20										20	100
IMAG				14								2	16	87.5
RECB					8								8	100
KSEF						16							16	100
EHLP							16						16	100
GTRU								16					16	100
PSNM									20				20	100
IDEN										28			28	100
CUSG											12		12	100
Average														98.86

Table 4.3. Contribution Model Hit Rate Round 2

Seeking Model Round 1 (Unstructured Sorting)

An unstructured sorting procedure similar to round 1 for the contribution model was carried out for the seeking model. Four judges (different from those in rounds 1 and 2 of the contribution model) were asked to sort all the items into categories that they defined themselves.

Round 1 sorting results were generally favorable with minor exceptions. In round one, the Kappa score averaged 0.96 (see Table 4.4) and the overall placement ratio of items within the target constructs was 0.95 (see Table 4.5). Based on the labels for the categories provided by the judges (refer to Appendix A.3.1), Judge 2 confused one item (SEFF3) from the seeker effort construct with the perceived utility of results construct, so SEFF3 was reworded to emphasize the difference between the two constructs. Judge 2 also confused one item (FOBL2) from the future obligation construct with the perceived utility of results construct. Therefore FOBL2 was reworded to make the distinction clear. Judge 2 also placed the remaining future obligation items under a separate construct called "future

use". Nevertheless, this argues well for any internal consistency measurements because the items were clustered, rather than scattered among other constructs. Since it was felt that the categories would be clearer when judges would be given the definitions of the constructs in round two, no rewording was done for these items. As in the case of the contribution model, the "comparison to others" wording of the items in the seeker economic reward construct confused Judge 1. Thus, in order not to confuse with the main intention of the construct the words "compared to others" were deleted from the items' wording. The final list of items for the second round of sorting is included in Appendix A.3.2.

	Round 1 Raw Agreement	**Round 1 Cohen's Kappa**	**Round 2 Raw Agreement**	**Round 2 Cohen's Kappa**
Judges 1 and 2	0.96	0.95	0.99	0.98
Judges 1 and 3	0.98	0.97	0.99	0.98
Judges 1 and 4	0.99	0.98	0.99	0.98
Judges 2 and 3	0.96	0.95	1.00	1.00
Judges 2 and 4	0.96	0.95	1.00	1.00
Judges 3 and 4	0.98	0.97	1.00	1.00
Average	**0.97**	**0.96**	**0.995**	**0.99**

Table 4.4. Seeking Model Inter Judge Agreement

Table 4.5. Seeking Model Hit Rate Round 1

Target Category	Actual Category							Total Qs	Hit Rate (%)
	SEFF	FOBL	SREW	PUOR	SKGW	SUSG	Other		
SEFF	15			1				16	93.75
FOBL		12		1			3	16	75
SREW			20					20	100
PUOR				28				28	100
SKGW					16			16	100
SUSG						12		12	100
Average									94.79

Seeking Model Round 2 (Structured Sorting)

As in the case of the contribution model, the second round of sorting for the seeking model involved giving each of a new set of four judges a set of cards with one item on each card and the definitions of all constructs. The judges were asked to sort the whole set of jumbled items into the construct categories. A "Do Not Fit" category (marked as NF in Table 4.6.) was also kept for ambiguously worded questions.

Target Category	Actual Category							Total Qs	Hit Rate
	SEFF	FOBL	SREW	PUOR	SKGW	SUSG	NF		
SEFF	16							16	100
FOBL		16						16	100
SREW			20					20	100
PUOR				28				28	100
SKGW					16			16	100
SUSG						12		12	100
Average									100

Table 4.6. Seeking Model Hit Rate Round 2

Sorting results in the second round were very positive. In this round, the Kappa score averaged 0.99 (see Table 4.4.*)* and the overall placement ratio of items within the target constructs was 1.00 (see Table 4.6.). The final list of items for the knowledge seeking survey is included in Appendix B.2.

4.7. Pilot Study

Full scale pilot tests of the questionnaires using respondents whose background was somewhat similar to the target population of the final study were conducted in October 2001 for contribution survey and January 2001 for the seeking survey. The primary aim of these tests was to purify the measures through ensuring that the various scales

demonstrated the required levels of reliability and validity. The respondents were also asked to comment on the clarity and conciseness of the survey instructions.

The surveys were administered to knowledge professionals who were part-time post-graduate students pursuing the Master of Computing degree in the School of Computing, National University of Singapore. These students were selected from the total program population because they were employed in knowledge intensive industries, were familiar with the concept of EKR, and had work experience of at least two years.

The survey questionnaires were distributed to the students at the end of classes that they attended. A cover letter was included with the survey instrument. The cover letter explained the purpose of the study and gave a description about EKR. Participation was completely voluntary. Nevertheless, respondents are given a token payment of $15 each for completing the survey. For the contribution survey, 155 questionnaires were returned from 266 target respondents, yielding a response rate of 58.27%. For the seeking survey, 128 questionnaires were returned from 250 target respondents, giving a response rate of 51.2%. Data analysis was carried out separately for the two models. The analysis focused on factor analysis, reliability, inter-item correlation, and item-scale correlation. The techniques for reliability measurement and factor analysis are described in detail in Appendix D.1. and D.2. respectively.

Pilot Study Results (Contribution model)

As recommended by Churchill (1979), inter-item correlations, item-scale correlations, and Cronbach alphas were first computed. This procedure allows problematic questions to be weeded out before they are subjected to factor analyses. Appendix C.1. presents the results

of the inter-item and item-scale correlations. All item-scale correlations were significant at $p < 0.001$ while inter-item correlations were significant at $p < 0.01$. Consequently, no changes were made to the scales.

Responses to the questions on the eleven constructs were subsequently subjected to factor analysis. The factors were detected using principal component analysis with varimax rotation. Twelve factors emerged with eigenvalues greater than 1.0, indicating their eligibility for selection (Kim and Mueller 1981). Factor loadings were examined to identify questions that load on to other factors (see Table 4.7). First, an item from generalized trust (GTRU1) loaded higher on to the pro-sharing norms factor. Since we could not conceptually distinguish this item from the other trust items and sorting as well as reliability results with this item included in the construct were acceptable, we retained this item in its intended construct.

Second, one identification item (IDEN2), which deals with the way an employee describes his / her organization to his / her friends, loaded onto a separate factor by itself. Again, since we could not conceptually distinguish this item from the other identification items and sorting as well as reliability results including this item were favorable, we retained this item in its intended construct. All constructs had Cronbach alphas that satisfied Nunnally's (1978) reliability criterion of being greater than 0.7 (see Table 4.7).

We made a change to the RECB construct after the pilot study and prior to the field study. We added two more items that are conceptually very similar to the existing two items for

Question	Factor											
	1	2	3	4	5	6	7	8	9	10	11	12
LOKP1 LOKP2 LOKP3 LOKP4					0.85 0.82 0.89 0.84							
CEFF1 CEFF2 CEFF3 CEFF4 CEFF5				0.84 0.88 0.83 0.74 0.76								
CREW1 CREW2 CREW3 CREW4 CREW5			0.61 0.83 0.90 0.87 0.69									
IMAG1 IMAG2 IMAG3 IMAG4							0.68 0.71 0.80 0.81					
RECB1 RECB2											0.75 0.82	
KSEF1 KSEF2 KSEF3 KSEF4						0.86 0.90 0.81 0.77						
EHLP1 EHLP2 EHLP3 EHLP4								0.57 0.81 0.82 0.77				
GTRU1 GTRU2 GTRU3 GTRU4		0.63							0.43 0.80 0.72 0.65			
PSNM1 PSNM2 PSNM3 PSNM4 PSNM5		0.79 0.76 0.76 0.75 0.46										
IDEN1 IDEN2 IDEN3 IDEN4 IDEN5 IDEN6 IDEN7	0.73 0.41 0.81 0.86 0.81 0.69 0.84											0.71
CUSG1 CUSG2 CUSG3										0.68 0.89 0.87		
Eigen-values	4.79	3.80	3.79	3.72	3.51	3.32	2.95	2.93	2.34	2.18	1.61	1.20
Variance Explained	10.19	8.08	8.05	7.92	7.47	7.07	6.28	6.23	4.98	4.63	3.43	2.55
Cumulative Variance	10.19	18.27	26.32	34.24	41.71	48.78	55.06	61.29	66.27	70.90	74.33	76.87
Cronbach Alpha	0.85	0.88	0.88	0.89	0.92	0.89	0.87	0.92	0.81	0.79	0.70	

Table 4.7. Results of Factor Analysis (Contribution Model Pilot)

this construct. This addition was for the purpose of improving measurement properties since typically a minimum of three items is recommended per construct (Kim and Mueller 1981).

Pilot Study Results (Seeking model)

Similar to the contribution model pilot, the inter-item correlations, item-scale correlations, and the Cronbach's alphas were computed for the seeking model pilot data. Again, all item-scale correlations were significant at $p < 0.00l$ level and inter-item correlations were also generally high and significant at the $p < 0.01$ level (see Appendix C.2). Cronbach alphas were all above Nunnally's reliability criterion of 0.7 (see Table 4.8). These results suggest that the scales had sufficient reliabilities and no changes were required.

Responses to the questions on the nine constructs were subsequently subjected to factor analysis. Results indicate that nine factors were separated out with eigenvalues greater than 1.0 (see Table 4.8). Examination of the factor loadings revealed that all questions loaded maximally on their own constructs.

All problems with the questionnaires that arose during the conceptual validation stage and the pilot study were addressed. None of the problems were serious enough to warrant the need to re-examine the domains of the constructs or to repeat the generation of items. Hence we proceeded to select a sample and administer the field survey. The contribution survey instrument consisted of 42 items and the seeking survey instrument consisted of 37 items (apart from background questions). Since the survey instruments were not too long we did not prune any items even though some constructs had more than the generally accepted 3 items (particularly those with multiple dimensions) (Fowler 1993).

Question	Factor								
	1	2	3	4	5	6	7	8	9
SEFF1					0.78				
SEFF2					0.86				
SEFF3					0.73				
SEFF4					0.80				
FOBL1							0.75		
FOBL2							0.87		
FOBL3							0.85		
FOBL4							0.71		
SREW1				0.70					
SREW2				0.86					
SREW3				0.86					
SREW4				0.85					
SREW5				0.77					
PUOR1	0.58								
PUOR2	0.66								
PUOR3	0.85								
PUOR4	0.85								
PUOR5	0.85								
PUOR6	0.87								
PUOR7	0.85								
SKGW1			0.89						
SKGW2			0.89						
SKGW3			0.88						
SKGW4			0.78						
GTRU1								0.55	
GTRU2								0.82	
GTRU3								0.77	
GTRU4								0.64	
PSNM1						0.77			
PSNM2						0.75			
PSNM3						0.69			
PSNM4						0.67			
PSNM5						0.64			
IDEN1		0.82							
IDEN2		0.65							
IDEN3		0.80							
IDEN4		0.87							
IDEN5		0.75							
IDEN6		0.83							
IDEN7		0.85							
SUSG1									0.68
SUSG2									0.82
SUSG3									0.80
Eigen-values	3.37	2.97	2.73	2.64	2.62	2.26	2.02	1.82	1.29
Variance Explained	10.21	9.0	8.28	7.99	7.94	6.84	6.11	5.51	3.90
Cumulative Variance	10.21	19.21	27.49	35.48	43.42	50.26	56.37	61.88	65.78
Cronbach Alpha	0.82	0.85	0.80	0.82	0.80	0.77	0.83	0.73	0.90

Table 4.8. Results of Factor Analysis (Seeking Model Pilot)

4.8. Field Study Description

In this section, we first describe the surveys' context, sample selection, and survey administration procedures. This is followed by the assessment of the two surveys' representativeness and presentation of the descriptive statistics of the samples.

4.8.1. Survey Context

Singapore, a small nation whose main resource is human skills and knowledge, needs to transform into a knowledge-based economy so as to survive and compete economically. The need to effectively exploit their intellectual resources has thus become a major challenge for knowledge-intensive organizations in Singapore. Despite the increasing awareness of and interest in KM in Singapore and the generally high level of IT infrastructure, there exists a wide range of views and perceptions (including unfavorable views) on KM and KMS (Law and Lee-Partridge 1999). It is still unclear for many organizations how KM projects can be initiated and implemented and how KM can contribute to business growth and development. Therefore in this kind of a scenario where awareness about KM is high and organizations are starting to implement KMS, a study of this nature is particularly useful to highlight the factors needed for successful implementation. As in the case of other initiatives, such as the IT and Biotechnology initiatives, the KM initiative is also largely driven by the Government-linked sector.

4.8.2. Sample Selection

Sample size affects research results. First, the sample size must be large enough to provide sufficient statistical power for multivariate tests to realistically identify significant results (Hair et al. 1998). Cohen (1977) recommends that to achieve the desired level of 80%

power with 0.05 significance level and a moderate effect size of 0.35, a sample size of 130 would be required. Second, a sample size must be able to satisfy thresholds required by the statistical technique the researcher is using. In our case, for the multiple regression statistical technique that we would be using, sample sizes of 100 and above will detect fairly small Rsquare values (10 percent to 15 percent) with up to 10 independent variables (as in the case of both our models) and a significance level of 0.05 (Hair et al. 1998).

Hence adopting the more stringent guideline of 130 prescribed for a statistical power of 80% and using the typical survey response rate of approx. 30-35% for relevant issues such as KM as an indicator of expected survey response (Newsted et al. 1998), we ought to select a sample to send out our surveys that contains approximately 400 subjects for each model i.e. total 800 subjects. Moreover to minimize the likelihood that our findings are idiosyncratic to a single organizational type, we should also choose a sample that represents a broad spectrum of organizational types. However, we need to base our selection on the ground reality of the state of KM initiatives in organizations in Singapore.

Based on our interviews with industry executives and media reports and articles, we could roughly divide organizations in Singapore into two broad categories depending on the degree of KM maturity. The first group of organizations consists of multinational companies with well-established KM programs in their parent companies that are then rolled out worldwide. An example of this category is consulting organization Accenture, with its Knowledge Exchange (KX) system administered from head quarters in Chicago and local knowledge managers taking care of KM in different country offices. We were not directly interested in surveying this category of companies since the KM programs are

fairly well established e.g., Accenture's KX system has been in use for a decade and implementation and adoption issues are generally ironed out with usage levels above 90%. We studied a few of these organizations e.g., Accenture and KPMG, as examples of KM mature companies to compare against the more novice companies in our study.

The second category of organizations we observed are the Singapore government linked departments and statutory boards that are embracing KM with varying degrees of involvement. Some companies are relatively more experienced in KM e.g., National Library Board started to implement KM programs two years ago, while some are relatively new to KM e.g., Civil Service College and A*Star (Agency for Science, Technology, and Research) are piloting KM initiatives across their organizations. This set of organizations provide a more suitable sample set for our study since they are mainly in the initial or intermediate stages of KM implementation and are likely to benefit from our recommendations on how to enhance usage of EKR for knowledge contribution and seeking.

To identify these organizations we searched the Singapore government website (www.gov.sg) for all ministries and statutory boards that have a KM function or officers responsible for KM. We also thoroughly searched the Government website to locate any press releases or other information about KM initiatives (since in some organizations the KM job roles are not yet demarcated). The search yielded a list of seventeen organizations and KM executives who acted as our point of contact within these organizations. The organizations were offered a report of our findings as an incentive to participate. Out of these seventeen government related organizations we contacted, ten responded positively

to our request for participation. The list of responding organizations is Agency for Science, Technology and Research (A*Star), Civil Services College (CSC), Defence Science and Technology Agency (DSTA), Ministry of Defence and Singapore Armed Forces (MINDEF + SAF), Institute of Technical Education (ITE), Jurong Town Corporation (JTC), KMAsia (consortium of KM organizations), National Library Board (NLB), Singapore Computer Systems (SCS – semi-private), and Singapore Prison Services (SPS). The remaining seven declined participation due to (1) KM programs still in discussion stage (four organizations) or (2) lack of availability of personnel to fill out the surveys (three organizations). We also contacted five established KM leaders to find out about their KM practices and act as a basis for comparison with the organizations in our survey.

4.8.3. Survey Administration Procedures

The survey administration was carried out between February 2002 and July 2002.The contact person in each organization was enlisted to (1) identify knowledge contributors and seekers within their organization, (2) act as the intermediary for distribution and collection of surveys, and (3) identify one or more KM executives within the organization who could inform us about the overall KM function in the organization. The first task was paramount in administering our survey since the contact person was the one who was able to identify the pool of survey participants for us. The second facilitation task was to distribute paper copies of the survey forms to participants on our behalf. The sealed responses were either collected by the contact person and passed back to us or sent directly to us using the attached self-addressed stamped envelopes. Based on the information provided by the company contact we were able to interview one or two KM

executives in each organization to better understand the KM initiatives in the organization and thus provide a context to better interpret our results.

The parcel sent out to each respondent included a cover letter stating the study's objective, a copy of the questionnaire, and a pre-paid reply envelope. In the field study, the respondents were asked to fill in the questionnaire with respect to a specific EKR they used in the course of their work. The respondents were assured of the confidentiality of their responses. They were requested to return the completed questionnaires within a month of receipt of the parcel.

4.8.4. Survey Response and Representativeness

A summary of the organization-wise responses to the Contributor and Seeker surveys is presented in Table 4.9. Out of 400 contributor survey forms sent out to 10 organizations, 150 responses were obtained, providing an overall response rate of 37.5%. Out of 400

Organization	Contributor Surveys sent out	Contributor Responses	Response Rate	Seeker Surveys sent out	Seeker Responses	Response Rate
A*star	25	10	40%	30	10	33.3%
CSC	15	4	26.7%	15	5	33.3%
DSTA	55	14	25.5%	35	12	34.3%
ITE	20	7	35%	-	-	-
JTC	50	17	34%	60	31	51.7%
KMAsia	120	56	46.7%	-	-	-
MINDEF+SAF	40	23	57.5%	40	21	52.5%
NLB	30	6	20%	30	9	30%
SCS	25	5	20%	30	10	33.3%
SPS	20	8	40%	160	62	38.8%
Total	**400**	**150**	**37.5%**	**400**	**160**	**40%**

Table 4.9. Survey Responses by Organization

seeker survey forms sent out to 8 organizations, 160 responses were obtained resulting in an overall response rate of 40%. Table 4.9. represents all responses regardless of missing

data. All responses were of high quality and no complete cases were excluded from the data.

	Responses		Non responses		Total	
	#	%	#	%	#	%
Contributor	150	48.4%	250	51%	400	50%
Seeker	160	51.6%	240	49%	400	50%
Total	310	100%	490	100%	800	100%
Chi-square = 0.527 D.F.=1 Significance= 0.468 Cells with count < 5 = 0 of 4						

Table 4.10. Survey Responses by User Category

The representativeness of the sample was assessed, the objective being to demonstrate through descriptive statistics and chi-square tests that the respondents are not a biased sample of the population of public sector firms, but in fact are representative of that population. This analysis represents the first level of attention to the external validity of the survey findings. The objective is to extend the survey findings from the sample to the first population of interest, that of all public sector firms in Singapore. The next population of interest is that of public sector firms in North America and other parts of the world. The relevance of the survey findings to these latter two populations is addressed further in the discussion of threats to external validity in Chapter 7.

Seeker	**Responses**		**Non responses**		**Total**	
	#	**%**	**#**	**%**	**#**	**%**
Computer Industry	10	6.3%	20	8.3%	30	7.5%
Defense	33	20.6%	42	17.5%	75	18.75%
Education	5	3.3%	10	4.2%	15	3.75%
Library Services	9	5.6%	21	8.8%	30	7.5%
Rehabilitation	62	38.4%	98	40.8%	160	40%
Real Estate + construction	31	19.5%	29	12.1%	60	15%
Research and Development	10	6.3%	20	8.3%	30	7.5%
Total	160	100%	240	100%	400	100%
Chi-square = 6.65 D.F.=6 Significance = 0.36 Cells with count < 5 = 0 of 14						

Table 4.11. Seeker Response vs Non response by Industry Sector

Table 4.10 shows survey responses and non-responses by responder category i.e. contributor and seeker. The results of chi square test indicate that there is no non-response bias (Fowler 1993) between the two categories i.e., the chi-square test is not statistically significant. Tables 4.11. and 4.12. indicate that there is no non-response bias with respect to industry sector.

Contributor	Responses		Non responses		Total	
	#	%	#	%	#	%
Computer Industry	61	40.7%	84	33.6%	145	36.25%
Defense	37	24.7%	58	23.2%	95	23.75%
Education	11	7.3%	24	9.6%	35	8.75%
Library Services	6	4%	24	9.6%	30	7.5%
Rehabilitation	8	5.3%	12	4.8%	20	5%
Real Estate + construction	17	11.3%	33	13.2%	50	12.5%
Research and Development	10	6.7%	15	6%	25	6.25%
Total	150	100%	250	100%	400	100%
Chi-square = 6.228 D.F.=6 Significance = 0.398 Cells with count < 5 = 0 of 14						

Table 4.12. Contributor Response vs Non response by Industry Sector

Contributor	Responses		Non responses		Total	
	#	%	#	%	#	%
100-249	14	9.33%	26	10.4%	40	10%
250-499	56	37.33%	64	25.6%	120	30%
500-749	29	19.33%	41	16.4%	70	17.5%
750-999	17	11.33%	33	13.2%	50	12.5%
1000-2499	20	13.33%	45	18%	65	16.25%
2500-4999	14	9.33%	41	16.4%	55	13.75%
Total	150	100%	250	100%	400	100%
Chi-square = 9.792 D.F.=5 Significance = 0.081						

Table 4.13. Contributor Response vs Non response by Organization Size

Tables 4.13. and 4.14. indicate the lack of non-response bias with respect to firm size.

Seeker	Responses		Non responses		Total	
	#	%	#	%	#	%
100-249	15	9.4%	30	12.5%	45	11.25%
250-499	-	-	-	-	-	-
500-749	30	18.7%	40	16.6%	70	17.5%
750-999	31	19.4%	29	12.1%	60	15%
1000-2499	72	45.0%	118	49.2%	190	47.5%
2500-4999	12	7.5%	23	9.6%	35	8.75%
Total	160	100%	240	100%	400	100%
Chi-square=5.3 D.F.=4 Significance=0.26						

Table 4.14. Seeker Response vs Non response by Organization Size

4.8.5. Descriptive Statistics

The following tables report the descriptive statistics of the respondents and their respective organizations. Table 4.15. and 4.16. present the individual characteristics (both demographic and job related) of seekers and contributors. While seeker respondents were equally divided among genders, contributor respondents were majority male (57.3%). In both user categories, majority of respondents were in their twenties. While majority of seeker respondents had a Master's degree, majority of contributor respondents had a Bachelor's degree. Relatively large proportions of seeker respondents worked in operations (25%) and IS areas (18.6%) while comparatively large percentage of contributors (33.3%) were employed in the IS function of their organizations.

The total work experience, tenure in current organization and current job, and experience with EKR for both categories of respondents are shown in Table 4.16. Majority of respondents have up to six years of total work experience. Most of them have worked in their current organizations for less than 3 years and have been in their current job for less than two years. The largest proportion of seekers (36.3%) have used EKR for less than a year while the largest proportion of contributors (34%) have used them for 2-3 years.

	Seeker Frequency and Percentage	Contributor Frequency and Percentage
Gender		
Male	80 (50%)	86 (57.3%)
Female	80 (50%)	64 (42.7%)
Age		
21-29	77 (48.1%)	76 (50.7%)
30-34	37 (23.1%)	24 (16%)
35-39	22 (13.8%)	20 (13.3%)
40-49	21 (13.1%)	25 (16.7%)
>= 50	3 (1.9%)	5 (3.3%)
Education		
High School	2 (1.3%)	20 (13.3%)
Bachelors	35 (21.9%)	91 (60.7%)
Masters	109 (68.1%)	35 (23.3%)
Doctorate	14 (8.7%)	4 (2.7%)
Functional Area		
Accounts	2 (1.2%)	2 (1.3%)
Corporate Communications	10 (6.2%)	3 (2%)
Corporate Services	7 (4.3%)	15 (10%)
Customer Service	5 (3.1%)	2 (1.3%)
Finance	9 (5.6%)	4 (2.7%)
Human Resource	15 (9.3%)	11 (7.3%)
Information Systems	30 (18.6%)	50 (33.3%)
Marketing	6 (4.3%)	13 (8.7%)
Product Development	7 (4.3%)	8 (5.3%)
Operations	40 (25%)	5 (3.3%)
Research and Development	11 (6.9%)	11 (7.3%)
Sales	2 (1.2%)	6 (4%)
Strategic Planning	8 (5%)	13 (8.7%)
Others	8 (5%)	7 (4.7%)

Table 4.15. Profile of Respondents

	Seeker Frequency and Percentage	Contributor Frequency and Percentage
Work Experience		
0 - < 3 years	40 (25%)	43 (28.7%)
3 - < 6 years	43 (26.9%)	35 (23.3%)
6 - < 9 years	18 (11.2%)	16 (10.7%)
9 - < 12 years	15 (9.4%)	19 (12.7%)
12 - < 15 years	18 (11.2%)	6 (4%)
>= 15 years	26 (16.3%)	31 (20.7%)
Tenure		
0 - < 3 years	88 (55%)	92 (61.3%)
3 - < 6 years	29 (18.1%)	24 (16%)
6 - < 9 years	13 (8.1%)	14 (9.3%)
9 - < 12 years	9 (5.7%)	9 (6%)
12 - < 15 years	6 (3.7%)	2 (1.3%)
>= 15 years	15 (9.4%)	9 (6%)
Current Job		
< 1 year	42 (26.2%)	42 (28%)
1 year - < 2 year	48 (30.0%)	33 (22%)
2 year - < 3 year	38 (23.8%)	37 (24.7%)
3 – < 5 years	20 (12.5%)	18 (12%)
5 – < 12 years	5 (3.1%)	16 (10.7%)
>= 12 years	7 (4.4%)	4 (2.7%)
EKR experience		
< 1 year	58 (36.3%)	38 (25.3%)
1 - < 2 years	49 (30.6%)	40 (26.7%)
2 - < 3 years	27 (16.9%)	51 (34%)
3 - < 5 years	26 (16.2%)	17 (11.3%)
>= 5 years	-	4 (2.7%)

Table 4.16. Experience Profile of Respondents

The job titles of the seekers include a range of designations from head, CEO, director, manager through to officer, engineer and analyst (see Table 4.17.). The designations of contributors show a similar range but with a greater percentage of senior designations (e.g. head, senior executive and general management) and smaller percentage of less senior titles (e.g. officer) as compared to seekers.

	Contributor Frequency and Percentage	Seeker Frequency and Percentage
Head – CEO, COO, CKO, CIO, heads of dept., director, vice president	21 (14%)	11 (6.9%)
Senior executive – community relations, home affairs, assistant director	13 (8.7%)	9 (5.6%)
General Management – manager, consulting, customer service, divisional, KM, project, program, sales	31 (20.7%)	19 (11.9%)
Assistant General Management – lease, marketing, training	9 (6.0%)	19 (11.9%)
Senior Officer – marketing, lease, development, finance, procurement, operations	10 (6.7%)	14 (8.7%)
Executive – administrative, finance, HR, recruitment	10 (6.7%)	12 (7.5%)
Officer – administrative, customer support, duty operations, equipment, finance, hall, housing unit, training, project, public affairs, procurement, record, staff	16 (10.7%)	41 (25.6%)
Executive assistant -- finance, logistic, personal	5 (3.3%)	11 (6.9%)
Engineer – software, project, support, system, knowledge	29 (19.3%)	18 (11.3%)
Analyst/ Designer	6 (4%)	6 (3.7%)

Table 4.17. Respondent Designations

The characteristics of EKR for the respondent organizations are shown in Table 4.18. All organizations use some form of IBM Lotus Notes based system. The content of EKR mainly includes lessons learnt, best practices, and case studies. The number of users varies from approx. 120 in the smaller organizations to 2000 in the larger organizations. All organizations surveyed had KM training, incentives of various forms, top management support for KM, and measures for KM success in place. However, there were no explicit mandates to use EKR and usage was by and large voluntary.

Company	Technology	EKR Content	Number of users (contributor +seeker)	Training / Incentives/ KM Measures
A*star	• IBM Lotus suite • Quickplace "Knowledge Universe"	• Contact and technology reports • Financial and budget reports • Trip reports • Meeting minutes	120	• Training provided • Incentives, starting to implement • Top management support • KM Measures, starting to implement
CSC	• Lotus Notes • Hummingbird • Cyberdocs "Liquid Spark"	• Project reviews • Course material • Trainer material • Vendor material • Business performance report	180	• Training provided • Incentives, part of performance appraisal • Top management support in form of video clips • KM Measures in place
DSTA	• Fulcrum • Portal software Plum Tree • Documentum and Interwoven (DMS)	• Project reviews • Preliminary review • Critical Design Review • After Action Review • Lessons learned	800	• Training, both online and physical orientation • Incentives as part of performance appraisal and special awards • KM part of core values • KM Measures: number of hits + Return on Investment
ITE	• Intranet + Lotus Notes	• Student counseling cases • Case studies	600	• Training • Incentive part of appraisal • Review by Knowledge Content Owner • KM Measures- usage
JTC	• Lotus Notes • Microsoft Share Point	• Case studies • Marketing literature • Business Process	900	• Training available • Incentive starting to implement • Top management support • KM Measures such as hits

KMAsia	• Intranet + Lotus Notes	• Project Proposals • Lessons Learned • Customer knowledge	450	• Training • Incentives as part of performance appraisal • Top management support • KM measures
MINDEF + SAF	• Customized Lotus Notes "SPOT ON"	• Infantry vehicle training • Automotive system maintenance • Advanced logistics training	700	• Training provided • Incentives for career advancement • Top management support • KM Measures in place
NLB	• Lotus Notes • Electronic registry system	• Reports • Presentations • Staff Suggestions	600	• Training provided • Incentives as a part of appraisal and awards • Top management support • Access Measures
SCS	• Intranet + Lotus Notes	• TQM Reports • Execution Reports • Interactive Applications for training	1000	• Training provided • Staff appraisal has learning component • Subsidy to internet connection (incentive) • Company performance indicators have KM component built in
SPS	• Intranet + lotus notes	• Documents, reports • Minutes of top management meeting • Forum and seminar contents • Discussion points	2000	1 Training available 2 Incentive part of appraisal 3 Top management support 4 Indirect measurements using balanced scorecard

Table 4.18. EKR Characteristics of Organizations

4.8.6. Response Pooling and Inter-rater Agreement

Prior to pooling responses together from 10 organizations for the contributor survey and 8 organizations for the seeker survey, we checked for similarity of potentially confounding factors in terms of EKR technology, EKR content, and organizational mechanisms across pooled organizations. First, the EKR technology employed in all organizations was similar

i.e., Lotus Notes based systems. Therefore it could be expected that the features of the EKR technology used would be similar for all respondents. This assumption was borne out by our interviews with KM executives in each organization and first-hand observation of the EKR systems. Second, the EKR content i.e., lessons learned, best practices, and case studies, was of comparable tacitness for all respondents. This is of concern since knowledge tacitness is a factor that has been found to influence EKR usage (Kankanhalli et al.). Third, the top management support and organizational mechanisms in place for KM rewards, training, and measures were similar across all surveyed organizations. Other control variables such as individual gender, age, education, tenure, work experience and organizational size would be assessed in the next chapter.

The inter-respondent agreement was checked for social capital factors within an organizational community i.e., generalized trust, pro-sharing norms, and identification. The agreement check indicated that the operationalization of these variables at individual level matched (was of similar value) within an organization and varied from one organization to another.

Chapter 5

Data Analysis

In this chapter, we describe the empirical validation of the knowledge contribution model and knowledge seeking models proposed in Chapter 3. First, the reliability and validity measures of the two model survey instruments are described. Single scores were created for each variable and the assumptions of multiple regression analysis (MRA) assessed. The results of hypotheses testing using MRA and moderated multiple regression (MMR) are presented. Lastly the effects of control variables are assessed and the relative contribution of different theoretical perspectives determined.

Multiple regression is the appropriate method of analysis when the research problem involves a single metric dependent variable (in our case usage of EKR for knowledge contribution or knowledge seeking) presumed to be related to two or more metric independent variables (Hair et al. 1998). The objective of MRA is to predict the changes in the dependent variable (DV) in response to changes in the independent variables (IV). This objective is most often achieved through the statistical rule of least squares. MMR (Sharma et al. 1981) is an extension of MRA used to test the effects of multiplicative terms or interactions of factors. This technique applies MRA to detect the significance of moderator variables over and above direct variable effects. Therefore the use of these techniques allowed us to test both direct and moderating hypotheses of our models.

5.1. Instrument Validation

An important objective of the research, in addition to studying relationships between model variables, is to develop valid constructs and measures of these constructs for

further study. As per Figure 4.1. in chapter 4, after field survey data collection the reliability and convergent validity of constructs were assessed using Cronbach Alpha and the discriminant validity was assessed through factor analysis. The predictive validity assessment of the two models through hypothesis testing is reported in subsequent sections of this chapter.

5.1.1. Reliability and Convergent Validity

The method used to statistically test the reliability of the scale questions was the Cronbach Alpha reliability coefficient (Cronbach 1951). Appendix D.1. provides a more detailed discussion on reliability. In the contribution model, the alpha value with item deleted diagnostic (see Appendix D, Table D.1.) was used to prune a few items from some of the constructs (CREW1, RECB1, PSNM5, and IDEN6). In the seeking model, using the same diagnostic (see Appendix D, Table D.2.), SREW1, PUOR1, GTRU4, PSNM5, IDEN6, and SUSG1 were dropped. A value of 0.707 or larger for Cronbach Alpha indicates adequate internal consistency (Nunally 1978). For our study all contribution and seeking model construct measures exhibited scores of Cronbach Alpha well above the acceptable threshold (see Table 5.1).

Contributor Construct	Cronbach Alpha	Seeker Construct	Cronbach Alpha
LOKP (1-4)	0.947	**SEFF (1-4)**	0.923
CEFF (1-5)	0.849	**FOBL (1-4)**	0.889
CREW (2-5)	0.958	**SREW (2-5)**	0.955
IMAG (1-4)	0.893	**PUOR (2-7)**	0.965
RECB (2-4)	0.854	**SKGW (1-4)**	0.971
EHLP (1-4)	0.963	**GTRU (1-3)**	0.772
KSEF (1-4)	0.956	**PSNM (1-4)**	0.928
GTRU (1-4)	0.845	**IDEN (1-5,7)**	0.961
PSNM (1-4)	0.926	**SUSG (2-3)**	0.936
IDEN (1-5,7)	0.955		
CUSG (1-3)	0.854		

Table 5.1. Reliability of Model Construct Measures

5.1.2. Factor Analysis Results

In order to assess discriminant validity of the contribution model and seeking model instruments and to provide a basis for creating cumulative (single) scores for each construct in MRA, factor analysis was performed. An exploratory factor analysis (EFA) method was used. Although a confirmatory factor analysis (CFA) method is superior for testing validity, an EFA was chosen mainly because the present study was in exploratory stage where no prior analyses have been conducted (Gorsuch 1983). Factor analysis is a method for determining the number and nature of the underlying variables (factors) amongst a larger number of measures (scales). The factor loadings indicate the extent to which each scale (questionnaire item) is associated with an underlying factor. Nunnally (1978) suggests that factor analysis can play an important part in assessing validity of constructs by providing useful information regarding the dimensions of the construct as revealed by the indicators chosen. Also the factor loadings may be used to derive factor scores for hypothesis testing and further analysis. Details of factor analysis procedures are provided in Appendix D.2.

Prior to factor analysis, the data were checked for completeness and accuracy. Missing values were treated in two ways (Hair et al. 1998). For a missing value in a multi-item scale, the value was estimated by the respondents mean response to other items in that scale. List-wise deletion of cases was applied in all other instances where data were missing.

Contribution Model

All the items belonging to the 11 contribution model constructs post reliability testing were entered into the factor analysis. Factor analysis detected 11 components where

items CEFF4 and CEFF5 loaded on a separate component from the remaining CEFF items and GTRU and PSNM items loaded on the same component. It was decided to omit CEFF4 and CEFF5 from the instrument since they tap onto a somewhat different dimension of contribution effort i.e. the effort to answer follow up queries from EKR contribution, as compared to the other 3 items (CEFF1, CEFF2, and CEFF3) that tap onto the effort to codify and enter knowledge into EKR. It was decided to specify an extra component in the factor analysis to observe if the GTRU and PSNM items would separate out into different components. As mentioned in Appendix D.2.4., specifying an extra component can be justified in these circumstances. Therefore the factor analysis was rerun after omitting two CEFF items and specifying an 11-factor solution.

Table 5.2. shows the results of the contribution model factor analysis (Appendix D.2.7. provides additional details). All rotated factors have eigen values above 1, which is the threshold for significant components (Johnson and Wichern 1998; Kim and Mueller 1981). The 11-factor solution accounts for 84.2% of the variance in the factor model, satisfying the variance heuristic (Gorsuch 1983). Also, all items load higher on their intended constructs than on other constructs, with a minimum loading of 0.58 (greater than the commonly accepted threshold of 0.5 (Hair et al. 1998)). Thus all items passed the discriminant validity test and the adequacy of factor analysis tests. The factor analysis also indicated that these items could be averaged to create the summated scale for each construct. The reliability of the CEFF measure after dropping items CEFF4 and CEFF5 also improved to 0.913.

	Component										
	1	2	3	4	5	6	7	8	9	10	11
LOKP1					0.87						
LOKP2					0.90						
LOKP3					0.90						
LOKP4					0.87						
CEFF1								0.85			
CEFF2								0.89			
CEFF3								0.90			
CREW2			0.88								
CREW3			0.91								
CREW4			0.92								
CREW5			0.89								
IMAG1						0.69					
IMAG2						0.82					
IMAG3						0.78					
IMAG4						0.86					
RECB2										0.71	
RECB3										0.87	
RECB4										0.88	
KSEF1				0.87							
KSEF2				0.89							
KSEF3				0.92							
KSEF4				0.91							
EHLP1		0.82									
EHLP2		0.86									
EHLP3		0.84									
EHLP4		0.81									
GTRU1									0.58		
GTRU2									0.74		
GTRU3									0.79		
GTRU4									0.63		
PSNM1							0.81				
PSNM2							0.82				
PSNM3							0.70				
PSNM4							0.66				
IDEN1	0.80										
IDEN2	0.86										
IDEN3	0.84										
IDEN4	0.87										
IDEN5	0.82										
IDEN7	0.85										
CUSG1											0.82
CUSG2											0.63
CUSG3											0.62
Eigen Value	5.70	3.98	3.85	3.76	3.67	2.97	2.87	2.69	2.66	2.41	1.67
Variance	13.16	9.27	8.96	8.75	8.54	6.92	6.68	6.27	6.19	5.59	3.88
Cumulative Variance	13.16	22.43	31.39	40.14	48.68	55.60	62.28	68.55	74.74	80.33	84.21

Table 5.2. Contribution Model Factor Analysis Results

Seeking Model

All items belonging to the 9 seeking model constructs post reliability testing were entered into the factor analysis. Factor analysis detected 8 components in which items from SUSG cross-loaded with items from PUOR. As mentioned in Appendix D.2.4.,

typically forcing one or two extra factors can be justified. On specifying 9 components, the results are obtained as shown in Table 5.3 (see Appendix D.2.8. for additional details).

Table 5.3. Seeking Model Factor Analysis Results

	Component								
	1	2	3	4	5	6	7	8	9
SEFF1					0.88				
SEFF2					0.92				
SEFF3					0.85				
SEFF4					0.89				
FOBL1							0.81		
FOBL2							0.90		
FOBL3							0.91		
FOBL4							0.76		
SREW2				0.96					
SREW3				0.96					
SREW4				0.95					
SREW5				0.84					
SKGW1			0.91						
SKGW2			0.94						
SKGW3			0.94						
SKGW4			0.92						
PUOR2	0.86								
PUOR3	0.91								
PUOR4	0.91								
PUOR5	0.91								
PUOR6	0.93								
PUOR7	0.91								
GTRU1								0.57	
GTRU2								0.87	
GTRU3								0.74	
PSNM1						0.80			
PSNM2						0.81			
PSNM3						0.74			
PSNM4						0.70			
IDEN1		0.86							
IDEN2		0.80							
IDEN3		0.84							
IDEN4		0.91							
IDEN5		0.89							
IDEN7		0.87							
SUSG2									0.74
SUSG3									0.72
Eigenvalue	5.84	5.67	3.81	3.61	3.31	3.00	2.97	1.86	1.28
Variance	15.78	15.33	10.30	9.76	8.94	8.12	8.02	5.02	3.47
Cumulative Variance	15.78	31.11	41.41	51.17	60.11	68.23	76.25	81.27	84.74

In this model also, all rotated factors have eigen value above 1, which is the threshold for significant components (Johnson and Wichern 1998; Kim and Mueller 1981). The 9-factor solution accounts for 84.74% of the variance in the factor model, satisfying

the variance heuristic (Gorsuch 1983). Further, all items load higher on their intended constructs than on other constructs with a minimum loading of 0.57 (greater than the threshold of 0.5 (Hair et al. 1998)). Thus all items passed the discriminant validity test and the adequacy of factor analysis tests. The factor analysis also indicated that these items could be averaged to create the summated scale for each construct.

5.2. Summated Scales and Factor Score Scales

As described in Appendix D.2.6. factor score scales were created for all contribution and seeking model constructs based on Bartlett's method (Bartlett 1937). Summated scales were also created for all the constructs by averaging items. We compared the regression results of using factor scores to create a single scale for each construct versus using the summated scale for each construct. Both sets of results are reported later in this chapter.

Table 5.4. Descriptive Statistics of Both Model Summated Variables

Contribution Variable	Minimum	Maximum	Mean	Std. Deviation
LOKP	1.00	6.00	2.25	1.17
CEFF	1.00	7.00	4.00	1.55
CREW	1.00	7.00	3.81	1.26
IMAG	2.00	7.00	4.58	0.98
RECB	1.00	7.00	4.37	1.14
KSEF	1.00	7.00	5.10	1.21
EHLP	1.00	7.00	5.33	1.09
GTRU	1.50	7.00	4.63	1.02
PSNM	1.00	7.00	4.65	1.15
IDEN	1.00	7.00	4.95	1.16
CUSG	2.67	6.67	4.89	1.11
Seeking Variable				
SEFF	1.00	6.00	3.19	1.18
FOBL	1.00	7.00	3.86	1.20
SREW	1.00	7.00	3.56	1.35
SKGW	1.00	7.00	5.45	0.99
PUOR	1.83	7.00	5.42	0.95
GTRU	1.67	7.00	4.60	0.98
PSNM	1.25	7.00	4.82	1.04
IDEN	1.14	7.00	5.05	1.06
SUSG	2.00	7.00	5.31	0.97

The descriptive statistics of the summated variables of the two models are given in Table 5.4. The range of majority of variables is between 1.00 and 7.00. The means range from 2.25 to 5.45 while the standard deviations range from 0.95 to 1.55.

5.3. MRA and its Assumptions

MRA is a statistical technique that can be used to analyze the relationship between a single DV (criterion) and several IV (predictors). Each IV is weighted by the MRA procedure to ensure maximal prediction of the DV from the set of IV. The weights denote the relative contribution of the IV to the overall prediction and facilitate interpretation as to the influence of each variable in making the prediction.

The most direct interpretation of the regression variate is a determination of the relative importance of each IV in the prediction of the DV. The selection of IV is based on theoretical relationships to the DV. MRA then provides a means of objectively assessing the magnitude and direction (positive or negative) of the relationship of each IV to the DV. Since there is simultaneous assessment, the relative importance of each IV is determined.

There are several approaches to choose which IV to include in the regression equation in order to obtain the "optimal" model (Hair et al. 1998). The simplest approach is to employ a confirmatory perspective wherein the researcher completely specifies all variables to be included. Although the confirmatory specification is simple in concept, it is necessary to ensure that the set of variables achieves the maximum prediction while maintaining a parsimonious model. This method is also called the *forcible entry* method (Hair et al. 1998).

In contrast to the confirmatory approach, the sequential search approach uses statistical criteria to select variables that maximize prediction with the smallest number of variables employed. A common and popular method in this category is the *stepwise estimation* method (Hair et al. 1998). The method starts with the simple regression model in which only the one IV that is highly correlated with the DV is used. Subsequently additional IV are added that explain the largest statistically significant portion of the error from the previous regression equation. The existing variables in the equation are re-examined to see if they still make significant contribution. Else they are removed. In this manner all IV are examined to see if they should be included in the model and if the other IV already in the model should be eliminated. When there are no more IV left, the procedure terminates.

Two measures are available to assess the overall significance of a model, the F ratio and the coefficient of determination (Hair et al. 1998). The *F statistic* is the ratio of the sum of square errors explained by the regression to the total sum of square errors, each sum of squares being divided by its appropriate degrees of freedom. If the F statistic is significant (sufficiently high), it indicates that the ratio of explained variance to baseline variance is high and accordingly, the regression variate must be significant in explaining the DV.

The other measure of assessing overall model significance is the *coefficient of determination* (Rsquare). It is defined as a measure of the proportion of the variance of the DV about its mean that is explained by the IV. The coefficient can vary between 0 and 1. If the regression is model is properly applied and estimated, it can be assumed that the higher the value of Rsquare, the greater the explanatory power of the model

and better the prediction of DV. However, since Rsquare is influenced by the number of variables in the model relative to the sample size, the value may be inflated if there is overfitting of data i.e. too many IV. Accordingly, an adjusted coefficient of determination (adjusted Rsquare) is computed which becomes smaller when there are fewer observations per IV.

Since the appropriate application of MRA and MMR typically requires the satisfaction of certain underlying assumptions (Hair et al. 1998), these assumptions i.e., (1) normality; (2) homogeneity of variances (homoscedasticity); (3) independence of errors; and (4) linearity, were investigated. Each of these assumptions is discussed as and when it appears in the data analysis sequence. We also looked for outliers and multicollinearity in the data since their presence may have unintended effects on the regression results. The various assumptions and their tests are discussed in detail in Appendix D.3.

5.3.1. Normality

A normal distribution is assumed by many statistical procedures including MRA and ANOVA (Hair et al. 1998). Normality can be visually assessed by looking at the histogram of frequencies of the variables or by examining the normal probability plot output by most statistical software. Numerical tests of normality include the skewness, kurtosis, and Kolmogorov-Smirnov test. Table 5.5. shows the values of these statistics for all variables from both models.

Four contribution model variables i.e. LOKP, CREW, RECB, and EHLP and one seeking model variable i.e. SKGW were found to have skewness and/or kurtosis values outside the normal range of –2.5 to 2.5. These variables also failed the Kolmogorov-

Construct	Shape		Kolmogorov-Smirnov	
	Skewness Z	Kurtosis Z	Statistic	Significance
LOKP	3.48*	-0.79	0.163*	0.001
CEFF	-0.61	-1.85	0.089	n.s.
CREW	-3.03*	1.17	0.239*	0.001
IMAG	0.25	1.22	0.085	n.s.
RECB	-2.98*	1.07	0.128*	0.001
KSEF	-2.22	0.81	0.094	n.s.
EHLP	-2.58*	2.77*	0.113*	0.003
GTRU	0.30	1.22	0.104	n.s.
PSNM	-1.57	1.32	0.071	n.s.
IDEN	-0.86	-0.18	0.061	n.s.
CUSG	-0.15	-0.18	0.105	n.s.
TLOKP	1.95	-2.10	0.068	n.s.
TCREW	0.68	1.86	0.095	n.s.
TRECB	0.31	0.92	0.051	n.s.
TEHLP	-0.12	0.05	0.042	n.s.
SEFF	0.60	-1.06	0.097	n.s.
FOBL	-2.23	1.06	0.099	n.s.
SREW	-1.23	0.07	0.102	n.s.
SKGW	-4.14*	6.01*	0.162	0.001
PUOR	-0.48	0.46	0.107	n.s.
GTRU	-0.10	1.22	0.098	n.s.
PSNM	-2.34	2.37	0.101	n.s.
IDEN	-0.96	0.94	0.074	n.s.
SUSG	-2.06	0.82	0.089	n.s.
TSKGW	0.59	0.70	0.092	n.s.

Table 5.5. Normality Tests of Both Model Variables

Smirnov normality test. Power transformations (see Appendix D.3.1.3 for details) were performed on these variables to correct for non-normality (see equations 5.1.–5.5.). The resultant normality indicators for transformed variables are also displayed in Table 5.5. It is observed that the transformed variables meet normality requirements.

TLOKP = (LOKP – 1) ** 0.82 (5.1)

TCREW = (8 – CREW) ** 0.6 (5.2)

TRECB = (8 – R ECB) ** 0.5 (5.3)

TEHLP = (8 – EHLP) ** 0.6 (5.4)

TSKGW = (8 – SKGW) ** 0.4 (5.5)

As such there was no theoretical basis for the variable transformations that were performed. The main purpose of the transformations was to observe whether there

would be any variations in the regression results due to satisfaction of normality or lack of it. Researchers have also suggested that sensitivity analysis should be employed to note the effect of transformations on regression results (Hair et al. 1998).

5.3.2. Outliers

Outliers are cases with extreme values with respect to one or more variables. Since outliers can radically alter the outcomes of analysis and are also violations of normality, they need to be considered separately by researchers (Hair et al. 1998). It is common to define outliers as cases, which are more than plus, or minus 3 standard deviations from the mean of the variable. Therefore, standardized scores of less than -3 or greater than 3 give indication of univariate (single variable) outliers. In total 6 univariate outliers were detected for the contribution model and 5 univariate outliers detected for the seeking model. We used the Mahalanobis distance criterion to detect multivariate outliers. Since none of the cases appeared as multivariate outliers and no valid reason existed to eliminate them, we did not eliminate any cases.

5.3.3. Multicollinearity

The ability of an IV to predict the DV is related not only to its correlation to the DV but also to its correlation to the other IV being used in the prediction. Multicollinearity in regression models is an unacceptably high level of intercorrelation among the independents, such that the effects of the independents cannot be separated (Hair et al. 1998). The impact of multicollinearity or correlation between IV is to reduce the predictive power of any single IV to the extent that it is associated with the other IV. Therefore it is likely that the IV which are maximally correlated with DV will appear as stronger predictors and possibly reduce the effect of any other IV which are correlated to these IV.

	SEFF	FOBL	SREW	TSKGW	PUOR	GTRU	PSNM	IDEN	SEFF * GTRU	FOBL * PSNM	FOBL * IDEN	SREW * PSNM	TSKGW * PSNM	SUSG
SEFF	1													
FOBL	-0.03	1												
SREW	0.05	0.29	1											
TSKGW	-0.26	0.07	0.08	1										
PUOR	-0.13	0.04	0.02	0.28	1									
GTRU	-0.05	0.08	0.20	0.16	0.18	1								
PSNM	-0.17	0.08	0.06	0.13	0.32	**0.57**	1							
IDEN	-0.28	0.08	0.02	0.29	0.26	**0.51**	**0.67**	1						
SEFF* GTRU	0.11	-0.10	0.13	0.04	-0.05	-0.16	0.03	0.13	1					
FOBL* PSNM	-0.15	-0.09	-0.19	0.06	0.09	0.04	0.02	0.04	-0.14	1				
FOBL* IDEN	-0.20	0.16	-0.01	0.15	0.11	-0.01	0.04	0.17	-0.04	**0.73**	1			
SREW* PSNM	0.07	-0.19	-0.24	0.01	0.04	0.17	0.13	0.06	-0.22	**0.57**	0.34	1		
TSKGW *PSNM	0.06	0.07	0.02	-0.10	0.09	0.07	0.23	0.01	-0.05	0.28	0.27	0.44	1	
SUSG	-0.16	-0.04	0.05	-0.36	0.67	0.08	0.17	0.21	0.02	-0.16	-0.25	0.06	-0.07	1

Table 5.6. Seeking Model Transformed Variables Correlation Matrix

	TLOKP	CEFF	KSEF	TCREW	TRECB	TEHLP	IMAG	GTRU	PSNM	IDEN	TLOKP* PSNM	CEFF* GTRU	CEFF* PSNM	CEFF* IDEN	TCREW* PSNM	TCREW* IDEN	IMAG* PSNM	TRECB* PSNM	KSEF* GTRU
TLOKP	1																		
CEFF	0.23	1																	
KSEF	-0.32	-0.19	1																
TCREW	-0.02	0.08	-0.13	1															
TRECB	0.12	0.24	-0.18	0.35	1														
TEHLP	**0.53**	0.31	-0.43	0.15	0.29	1													
IMAG	-0.04	-0.07	0.07	**-0.53**	-0.41	-0.33	1												
GTRU	-0.29	-0.41	0.23	-0.21	-0.30	-0.34	0.130	1											
PSNM	-0.18	-0.40	0.29	-0.16	-0.14	-0.30	0.22	**0.66**	1										
IDEN	-0.33	-0.33	0.24	-0.16	-0.23	-0.42	0.21	**0.60**	**0.66**	1									
TLOKP*PSNM	-0.07	0.28	-0.12	0.16	0.08	0.12	-0.05	-0.20	-0.25	-0.30	1								
CEFF*GTRU	0.18	0.20	-0.32	0.20	0.08	0.24	0.01	-0.17	-0.22	-0.14	0.32	1							
CEFF*PSNM	0.26	0.19	-0.36	0.08	0.13	0.29	0.08	-0.25	-0.11	-0.21	0.26	**0.69**	1						
CEFF*IDEN	0.17	0.24	-0.34	0.10	0.22	0.26	-0.08	-0.16	-0.21	-0.09	0.26	**0.66**	**0.72**	1					
TCREW*PSNM	0.15	0.09	-0.14	0.03	0.19	0.16	-0.12	-0.27	-0.05	-0.09	-0.01	0.02	0.19	0.10	1				
TCREW*IDEN	-0.01	0.09	-0.14	0.12	0.15	-0.02	-0.03	-0.13	-0.08	0.06	-0.05	0.12	0.08	0.21	**0.63**	1			
IMAG*PSNM	-0.05	0.08	-0.01	-0.11	-0.09	0.08	0.12	-0.03	-0.15	-0.01	0.06	0.03	-0.13	0.01	**-0.66**	-0.40	1		
TRECB*PSNM	0.07	0.13	-0.14	0.18	0.07	0.05	-0.08	-0.19	-0.23	-0.26	0.29	0.19	0.26	0.13	0.38	0.21	-0.49	1	
KSEF*GTRU	-0.10	-0.32	0.10	-0.08	-0.22	-0.12	0.05	0.36	0.39	0.24	-0.41	-0.47	-0.43	-0.44	-0.15	-0.24	0.02	-0.22	1
CUSG	-0.25	-0.25	0.46	-0.32	-0.31	-0.54	0.26	0.21	0.24	0.26	-0.19	-0.34	-0.24	-0.29	-0.08	-0.17	-0.03	0.01	0.19

Table 5.7. Contribution Model Transformed Variables Correlation Matrix

There are several indicators of multicollinearity problems, one indicator of bivariate collinearity being the intercorrelation among independents exceeding 0.80 (Berry 1993). Table 5.6. and 5.7. show the intercorrelations between variables in the seeking model and contribution model respectively, the highest value being 0.73. Further tests for multivariate multicollinearity such as tolerance, VIF and condition indices are described in Appendix D.3.2.

5.3.4. Homogeneity of Variances

Homoscedasticity is an assumption that DV exhibit equal levels of variance across the range of predictor variables (Hair et al. 1998). Homoscedasticity is desirable because the variance of the DV being explained should not be concentrated in only a limited range of the independent values. The most common test for this assumption is the Levene's test for homogeneity of variance. If the Levene statistic is significant at the 0.05 level or better, the researcher rejects the null hypothesis that the groups have equal variances. Therefore ideally we want the Levene statistic to be non-significant. Table 5.8. shows this statistic for the variables of both models. We observe two minor violations of the test for IMAG and GTRU variables. Typically non-homogeneity of variance problems are rectified by transformations of the DV (Hair et al. 1998). Since the other properties (e.g. normality) of the DV are satisfactory and the violations detected by the Levene test are minor, we did not attempt to transform the DV.

After partial checking for satisfaction of assumptions we proceeded with MRA and MMR analysis. The remaining tests for assumptions would be assessed as part of the regression procedure itself. As suggested by Hair et al. (1998) we performed regression analysis with

transformed, untransformed, and factor score variables to observe sensitivity of regression results to these differences.

Contribution Variable	Levene Statistic	Sig.	Seeking Variable	Levene Statistic	Sig.
TLOKP	1.515	0.103	**SEFF**	1.027	0.434
CEFF	1.526	0.091	**FOBL**	1.207	0.252
TCREW	1.405	0.124	**SREW**	1.345	0.161
IMAG	1.674	0.049*	**TSKGW**	0.692	0.807
TRECB	0.850	0.621	**PUOR**	1.570	0.072
KSEF	1.399	0.138	**GTRU**	0.847	0.617
TEHLP	1.147	0.319	**PSNM**	1.395	0.135
GTRU	1.677	0.048*	**IDEN**	1.057	0.401
PSNM	1.388	0.136			
IDEN	1.262	0.199			

Table 5.8. Levene Statistic for Both Model Variables

5.4. MMR Analysis

MMR analysis is commonly used (Aguinis and Pierce 1999) for testing moderating effects in IS (e.g. (McKeen et al. 1994) and (Weill and Olson 1989)) and in other disciplines (Jehn et al. 1999). MMR involves hierarchical regression that first tests the relationship of the IV of interest with the DV and secondly tests the relationship of a term that carries information about both IV (the interaction term). The interaction term is computed by multiplying the two predictors. The change in Rsquare and F values between the two steps if significant indicates the presence of interaction or moderation effect (see Sharma et al (1981) for a more detailed exposition on the procedure). The significance of F change is equal to the significance of the interaction term. Entering the predictors and interaction term simultaneously in a single step is acceptable and yields the same results as entering non-interaction terms first (Stone and Hollenbeck 1984). The only unacceptable sequence of entering variables is when the interaction term is entered into the regression as a first step by itself.

MMR is preferred over other techniques of detecting moderator effects such as sub-sample analysis (or median split) since the artificial dichotomization of continuous variable in sub-sample analysis leads to considerable reduction in statistical power. Also the measurement models (factor structure) for both sub-samples need to be similar in order to be able to perform comparison of coefficients for corresponding paths in different sub-samples (Carte and Russell 2003). Further, sub-sample analysis does not allow multiple moderation effects of different moderating variables to be tested simultaneously as is required for our study.

Although MMR has received criticism for having low statistical power, being unable to detect weak interaction effects, and for underestimating effects (Chin et al. 1996), it can give information about the type of moderator, direction, and strength of moderation particularly when used with cognizance of its limitations. In our study we have attempted to alleviate some of the limitations e.g., limitation of predictor variable variance reduction alleviated through appropriate sampling, and scale coarseness problem alleviated through employing 7 point scales (Aguinis and Pierce 1999). Further, some of the problems due to noisy measures in earlier studies (Chin et al. 1996) should be reduced with the use of relatively high reliability measures in our study. Lack of details in previous studies is remedied by reporting sample sizes, standardized coefficients, and significance levels in our study. Particularly we do not expect much difference between our MMR results and those from PLS testing of interaction effects since measures are adequately reliable, items within a construct are consistent and load fairly highly onto their constructs (see factor loadings of Tables 5.2. and 5.3.).

We now present the results of testing direct and moderating relationships hypothesized in the two models of Chapter 3. Three sets of results are presented: one each for transformed summated variables, untransformed summated variables, and factor score variables.

5.5. Contribution Model Results of Hypothesis Testing

All direct and interaction terms were employed simultaneously such that their effect could be seen in the context of the total model (testing individual moderation effects in isolation would not allow us to assess their significance in the presence of other direct and moderating effects). As recommended for reducing collinearity problems (Aiken and West 1991; Cronbach 1987), centered (mean subtracted) IV were used for MMR prediction.

5.5.1. Transformed Variables

Table 5.9. presents the results of testing the overall contribution model with 10 IV and 8 moderating terms entered using the stepwise estimation method. The stepwise method entered the IV in the order TEHLP, KSEF, TCREW, CEFF*GTRU, TRECB*PSNM, and TCREW*IDEN. The Rsquare (0.453), adjusted Rsquare (0.430) and F value (19.764, 0.00 significance) indicate that the model is satisfactory in terms of explaining variance in the DV[1]. Three direct predictors (enjoyment in helping others, knowledge self-efficacy, and

	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	4.835	0.070		68.604	0.0001
TEHLP	-0.925	0.165	-0.389	-5.596	0.0001
KSEF	0.192	0.063	0.218	3.047	0.003
TCREW	-0.532	0.161	-0.213	-3.308	0.001
CEFF*GTRU	-0.083	0.038	-0.148	-2.202	0.029
TRECB*PSNM	0.441	0.178	0.161	2.480	0.014
TCREW*IDEN	-0.298	0.136	-0.140	-2.190	0.030

Table 5.9. Regression Results for Transformed Variables Contribution Model

[1] According to Falk and Miller (1992), explanatory power above 10% is considered acceptable.

contributor economic rewards) are significant (at 0.05 level) in predicting usage. In addition, three moderating terms (contribution effort * generalized trust, reciprocity benefit * pro-sharing norms, and contributor economic reward * identification) are significant in predicting usage. Out of 10 hypothesized relationships, 5 were supported (see Table 5.10).

Hypotheses		Coefficient	T-value	P-value	Result
C1	TLOKP*PSNM	-0.118	-1.738	0.084	Not supported
C2a	CEFF*GTRU	-0.148	-2.202	0.029	Supported
C2b	CEFF*PSNM	0.090	0.996	0.321	Not supported
C2c	CEFF*IDEN	0.027	0.321	0.748	Not supported
C3a	TCREW*PSNM	0.113	1.262	0.209	Not supported
C3b	TCREW*IDEN	-0.140	-2.190	0.030	Supported
C4	IMAG*PSNM	0.010	0.133	0.894	Not Supported
C5	TRECB*PSNM	0.161	2.480	0.014	Supported
C6	KSEF	0.218	3.047	0.003	Supported
C7	TEHLP	-0.389	-5.596	0.0001	Supported

Table 5.10. Hypotheses Testing Results for Transformed Variables Contribution Model

Since CREW, RECB, and EHLP had been inverted during transformation, the signs of the coefficients need to be interpreted accordingly. The collinearity diagnostics and other tests for multiple regression assumptions are described in Appendix D.3.4. All assumptions were adequately satisfied.

5.5.2. Untransformed Variables

The contribution model regression results with untransformed variables are shown in Table 5.11. The Rsquare (0.455) and adjusted Rsquare (0.432) for this model are marginally higher than for the transformed variables model and have considerable

	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	1.742	0.382		4.566	0.0001
EHLP	0.386	0.068	0.394	5.702	0.0001
KSEF	0.202	0.062	0.230	3.248	0.001
CREW	0.167	0.054	0.198	3.121	0.002
CREW*IDEN	0.097	0.039	0.158	2.470	0.015
RECB*PSNM	-0.112	0.048	-0.150	-2.354	0.020
CEFF*GTRU	-0.085	0.038	-0.150	-2.234	0.027

Table 5.11. Regression Results for Untransformed Variables Contribution Model

explanatory capability (Falk and Miller 1992). The F value (19.907) for this model is marginally higher than for the transformed variables model and is also highly significant. As with the corresponding transformed variables model, EHLP, KSEF, CREW, CREW*IDEN, RECB*PSNM, and CEFF*GTRU are significant in predicting the DV. The significance values for these terms are somewhat different than for the corresponding terms in the transformed variables model. This can be expected due to the non-linear nature of the variable transformations. In this model, MR assumptions are not satisfied to the extent of the transformed variables model.

5.5.3. Factor Score Variables

Lastly we compared the results of hypothesis testing of transformed and untransformed variables models with the results of testing hypotheses for the factor score model. Contradictory evidence has been cited as to whether factor score regression results will be the same as summated scale regression results, with some authors claiming that the factor score variables are superior (Hair et al. 1998). Therefore we decided to verify the regression results for the factor score models. The contribution model regression results with factor score variables are shown in Table 5.12. The Rsquare (0.472) and adjusted Rsquare (0.450) for this model are somewhat higher than for the transformed and value

	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	-0.050	0.065		-0.774	0.440
EHLP	0.420	0.068	0.420	6.170	0.0001
KSEF	0.219	0.070	0.219	3.143	0.002
CREW	0.206	0.062	0.206	3.297	0.001
CEFF*GTRU	-0.125	0.055	-0.151	-2.273	0.025
RECB*PSNM	-0.136	0.058	-0.147	-2.348	0.020
CREW*IDEN	0.115	0.053	0.137	2.170	0.032

Table 5.12. Contribution Model Regression Results with Factor Score Variables

(21.323) for this model is somewhat higher than for the transformed and untransformed variables models and is also highly significant. As with the corresponding transformed and untransformed variables models, EHLP, KSEF, CREW, CREW*IDEN, RECB*PSNM, and CEFF*GTRU are significant in predicting the DV. The significance values for these terms are more or less similar to the significance of the corresponding terms in the transformed and untransformed variables models. In this model too, regression assumptions are not satisfied to the extent of the transformed variables model. In general we can conclude that all three models provide similar results.

5.6. Seeking Model Results of Hypothesis Testing

In the case of the seeking model as well, three sets of regression results were computed, one each for transformed variables, untransformed variables, and factor score variables.

5.6.1. Transformed Variables

Table 5.13. presents the results of testing the overall seeking model with 8 IV and 5 moderating terms entered using the stepwise estimation method. The stepwise method entered the IV in the order PUOR, TSKGW, FOBL*IDEN, and TSKGW*PSNM. The Rsquare (0.534), adjusted Rsquare (0.522) and F value (44.186 with 0.00 significance)

	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	5.331	0.053		99.997	0.0001
PUOR	0.641	0.059	0.624	10.798	0.0001
TSKGW	-0.139	0.057	-0.142	-2.432	0.016
FOBL*IDEN	-0.137	0.039	-0.206	-3.541	0.001
TSKGW*PSNM	0.130	0.046	0.163	2.810	0.006

Table 5.13. Regression Results for Transformed Variables Seeking Model

indicate that the model is satisfactory in terms of explaining variance in the DV (Falk and Miller 1992). Two direct predictors (perceived utility of results and seeker knowledge growth) are significant (at 0.05 level) in predicting usage. In addition, two moderating terms (future obligation * identification and seeker knowledge growth * pro-sharing norms) are significant in predicting usage. Out of 6 hypothesized relationships, 3 were supported (see Table 5.14.).

Hypotheses		Coefficient	T-value	P-value	Result
S1	SEFF*GTRU	0.049	0.895	0.372	Not supported
S2a	FOBL*PSNM	-0.023	-0.290	0.772	Not supported
S2b	FOBL*IDEN	-0.206	-3.541	0.001	Supported
S3	SREW*PSNM	0.049	0.776	0.439	Not supported
S4	TSKGW*PSNM	0.163	2.810	0.006	Supported
S5	PUOR	0.624	10.798	0.0001	Supported

Table 5.14. Hypotheses Testing Results for Transformed Variables Seeking Model

Since SKGW had been inverted during transformation, the signs of the coefficients need to be interpreted accordingly. Evidence of satisfaction of regression assumptions for the transformed variables seeking model is given in Appendix D.3.5.

5.6.2. Untransformed Variables

The seeking model regression results with untransformed variables are shown in Table 5.15. The Rsquare (0.534) and adjusted Rsquare (0.522) for this model are the same as for the transformed variables model and have considerable explanatory capability. The F value (44.186) for this model is the same as for the transformed variables model and is

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	5.331	0.053		99.997	0.0001
PUOR	0.641	0.059	0.624	10.798	0.0001
SKGW	0.139	0.057	0.142	2.432	0.016
FOBL*IDEN	-0.137	0.039	-0.206	-3.541	0.001
SKGW*PSNM	-0.130	0.046	-0.163	-2.810	0.006

Table 5.15. Regression Results for Untransformed Variables Seeking Model

also highly significant. As with the corresponding transformed variables model, PUOR, SKGW, FOBL*IDEN and SKGW*PSNM are significant in predicting the DV. Since only one variable (SKGW) was transformed hardly any difference in regression results between transformed variables model and untransformed variables model is apparent.

5.6.3. Factor Score Variables

The seeking model regression results with factor score variables are shown in Table 5.16.

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.017	0.055		0.308	0.759
PUOR	0.626	0.058	0.624	10.836	0.0001
FOBL*IDEN	-0.178	0.049	-0.212	-3.667	0.0001
SKGW*PSNM	-0.140	0.049	-0.165	-2.858	0.005
SKGW	0.138	0.058	0.139	2.379	0.019

Table 5.16. Seeking Model Regression Results with Factor Score Variables

The Rsquare (0.537) and adjusted Rsquare (0.525) for this model are marginally higher than for the transformed and untransformed variables models and have considerable explanatory capability. The F value (44.699) for this model is marginally higher than for the transformed and untransformed variables models and is also highly significant. As with the corresponding transformed and untransformed variables models, PUOR, FOBL*IDEN, SKGW*PSNM, and SKGW are significant in predicting the DV. The significance values for these terms are more or less similar to the significance of the corresponding terms in the transformed and untransformed variables models. Therefore we find that all three models have similar results.

5.7. Assessing Control Variables

Further analysis was conducted to rule out any rival hypotheses that the significance of the theoretical variables was a spurious result of their covariation with certain control variables.

5.7.1. Contribution Model

Previous literature suggests that gender (Jarvenpaa and Staples 2000), age (Jarvenpaa and Staples 2000), work experience (Constant et al. 1994) and education (Constant et al. 1994) may have an effect on knowledge contribution behavior. The primary potential confounds to be controlled in the contribution model are experience and education since they can be expected to covary with IV like loss of knowledge power, knowledge self-efficacy and image. The effects of gender and age though not so seemingly apparent are also worth investigating particularly due to previous evidence of their effects (Jarvenpaa and Staples 2000). Organization size was included as a proxy for other variables such as critical mass that may influence EKR usage. Hence these six variables (age, gender, education, current organization work experience, total work experience, and organization size) were captured and included in an augmented regression model to provide for greater quasi-experimental control.

Table 5.17. presents a full model incorporating all theoretical and control variables. The model represents a conservative approach of testing the theoretical model since the control variables could distort the size and stability of the theoretical variables' path coefficients. As per the table, there were no changes to the size and significance of the path coefficients

found important in the original theoretical model. Total work experience was the most correlated control variable with EKR usage for knowledge contribution but was not even significant at the 0.10 level in the full model. Additionally including the control variables on top of the theoretical variables did not increase variance explained. Hence we concluded that the significant effects of the theoretical variables were not a result of spurious covariation between the theoretical and the control variables.

Construct	Full model		Theoretical Model		Control Model	
	Beta	**Sig**	**Beta**	**Sig**	**Beta**	**Sig**
EHLP	0.420	**0.0001**	0.420	**0.0001**		
KSEF	0.219	**0.002**	0.219	**0.002**		
CREW	0.206	**0.001**	0.206	**0.001**		
CEFF*GTRU	-0.151	**0.025**	-0.151	**0.025**		
RECB*PSNM	-0.147	**0.020**	-0.147	**0.020**		
CREW*IDEN	0.137	**0.032**	0.137	**0.032**		
LOKP*PSNM	-0.123	0.062	-0.123	0.062		
CEFF*PSNM	0.062	0.479	0.062	0.479		
CEFF*IDEN	0.034	0.688	0.034	0.688		
CREW*PSNM	-0.113	0.180	-0.113	0.180		
IMAG*PSNM	0.022	0.771	0.022	0.771		
GENDER	0.097	0.114			0.131	0.123
AGE	0.037	0.548			-0.215	0.256
EDUCATION	-0.029	0.647			-0.018	0.836
WORK EXPERIENCE (Current organization)	0.052	0.410			-0.032	0.750
TOTAL WORK EXPERIENCE	0.070	0.262			0.385	**0.036**
ORGANIZATION SIZE	-0.022	0.732			-0.061	0.462
Rsquare	**0.472**		**0.472**		**0.070**	

Table 5.17. Comparison of Full, Control, and Theoretical Contribution Models

5.7.2. Seeking Model

Previous literature suggests that educational level and tenure affect pro-social attitudes and behavior (Brief and Motowidlo 1986) and hence could possibly impact knowledge sharing behaviour within organizations. In the context of KM, gender (Jarvenpaa and Staples

2000), age (Jarvenpaa and Staples 2000), work experience (Constant et al. 1994) and education (Constant et al. 1994) are reported to affect knowledge sharing. The main potential confounds to be controlled for in the seeking model are experience and education since they can be expected to covary with IV like perceived utility of results and knowledge growth. Tenure may covary with trust and identification. The effects of gender and age though not so seemingly apparent are also worth investigating due to previous evidence on their effects (Jarvenpaa and Staples 2000). Organization size was included as a proxy for other variables that may influence EKR usage. Hence these six variables (gender, age, education, tenure, total work experience and organization size) were included in an augmented seeking regression model to provide for greater control.

Table 5.18. presents the results for a full model incorporating all theoretical and control variables. There were no major changes to the size and significance of the path

Construct	Full model		Theoretical Model		Control Model	
	Beta	**Sig**	**Beta**	**Sig**	**Beta**	**Sig**
PUOR	0.620	**0.000**	0.624	**0.000**		
FOBL*IDEN	-0.235	**0.000**	-0.212	**0.000**		
SKGW*PSNM	-0.184	**0.002**	-0.165	**0.005**		
SKGW	0.149	**0.011**	0.139	**0.019**		
SEFF*GTRU	0.043	0.430	0.055	0.316		
FOBL*PSNM	-0.049	0.553	-0.040	0.628		
SREW*PSNM	0.028	0.661	0.044	0.489		
GENDER	-0.043	0.432			-0.134	0.110
AGE	0.027	0.616			-0.073	0.720
EDUCATION	-0.006	0.916			-0.024	0.776
WORK EXPERIENCE (Current organization)	0.020	0.715			0.072	0.546
TOTAL WORK EXPERIENCE	0.011	0.841			0.067	0.739
ORGANIZATION SIZE	-0.014	0.150			-0.093	0.258
Rsquare	**0.539**		**0.537**		**0.031**	

Table 5.18. Comparison of Full, Control, and Theoretical Seeking Models

coefficients found important in the original theoretical model. Gender was the most correlated control variable with EKR usage for knowledge seeking but was not even significant at the 0.10 level in the full model. Additionally including the control variables on top of the theoretical variables only explained an incremental variance of 0.2%. Hence we concluded that the significant effects of the theoretical variables were not a result of spurious covariation between the theoretical and the control variables.

5.8. Assessing Relative Importance of Theoretical Perspectives

As described in the theoretical background in Chapter 2, SET explains the individual motivations for usage of EKR whereas SCT explains the organizational community influences. To compare the relative contributions of the social exchange (individual) and social capital (community) perspectives, two sub-models involving each theoretical perspective were analyzed for the knowledge contribution model as well as the knowledge seeking model.

Construct	Model 1		Model 2	
	Beta	**Sig**	**Beta**	**Sig**
EHLP	0.416	**0.0001**		
KSEF	0.262	**0.0001**		
CREW	0.223	**0.001**		
LOKP	0.055	0.469		
CEFF	-0.070	0.293		
IMAG	-0.007	0.930		
RECB	0.094	0.174		
LOKP*PSNM			-0.154	0.070
CEFF*GTRU			-0.271	**0.022**
CEFF*PSNM			-0.007	0.955
CEFF*IDEN			-0.062	0.616
CREW*PSNM			0.050	0.681
CREW*IDEN			0.086	0.406
IMAG*PSNM			0.003	0.980
RECB*PSNM			-0.172	0.072
Rsquare	**0.42**		**0.163**	

Table 5.19. Comparison of SET and SCT knowledge contribution models

Table 5.19. provides a comparison of the SET and SCT models for usage of EKR for knowledge contribution. Model 1 represents SET and explains 42% of the variance in EKR usage for knowledge contribution. Model 2 represents the influence of SCT and accounts for 16.3% of the variance in EKR usage for knowledge contribution. These results suggest that individual costs and benefits of usage play the most influential role in determining contributors' motivation followed by the moderating influence of social capital (organizational community) factors.

Table 5.20. provides a similar comparison of the SET and SCT models for usage of EKR for knowledge seeking. Model 1 represents SET and explains 48.6% of the variance in EKR usage for knowledge seeking. Model 2 represents the influence of SCT and accounts for 9.7% of the variance in EKR usage for knowledge seeking. These results suggest that for knowledge seeking also, individual costs and benefits of usage play the most influential role in determining seekers' motivation followed by the moderating influence of social capital (organizational community) factors. The relative importance of SCT in explaining knowledge seeking behaviour appears to be less as compared to explaining knowledge contribution behaviour.

	Model 1		**Model 2**	
Construct	**Beta**	**Sig**	**Beta**	**Sig**
PUOR	0.620	**0.0001**		
SKGW	0.189	**0.002**		
SEFF	-0.032	0.592		
FOBL	0.007	0.908		
SREW	-0.071	0.222		
FOBL*IDEN			0.312	**0.0001**
SKGW*PSNM			-0.162	**0.042**
SEFF*GTRU			0.042	0.582
FOBL*PSNM			-0.051	0.662
SREW*PSNM			0.033	0.711
Rsquare	**0.486**		**0.097**	

Table 5.20. Comparison of SET and SCT knowledge seeking models

At the same time, the results of Tables 5.19 and 5.20 indicate that the additional explanatory power of SCT is still significant enough to justify its use in online communities of EKR users (see section 2.10.3. of Chapter 2).

Chapter 6

Discussion and Implications

This study sought to unravel the factors that shape usage of EKR for knowledge contribution and knowledge seeking by employing the combination of two theoretical perspectives: SET and SCT. This chapter discusses the results of hypothesis testing of the two models (knowledge contribution and knowledge seeking) based on the theoretical perspectives. It also attempts to interpret these findings and draw implications for theory, methodology, and practice. However prior to discussing and interpreting the findings, the strengths and weaknesses of each model variable are described.

6.1. Discussion of Model Constructs

Given the lack of empirical research on costs and benefits of EKR usage and social capital factors, an important objective of this research has been to develop and validate the model constructs to facilitate further research in this area. Significant emphasis has been placed on developing measures with high construct validity. Chapters 4 and 5 report the results of systematically testing the conceptual validity and construct validity of all constructs. We believe that this process of validation and explanation constitutes an important component of the study's contribution.

Before examining each individual variable in terms of construct validity, it is observed that the research instruments (variables of both models) derive credibility from several analyses conducted. Content validity has been adequately addressed through thorough review of multiple streams of literature, conceptual validation, discussions with

industry executives and faculty experts, pilot testing, and presentations in conferences and workshops. The similar results obtained from testing regression models with untransformed summated variables, transformed summated variables, and factor score variables also provided evidence of instrument reliability. While we were not able to test the full models using the pilot study dataset due to limitations of convenience sampling for the pilot, comparison of instrument properties across both pilot study and field study datasets yielded fairly consistent findings. These findings lend credibility to the research instruments because inputs to these measures for the pilot study and the field study were collected almost a year apart. Finally the significance of hypothesized relationships also serves the equally important purpose of lending evidence in support of predictive validity, and hence construct validity. The discussion of the predictive validity of each construct is done in the section on discussion of results (Section 6.2.).

6.1.1. Knowledge Contribution Model Constructs

Loss of Knowledge Power

Since no previous instrument was found, all four items for this construct were self-developed based on descriptions of the concept in previous literature. In both the pilot study and field study the construct performed well in terms of reliability (0.92 and 0.95) and factor loadings (minimum of 0.82). No items had to be dropped. Therefore, the construct derives its validity from the observed high internal consistency and discriminant validity. However the predictive validity of this construct was not established in our study since the moderated relationship between loss of knowledge power and EKR usage for knowledge contribution was not supported.

Contribution Effort

The contribution effort scale demonstrated adequate construct validity in terms of internal consistency, discriminant validity, and predictive validity. The internal consistency was high in both the pilot study (0.89) and the field study (0.91). The factor loadings in the field study allowed two components of contribution effort to be distinguished, the effort to enter or codify knowledge into EKR and the effort to follow up on queries resulting from the original contribution. The codification effort component was retained for subsequent analysis since the follow-up component was not felt to be a primary cost of contributing knowledge to EKR. Overall factor loadings were high (between 0.85 and 0.90). The predictive validity of this construct was supported through its significant relationship with EKR usage for knowledge contribution, moderated by generalized trust. However, the moderation of this relationship by other social capital factors (pro-sharing norms and identification) needs to be further investigated.

Contributor Economic Reward

The contributor economic reward construct exhibited satisfactory construct validity. Initially five items were formulated to measure this construct. However, the Alpha if item deleted diagnostic indicated that the item corresponding to expectation of getting better work assignments as a reward for knowledge contribution to EKR did not load as well as the other items related to expectation of promotion, higher salary, higher bonus, and better job security. A plausible explanation could be that respondents did not feel that this was a likely benefit of contributing knowledge to EKR and were motivated by the other (possibly more tangible) benefits. The internal consistency of the measure improved with the deletion of this item (from 0.93 to 0.96). Also the

minimum factor loading went up from 0.71 to 0.88 with the deletion of this item, indicating better discriminant validity. The predictive validity of this measure was substantiated by its significant direct and moderated (by identification) relationship with EKR usage for knowledge contribution. However the moderating effect of pro-sharing norms on this relationship was not supported.

Image

The validity of this construct was strong in all respects expect predictive validity. The internal consistency was considerably above the minimum threshold of 0.707 (0.87 for pilot study and 0.89 for field study). The factor loadings of all four items were adequate (minimum 0.69) indicating discriminant validity. The measure has considerable theoretical basis from technology adoption literature (Moore and Benbasat 1991), incentives literature (Green 1989), and IS literature (Kalman 1999). The predictive validity of this construct was not supported by our study.

Reciprocity Benefit

This construct exhibited adequate validity in all respects including predictive validity. Although initially two items were formulated for this construct (no previous measure was found), subsequently two additional items were added to strengthen the measure, out of which one item was later dropped as problematic. The internal consistency of the resultant three-item measure was adequate (0.85 in the field study). The discriminant validity was also satisfactory with all factor loadings exceeding 0.71. The predictive validity of this construct was as hypothesized with a significant moderating effect of pro-sharing norms on the relationship between this construct and the DV.

Therefore this study is significant in validating the effect of reciprocity norms (moderated by pro-sharing norms) on the usage of EKR for knowledge sharing.

Knowledge Self Efficacy

This construct performed well in all respects of construct validity. The four items for this construct had high internal consistency (0.89 in the pilot study and 0.96 in the field study). Discriminant validity was also satisfactory with loadings exceeding 0.77 in the pilot study and 0.87 in the field study. This instrument was mainly derived from Kalman's (1999) measure. It exhibited a significant positive relationship with EKR usage for knowledge contribution. Therefore the predictive validity of this construct was well substantiated.

Enjoyment in Helping Others

This construct was strong in all respects including predictive validity. The internal consistency of the four-item measure was high with 0.92 alpha in the pilot study and 0.96 alpha in the field study. Discriminant validity was not very high in the pilot study (loadings between 0.57 and 0.82) but improved in the field study (0.81 to 0.86). The reason for this could be that organizational employees in the field study probably felt a stronger benefit from helping colleagues than part-time students in the pilot study who may not have developed such feelings of altruism towards their colleagues. The predictive validity of this construct was very high with strong direct positive relationship between this construct and usage of EKR for knowledge contribution.

6.1.2. Knowledge Seeking Model Constructs

Seeker Effort

Seeker effort exhibited satisfactory properties in terms of internal consistency and discriminant validity. The internal consistency of the four-item measure was high in both the pilot study (0.80) and the field study (0.92). The factor loadings as in the case of most constructs improved from the pilot study (between 0.73 and 0.86) to the field study (between 0.85 and 0.92). However, contrary to hypothesis, this construct did not exhibit a moderated relationship with the DV. Therefore the predictive validity of this construct needs to be further investigated.

Future Obligation

Overall this construct performed well in terms of internal consistency, discriminant validity and predictive validity. The Cronbach alpha value for the four-item measure was adequate in both the pilot study (0.83) and the field study (0.89). Factor loadings were also satisfactory (0.75 - 0.87 in the pilot study and 0.76 - 0.91 in the field study). The relationship between future obligation and usage of EKR for knowledge seeking was partially as hypothesized. The relationship was moderated by identification but not by pro-sharing norms. The effect of norms on the relationship between future obligation and EKR usage for knowledge seeking needs to be further investigated.

Seeker Economic Reward

A counterpart to the contributor economic reward construct, the seeker economic reward construct was found to have high internal consistency and discriminant validity when the first item pertaining to the expectation of rewards of better work assignment for knowledge seeking was dropped. The alpha value for the 4 remaining items was

0.96 and the factor loadings ranged from 0.84 to 0.96. Contrary to hypothesis, the construct did not exhibit any significant moderated relationship with the DV. Therefore the predictive validity of the construct needs to be further explored.

Perceived Utility of Results

Notwithstanding that the 7 items for this construct were self-developed, the measure performed well. Of the 7 items, only one (PUOR1) loaded poorly on the construct during factor analysis. Considering that there was another item to measure reliability of results, this item could be culled without affecting content validity. The construct derives validity from its basis in theory (analogous to the perceived usefulness construct of TAM (Davis 1989)), the large number of items covering different aspects of utility, the observed high internal consistency (0.97) and discriminant validity (minimum loading 0.86), and the strong predictive validity. This strong positive relationship between perceived utility of results and EKR usage for knowledge seeking found in our study is consistent with previous KM studies (Goodman and Darr 1998; Wasko and Faraj 2000).

Seeker Knowledge Growth

This construct exhibited satisfactory properties in terms of internal consistency, discriminant validity and predictive validity. The internal consistency in both pilot (0.80) and field (0.97) studies was high. All four items loaded well onto the construct with minimum factor loading of 0.91. This construct proved to be a strong predictor of usage of EKR for knowledge seeking over and above perceived utility of results. i.e., it explained considerable additional variance in spite of being correlated to PUOR. Further, the relationship between this construct and the DV was moderated by pro-

sharing norms as hypothesized. Therefore this study is significant in explicating the important role of perceptions of knowledge growth in motivating users to seek knowledge from EKR.

6.1.3. Common Constructs

Generalized Trust

This construct had somewhat different properties for the knowledge contribution and knowledge seeking field data. Item 4 (relating to the belief that people in the organization share the best knowledge that they have) was omitted from the knowledge seeking model since it had poor properties in terms of internal consistency and factor loading. This item was retained in the knowledge contribution study since it had better internal consistency properties, even though the factor loading was not very high (0.63). Even then, the internal consistency of this measure in the knowledge contribution study was higher (0.85) than in the knowledge seeking study (0.77). The predictive validity of this construct was stronger in the knowledge contribution model than in the knowledge seeking model. In the contribution model trust moderated the relationship between contribution effort and EKR usage whereas in the seeking model it did not appear to have a significant effect. Therefore this construct warrants further investigation in the context of knowledge seeking.

Pro-sharing Norms

After deletion of item 5 (norm for toleration of mistakes) this construct had considerable internal consistency in both the knowledge contribution study and the knowledge seeking study (0.93 in both cases). Additionally, the discriminant validity of the 4-item construct was adequate with minimum factor loading of 0.66 in the

contribution model and 0.70 in the seeking model. In the contribution model, strength of pro-sharing norms was found to moderate the relationship between reciprocity benefit and usage of EKR. In the seeking model, strength of pro-sharing norms was found to moderate the relationship between knowledge growth and usage of EKR. Several other hypothesized moderating effects of pro-sharing norms were not supported, warranting further investigation.

Identification

The identification measure exhibited satisfactory psychometric properties particularly after deleting item number 6 ("I really care about the fate of my organization"). Since this construct measure had two other items relating to the loyalty dimension, the omission of this item did not appear to adversely affect its validity. The internal consistency of this measure was high (0.96) in both knowledge contribution and knowledge seeking field studies. The factor loadings were also adequate with minimum item loading of 0.80 in both studies. In the seeking model, identification was found to moderate the relationship between future obligation and EKR usage. In the contribution model, identification moderated the relationship between economic rewards and usage of EKR. However, it was not found to moderate the relationship between contribution effort and usage of EKR. This rival hypothesis warrants further investigation.

6.2. Discussion of Results

The primary objective of this research was to identify and assess a set of important variables that affect knowledge professionals' usage of EKR for contributing and seeking knowledge. In general, our empirical results provide support for our integrative framework that encompasses the social exchange and social capital

theoretical perspectives. Figures 6.1. and 6.2. provide graphical summaries of the results of the two models.

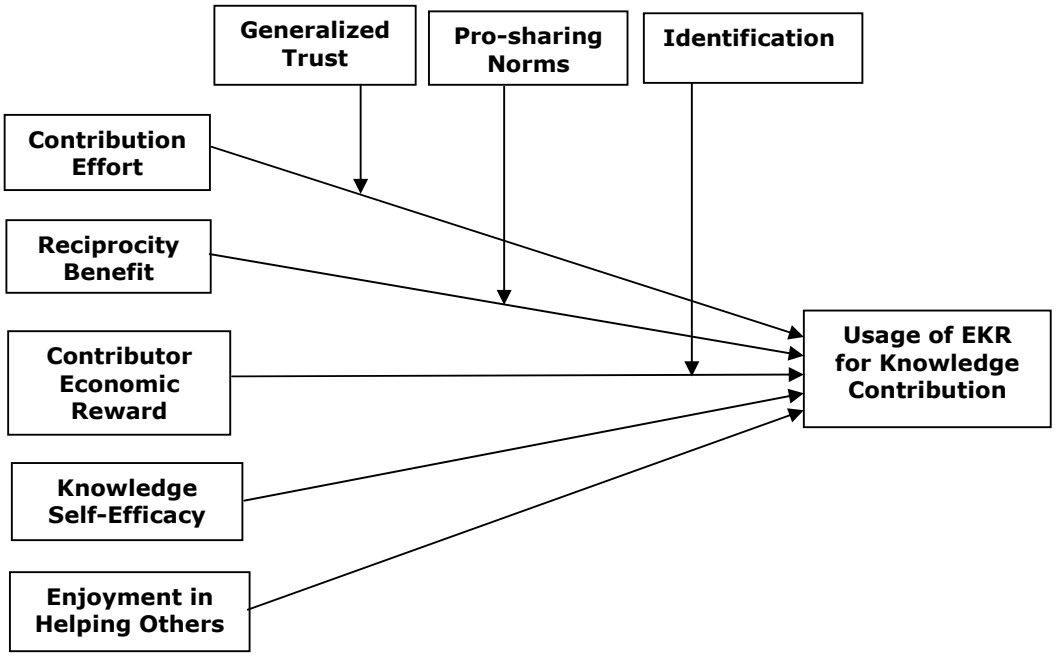


Figure 6.1. Knowledge Contribution Model Results

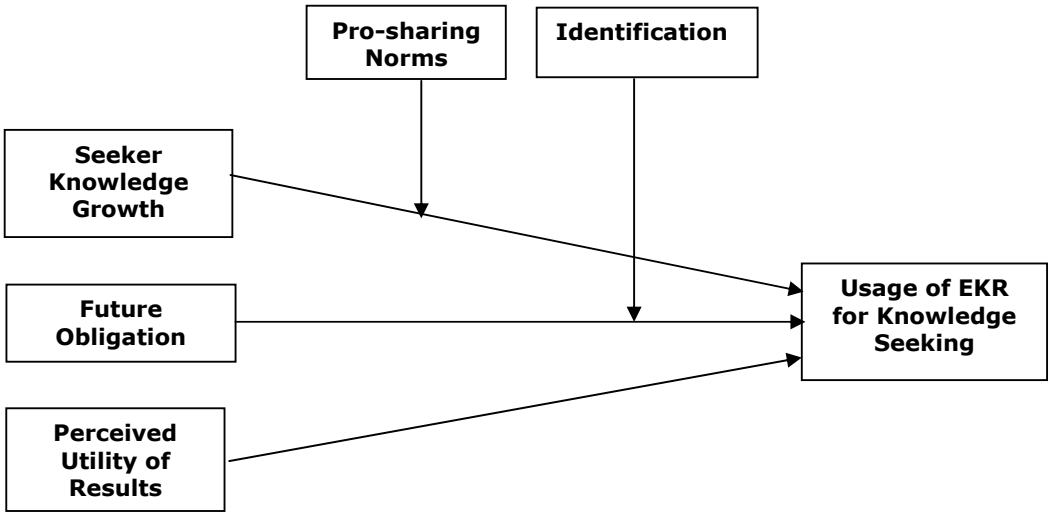


Figure 6.2. Knowledge Seeking Model Results

Perceived benefits such as enjoyment in helping others, knowledge self-efficacy, and economic rewards had significant effects on usage of EKR for knowledge contribution. Among social capital factors, trust had significant moderating effect on the relationship

between contribution effort and EKR usage for knowledge contribution, pro-sharing norms moderated the relationship between reciprocity benefit and usage, and identification moderated the relationship between economic rewards and usage.

Perceived benefits such as perceived utility of results and seeker knowledge growth had significant effects on usage of EKR for knowledge seeking. Among social capital factors, pro-sharing norms appeared to moderate the relationship between seeker knowledge growth and usage of EKR for knowledge seeking and identification moderated the relationship between future obligation and EKR usage.

Results for the two models are discussed in detail below. As can be seen from the two figures, the resultant models are considerably more parsimonious than the preliminary models of Chapter 3.

6.2.1. Knowledge Contribution Model

Enjoyment in helping others was a significant predictor of usage of EKR for knowledge contribution. It appears that individuals would be motivated to contribute knowledge to EKR if they perceive the "feel good" or psychic rewards of helping others. This finding is consistent with previous KM conceptual and case study literature that there exists some degree of altruism which motivates people to help others by sharing their knowledge (Ba et al. 2001; Davenport and Prusak 1998) and derive pleasure from exhibiting such pro-social behavior (Constant et al. 1994; Wasko and Faraj 2000). The mean value of this construct is quite high (5.33) indicating considerable belief in this benefit. As expected this relationship was not moderated by the social capital factors under study.

Knowledge self-efficacy is another predictor that was found to be significantly related to usage of EKR for knowledge contribution. In other words, individual's confidence in their ability to contribute knowledge that would positively impact organizational performance was found to motivate them to use EKR. This result is consistent with previous KM experiments (Constant et al. 1996) and conceptual articles (Ba et al. 2001) that reported the significance of the related concept of instrumentality i.e. employees belief that their knowledge could help solve problems of importance to the organization. Here again the mean value of the construct was 5.1 (neutral value being 4) indicating considerable believe in this benefit. As hypothesized, this effect was significant on its own i.e. not moderated by the social capital factors under study.

As expected, the relationship between ***economic rewards*** and usage of EKR for knowledge contribution was moderated by identification. When identification is high, the effect of economic rewards on contributor usage is stronger i.e. high identification with the organization reinforces the positive effect of economic incentives on knowledge contribution. On the other hand, the relationship between economic rewards and EKR usage was not moderated by pro-sharing norms. This could be due to the fact that effect of economic incentives that were prevalent in the organizations under study is viewed as independent of the existence of pro-sharing norms. Our study is important in bringing out the contextual conditions under which economic rewards would impact knowledge contribution to EKR.

Reciprocity benefit was also a significant predictor of usage of EKR for knowledge contribution. Its effect was moderated by pro-sharing norms. When pro-sharing norms are strong, knowledge contributors do not look for direct reciprocation of their

contributions. They are probably comfortable in the belief that someone would help them when they need it even if they don't contribute. Our finding agreed with the previous literature on importance of reciprocity benefits for knowledge contributors (Connolly and Thorn 1990; Kollock 1999), and additionally explicated the contextual conditions under which reciprocity benefit would act as a motivator for knowledge contribution to EKR.

Contribution effort was a significant predictor of usage of EKR for knowledge contribution, moderated by trust. As hypothesized, increased trust reduced the negative effect of contribution effort on usage of EKR. When contributors are sure that they would get credit for the knowledge they share and that their knowledge would be used appropriately, the effort of contributing seems less onerous. However, the relationship between contribution effort and usage was not moderated by pro-sharing norms and identification. This could be because norms are not sufficiently binding and identification not sufficiently motivating to overcome the negative effects of contribution effort. Our finding agrees with previous literature (Ba et al. 2001; Goodman and Darr 1998) on the deterrent effect of contribution effort for knowledge contribution. Further, our study explicates the contextual conditions under which the relationship between contribution effort and usage of EKR is significant.

The effect of ***loss of knowledge power*** on usage of EKR for knowledge contribution was not found to be significant in our study. The low mean value (2.25) of this construct on a scale with neutral value 4 indicated that this belief was not strong among our respondents. Loss of knowledge power may not be that important a cost for contributors if they perceive that sharing some (possibly small and possibly less tacit)

portion of their total expertise is not likely to make them more substitutable in the organization. Knowledge contributors are likely to have control over the extent of knowledge they contribute and therefore may not reveal their most valuable knowledge unless there is sufficient incentive.

Our study found that ***image*** was not a significant predictor of usage of EKR for knowledge contribution. This could be due to two reasons: (1) Its effect on the DV may have been masked by stronger predictors with which it was correlated i.e. enjoyment in helping others and economic rewards, (2) The possible dual effect of image. Previous literature suggests that increased recognition by peers and the organizational community is an important motivator for employees to contribute their knowledge (Constant et al. 1994; Hall 2001; O'Dell and Grayson 1998; Kollock 1999). The flip side of the argument is that image may have a negative effect on knowledge contribution in case incorrect knowledge is contributed and there is fear that this will result in loss of image. Therefore, possibly, dual measures of image may have to be used in future knowledge sharing studies.

6.2.2. Knowledge Seeking Model

There is a significant positive relationship between ***perceived utility of results*** and EKR usage for knowledge seeking. In other words, if users feel that the results from EKR are accurate, relevant and timely to satisfy their job-related needs, they would be more willing to seek knowledge from EKR. This result is consistent with previous KM literature (Goodman and Darr 1998; Wasko and Faraj 2000) and technology adoption literature (Agarwal 2000) where perceived usefulness has been consistently reported as

a significant predictor of technology usage. As hypothesized, this relationship was not moderated by the social capital factors under study.

There is a significant positive relationship between ***seeker knowledge growth*** and usage of EKR for knowledge seeking. In other words, people would be inclined to seek knowledge from EKR for the sake of the intrinsic benefit of enhancing their knowledge over and above the extrinsic benefit of obtaining useful (job-related) results from the EKR. This benefit could result from a possible increase in their feelings of self-image and self-efficacy from knowledge growth and the possibility of being able to enhance job performance in the future with the enhanced knowledge. This relationship is moderated by pro-sharing norms in that strong norms reduce the need for this intrinsic benefit. Our results agree with previous KM literature (Wasko and Faraj 2000) on the importance of knowledge growth as a benefit for knowledge seekers and additionally identify the contextual conditions under which this benefit motivates knowledge seeking from EKR.

Future obligation cost was perceived as an important deterrent for people to seek knowledge from EKR under conditions of low identification. When identification is high, people would choose the behavior which best promotes the perceived interests of the organization (Johnson et al. 1999). Under such conditions, seekers may be motivated to contribute knowledge as and when required. Particularly, they may not strongly perceive a cost of having to repay back in future for seeking knowledge from EKR now. Contrary to hypothesis, the relationship between future obligation and the DV was not moderated by pro-sharing norms i.e. norms were not significant in overriding the deterrent effect of future obligation on EKR usage. Therefore, our study

was significant in identifying the conditions under which future obligation acts as a cost for people seeking knowledge from EKR.

In our study, ***seeker effort*** did not exhibit a significant relationship with usage of EKR for knowledge seeking. The mean value of this construct (3.19) was below the neutral value of 4 indicating weak perceptions of this belief among our respondents. For most technology savvy knowledge professionals experienced in searching on the web, seeker effort may not be a significant cost. Additionally if EKR retrieval technology is well designed and previous experience with searching has been favorable, seeker effort may not be a significant deterrent to EKR usage.

Seeker economic rewards were not significant predictors of EKR usage in our study. The mean value for this variable (3.56) was below neutral indicating that respondents did not have a very strong belief in this benefit. Economic incentives for seekers may be relatively less prevalent and of lesser magnitude than economic rewards for contributors. Therefore utility of results and knowledge growth may be stronger motivators for knowledge seekers than economic rewards.

6.3. Implications of Results

This study has important implications for theory, methods, and practice. Implications for theory are discussed in terms of the overall conceptual framework and each of the theoretical perspectives. Implications for methods are discussed in terms of implications for instrument development and implications for data analysis. Implications for practice are proposed for technology architects, organizational management, knowledge contributors and knowledge seekers.

6.3.1. Implications for Theory

This research provides support for our ***conceptual framework*** that was adapted from social exchange and social capital theories. It demonstrates that social exchange factors (costs and benefits) can act as significant predictors of usage of EKR for knowledge contribution and knowledge seeking and indicates which antecedents are relatively more important. It also shows that social capital factors moderate relationships between social exchange costs and benefits and usage of EKR. The moderating influences help to explicate the organizational community conditions under which different costs and benefits would impact usage behavior. Our conceptual models explain 46% of the variance in contribution usage and 53.4% of the variance in seeking usage as compared to an explanatory power of 29.2% in a previous study of usage of electronic media for contribution and seeking (Jarvenpaa and Staples 2000). TRA based studies have explained 5.4% of the variance in knowledge contribution via electronic media (Bock and Kim 2002). These results validate the importance of using SET and SCT theoretical perspectives in predicting usage of EKR. Moreover, the inclusion of variables from multiple theoretical perspectives into a single model for statistical testing is likely to lead to more valid and stable research findings. Our study represents an important step towards building a general theory of generalized knowledge exchange by integrating the individual level social exchange perspective with the organizational community level social capital perspective.

With regard to ***SET applied to knowledge contribution to EKR***, an important contribution of our research is in explaining the motivating role of intrinsic (enjoyment in helping others and knowledge self-efficacy) and extrinsic (economic rewards and reciprocity) benefits experienced by contributors. Effects of extrinsic benefits were moderated by social capital factors to either enhance (e.g. economic rewards and identification) or reduce (e.g. reciprocity benefit and pro-sharing norms) the effects of the benefits on EKR usage. Intrinsic benefits (enjoyment in helping others and knowledge self-efficacy) appeared to be strong predictors of EKR usage on their own.

The costs that contributors experience (contribution effort) can be moderated by social capital factors (trust) such that their deterrent effect is reduced under conditions of higher social capital. Certain costs and benefits of contribution may be significant predictors on their own but not in the presence of stronger correlated predictors. Therefore a contribution of our study is to point future research towards exploring inter-relationships and dependencies among various costs and benefits rather than providing lists of costs and benefits as much previous research has done.

With regard to ***SET applied to seeking knowledge from EKR*** too, our study was important in explicating the motivating role of both intrinsic (knowledge growth) and extrinsic (perceived utility of results) benefits experienced by seekers. Extrinsic task-related benefits (perceived utility of results) appear stronger than extrinsic economic benefits. The effect of extrinsic benefits (perceived utility of results) was not moderated by social capital factors, while the effect of intrinsic benefits was moderated by these factors (e.g. knowledge growth and pro-sharing norms). This moderation behavior is contrary to that for knowledge contribution. As in the case of contributor costs, the deterrent effect of seeker costs (future obligation) was reduced by social capital factors (identification). Again, as in the case of the contributor costs and benefits, seeker costs and benefits also appear to exhibit interdependencies that need to be further investigated.

With regard to ***SCT applied to knowledge contribution and knowledge seeking in EKR***, the role of the relational dimension of social capital (trust, norms and identification) in motivating knowledge exchange is partially validated. Pro-sharing norms are significant moderators for extrinsic benefits (reciprocity benefit) for knowledge contribution and for intrinsic benefits (knowledge growth) for knowledge

seeking. Identification is a significant moderator for extrinsic benefits (economic rewards) for knowledge contribution. It is also a moderator for reducing the effect of costs (future obligation) of knowledge seeking. Trust only appears as moderator for reducing the effect of costs (contribution effort) of knowledge contribution.

Our study benefits ***research on the usage of EKR in particular*** and ***KMS in general*** in several ways. First, focusing on the usage of EKR by contributors and seekers in various stages of EKR implementation (though not very mature stages) allows us to derive findings that are more generalizable in nature. Second, our choice of sample that straddles across industries in the public sector is likely to make our results generalizable across these industry sectors. Third, our results derive credibility and validity from the use of respondents who have direct experience in using EKR as contributors or seekers. This allows them to be aware of, perceive, and report on their perceptions of the costs and benefits they experience in using EKR and the feelings of trust, norms, and identification they hold towards the organizational community. In general, this research demonstrates that it is possible to construct strong predictive variance models and achieve significant results when researchers confine their focus to specific class of KMS and specific contexts, and employ rigorous methodology and comprehensive theory tailored to those systems and contexts.

The theoretical frameworks developed in this study can be extended to explain and compare the antecedents of knowledge sharing via different forms of KMS such as electronic COP and also direct face-to-face communication. Further, SET and SCT can be applied to different knowledge sharing contexts both at intra and inter-organizational levels. For example, these theoretical perspectives may be employed to

explain knowledge sharing in long-term virtual project teams and inter-organizational knowledge sharing in industry bodies. SCT's applicability is enhanced by its successful extension to online communities.

6.3.2. Implications for Methods

This study has employed a systematic and rigorous methodology for the development of measures for the theoretical constructs. It combined Churchill's (1979) paradigm with Moore and Benbasat's (1991) sorting procedures to create, purify, and validate the developed measures. We believe that the strong results manifested in the measurement model could not have been achieved without following these systematic and rigorous procedures.

Measures were created for loss of knowledge power, contribution effort, contributor and seeker economic rewards, contributor reciprocity benefit, enjoyment in helping others, seeker effort, seeker future obligation, perceived utility of results, seeker knowledge growth, and usage of EKR for knowledge contribution and knowledge seeking constructs. Existing measures of image and knowledge self-efficacy were customized for our study. A significant contribution of our research was the creation of comprehensive measures for the relational dimension of social capital. Previous literature (e.g. Tsai and Ghoshal 1998) has developed measures for the overall dimension but has not gone to the extent of operationalizing individual components of the relational dimension i.e. trust, norms, and identification. We feel that this contribution is particularly useful for promoting further empirical research on social capital, which has become a topic of great interest and importance in recent times

(Cohen and Prusak 2001). All new and modified measures exhibited satisfactory psychometric properties.

Yet another implication of this study in terms of methodology is the ***testing of alternative analysis techniques*** to verify robustness of results. First, the sensitivity of results to satisfaction of normality assumptions was tested by performing regression with both transformed (to comply with normality assumptions) and untransformed variables. In general our findings do not appear to be sensitive to these assumptions confirming previous observations (Hair et al. 1998) that regression results are not sensitive to small violations of normality assumptions. Second, our results did not appear to be sensitive to the method of creating single measures from multiple item measures for constructs. Both refined factor score scales and coarse summated scales yielded similar regression results for both contribution and seeking models.

The ***method of moderator analysis*** was chosen as MMR. Although MMR has its drawbacks, it is preferred over other methods of moderator effect analysis such as split sample testing and product term testing. Split sample analysis has been criticized mainly for the considerable reduction in statistical power due to splitting the sample along the median value of the moderator variable and also for the difficulty in comparing coefficients across measurements models of sub-samples, which may not be comparable. Product term testing has been criticized for the complexity and clumsiness of multiplying each item of the predictor measure with each item of the moderator to create a large number of measures for the interaction term, which can be quite unwieldy to handle particularly when there are several interaction terms in a model. Therefore MMR was preferred for providing robust results particularly when using

high reliability measures and non-dichotomous IV. Further, MMR allowed for the simultaneous testing of moderating effects due to different moderators, not possible with split-sample analysis.

6.3.3. Implications for Practice

This research has practical implications for organizational management, technology architects, and users of EKR. The findings could help the different stakeholders to take action that can promote EKR use for commercial profits (for technology architects and vendors), for organizational benefit (for organizational management), and for personal benefit (for individual users).

Organizational Management

This research suggests several implications for management to promote the usage of EKR by enhancing significant benefits and alleviating significant costs for users.

Following implications are relevant for increasing **contributor usage**:

- *Increase feeling of enjoyment in helping others*. This could be accomplished by connecting seekers with contributors and allowing them to express their appreciation of how useful the knowledge contributed has been in their work. This would serve to increase contributors' perception of enjoyment in helping those who are in need and fuel their feelings of altruism. For example, altruism and community spirit is encouraged through such means in Microsoft corporation's Most Valuable Professionals or MVPs program where people provide technical assistance to other users of Microsoft technology (Microsoft 2002).
- *Increase perceptions of knowledge self-efficacy* by highlighting knowledge contribution success stories and their positive impact on organizational

performance. This would serve to increase knowledge self-efficacy perceptions among potential contributors. A number of organizations such as Global Knowledge Partnership (http://www.globalknowledge.org) publicize knowledge contribution success stories. Praise of knowledge professionals' capabilities and work by superiors would also serve to heighten feelings of knowledge self-efficacy.

- *Target economic rewards particularly for individuals who have greater identification with the organization*. Organizations may use both tangible and intangible incentives to encourage employees to contribute knowledge to EKR. Organizations like IBM Global Services have introduced schemes to identify and reward specific instances of knowledge contribution (Berry 2000). High identification individuals may be more readily motivated by incentives to contribute knowledge to EKR. They could thereby act as initial users to build up a critical mass of contributors such that seekers may find useful content when they search the EKR. Subsequently lower identification employees could be motivated through other significant benefits.
- *Alleviate negative effects of knowledge contribution effort through setting up higher trust conditions*. Higher trust could be promoted by ensuring that credit is given for knowledge contributions i.e. all knowledge contributions are duly acknowledged. Such practices are adhered by successful KM organizations such as Buckman Laboratories (Buckman 1997). Also realizing that contribution effort can be a significant barrier to EKR usage under low trust condition, measures should be taken to alleviate this effort. Organizations could allocate time for their employees to share knowledge and integrate the capturing and sharing knowledge

into the work processes as is done at major consultancy firms such as Accenture (Hansen et al. 1999).

- *Increase reciprocity benefits particularly under conditions of low pro-sharing norms.* This can be accomplished by ensuring that requests for help by people who have contributed in the past are answered. Alternatively, improving pro-social norms would reduce knowledge contributors' need for reciprocity benefit. Organizations have been successful in improving such norms through means as diverse as British Petroleum's creation of open office spaces (Chiem 2001) to General Electric's practice of moving employees among departments (Dzinkowski 2001).

Following implications are relevant for increasing **seeker usage**:

- *Perceived utility of results needs to be increased*. Therefore EKR should be populated with relevant, accurate, and timely knowledge pertaining to the needs of seekers. This finding has implications both for KM managers as well as other senior management. First, contributors should be encouraged to share their knowledge using various recommendations suggested in the preceding discussion. Second, quality of knowledge can be vetted by implementing appropriate content review processes (Kankanhalli et al. 2001). Reviewing and filtering processes can be fully automatic (e.g., agent filtering), semi-automatic, or done entirely by human experts (Ackerman 1998). The costs of the reviewing and filtering processes versus the quality of knowledge gathered are an important tradeoff when organizations choose between automatic and human forms of knowledge filtering (O'Leary 2001). At one extreme, some organizations collect every bit of information about a topic and then let the indexing and retrieval technologies sort

out what is relevant. At the other extreme, certain organizations exercise strict quality control through human experts by filtering out low quality knowledge and accept the risk of losing some potentially useful knowledge. When confronted with such a tradeoff, organizations need to be cognizant of the fact that the costs of quality assurance may yield benefits in the form of greater usage of EKR by knowledge seekers (and perhaps better individual productivity as a result of the greater usage). Third, currency can be maintained by ensuring frequent updates through contributors and knowledge content owners. Fourth, feedback of users must be periodically solicited so that the EKR can evolve to remain relevant to seekers.

- *Increase perceptions of knowledge growth* by highlighting the learning benefits of using EKR. If seekers are convinced of personal knowledge growth, they may be motivated to use EKR even when knowledge found is not directly relevant to their immediate work. Organizations such as Clarica Life Insurance focus strongly on developing individual capability through highlighting the learning benefits of KM (Barth 2000). Promoting employees' personal growth and development would also lead to higher employee satisfaction and morale in the long term. Such measures would be necessary particularly under conditions of low pro-sharing norms. High pro-sharing norms would over-ride the need for such benefits.
- *Decrease cost of future obligation to increase seeker usage*. Future obligation cost can be reduced under conditions of high identification. Therefore, identification needs to be promoted by increasing employee affiliation, membership, and loyalty. A number of organizations such as SAP have realized the importance of fostering identification for facilitating knowledge sharing and reuse (Huysman 2002).

Technology Architects

EKR technology developers and vendors may benefit from the findings of this research that suggest ways to promote usage of their products. Based on our findings, reducing contribution effort and increasing utility of results are key concerns of EKR users that can be addressed by technology designers.

- *EKR should be designed so that entry of knowledge documents is as minimally onerous to contributors as possible*. Mechanisms to facilitate knowledge entry include intelligent acquisition and improved content taxonomy. An interactive system that prompts for knowledge and organizes the knowledge can reduce contribution effort. A comprehensive domain categorization that captures inter-category relationships can ease contribution effort. KM products that claim some degree of automatic classification of knowledge documents include Autonomy's ActiveKnowledge technology and Invention Machine's semantic processing technology (Lawton 2001). Cost of knowledge capture can also be reduced by allowing more natural forms of knowledge acquisition (e.g. audio or video contribution) as opposed to purely text contribution. This may be particularly appropriate for more tacit forms of knowledge. Although some commercial KM systems allow entry of video and audio documents, the challenge remains to integrate these knowledge sources with more conventional text documents.
- *Seeker utility of results can be increased* by designing filtering, indexing, and retrieval technologies that ensure appropriate content goes into EKR and can be readily found. Indexing and retrieval technologies need to be designed that can efficiently customize and refine searches and provide relevance feedback. Knowledge seekers need to be provided information about the quality of knowledge retrieved to enable them to make reasonable judgments about reuse.

Examples of such information include quality ratings, reviews, and number of hits. An example of such technologies is Invention Machine's semantic processing engine that has been used by companies like Intel to find knowledge that helped them develop new products (Lawton 2001).

Knowledge Contributors

Knowledge contributors need to derive ways to reduce their significant costs and increase their significant benefits.

- *Increase feelings of enjoyment in helping others*. Contributors should realize that helping others by contributing quality knowledge to EKR has intrinsic rewards. Such altruistic behavior can also increase feelings of self-image, self-expression, and self-efficacy (Constant et al. 1994).
- *Increase feelings of knowledge self-efficacy*. Contributors must ensure that the knowledge they are contributing is relevant to the organization. This would serve to increase their feelings of knowledge self-efficacy. Resultant effects of contributing relevant and quality knowledge are that their contributions would be used more and consequently rewarded more in some form or other.
- *Increase reciprocity benefit when pro-sharing norms are low*. Under conditions of low pro-sharing norms, contributors need to convince themselves that when they contribute to EKR, their own future needs will be met by contributions from others i.e. they need to believe in a more generalized form of reciprocity.
- *Increase economic rewards when identification is high*. Under conditions of low identification, economic rewards are not likely to be as effective. Conversely when identification is high, contributors should seek extrinsic economic rewards such as

bonuses, salary benefits, and career growth options for contributing their knowledge to EKR.

- *Reduce contribution effort when trust is low*. Under conditions of low trust, contributors may reduce contribution effort by contributing less in quantity and contributing less tacit forms of knowledge. This would be a mechanism for them to protect themselves against lack of appropriate credit being given for their contributions. However such behavior would be detrimental in the long term because the success of EKR would depend on a critical mass of contributors who contribute quality knowledge by expending their effort.

Knowledge Seekers

Knowledge seekers also need to derive ways to reduce their significant costs and increase their significant benefits.

- *Increase perceived utility of results*. From seeker perspective the main mechanism to increase perceived utility of results is to ensure that they search EKR effectively such that they are able to locate relevant knowledge if it is available. They can hone their search skills by improving selection of key words and refinement of search queries.
- *Increase knowledge growth when pro-sharing norms are low*. Under conditions of low pro-sharing norms, seekers need to convince themselves that they will learn more by using EKR. They can increase their awareness of the knowledge growth and self-development benefits of using EKR since these benefits are likely to be important for future work and career growth as well.
- *Reduce obligation when identification is low*. Under conditions of low identification, seekers should seek less in order to reduce cost of future obligation.

By using EKR less they will be protecting themselves against future need to contribute in order to repay back for seeking knowledge now. This may be a good self-protection mechanism for seekers but eventually it would be detrimental to the success of EKR because EKR would not be effective unless there is a critical mass of seekers.

Chapter 7

Conclusion

In this chapter, we summarize the contributions of this study and discuss some potential limitations of the research. Lastly, several suggestions for further research stimulated by this study are presented.

7.1. Contributions

This thesis makes the following contributions to theory, method and practice.

- Answers the research questions about the relative importance of individual costs and benefits in impacting EKR usage for knowledge contribution and knowledge seeking. It also explicates the contextual conditions under which these factors significantly affect EKR usage.
- Provides a review of knowledge contribution and knowledge seeking literature from various streams. It highlights key gaps in the literature and suggests an integrative framework to address the gaps.
- Provides an integrated framework that encompasses individual level social exchange motivations and community level social capital dimensions to explain usage of EKR. As highlighted in this thesis, behavioral costs of knowledge exchange through EKR have not been empirically studied in the previous literature. Also individual and community level perspectives have not been combined in this context.
- Develops measures of user costs and benefits that are specific to the examination of usage of EKR. To date there are no validated scales for most of the constructs except knowledge self-efficacy and image. Further, the relational dimension of social capital

has previously been operationalized through measures that do not distinguish the different components of this dimension. Our research defines measures for each of the three components i.e. trust, pro-sharing norms, and identification. Obligation is operationalized as an individual level cost and reciprocity as an individual level benefit. Thus, the systematic and rigorous development of measures for the theoretical constructs represents a significant contribution of this thesis.

- Contributes to theory building in the area of knowledge sharing and knowledge management, given the high construct validity of the scales, strong research findings, and high explanatory power as compared to previous related studies. It also provides important implications for each of the theoretical perspectives.
- Undertakes sensitivity analysis for violation of regression assumptions and different ways of computing single scale measures of variables. This provides evidence of robustness of results to different methods of computing variable measures.
- Validates and assesses the applicability of our conceptual models and theoretical perspectives in public organizations in an Asia-Pacific context. The field data draws from different industry sectors within the government and therefore the results should be generalizable across these sectors.
- The field data also draws from organizations in initial and intermediate stages of EKR implementation (though none which are very mature). Therefore results should be generalizable across these stages of maturity.
- Provides important implications for theory, methods, and practice. Practical implications are discussed for organizational management, technology designers, and EKR users.

7.2. Potential Limitations

Potential threats to validity listed by Cook and Campbell (1979) provide a basis for discussing the limitations of this research. These are threats to internal validity, threats to construct validity, threats to statistical conclusion validity and threats to external validity.

7.2.1. Threats to Internal Validity

Internal validity refers to "the validity with which statements can be made about whether there is a causal relationship from one variable to another in the form in which the variables were manipulated or measured" (Cook and Campbell 1979, pp. 38). In this regard, threats to internal validity cast doubts on whether there was a causal relationship between the independent variables as measured and the dependent variable as measured. There are two possible threats to internal validity. First, the use of regression does not allow us to explore the possibility of bi-directional (feedback) effects. For instance the effect of usage on subsequent perception of costs and benefits is recognized but cannot be tested. Second, the use of cross-sectional data to test for causality is a limitation of the study. When data is collected at one time instance, assumption of causality is always suspect. Only a longitudinally designed study would allow one to assess the directions of causality with confidence. However, given the newness of our integrated framework, cross-sectional studies can be used as exploratory vehicles to determine relationships of interest. Future research using these theoretical models can employ a longitudinal design to investigate the directions of causality.

7.2.2. Threats to Construct Validity

Threats to construct validity result in "confounding" or plausible rival explanations of the phenomenon. Several steps have been taken to minimize threats to construct validity. First, theoretical foundations were extensively reviewed to provide definitions and generate measures for the constructs of interest. Second, the measures were rigorously developed using the combined approach of Churchill (1979) and Moore and Benbasat (1991). Third, the measures were carefully tested using pilot and field data and the implications of the results were discussed. Most of chapter 4 and part of chapter 5 were devoted to explaining those steps undertaken.

Nonetheless, constructs such as utility of results, contributor and seeker effort, and usage itself could benefit from more objective assessment. Moreover, the fact that our theoretical models account for 45-55% of the variance in usage suggests that additional predictors may be missing. Therefore future research could look into improving explanatory power.

7.2.3. Threats to Statistical Conclusion Validity

Statistical conclusion validity is concerned with the question of "whether a presumed cause-and-effect covary" (Cook and Campbell 1979). Threats to statistical conclusion validity cast doubts on whether it is reasonable to accept the predicted relationships, given a specified alpha level and the obtained variances. One possible threat to statistical conclusion validity is sample size. We have taken great pains to ensure that we would have enough sample size before data was collected. Given the number of constructs (11 in the contributor model and 9 in the seeker model) and the number of measures for our largest construct (7), the samples sizes of 150 and 160 should be more than adequate at

least for the direct effects. For moderating effects however we still have the limitations of lower reliability of product terms and scale coarseness (continuous variables are preferable). One possible consequence of inadequate power is Type II error, a failure to identify a relationship that exists. Since approximately half of our hypothesized direct and moderating effects were significant, we conclude that our sample size did not compromise our test results of the hypothesized relationships severely.

7.2.4. Threats to External Validity

External validity is concerned with whether causal relationships can be generalized to and across populations of persons, settings, treatments, and times (Cook and Campbell 1979). Given that ours is a field study, threats to external validity should be reduced. The choice of a sample with varying characteristics also helps to minimize these threats. From the descriptive statistics, it was observed that the sample is diverse in terms of gender, age, education, experience, tenure, functional background, size of organization, and industry sector. These measures were included as control variables and evaluated. None of the variables was significant at 5% significance level. Finally, our comparison of respondents versus non-respondents revealed no significant differences. However, it is important to note that this study was conducted on organizations operating in Singapore. Although most of the organizations in our sample are typical companies in different government sectors, due caution must be exercised when generalizing results to knowledge professionals in organizations operating in differing institutional and cultural contexts.

7.3. Directions for Future Research

The results of this research suggest several avenues for future work. The directions are discussed in terms of studying additional constructs and relationships, replication of the work across other settings (e.g. different KMS, users, organizations, and other nations / cultures), and extension to allied socio-technical problems.

Additional constructs and relationships

- Include additional constructs for individual costs (e.g. system learning cost, review cost, and follow-up cost), benefits (e.g. network benefit), organizational contexts (e.g. size of EKR user community), and task factors (e.g. task interdependence and tacitness) to possibly enhance explanatory power.
- Replicate the study of our theoretical models using longitudinal designs. Where possible feedback links from EKR usage to perceived costs and benefits should be included and tested. Such studies would allow us to ascertain with greater confidence the directions of causality and allow a richer interpretation of the theoretical model.
- Explore interactions and causal links among cost, benefit and social capital variables and between variables from different theoretical perspectives, given the correlations between them. This will allow us to understand why certain costs or benefits dominate the effect of others and why certain moderators are significant while others are not.
- Formulate and test a second order model of costs and benefits using structural equation modeling techniques. Perceived cost and perceived benefit could be considered as second order constructs with different costs and benefits as their formative indicators.

This approach could allow a more rigorous test of the concepts behind SET and improve its applicability.

- Validate the usefulness of the contributor image construct, contributor loss of knowledge power construct, seeker economic rewards construct, and seeker effort construct. These constructs were not significant in our model and further attention is warranted to assess their predictive validity.

Replication across different KMS, users, organizations, nations / cultures

- Conduct studies examining usage of different types of KMS (e.g. personalization based KMS as opposed to codification based KMS) incorporating our theoretical models for testing and validation. Such an approach could further contribute to theory building in KM.
- Assess the effect of different user demographics on the perceived costs and benefits and consequent usage of EKR. This will allow specific usage enhancement measures to be catered for different demographic groups.
- Conduct similar studies across different industry sectors. For example EKR usage models could be compared across public and private sectors, product versus service sectors, and other classifications of industries to observe variations due to industry factors.
- Replicate the study of our theoretical models in other national and cultural settings. The more studies of cross-country/ cultural nature are conducted, the better informed we will be concerning the applicability of KM theories under different institutional, economic, and cultural conditions.

Allied socio-technical problems

- Combine contributor and seeker perspectives to formulate an overall model of EKR usage. Conduct a study of costs and benefits of EKR implementation at the organizational level and investigate the variation in effectiveness of EKR across organizations. This could provide a better understanding of how KM using EKR can impact organizational performance.
- Investigate other aspects of social capital such as structural and cognitive aspects and observe their effect on the motivation, access, and shared understanding for knowledge exchange. This will allow for a richer testing of SCT.
- Investigate frequency of knowledge transaction as well as contribution and seeking cost per transaction. These parameters may vary for different forms of KMS and direct exchange. This may allow for explanation of user decision to choose a particular KMS or form of knowledge exchange.
- Investigate ease of monitoring contribution and seeking behavior. This is likely to vary for different forms of KMS and for direct exchange. Finding better ways of monitoring such behavior could help to design better incentive systems for promoting usage of KMS.
- Investigate effectiveness of mandated usage of EKR. Would mandates produce full compliance? Would the quality of knowledge contributions be different for mandated use? Would the degree of knowledge reuse be different?
- Study the mechanisms for seekers to evaluate contribution quality. These mechanisms may vary for different forms of KMS and direct exchange. Assessment and comparison of different mechanisms could facilitate seeker usage.

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APPENDIX A – INSTRUMENT DEVELOPMENT

A.1. OPERATIONALIZATION OF CONSTRUCTS

Item code	Item Wording	Source
LOKP1	Sharing my knowledge through EKR makes me lose my unique value in the organization	Self developed based on (Thibaut and Kelley 1986).
LOKP2	Sharing my knowledge through EKR makes me lose my power base in the organization.	Self developed based on (Orlikowski 1993)
LOKP3	Sharing my knowledge through EKR makes me lose my knowledge that makes me stand out with respect to others.	Self developed based on (Orlikowski 1993)
LOKP4	Sharing my knowledge through EKR makes me lose my knowledge that no one else has.	Self developed based on (Orlikowski 1993)

Table A.1.1. Operationalization of Loss of Knowledge Power

Item code	Item Wording	Source
CEFF1	I don't have the time to enter my knowledge into the EKR.	Self developed based on (Orlikowski 1993)
CEFF2	It is laborious to codify my knowledge into the EKR.	Self developed based on (Orlikowski 1993)
CEFF3	The effort is high for me to codify my knowledge into the EKR.	Self developed based on (Orlikowski 1993)
CEFF4	I'm worried that if I share my knowledge through EKR, I will have to spend additional time answering follow up questions.	Self developed based on (Goodman and Darr 1998)
CEFF5	I'm afraid that my submission to EKR will evoke additional clarifications or requests for assistance.	Self developed based on (Goodman and Darr 1998)

Table A.1.2. Operationalization of Contribution Effort

Item code	Item Wording	Source
CREW1	I expect to get a better work assignment when I share my knowledge through EKR more regularly as compared to my colleagues.	(Kalman 1999)
CREW2	I expect to be promoted when I share my knowledge through EKR more regularly as compared to my colleagues.	Self developed based on (Hargadon 1998)
CREW3	I expect to get a higher salary when I share my knowledge through EKR more regularly as compared to my colleagues.	Self developed based on (Hall 2001)
CREW4	I expect to get a higher bonus when I share my knowledge through EKR more regularly as compared to my colleagues.	Self developed based on (Hall 2001)
CREW5	I expect to get more job security when I share my knowledge through EKR more regularly as compared to my colleagues.	Self developed based on (Davenport and Prusak 1998)

Table A.1.3. Operationalization of Contributor Economic Reward

Item code	Item Wording	Source
IMAG1	Sharing my knowledge through EKR improves my image within the organization.	(Moore and Benbasat 1991)
IMAG2	People in the organization who share their knowledge through EKR have more prestige than those who do not.	(Moore and Benbasat 1991)
IMAG3	Sharing my knowledge through EKR improves others recognition of me.	(Green 1989)
IMAG4	When I share my knowledge through EKR, the people I work with respect me.	(Kalman 1999)
IMAG5	When I share my knowledge through EKR, my superiors praise me.	(Kalman 1999)

Table A.1.4. Operationalization of Image

Item code	Item Wording	Source
RECB1	When I share my knowledge through EKR, I believe that I will get an answer for giving an answer.	Self developed based on (Wasko and Faraj 2000)
RECB2	When I share my knowledge through EKR, I expect somebody to respond when I'm in need.	Self developed based on (Yamagishi and Cook 1993)

Table A.1.5. Operationalization of Reciprocity Benefit

Item code	Item Wording	Source
KSEF1	I have confidence in my ability to provide knowledge that others in my organization consider valuable.	(Kalman 1999)
KSEF2	I have the expertise needed to provide valuable knowledge for my organization	(Kalman 1999)
KSEF3	It doesn't really make any difference whether I add to the knowledge others are likely to share through the EKR.	(Kalman 1999)
KSEF4	Most other employees can provide more valuable knowledge than I can.	(Kalman 1999)

Table A.1.6. Operationalization of Knowledge Self-Efficacy

Item code	Item Wording	Source
EHLP1	I enjoy sharing my knowledge with others through EKR.	Self developed based on (Wasko and Faraj 2000)
EHLP2	I enjoy helping others by sharing my knowledge through EKR.	Self developed based on (Wasko and Faraj 2000)
EHLP3	It feels good to help someone else by sharing my knowledge through EKR.	Self developed based on (Wasko and Faraj 2000)
EHLP4	Sharing my knowledge with others through EKR gives me pleasure.	Self developed based on (Wasko and Faraj 2000)

Table A.1.7. Operationalization of Enjoyment in Helping Others

Item code	Item Wording	Source
CUSG1	What is your degree of usage of EKR to contribute your knowledge? [] Daily [] Weekly [] Monthly [] Quarterly [] Half yearly [] Less than once in 6 months	(Igbaria et al. 1996)
CUSG2	I often use EKR to contribute my knowledge in my work.	Self developed
CUSG3	I regularly use EKR to contribute my knowledge in my work.	(Davis 1989)

Table A.1.8. Operationalization of Usage of EKR for Knowledge Contribution

Item code	Item Wording	Source
SEFF1	It takes too much time for me to find the required knowledge from the EKR.	Self developed based on (Constant et al. 1996)
SEFF2	It is laborious for me to find the required knowledge from the EKR.	Self developed based on (Markus 2001)
SEFF3	The knowledge I need cannot be readily found in the EKR	Self developed
SEFF4	It requires a lot of effort for me to locate the knowledge I need in the EKR.	Self developed based on (Goodman and Darr 1998)

Table A.1.9. Operationalization of Seeker Effort

Item code	Item Wording	Source
FOBL1	When I seek knowledge from the EKR, I feel obliged to contribute to EKR in the future.	Self developed based on (Wasko and Faraj 2000)
FOBL2	I cannot seek knowledge from the EKR without contributing back.	Self developed based on (Wasko and Faraj 2000)
FOBL3	If I obtain knowledge from the EKR, I feel that I have to contribute my knowledge to the EKR in future.	Self developed
FOBL4	When I seek knowledge from the EKR, I feel pressured to contribute my knowledge to the EKR in future.	Self developed

Table A.1.10. Operationalization of Future Obligation

Item code	Item Wording	Source
SREW1	I expect to get a better work assignment when I seek knowledge from EKR more regularly as compared to my colleagues.	(Kalman 1999)
SREW2	I expect to be promoted when I seek knowledge from EKR more regularly as compared to my colleagues.	Self developed based on (Hargadon 1998)
SREW3	I expect to get a higher salary when I seek knowledge from EKR more regularly as compared to my colleagues.	Self developed based on (Hall 2001)
SREW4	I expect to get a higher bonus when I seek knowledge from EKR more regularly as compared to my colleagues.	Self developed based on (Hall 2001)
SREW5	I expect to get more job security when I seek knowledge from EKR more regularly as compared to my colleagues.	Self developed based on (Davenport and Prusak 1998)

Table A.1.11. Operationalization of Seeker Economic Reward

Item code	Item Wording	Source
PUOR1	The EKR provides me with reliable knowledge for my job.	Self developed
PUOR2	I am able to trust the knowledge I obtain from the EKR.	Self developed
PUOR3	The EKR provides me with accurate knowledge that I need.	Self developed
PUOR4	The EKR provides me with relevant knowledge for my job.	Self developed
PUOR5	The EKR provides me with up-to-date knowledge for my job.	Self developed
PUOR6	The EKR provides me with current knowledge for my work.	Self developed
PUOR7	The EKR provides me with timely knowledge for my purposes.	Self developed

Table A.1.12. Operationalization of Perceived Utility of Results

Item code	Item Wording	Source
SKGW1	Seeking knowledge from EKR promotes my knowledge growth and development.	Self developed based on (Green 1989)
SKGW2	Seeking knowledge from EKR helps me strengthen my concepts.	Self developed based on (Wasko and Faraj 2000)
SKGW3	Seeking knowledge from EKR sharpens my knowledge.	Self developed
SKGW4	Seeking knowledge from EKR reinforces my competence.	Self developed based on (Goodman and Darr 1998)

Table A.1.13. Operationalization of Seeker Knowledge Growth

Item code	Item Wording	Source
SUSG1	What is your degree of usage of EKR to seek knowledge? [] Daily [] Weekly [] Monthly [] Quarterly [] Half yearly [] Less than once in 6 months	(Igbaria et al. 1996)
SUSG2	I often use EKR to seek knowledge in my work.	Self developed
SUSG3	I regularly use EKR to seek knowledge in my work.	(Davis 1989)

Table A.1.14. Operationalization of Usage of EKR for Knowledge Seeking

Item code	Item Wording	Source
GTRU1	I believe that people in my organization give credit for other's knowledge where it is due.	Self developed based on (Mishra 1996)
GTRU2	I believe that people in my organization do not use unauthorized knowledge.	Self developed based on (Mishra 1996)
GTRU3	I believe that people in my organization use other's knowledge appropriately.	Self developed based on (Mishra 1996)
GTRU4	I believe that people in my organization share the best knowledge that they have.	Self developed based on (Mishra 1996)

Table A.1.15. Operationalization of Generalized Trust

Item code	Item Wording	Source
PSNM1	There is a norm of cooperation in my organization	Self developed based on (Goodman and Darr 1998)
PSNM2	There is a norm of collaboration in my organization.	Self developed based on (Goodman and Darr 1998)
PSNM3	There is a norm of sharing knowledge in my organization.	Self developed based on (Starbuck 1992)
PSNM4	There is a willingness to value and respond to diversity in my organization.	Self developed based on (Leonard-Barton 1995)
PSNM5	There is a norm of openness to conflicting views in my organization.	Self developed based on (Leonard-Barton 1995)
PSNM6	There is a norm of tolerance of mistakes in my organization.	Self developed based on (Leonard-Barton 1995)

Table A.1.16. Operationalization of Pro-Sharing Norms

Item code	Item Wording	Source
IDEN1	I am glad I chose to work for this organization rather than another company.	(Cheney 1983)
IDEN2	I talk of this organization to my friends as a great company to work for.	(Cheney 1983)
IDEN3	I am willing to put in a great deal of effort beyond that normally expected to help my organization to be successful.	(Cheney 1983)
IDEN4	I find that my values and my organization's values are very similar.	(Cheney 1983)
IDEN5	In general the people employed by my organization are working toward the same goal.	(Cheney 1983)
IDEN6	I find it easy to identify myself with my organization.	(Cheney 1983)
IDEN7	I feel that my organization cares about me.	(Cheney 1983)
IDEN8	I really care about the fate of this organization.	(Cheney 1983)
IDEN9	I am proud to be an employee of this organization.	(Cheney 1983)

Table A.1.17. Operationalization of Identification

A.2. CONCEPTUAL VALIDATION – Contribution Model

A.2.1. **Judges Labels for Categories in First Round**

Constructs	Judges			
	1	2	3	4
Loss of Knowledge Power (1-4)	Knowledge Cost of Sharing	Effect on Self-Image and Recognition (1-2)	Disadvantages	Perceived Disadvantages to Contribute
		Effect on Individual Knowledge Competency * (3-4)		
Contribution Effort (1-5)	Time and Effort Cost of Using EKR (1-3)	Amount of Usage (1)	Effort	Effort
		Ease of Usage * (2,3)		
	Consequence Preference Method * (4,5)	Perception of EKR system (4,5)		
Contributor Economic Reward (1-5)	Tangible Benefit	Sharing Knowledge with Respect to Others	Comparison with Others	Perceived Benefit to Contribute (External Remuneration)
Image (1-5)	Image (1-4)	Effect on Self-Image and Recognition (1,3)	Reputation Improvement (1-4)	Benefit (Relationship) (1-4)
		Norms of Sharing (2)		
		Relationship with Colleagues (4,5)*		
	Tangible Benefit (5)		Self-Esteem (5)*	Benefit (Remuneration) (5)

Reciprocity Benefit (1-2)	Sharing Behavior	Expectation to Obtain Solution	Gratitude	General Benefit of Knowledge Sharing
Knowledge Self-Efficacy (1-4)	Self-Confidence (1,2)	Ability to Provide Know-ledge	Self-Confidence	Belief in One's Ability to Contribute
	Bad Question * (3)			
	Believe in Others (4)			
Enjoy Helping Others (1-4)	Pleasure / Enjoyment in Sharing	Effect on Satisfaction of Sharing Knowledge	Enjoyment	Enjoyment
Trust (1-4)	Believe in Others	Trust in People	Acknowledge-ment	Organizational Attitude towards Knowledge Sharing
Pro-sharing Norms (1-6)	Organization Characteristic	Norms of Sharing (1-3)	Acceptance of Sharing in Organization	Cooperation (1,2,4,5,6)
		Tolerance of Conflicts (4-6)*		Organizational Attitude towards Knowledge sharing (3)
Identification (1-9)	Alignment and Satisfaction towards Organization (1,2,4,6,9)	Attitude towards Organization	Alignment and Closeness of Self and Organization	Belief about Organization (1,2,3,4,6,7,8,9)
	Organization Characteristics (5)			Belief about People * (5)
	Bad Questions (3,7,8)*			
Usage (1-3)	Usage	Amount of Usage	Tendency to use	Usage

* New Categories created by judges

A.2.2. Second round - Items for sorting

Item code	Item Wording
LOKP1	Sharing my knowledge through EKR makes me lose my unique value in the organization
LOKP2	Sharing my knowledge through EKR makes me lose my power base in the organization.
LOKP3 +	Sharing my knowledge through EKR makes me lose my knowledge advantage that makes me stand out with respect to others.
LOKP4	Sharing my knowledge through EKR makes me lose my power due to knowledge that no one else has.
CEFF1+	It takes too much time to enter my knowledge into the EKR
CEFF2	It is laborious to codify my knowledge into the EKR.
CEFF3	The effort is high for me to codify my knowledge into the EKR.
CEFF4+	When I share my knowledge through EKR, I have to spend too much time answering follow up questions
CEFF5+	When I share my knowledge through EKR, follow up requests for clarification and assistance take up a lot of my time.
CREW1+	I expect to get a better work assignment when I share my knowledge through EKR regularly.
CREW2+	I expect to be promoted when I share my knowledge through EKR regularly.
CREW3+	I expect to get a higher salary when I share my knowledge through EKR regularly.
CREW4+	I expect to get a higher bonus when I share my knowledge through EKR regularly.
CREW5+	I expect to get more job security when I share my knowledge through EKR regularly.
IMAG1	Sharing my knowledge through EKR improves my image within the organization.
IMAG2	People in the organization who share their knowledge through EKR have more prestige than those who do not.
IMAG3	Sharing my knowledge through EKR improves others recognition of me.
IMAG4+	When I share my knowledge through EKR, the people in my organization respect me more.
RECB1	When I share my knowledge through EKR, I believe that I will get an answer for giving an answer.
RECB2	When I share my knowledge through EKR, I expect somebody to respond when I'm in need.

KSEF1	I have confidence in my ability to provide knowledge that others in my organization consider valuable.
KSEF2	I have the expertise needed to provide valuable knowledge for my organization
KSEF3+	I have the competence to provide knowledge that can make a difference to my organization.
KSEF4+	I am confident that I can provide knowledge that is valuable to others in my organization.
EHLP1	I enjoy sharing my knowledge with others through EKR.
EHLP2	I enjoy helping others by sharing my knowledge through EKR.
EHLP3	It feels good to help someone else by sharing my knowledge through EKR.
EHLP4	Sharing my knowledge with others through EKR gives me pleasure.
GTRU1	I believe that people in my organization give credit for other's knowledge where it is due.
GTRU2	I believe that people in my organization do not use unauthorized knowledge.
GTRU3	I believe that people in my organization use other's knowledge appropriately.
GTRU4	I believe that people in my organization share the best knowledge that they have.
PSNM1	There is a norm of cooperation in my organization
PSNM2	There is a norm of collaboration in my organization.
PSNM3	There is a willingness to value and respond to diversity in my organization.
PSNM4	There is a norm of openness to conflicting views in my organization.
PSNM5	There is a norm of tolerance of mistakes in my organization.
IDEN1	I am glad I chose to work for this organization rather than another company.
IDEN2	I talk of this organization to my friends as a great company to work for.
IDEN3	I find that my values and my organization's values are very similar.
IDEN4	I find it easy to identify myself with my organization.
IDEN5	I feel that my organization cares about me.
IDEN6	I really care about the fate of this organization.
IDEN7	I am proud to be an employee of this organization.

+ Question changed from round one

A.3. CONCEPTUAL VALIDATION – SEEKING MODEL

A.3.1. Judges Labels for Categories in First Round

Constructs	Judges			
	1	2	3	4
Seeker Effort (1-4)	Effort	Ease of Usage (1,2,4) *	Effort	Time and Effort Cost of Using EKR
		Perception of EKR system (3) *		
Future Obligation (1-4)	General Cost of Seeking	Perception of EKR system (2)	Gratitude / Obligation	Sharing Behavior
		Future Use (1,3,4) *		
Seeker Economic Reward (1-5)	Comparison with Colleagues *	Perceived Benefit to Seek	Tangible Benefit	Reward
Perceived Utility of Results (1-7)	EKR Output Characteristics	Perception of EKR system	Tangible Benefit	General Benefit of Knowledge Seeking
Seeker Knowledge Growth (1-4)	Knowledge Gain	Effect on Knowledge Competency	Improvement of Knowledge	Professional Competence
Usage (1-3)	Usage	Amount of Usage	Tendency to use	Usage

* New Categories created by judges

A.3.2. Second round - Items for sorting

Item code	Item Wording
SEFF1	It takes too much time for me to find the required knowledge from the EKR.
SEFF2	It is laborious for me to find the required knowledge from the EKR.
SEFF3 +	I am not able to readily find the knowledge I need in the EKR.
SEFF4	It requires a lot of effort for me to locate the knowledge I need in the EKR.
FOBL1	When I seek knowledge from the EKR, I feel obliged to contribute to EKR in the future.
FOBL2 +	I feel that I should not simply take knowledge from the EKR without ever contributing back to the EKR.
FOBL3	If I obtain knowledge from the EKR, I feel that I have to contribute my knowledge to the EKR in future.
FOBL4	When I seek knowledge from the EKR, I feel pressured to contribute my knowledge to the EKR in future.
SREW1 +	I expect to get a better work assignment when I seek knowledge from EKR regularly.
SREW2 +	I expect to be promoted when I seek knowledge from EKR regularly.
SREW3 +	I expect to get a higher salary when I seek knowledge from EKR regularly.
SREW4 +	I expect to get a higher bonus when I seek knowledge from EKR regularly.
SREW5 +	I expect to get more job security when I seek knowledge from EKR regularly.
PUOR1	The EKR provides me with reliable knowledge for my job.
PUOR2	I am able to trust the knowledge I obtain from the EKR.
PUOR3	The EKR provides me with accurate knowledge that I need.
PUOR4	The EKR provides me with relevant knowledge for my job.
PUOR5	The EKR provides me with up-to-date knowledge for my job.
PUOR6	The EKR provides me with current knowledge for my work.
PUOR7	The EKR provides me with timely knowledge for my purposes.
SKGW1	Seeking knowledge from EKR promotes my knowledge growth and development.
SKGW2	Seeking knowledge from EKR helps me strengthen my expertise
SKGW3	Seeking knowledge from EKR sharpens my knowledge.
SKGW4	Seeking knowledge from EKR reinforces my competence.

+ Question changed from round one

APPENDIX B – SURVEY INSTRUMENTS

B.1. CONTRIBUTOR SURVEY

Survey on Contributor Usage of Electronic Knowledge Repositories (EKR)

Electronic Knowledge Repositories (EKR) are a common form of knowledge management systems that are designed specifically to facilitate the sharing and integration of an organization's knowledge for the purpose of leveraging knowledge to further the business goals and improve the competitive position of the organization.

EKR are focused on supporting the following activities involving organizational knowledge:
- Gathering
- Organization
- Dispensing

The technologies that EKR typically consist of are:
- Storage
- Indexing and Retrieval

EKR are different from structured databases in that they store more tacit forms of knowledge e.g. Knowledge documents.

Examples of EKR are the Lotus Notes based Knowledge Xchange system used by Accenture to store best practices, and Xerox's Eureka system that stores trouble-shooting tips from technical representatives.

BACKGROUND INFORMATION

Name: _____ (optional)
Email: _____ (optional)

Please provide demographic information of yourself and your firm.

1. Please indicate your gender:

   [] Male [] Female

2. What is your age?

   [] 21-29 [] 40-49
   [] 30-34 [] 50 and over
   [] 35-39

3. What is your highest qualification?

   [] High School [] Bachelors [] Masters [] Doctorate

4. How many years have you been working in your current organization?

   [] 0 - <3 [] 9 – <12

[] 3 – <6 [] 12 - <15
[] 6 – <9 [] >= 15

5. How many <u>years</u> of <u>total working experience</u> do you have?

   [] 0 - <3 [] 9 - <12
   [] 3 – <6 [] 12 - <15
   [] 6 – <9 [] >= 15

6. What is your job title in the organization? _____

   How long have you been working in your present position? _____

7. Which department in your organization do you belong to?

   [] Finance
   [] Human Resources
   [] Marketing
   [] Product Development
   [] Operations
   [] Sales
   [] Accounts
   [] Strategic Planning
   [] Information Systems
   [] Research and Development
   [] Other (please specify): _____

8. What industry does your organization belong to?

   [] Manufacturing
   [] Finance: Banking/Insurance
   [] Trade: Wholesale/Retail
   [] Computer Industry: Software Services/Consultants/Vendors
   [] Transportation Services
   [] Utilities and Communications
   [] Construction and Engineering
   [] Education
   [] Travel, Tourism and Leisure Services
   [] Medical and Legal Services
   [] Petroleum and Chemical
   [] Food
   [] Entertainment
   [] Other (please specify): _____

9. What is the number of employees in your organization?

   [] Fewer than 50 [] 750 - 999
   [] 50 – 99 [] 1000 - 2499
   [] 100 –249 [] 2500 - 4999
   [] 250 – 499 [] 5000 - 9999
   [] 500 – 749 [] 10000 or more

Based on the definition of EKR as a repository of knowledge documents, two roles of users can be identified. **CONTRIBUTORS** in the organization can place their reports and documents in the EKR and **SEEKERS** can search for documents from the EKR to help them in their job.

With respect to the EKR you commonly use in your organization describe your behavior as a **CONTRIBUTOR** who can place your reports and documents in the system.

Please answer the questions below.

10. With reference to the EKR you have contributed to please answer the following.

a. The kind of EKR you have contributed to in terms of both the technology it uses and the content it stores

Technology: _____

Content: _____

b. The type of job you have used it for _____

c. Since when have you been using the EKR?_____

COST FACTORS – This section solicits your perceptions on the **costs involved in contributing knowledge** to EKR. Please score each question using the 1 to 7 scale.

1 = Strongly Disagree 2 = Moderately Disagree 3 = Slightly Disagree
4 = Neutral 5 = Slightly Agree 6 = Moderately Agree 7 = Strongly Agree

	Strongly Disagree			Neutral			Strongly Agree
11. Sharing my knowledge through EKR makes me lose my unique value in the organization	---------- 1	2	3	4	5	6	7
12. Sharing my knowledge through EKR makes me lose my power base in the organization.	---------- 1	2	3	4	5	6	7
13. Sharing my knowledge through EKR makes me lose my knowledge advantage that makes me stand out with respect to others.	---------- 1	2	3	4	5	6	7
14. Sharing my knowledge through EKR makes me lose my power due to my knowledge that no one else has.	---------- 1	2	3	4	5	6	7

	Strongly Disagree			Neutral			Strongly Agree
15. It takes too much time to enter my knowledge into the EKR.	---------- 1	2	3	4	5	6	7
16. It is laborious to codify my knowledge into the EKR.	---------- 1	2	3	4	5	6	7
17. The effort is high for me to codify my knowledge into the EKR.	---------- 1	2	3	4	5	6	7
18. When I share my knowledge through EKR, I have to spend too much time answering follow up questions.	---------- 1	2	3	4	5	6	7
19. When I share my knowledge through EKR, follow up requests for clarification and assistance take up a lot of my time.	---------- 1	2	3	4	5	6	7

KNOWLEDGE SELF-EFFICACY FACTORS – This section solicits your perceptions on **your ability to contribute useful knowledge** to EKR. Please score each question using the 1 to 7 scale.

	Strongly Disagree			Neutral			Strongly Agree
20. I have confidence in my ability to provide knowledge that others in my organization consider valuable	---------- 1	2	3	4	5	6	7
21. I have the expertise needed to provide valuable knowledge for my organization.	---------- 1	2	3	4	5	6	7
22. I have the competence to provide knowledge that can make a difference to my organization.	---------- 1	2	3	4	5	6	7
23. I am confident that I can provide knowledge that is valuable to others in my organization.	---------- 1	2	3	4	5	6	7

BENEFIT FACTORS – This section solicits your perceptions on the **benefits derived from contributing knowledge** to EKR. Please score each question using the 1 to 7 scale.

	Strongly Disagree			Neutral			Strongly Agree
24. I expect to get a better work assignment when I share my knowledge through EKR regularly.	---------- 1	2	3	4	5	6	7

25. I expect to be promoted when I share my knowledge through EKR regularly.	----------	1	2	3	4	5	6	7
26. I expect to get a higher salary when I share my knowledge through EKR regularly.	----------	1	2	3	4	5	6	7
27. I expect to get a higher bonus when I share my knowledge through EKR regularly.	----------	1	2	3	4	5	6	7
28. I expect to get more job security when I share my knowledge through EKR regularly.	----------	1	2	3	4	5	6	7

		Strongly Disagree			Neutral			Strongly Agree
29. When I share my knowledge through EKR, I believe that I will get an answer for giving an answer.	----------	1	2	3	4	5	6	7
30. When I share my knowledge through EKR, I expect somebody to respond when I'm in need.	----------	1	2	3	4	5	6	7
31. When I contribute knowledge to EKR, I expect to get back knowledge when I need it.	----------	1	2	3	4	5	6	7
32. When I share my knowledge through EKR, I believe that somebody will respond when I am in need.	----------	1	2	3	4	5	6	7

		Strongly Disagree			Neutral			Strongly Agree
33. I enjoy sharing my knowledge with others through EKR	----------	1	2	3	4	5	6	7
34. I enjoy helping others by sharing my knowledge through EKR.	----------	1	2	3	4	5	6	7
35. It feels good to help someone else by sharing my knowledge through EKR.	----------	1	2	3	4	5	6	7
36. Sharing my knowledge with others through EKR gives me pleasure.	----------	1	2	3	4	5	6	7

		Strongly Disagree			Neutral			Strongly Agree
37. Sharing my knowledge through EKR improves my image within the organization.	----------	1	2	3	4	5	6	7
38. People in my organization who share their knowledge through EKR have more prestige than those who do not.	----------	1	2	3	4	5	6	7

39. Sharing my knowledge through EKR improves <u>other's</u> recognition of me.	----------	1	2	3	4	5	6	7
40. When I share my knowledge through EKR, the people in my organization respect me more.	----------	1	2	3	4	5	6	7

<u>ORGANIZATION-RELATED FACTORS</u> – This section solicits your perceptions on your current organization. Please score each question using the 1 to 7 scale.

		Strongly Disagree			Neutral			Strongly Agree
41. I believe that people in my organization give credit for other's knowledge where it is due.	----------	1	2	3	4	5	6	7
42. I believe that people in my organization do not use unauthorized knowledge.	----------	1	2	3	4	5	6	7
43. I believe that people in my organization use other's knowledge appropriately.	----------	1	2	3	4	5	6	7
44. I believe that people in my organization share the best knowledge that they have.	----------	1	2	3	4	5	6	7

		Strongly Disagree			Neutral			Strongly Agree
45. There is a norm of cooperation in my organization.	----------	1	2	3	4	5	6	7
46. There is a norm of collaboration in my organization.	----------	1	2	3	4	5	6	7
47. There is a willingness to value and respond to diversity in my organization.	----------	1	2	3	4	5	6	7
48. There is a norm of openness to conflicting views in my organization.	----------	1	2	3	4	5	6	7
49. There is a norm of tolerance of mistakes in my organization.	----------	1	2	3	4	5	6	7

		Strongly Disagree			Neutral			Strongly Agree
50. I am glad I chose to work for this organization rather than another company.	----------	1	2	3	4	5	6	7
51. I talk of this organization to my friends as a great company to work for.	----------	1	2	3	4	5	6	7
52. I find that my values and my organization's values are very similar.	----------	1	2	3	4	5	6	7
53. I find it easy to identify myself with my organization.	----------	1	2	3	4	5	6	7

54. I feel that my organization cares about me.	----------	1	2	3	4	5	6	7
55. I really care about the fate of this organization.	----------	1	2	3	4	5	6	7
56. I am proud to be an employee of this organization.	----------	1	2	3	4	5	6	7

EKR USAGE – These items solicit your perceptions on your **current** usage pattern.

57. What is your degree of usage of EKR to contribute your knowledge?
    [] Daily [] Weekly [] Monthly [] Quarterly
    [] Half yearly [] Less than once in 6 months

Please score each question using the 1 to 7 scale.

		Strongly Disagree			Neutral			Strongly Agree
58. I often use EKR to contribute my knowledge in my work.	----------	1	2	3	4	5	6	7
59. I regularly use EKR to contribute my knowledge in my work.	----------	1	2	3	4	5	6	7

THANK YOU FOR YOUR COOPERATION

B.2. SEEKER SURVEY

Survey on Seeker Usage of Electronic Knowledge Repositories (EKR)

Electronic Knowledge Repositories (EKR) are a common form of knowledge management systems that are designed specifically to facilitate the sharing and integration of an organization's knowledge for the purpose of leveraging knowledge to further the business goals and improve the competitive position of the organization.

EKR are focused on supporting the following activities involving organizational knowledge:
- Gathering
- Organization
- Dispensing

The technologies that EKR typically consist of are:
- Storage
- Indexing and Retrieval

EKR are different from structured databases in that they store more tacit forms of knowledge e.g. Knowledge documents.

Examples of EKR are the Lotus Notes based Knowledge Xchange system used by Accenture to store best practices, and Xerox's Eureka system that stores trouble-shooting tips from technical representatives.

BACKGROUND INFORMATION

Name: _____ (optional)
Email: _____ (optional)

Please provide demographic information of yourself and your firm.

1. Please indicate your gender:

   [] Male [] Female

2. What is your age?

   [] 21-29 [] 40-49
   [] 30-34 [] 50 and over
   [] 35-39

3. What is your highest qualification?

   [] High School [] Bachelors [] Masters [] Doctorate

4. How many years have you been working in your current organization?

   [] 0 - <3 [] 9 – <12
   [] 3 – <6 [] 12 - <15
   [] 6 – <9 [] >= 15

5. How many years of total working experience do you have?

   [] 0 - <3 [] 9 - <12
   [] 3 – <6 [] 12 - <15
   [] 6 – <9 [] >= 15

6. What is your job title in the organization? _____

   How long have you been working in your present position? _____

7. Which department in your organization do you belong to?

   [] Finance
   [] Human Resources
   [] Marketing
   [] Product Development
   [] Operations
   [] Sales
   [] Accounts
   [] Strategic Planning
   [] Information Systems
   [] Research and Development
   [] Other (please specify): _____

8. What industry does your organization belong to?

   [] Manufacturing
   [] Finance: Banking/Insurance
   [] Trade: Wholesale/Retail
   [] Computer Industry: Software Services/Consultants/Vendors
   [] Transportation Services
   [] Utilities and Communications
   [] Construction and Engineering
   [] Education
   [] Travel, Tourism and Leisure Services
   [] Medical and Legal Services
   [] Petroleum and Chemical
   [] Food
   [] Entertainment
   [] Other (please specify): _____

9. What is the number of employees in your organization?

   [] Fewer than 50 [] 750 - 999
   [] 50 – 99 [] 1000 - 2499
   [] 100 –249 [] 2500 - 4999
   [] 250 – 499 [] 5000 - 9999
   [] 500 – 749 [] 10000 or more

Based on the definition of EKR as a repository of knowledge documents, two roles of users can be identified. **CONTRIBUTORS** in the organization can place their reports and documents in the EKR and **SEEKERS** can search for documents from the EKR to help them in their job.

With respect to the EKR you commonly use in your organization describe your behavior as a **SEEKER** who may use the EKR to search for knowledge for completing your job.

Please answer the questions below.

10. **With reference to the EKR you have seeked from please answer the following.**

a. The kind of EKR you have seeked from in terms of both the technology it uses and the content it stores

Technology: _____

Content: _____

b. The type of job you have used it for _____

c. Since when have you been using the EKR?_____

COST FACTORS – This section solicits your perceptions on the **costs involved in seeking knowledge** from EKR. Please score each question using the 1 to 7 scale.

1 = Strongly Disagree 2 = Moderately Disagree 3 = Slightly Disagree
4 = Neutral 5 = Slightly Agree 6 = Moderately Agree 7 = Strongly Agree

	Strongly Disagree			Neutral			Strongly Agree
11. It takes too much time for me to find the required knowledge from the EKR.	1	2	3	4	5	6	7
12. It is laborious for me to find the required knowledge from the EKR.	1	2	3	4	5	6	7
13. I am not able to readily find the knowledge I need in the EKR.	1	2	3	4	5	6	7
14. It requires a lot of effort for me to locate the knowledge I need in the EKR.	1	2	3	4	5	6	7

	Strongly Disagree			Neutral			Strongly Agree
15. When I seek knowledge from the EKR, I feel obliged to contribute to EKR in the future.	1	2	3	4	5	6	7
16. I feel that I should not simply take knowledge from the EKR without ever contributing back to the EKR.	1	2	3	4	5	6	7

17. If I obtain knowledge from the EKR, I feel that I have to contribute my knowledge to the EKR in future.	----------	1	2	3	4	5	6	7
18. When I seek knowledge from the EKR, I feel pressured to contribute my knowledge to the EKR in future.	----------	1	2	3	4	5	6	7

BENEFIT FACTORS – This section solicits your perceptions on **the benefits derived from seeking knowledge** from EKR. Please score each question using the 1 to 7 scale.

		Strongly Disagree			Neutral			Strongly Agree
19. I expect to get a better work assignment when I seek knowledge from EKR regularly.	----------	1	2	3	4	5	6	7
20. I expect to be promoted when I seek knowledge from EKR regularly.	----------	1	2	3	4	5	6	7
21. I expect to get a higher salary when I seek knowledge from EKR regularly.	----------	1	2	3	4	5	6	7
22. I expect to get a higher bonus when I seek knowledge from EKR regularly.	----------	1	2	3	4	5	6	7
23. I expect to get more job security when I seek knowledge from EKR regularly.	----------	1	2	3	4	5	6	7

		Strongly Disagree			Neutral			Strongly Agree
24. Seeking knowledge from EKR promotes my knowledge growth and development.	----------	1	2	3	4	5	6	7
25. Seeking knowledge from EKR helps me strengthen my expertise.	----------	1	2	3	4	5	6	7
26. Seeking knowledge from EKR sharpens my knowledge.	----------	1	2	3	4	5	6	7
27. Seeking knowledge from EKR reinforces my competence.	----------	1	2	3	4	5	6	7

		Strongly Disagree			Neutral			Strongly Agree
28. The EKR provides me with reliable knowledge for my job.	----------	1	2	3	4	5	6	7
29. I am able to trust the knowledge I obtain from the EKR.	----------	1	2	3	4	5	6	7
30. The EKR provides me with accurate knowledge that I need.	----------	1	2	3	4	5	6	7

31. The EKR provides me with relevant knowledge for my job.	----------	1	2	3	4	5	6	7
32. The EKR provides me with up-to-date knowledge for my job.	----------	1	2	3	4	5	6	7
33. The EKR provides me with current knowledge for my work.	----------	1	2	3	4	5	6	7
34. The EKR provides me with timely knowledge for my purposes.	----------	1	2	3	4	5	6	7

ORGANIZATION-RELATED FACTORS – This section solicits your perceptions on **your <u>current</u> organization**. Please score each question using the 1 to 7 scale.

		Strongly Disagree			Neutral			Strongly Agree
35. I believe that people in my organization give credit for other's knowledge where it is due.	----------	1	2	3	4	5	6	7
36. I believe that people in my organization do not use unauthorized knowledge.	----------	1	2	3	4	5	6	7
37. I believe that people in my organization use other's knowledge appropriately.	----------	1	2	3	4	5	6	7
38. I believe that people in my organization share the best knowledge that they have.	----------	1	2	3	4	5	6	7

		Strongly Disagree			Neutral			Strongly Agree
39. There is a norm of cooperation in my organization.	----------	1	2	3	4	5	6	7
40. There is a norm of collaboration in my organization.	----------	1	2	3	4	5	6	7
41. There is a willingness to value and respond to diversity in my organization.	----------	1	2	3	4	5	6	7
42. There is a norm of openness to conflicting views in my organization.	----------	1	2	3	4	5	6	7
43. There is a norm of tolerance of mistakes in my organization.	----------	1	2	3	4	5	6	7

		Strongly Disagree			Neutral			Strongly Agree
44. I am glad I chose to work for this organization rather than another company.	----------	1	2	3	4	5	6	7
45. I talk of this organization to my friends as a great company to work for.	----------	1	2	3	4	5	6	7

46. I find that my values and my organization's values are very similar.	----------	1	2	3	4	5	6	7
47. I find it easy to identify myself with my organization.	----------	1	2	3	4	5	6	7
48. I feel that my organization cares about me.	----------	1	2	3	4	5	6	7
49. I really care about the fate of my organization.	----------	1	2	3	4	5	6	7
50. I am proud to be an employee of this organization.	----------	1	2	3	4	5	6	7

EKR USAGE – These items solicit your perceptions on your **current** usage pattern.

51. What is your degree of usage of EKR to seek knowledge?
    [] Daily [] Weekly [] Monthly [] Quarterly
    [] Half yearly [] Less than once in 6 months

Please score each question using the 1 to 7 scale.

		Strongly Disagree			Neutral			Strongly Agree
52. I often use EKR to seek knowledge in my work.	----------	1	2	3	4	5	6	7
53. I regularly use EKR to seek knowledge in my work	----------	1	2	3	4	5	6	7

THANK YOU FOR YOUR COOPERATION

APPENDIX C – PILOT STUDIES

C.1. RESULTS OF PILOT STUDY (CONTRIBUTION MODEL)

Item – Scale Correlations

Measures	LOKP	CEFF	CREW	IMAG	RECB	KSEF	EHLP	GTRU	PSNM	IDEN	CUSG
Item-scale (r-score)	0.90	0.87	0.81	0.85	0.89	0.84	0.86	0.72	0.85	0.81	0.69
	0.90	0.90	0.82	0.81	0.59	0.91	0.92	0.77	0.88	0.50	0.95
	0.91	0.86	0.88	0.86		0.92	0.91	0.85	0.87	0.85	0.93
	0.87	0.77	0.83	0.85		0.79	0.89	0.85	0.86	0.86	
		0.77	0.72						0.68	0.88	
										0.72	
										0.88	
Number of Measures	**4**	**5**	**5**	**4**	**2**	**4**	**4**	**4**	**5**	**7**	**3**

All r-scores are significant at $p < 0.001$.

Inter-item Correlations by Scale ($p < 0.01$)

LOKP

	LOKP1	LOKP2	LOKP3	LOKP4
LOKP1	1.00			
LOKP2	0.77	1.00		
LOKP3	0.76	0.70	1.00	
LOKP4	0.67	0.74	0.77	1.00

CEFF

	CEFF1	CEFF2	CEFF3	CEFF4	CEFF5
CEFF1	1.00				
CEFF2	0.83	1.00			
CEFF3	0.71	0.82	1.00		
CEFF4	0.48	0.53	0.54	1.00	
CEFF5	0.49	0.54	0.52	0.84	1.00

CREW

	CREW1	CREW2	CREW3	CREW4	CREW5
CREW1	1.00				
CREW2	0.57	1.00			
CREW3	0.53	0.75	1.00		
CREW4	0.43	0.66	0.86	1.00	
CREW5	0.34	0.47	0.65	0.68	1.00

IMAG

	IMAG1	IMAG2	IMAG3	IMAG4
IMAG1	1.00			
IMAG2	0.60	1.00		
IMAG3	0.57	0.60	1.00	
IMAG4	0.59	0.61	0.76	1.00

RECB

	RECB1	RECB2
RECB1	1.00	
RECB2	0.54	1.00

KSEF

	KSEF1	KSEF2	KSEF3	KSEF4
KSEF1	1.00			
KSEF2	0.78	1.00		
KSEF3	0.64	0.74	1.00	
KSEF4	0.63	0.64	0.65	1.00

EHLP

	EHLP1	EHLP2	EHLP3	EHLP4
EHLP1	1.00			
EHLP2	0.74	1.00		
EHLP3	0.68	0.79	1.00	
EHLP4	0.65	0.79	0.78	1.00

GTRU

	GTRU1	GTRU2	GTRU3	GTRU4
GTRU1	1.00			
GTRU2	0.40	1.00		
GTRU3	0.46	0.55	1.00	
GTRU4	0.49	0.53	0.66	1.00

PSNM

	PSNM1	PSNM2	PSNM3	PSNM4	PSNM5
PSNM1	1.00				
PSNM2	0.84	1.00			
PSNM3	0.67	0.68	1.00		
PSNM4	0.59	0.64	0.71	1.00	
PSNM5	0.37	0.44	0.50	0.61	1.00

IDEN

	IDEN1	IDEN2	IDEN3	IDEN4	IDEN5	IDEN6	IDEN7
IDEN1	1.00						
IDEN2	0.35	1.00					
IDEN3	0.67	0.34	1.00				
IDEN4	0.67	0.25	0.72	1.00			
IDEN5	0.67	0.34	0.69	0.72	1.00		
IDEN6	0.40	0.29	0.54	0.51	0.59	1.00	
IDEN7	0.66	0.32	0.85	0.73	0.73	0.67	1.00

CUSG

	CUSG1	CUSG2	CUSG3
CUSG1	1.00		
CUSG2	0.50	1.00	
CUSG3	0.43	0.88	1.00

C.2. RESULTS OF PILOT STUDY (SEEKING MODEL)

Item – Scale Correlations

Measures	SEFF	FOBL	SKGW	SREW	PUOR	GTRU	PSNM	IDEN	SUSG
Item-scale (r-score)	0.73	0.89	0.79	0.96	0.67	0.73	0.83	0.80	0.86
	0.86	0.84	0.85	0.99	0.74	0.76	0.87	0.56	0.95
	0.80	0.88	0.79	0.97	0.85	0.86	0.88	0.86	0.95
	0.78	0.85	0.63	0.98	0.69	0.86	0.85	0.87	
				0.97	0.75		0.67	0.89	
					0.70			0.77	
					0.76			0.85	
Number of Measures	**4**	**4**	**4**	**5**	**7**	**4**	**5**	**7**	**3**

All r-scores are significant at $p < 0.001$.

Inter-item Correlations by Scale ($p < 0.01$)

SEFF

	SEFF1	SEFF2	SEFF3	SEFF4
SEFF1	1.00			
SEFF2	0.48	1.00		
SEFF3	0.52	0.57	1.00	
SEFF4	0.37	0.64	0.45	1.00

FOBL

	FOBL1	FOBL2	FOBL3	FOBL4
FOBL1	1.00			
FOBL2	0.63	1.00		
FOBL3	0.71	0.64	1.00	
FOBL4	0.62	0.65	0.72	1.00

SREW

	SREW1	SREW2	SREW3	SREW4	SREW5
SREW1	1.00				
SREW2	0.71	1.00			
SREW3	0.83	0.56	1.00		
SREW4	0.91	0.86	0.75	1.00	
SREW5	0.75	0.76	0.65	0.57	1.00

PUOR

	PUOR1	PUOR2	PUOR3	PUOR4	PUOR5	PUOR6	PUOR7
PUOR1	1.00						
PUOR2	0.37	1.00					
PUOR3	0.40	0.36	1.00				
PUOR4	0.54	0.31	0.60	1.00			
PUOR5	0.36	0.37	0.50	0.36	1.00		
PUOR6	0.23	0.32	0.55	0.50	0.36	1.00	
PUOR7	0.32	0.25	0.41	0.51	0.35	0.44	1.00

SKGW

	SKGW1	SKGW2	SKGW3	SKGW4
SKGW1	1.00			
SKGW2	0.80	1.00		
SKGW3	0.70	0.77	1.00	
SKGW4	0.57	0.62	0.71	1.00

GTRU

	GTRU1	GTRU2	GTRU3	GTRU4
GTRU1	1.00			
GTRU2	0.36	1.00		
GTRU3	0.35	0.44	1.00	
GTRU4	0.31	0.52	0.68	1.00

PSNM

	PSNM1	PSNM2	PSNM3	PSNM4	PSNM5
PSNM1	1.00				
PSNM2	0.42	1.00			
PSNM3	0.62	0.34	1.00		
PSNM4	0.30	0.29	0.31	1.00	
PSNM5	0.41	0.43	0.44	0.48	1.00

IDEN

	IDEN1	IDEN2	IDEN3	IDEN4	IDEN5	IDEN6	IDEN7
IDEN1	1.00						
IDEN2	0.36	1.00					
IDEN3	0.31	0.60	1.00				
IDEN4	0.37	0.49	0.36	1.00			
IDEN5	0.32	0.55	0.50	0.36	1.00		
IDEN6	0.25	0.41	0.51	0.35	0.44	1.00	
IDEN7	0.25	0.42	0.41	0.31	0.52	0.68	1.00

SUSG

	SUSG1	SUSG2	SUSG3
SUSG1	1.00		
SUSG2	0.71	1.00	
SUSG3	0.68	0.92	1.00

APPENDIX D - ADDITIONAL STATISTICS

D.1. Reliability

A measure is reliable to the degree that it supplies consistent results. Reliability is thus a contributor to validity and is a necessary but not sufficient condition for validity. Reliability is concerned with estimates of the degree to which a measurement is free from random or unstable error. Reliable instruments are robust and work well at different times under different conditions. Design measures taken to improve reliability include: a single investigator to collect all the study data; explicit guidelines to respondents on how the instrument should be completed; use of a broad sample of items including some repetition of similar questions in the instrument; and where possible the employment of previously tested items (Dooley 2001).

The method used to statistically test the reliability of scale questions is the ***Cronbach Alpha*** reliability coefficient (Cronbach 1951). This coefficient measures internal consistency of the scales related to a construct and is calculated as follows:

$$\frac{N*p}{[1+p*(N-1)]}$$

Where N = number of item and
p = mean of inter-item correlation

A value of 0.707 or larger for Cronbach Alpha indicates adequate internal consistency (Nunally 1978).

Construct and Measures	Corrected Item-total Correlation	Alpha if Item Deleted
LOKP1	0.8404	0.9411
LOKP2	0.8964	0.9248
LOKP3	0.8805	0.9287
LOKP4	0.8781	0.9293
CEFF1	0.5405	0.8478
CEFF2	0.5565	0.8443
CEFF3	0.7959	0.7796
CEFF4	0.7276	0.8001
CEFF5	0.6881	0.8115
CREW1	0.5729	0.9580
CREW2	0.9081	0.8966
CREW3	0.8983	0.8975
CREW4	0.8972	0.8977
CREW5	0.8200	0.9130
IMAG1	0.7314	0.8715
IMAG2	0.6827	0.8925
IMAG3	0.7948	0.8483
IMAG4	0.8470	0.8272
RECB1	0.6068	0.8544
RECB2	0.7329	0.8043
RECB3	0.7140	0.8107
RECB4	0.7504	0.7947
EHLP1	0.8935	0.9566
EHLP2	0.9393	0.9424
EHLP3	0.9239	0.9481
EHLP4	0.8835	0.9588
KSEF1	0.8523	0.9533
KSEF2	0.9103	0.9359
KSEF3	0.9143	0.9346
KSEF4	0.8886	0.9424
GTRU1	0.6334	0.8248
GTRU2	0.7192	0.7876
GTRU3	0.7647	0.7799
GTRU4	0.6480	0.8253
PSNM1	0.8213	0.8930
PSNM2	0.8145	0.8943
PSNM3	0.8200	0.8923
PSNM4	0.8386	0.8884
PSNM5	0.6597	0.9255
IDEN1	0.8232	0.9437
IDEN2	0.8732	0.9393
IDEN3	0.8586	0.9408
IDEN4	0.9015	0.9367
IDEN5	0.8390	0.9422
IDEN6	0.6824	0.9546
IDEN7	0.8551	0.9411
CUSG1	0.4428	0.8459
CUSG2	0.7689	0.6056
CUSG3	0.7792	0.5969

Table D.1. Internal Consistency Reliability of Contribution Model Constructs

Construct and Measures	Corrected Item-total Correlation	Alpha if Item Deleted
SEFF1	0.8242	0.8993
SEFF2	0.8717	0.8831
SEFF3	0.7553	0.9218
SEFF4	0.8382	0.8944
FOBL1	0.6922	0.8635
FOBL2	0.8270	0.8096
FOBL3	0.8149	0.8154
FOBL4	0.6302	0.8857
SREW1	0.5396	0.9547
SREW2	0.9039	0.8859
SREW3	0.9165	0.8837
SREW4	0.9090	0.8842
SREW5	0.7631	0.9140
PUOR1	0.8272	0.9652
PUOR2	0.8671	0.9625
PUOR3	0.9026	0.9598
PUOR4	0.9030	0.9596
PUOR5	0.8876	0.9609
PUOR6	0.9059	0.9594
PUOR7	0.8779	0.9619
SKGW1	0.9188	0.9633
SKGW2	0.9454	0.9556
SKGW3	0.9080	0.9662
SKGW4	0.9324	0.9593
GTRU1	0.6109	0.7632
GTRU2	0.6215	0.7567
GTRU3	0.6884	0.7375
GTRU4	0.5926	0.7719
PSNM1	0.8151	0.8999
PSNM2	0.8216	0.8991
PSNM3	0.8198	0.9002
PSNM4	0.8626	0.8897
PSNM5	0.6862	0.9283
IDEN1	0.8539	0.9547
IDEN2	0.8501	0.9551
IDEN3	0.8472	0.9552
IDEN4	0.9120	0.9500
IDEN5	0.9112	0.9502
IDEN6	0.7714	0.9609
IDEN7	0.8823	0.9525
SUSG1	0.3677	0.9362
SUSG2	0.7157	0.5396
SUSG3	0.7487	0.5065

Table D.2. Internal Consistency Reliability of Seeking Model Constructs

D.2. Factor Analysis

Factor analysis is a method for determining the number and nature of the underlying variables (factors) amongst a larger number of measures (scales). The factor loadings indicate the extent to which each scale (questionnaire item) is associated with an underlying factor.

Factor analysis has two main and sometimes conflicting objectives: to represent relationships amongst sets of variables parsimoniously, and to yield meaningful factors. The following discussion describes: (1) the method of factor extraction, (2) the method of factor rotation, (3) tests of factor analysis appropriateness, (4) criteria for choosing the number of factors extracted, (5) variable loadings, and (6) factor scores.

D.2.1. Factor Extraction Method

In analyzing the factor structure of the data, ***principal components*** factoring was used primarily because it always converges. However, in general, principal components analysis gives similar results to other methods of factor extraction (Kim and Mueller 1981). In principal components analysis, linear combinations of the observed variables are formed. The first principal component is the combination that accounts for the largest amount of variance in the sample. The second principal component accounts for the next largest amount of variance, and is uncorrelated with the first. Successive components account for progressively smaller portions of the total sample variance and are all uncorrelated with each other. Principal components analysis accounts for all of the variance in the observed variables.

D.2.2. Factor Rotation

The purpose of factor rotation is to achieve a simple and interpretable factor structure. Ideally, each factor will have high loadings for only some of the variables. This helps the interpretation of the factors. It is also preferred that each variable have a high loading on only one factor. This permits the factors to be differentiated. The most commonly used method of rotation is the ***varimax*** method, which attempts to minimize the number of variables that have a high loading on a factor (Gorsuch 1983). As other methods of rotation were experimented with, and found to yield similar results, results reported in this thesis are all based on varimax rotation.

D.2.3. Tests of Factor Analysis Appropriateness

Several statistics are used to test the appropriateness of factor analysis: KMO, BTS, number of items, and number of cases.

D.2.3.1 KMO

KMO, or the Kaiser–Meyer-Olkin measure of sampling adequacy, is an index for comparing the magnitudes of the observed correlation coefficients to the magnitudes of the partial correlation coefficients (Kaiser 1974). If the sum of the squared partial correlation coefficients between all pairs of variables is small when compared to the sum of the correlation coefficients, the KMO measure is close to 1. Small values for the KMO measure indicate that a factor analysis of the variables may not be a good idea, since correlations between pairs of variables cannot be explained by the other variables. Kaiser (1974) characterized KMO measures in the 0.90s as marvelous, in the

0.80s as meritorious, in the 0.70s as middling, in the 0.60s as mediocre, in the 0.50s as miserable, and below 0.50 as unacceptable.

D.2.3.2 BTS

BTS, or Bartlett's test of sphericity (Bartlett 1937), can be used to test the hypothesis that the correlation matrix is an identity matrix or that all diagonal terms are 1 and all off diagonal terms are 0. In other words, the statistic tests the amount of correlation amongst the items. If the BTS is large and the associated significance level is small, it is unlikely that the correlation matrix is an identity matrix, and there is thus adequate correlation amongst the items to justify the factor analysis approach.

D.2.3.3 Ratio of Items to Factors

The items per factor statistic indicates the total number of items in the analysis divided by the number of factors extracted. Kim and Mueller (1981) suggest at least three items for each factor. In general researchers seem to agree that one should have at least twice as many items as factors in the analysis.

D.2.3.4 Ratio of Cases to Items

A final consideration in deciding the appropriateness of factor analysis is the ratio of cases to items. A heuristic commonly employed (Cattell 1952) is the 4 to 1 rule. Mathematically, factor analysis will work provided the number of cases is greater than the number of factors hypothesized to exist within the data. Therefore some researchers (e.g. Rummel 1970) have even suggested that factor analysis can be

performed on a data matrix in which the number of variables exceeds the number of cases.

D.2.4. Criteria for Number of Factors

Main criteria considered in identifying the number of meaningful factors within the data matrix were (a) eigenvalues, (b) total variance and marginal variance explained, and (c) observation of the scree plot. Gorsuch (1983) suggests that the number of factors and the associated method of determining that number may legitimately vary with the research design. When a small number of items are factored, the mathematical approach to determining number of factors often indicates too few factors. He also suggests that forcing one or two extra factors does not affect the stability of the rotated solution. Cattell has recommended that an extra factor or two be extracted (Cattell 1952), while Gorsuch (1983) suggests that if one is in doubt concerning extracting the proper number of factors, the error should probably be slightly on the side of too many factors, provided that the common factors do not degenerate.

D.2.4.1 Eigen value criterion

The eigenvalue criterion states that factors with eigen values less than unity should not be interpreted as being meaningful when the correlational, unadjusted matrix is used (Kim and Mueller 1981). The correlational matrix is used in the principal components factor model. The logic behind this heuristic is that a factor with an eigenvalue less than unity is contributing less to an explanation of the variance in the data than that of the average single variable.

D.2.4.2 Total and Marginal Variance Explained

Gorsuch (1983) suggests that usually factor extraction is stopped after a large proportion of the variance has been extracted and when the next factor extracted would add only a very small amount to the total variance extracted. Typically the factor process is stopped when 75-85% of the variance in the factor model has been accounted for.

D.2.4.3 Scree Plot

The scree plot is a two dimensional graph with factors on the x-axis and eigenvalues on the y-axis. The factors are typically arranged in descending order and researchers can interpret that the appropriate number of factors for a particular analysis is the number of factors before the plotted line turns sharply right (Hair et al. 1998).

D.2.5. Factor Loading

In order to assess which variables are associated with each factor, a criterion for distinguishing a 'significant' loading is required. As the structure matrix loadings are correlation coefficients, the higher the loading the more significant the variable is to the interpretation of the factor. Bearing in mind that a loading of exactly zero is unlikely with empirical data, minimum value cut-offs employed by researchers vary substantially. In this study, given the generally large loadings, a cut-off of 0.5 (Hair et al. 1998) yielded the most meaningful factors.

D.2.6. Factor Score

Factor loadings can be used to derive factor scores for constructs. There are two general classes of methods for estimating factor scores. The first class has been referred to as the "exact", "complex", or "refined" methods. These methods yield approximately standardized factor score estimates with different properties. For example, Thurstone's (1935) ***regression*** approach produces factor score estimates that maximize determinacy; whereas ***Anderson and Rubin's*** (1956) approach yields factor score estimates that are perfectly orthogonal (uncorrelated). ***Bartlett's*** (1937) approach is univocal for orthogonal factors but neither maximizes validity nor preserves correlations.

The second class of scoring procedures has been referred to as the "inexact", "unit-weighted", or "coarse" methods by different authors. The factor score estimates are computed by simply summing the responses of subsets of the factored items. For example, it is common practice to: extract and rotate a number of factors, examine the structure coefficients (the correlations between the items and the factors) for salient items using some conventional cut-point such as .40 or .50, and sum the responses of the salient items on each factor to compute the factor score estimate. If an item yields a negative structure coefficient it is subtracted rather than added in the computations, and items on different scales are first standardized before they are summed. These scores are very common in the literature, particularly in scale construction efforts, and may be referred to as total, index, sum, domain, facet, scale, or subscale scores.

While the refined methods can insure certain statistical properties, such as maximizing determinacy or constraining the factor score estimates to orthogonality, the coarse

methods are simple to compute and are generally believed to be more stable across independent samples of observations compared to the refined methods. In this study, we tried out both approaches of scoring (i.e. refined and coarse) and obtained similar regressions results with both.

D.2.7. Contribution Model Factor Analysis

From factor analysis of all contribution model constructs it was observed that: (1) The factor solution has Kaiser–Meyer-Olkin measure of sampling adequacy of 0.835 that is "meritorious" in terms of Kaiser (1974); (2) The solution satisfies the minimum criterion of more than two items per factor (Kim and Mueller 1981); (3) Bartlett's test of sphericity has a significance of 0.00 as desired (Bartlett 1937); (4) The ratio of cases to variables has a satisfactory value of 3.5 (Rummel 1970); (5) The scree plot (Figure D.1.) also indicates that the 11 factor solution seems appropriate.

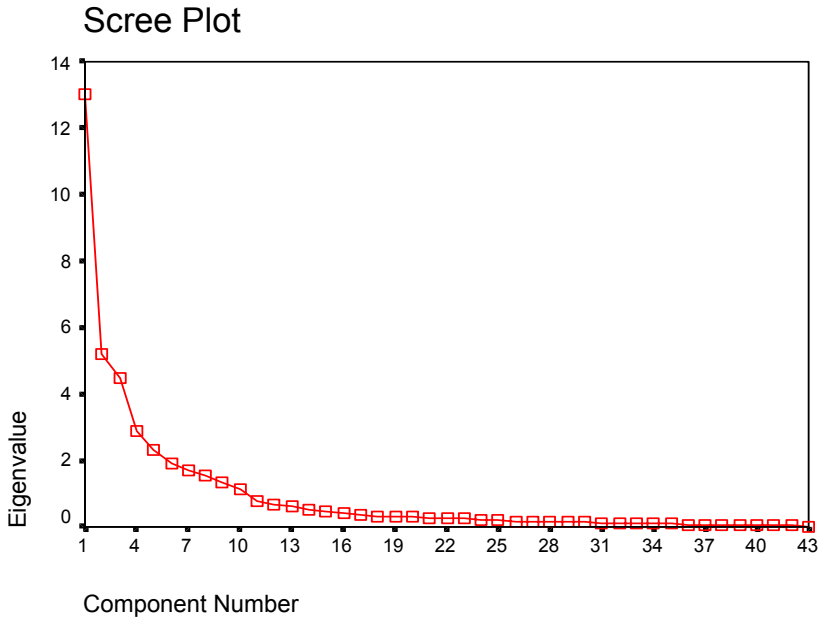

Figure D.1. Contribution Model Factor Solution Scree Plot

D.2.8. Seeking Model Factor Analysis

From the factor analysis of seeking model constructs it is observed that: (1) The factor solution has KMO of 0.848 that is "meritorious" in terms of Kaiser (1974); (2) The solution satisfies the minimum criterion of at least two items per factor (Kim and Mueller 1981); (3) BTS has as significance of 0.00 for the solution indicating adequacy of the factor solution (Bartlett 1937); (4) The ratio of cases to variables has a satisfactory value of 4.32 (Cattell 1952); (5) The scree plot (Figure D.2.) also indicates that the 9 factor solution seems appropriate.

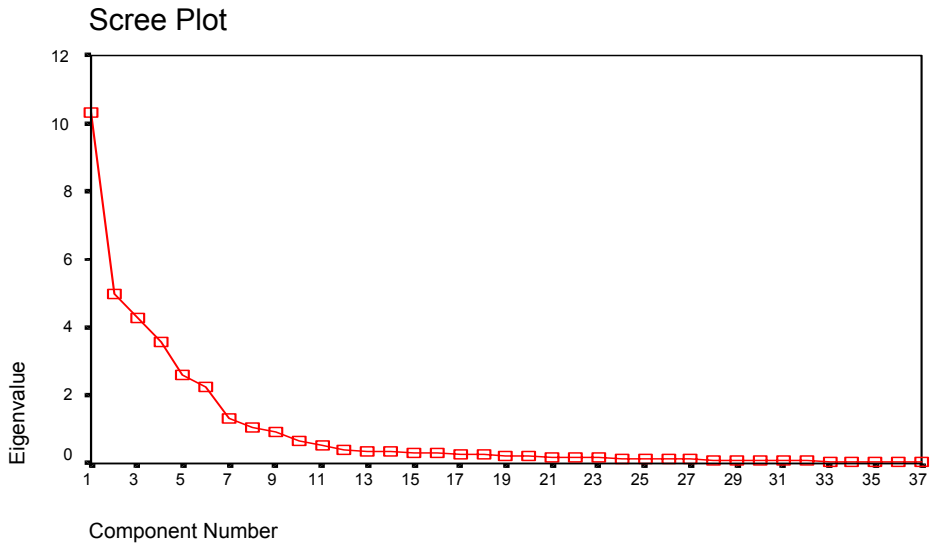

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Figure D.2. Seeking Model Factor Solution Scree Plot

D.3. Multiple Regression Assumptions

D.3.1. Normality

A normal distribution is assumed by many statistical procedures including MRA and ANOVA (Hair et al. 1998). Normal distributions take the form of a symmetric bell-shaped curve. The normal distribution has properties that there is less than 0.05 probability that a sampled case will lie outside 2 standard deviations of the mean and

less than 0.01 probability that it will lie outside 3 standard deviations of the mean. Normality can be visually assessed by examining the histogram of standardized residuals. Visual inspection is facilitated by superimposing a normal curve on the histogram. The normal probability plot, also called P-P plot, is an alternative method for visual inspection, plotting observed cumulative probabilities of occurrence of the standardized residuals on the Y axis and expected normal probabilities of occurrence on the X-axis, such that a 45 degree line will appear when the observed conforms to the normally expected and the assumption of normally distributed error is met (Hair et al. 1998). Numerical indicators of normality include the skewness, kurtosis and the Kolmogorov-Smirnov test for large samples.

D.3.1.1 Skew

Skewness is the tilt in a distribution. A common rule of thumb test for normality is to compute the skewness statistic for a distribution and divide it by the standard error to obtain the ratio (z-value). A z-value within the range of –2.5 to 2.5 is taken to indicate that the distribution is normal (Hair et al. 1998). A positive value of skew indicates a distribution leaning towards the right while a negative value of skew results from a left-leaning distribution.

D.3.1.2 Kurtosis

Another measure of normality is the kurtosis or peakedness of a distribution. A common heuristic test for normality is to compute the kurtosis statistic and divide it by the standard error. As in the case of skew, the ratio (z-value) for kurtosis should typically lie between –2.5 and 2.5 for a normal distribution (Hair et al. 1998). Negative

kurtosis (flatter than normal) indicates too many cases in the tails of the distribution while positive kurtosis (peaked than normal) indicates too few cases in the tails.

D.3.1.3 Transformations

Various transformations have been employed to correct for skew (and sometimes resulting kurtosis) (Hair et al. 1998). These include square roots, logarithmic, and inverse (1/x) transforms to pull in outliers and normalize positive skew. Inverse (reciprocal) transforms are stronger than logarithmic transforms that are stronger than roots. Correction for negative skew involves first subtracting all values of the variable from the highest value plus 1 and then applying the same transformations as for positive skew. The most generic transform is the power transform that takes the form X: (X+C)**P, where X is the variable in question and C and P are constants. Values of P less than 1 i.e., roots, correct for positive skew. However, too great reduction of P will overcorrect and cause left skew. When the best P is found, further refinements can be made by adjusting C. For right skew for instance, subtracting C will decrease skew.

D.3.2. Multicollinearity

Two measures commonly used for assessing multivariate collinearity are the ***tolerance*** value and its inverse i.e. ***variance inflation factor*** (Neter et al. 1996). These measures tell us the degree to which each IV is explained by the other IV. Tolerance is the amount of variability of the selected IV not explained by other IV. A common cut-off threshold is a tolerance value of 0.2 that corresponds to a variance inflation factor value of 5, i.e. tolerance < 0.2 and VIF > 5 are indicative of multicollinearity problems. Another diagnostic technique for assessing multicollinearity and its effects is the

condition index and its corresponding variance components. It has been suggested that condition indices of 30 or more and the proportion of the variation for a coefficient greater than 0.50 are indicative of potentially problematic multicollinearity (Hair et al. 1998).

D.3.3. Independence of Errors

Violations of independence of errors assumption i.e. serial correlation in the residuals means that there is room for improvement in the regression model, and extreme serial correlation is often a symptom of a badly misspecified model. Serial correlation is also sometimes a byproduct of a violation of the linearity assumption, as in the case of a straight trend line fitted to data that are growing exponentially over time. The Durbin-Watson statistic provides a test for significant residual autocorrelation. For independence of error assumption to be satisfied, ideally its value should be close to 2.0 i.e. between 1.4 and 2.6 (Curwin and Slater 2000).

D.3.4. Contribution Model Regression Assumptions

The **collinearity diagnostics** for the significant terms in the contribution model indicate that all terms have acceptable tolerance greater than 0.20 and VIF less than 5.00 (see Table D.3.). The tolerance and VIF for excluded variables are also acceptable. Further, the condition indices (maximum value 1.965) are well below 30 (see Table D.4.), the threshold above which problems of multi-collinearity are indicated (Hair et al. 1998).

	Collinearity Statistics	
	Tolerance	VIF
TEHLP	0.789	1.267
KSEF	0.747	1.339
TCREW	0.923	1.083
CEFF*GTRU	0.844	1.184
RECB*PSNM	0.909	1.100
CREW*IDEN	0.929	1.076
TLOKP	0.692	1.445
CEFF	0.878	1.139
TRECB	0.801	1.249
IMAG	0.622	1.607
GTRU	0.824	1.214
PSNM	0.833	1.201
IDEN	0.751	1.331
LOKP*PSNM	0.818	1.222
CEFF*PSNM	0.467	2.141
CEFF*IDEN	0.526	1.901
CREW*PSNM	0.477	2.096
IMAG*PSNM	0.641	1.561
KSEF*GTRU	0.721	1.388
LOKP*GTRU	0.805	1.243

Table D.3. Tolerance and VIF for Contribution Model Variables

Condition Index	Variance Proportions						
	(Constant)	TEHLP	KSEF	TCREW	CEFF*GTRU	RECB*PSNM	CREW*IDEN
1.000	0.03	0.06	0.08	0.05	0.10	0.06	0.04
1.246	0.17	0.20	0.10	0.00	0.01	0.07	0.12
1.392	0.31	0.02	0.00	0.23	0.09	0.13	0.10
1.505	0.03	0.00	0.10	0.42	0.03	0.00	0.34
1.607	0.00	0.00	0.00	0.13	0.00	0.42	0.32
1.815	0.28	0.42	0.06	0.01	0.41	0.02	0.02
1.965	0.18	0.31	0.46	0.05	0.27	0.00	0.06

Table D.4. Condition Indices for Contribution Model Variables

The Durbin Watson statistic value of 1.594 lies between 1.5 and 2.5, implying that the **independence of errors assumption** is satisfied (Curwin and Slater 2000). As indicator of the satisfaction of **linearity assumption**, the standard deviation of residuals (0.79) is less than the standard deviation of the DV (1.11) (Garson 2002).

The assumption about the **normal distribution of error terms** can be checked by examining the histogram of standardized residuals and the P-P plot (Hair et al. 1998).

Figure D.3. shows the residuals histogram for the transformed variables model. The P-P plot for our model is shown in Figure D.4. Both plots indicate little deviation from the normal.

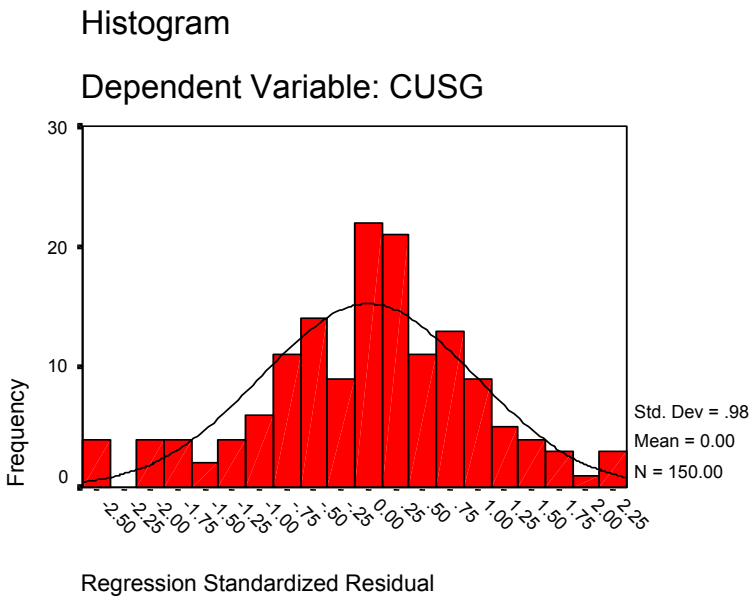

Figure D.3. Residual Histogram (transformed variables contribution model)

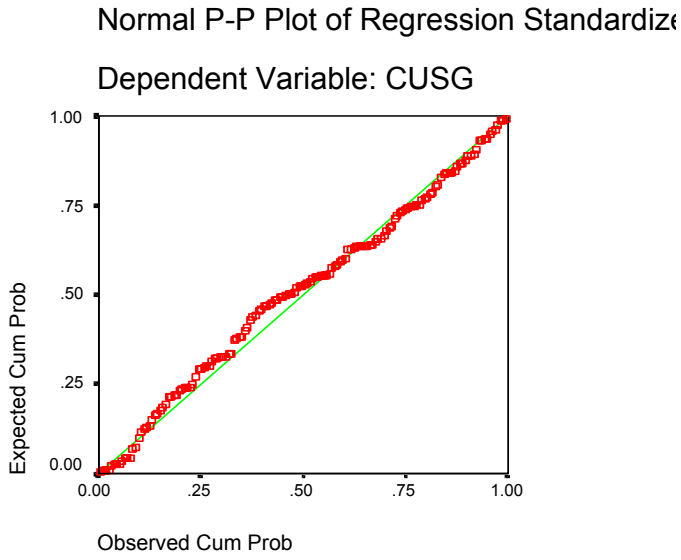

Figure D.4. Normal P-P plot (transformed variables contribution model)

Lastly, the **homogeneity of variances assumption** was tested using a standardized scatterplot of the standardized residuals (ZRESID) versus the standardized predicted values (ZPRED). The scatterplot (see Figure D.5.) shows a random pattern indicating that the error is homoscedastic.

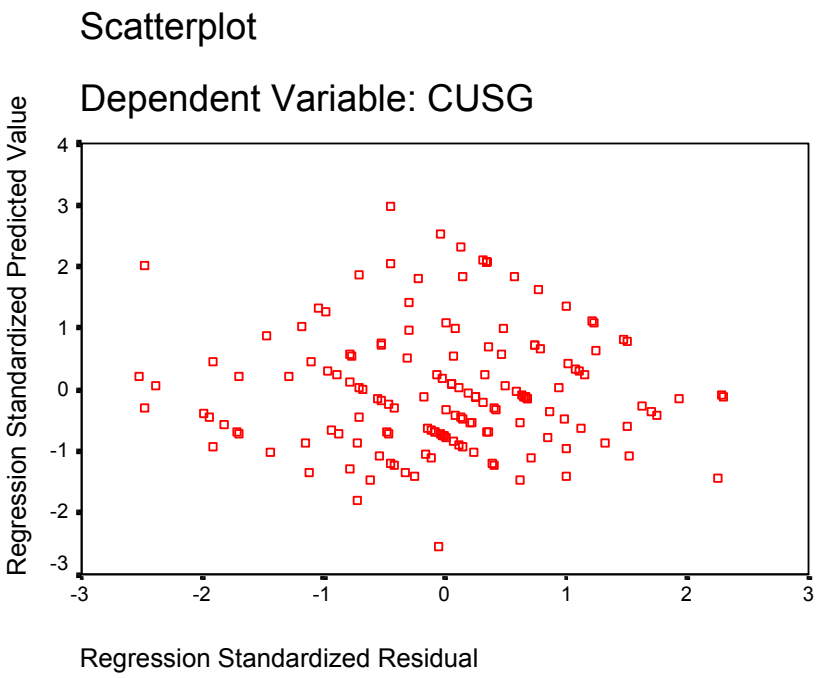

Figure D.5. Scatter Plot (transformed variables contribution model)

D.3.5. Seeking Model Regression Assumptions

The **collinearity diagnostics** (see Table D.5.) for the significant terms in the seeking model indicate that all terms have acceptable tolerance greater than 0.20 and VIF less than 5.00. The tolerance and VIF for excluded variables are also acceptable. Further, the condition indices (maximum value 1.55) are well below 30 (see Table D.6.), the threshold above which problems of multi-collinearity are indicated (Hair et al. 1998).

	Collinearity Statistics	
	Tolerance	**VIF**
PUOR	0.907	1.103
TSKGW	0.882	1.134
FOBL*IDEN	0.896	1.115
SKGW*PSNM	0.899	1.112
SEFF	0.895	1.117
FOBL	0.971	1.030
SREW	0.992	1.008
GTRU	0.945	1.058
PSNM	0.848	1.180
IDEN	0.870	1.149
SEFF*GTRU	0.991	1.009
FOBL*PSNM	0.465	2.151
SREW*PSNM	0.750	1.334

Table D.5. Tolerance and VIF for Seeking Model Variables

Condition Index	Variance Proportions				
	(Constant)	**PUOR**	**TSKGW**	**FOBL*IDEN**	**SKGW*PSNM**
1.000	0.03	0.17	0.12	0.21	0.11
1.080	0.11	0.11	0.23	0.04	0.24
1.229	0.45	0.00	0.04	0.05	0.08
1.337	0.00	0.49	0.12	0.39	0.12
1.550	0.01	0.23	0.48	0.31	0.46

Table D.6. Condition Indices for Seeking Model Variables

The Durbin Watson statistic value of 1.839 lies between 1.5 and 2.5, implying that the **independence of errors assumption** is satisfied (Curwin and Slater 2000). As indicator of the satisfaction of **linearity assumption**, the standard deviation of residuals (0.66) is less than the standard deviation of the DV (0.97) (Garson 2002).

The assumption about the **normal distribution of error terms** was checked by examining the histogram of standardized residuals and P-P plot (Hair et al. 1998). Figure D.6. shows the residuals histogram for the transformed variables model. The P-P plot for our model is shown in Figure D.7. Both plots indicate little deviation from the normal.

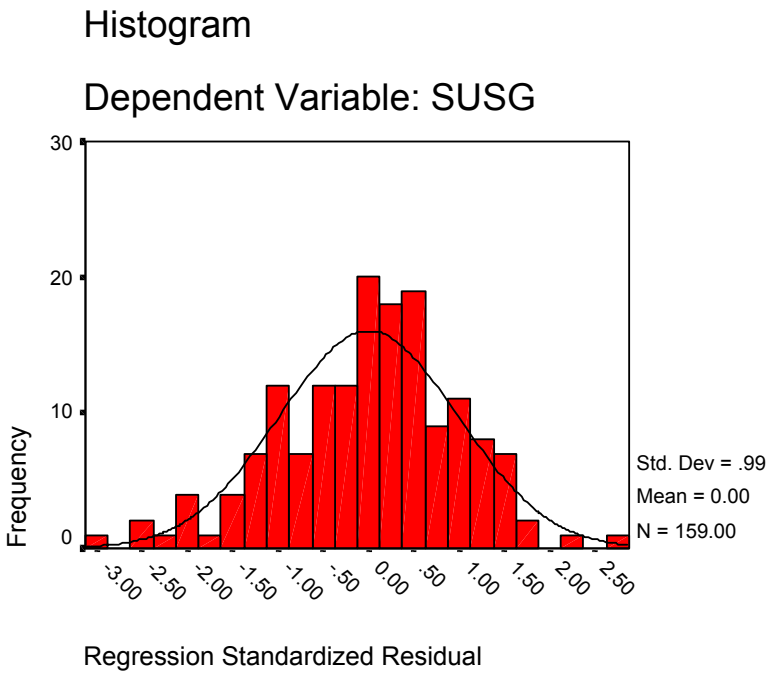

Figure D.6. Residual Histogram (transformed variables seeking model)

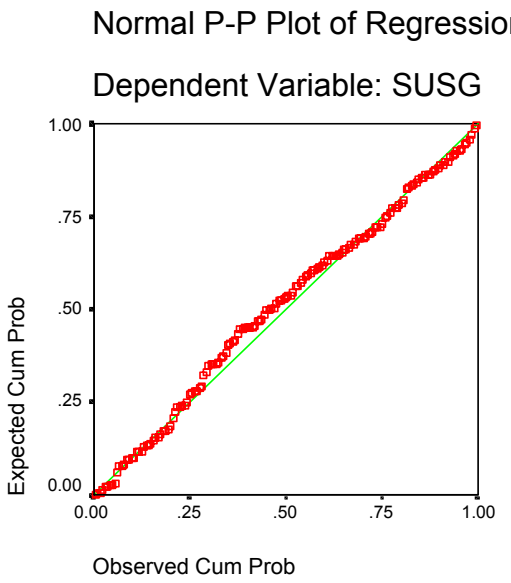

Figure D.7. Normal P-P plot (transformed variables seeking model)

Lastly, the **homogeneity of variances assumption** was tested using a standardized scatter plot of the standardized residuals (ZRESID) versus the standardized predicted

values (ZPRED). The scatter plot (see Figure D.8.) shows a random pattern indicating that the error is homoscedastic.

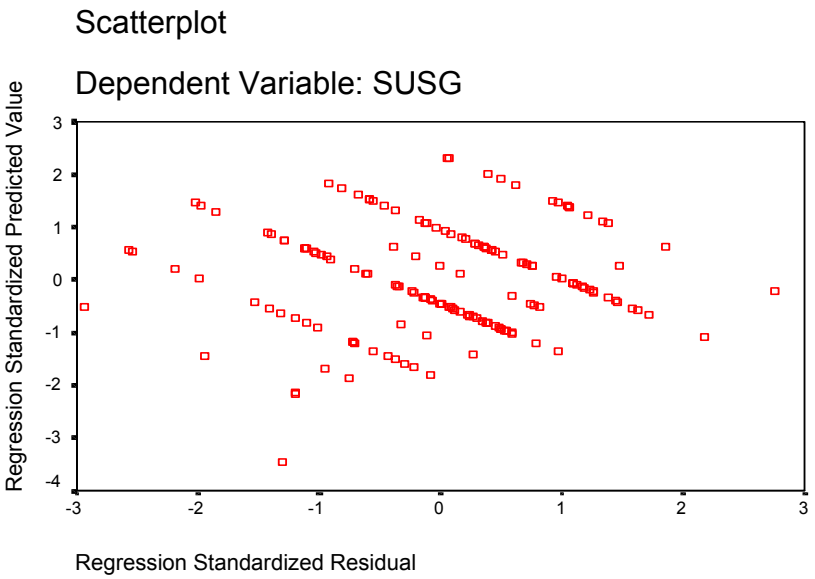

Figure D.8. Scatter Plot (transformed variables seeking model)