AN EXAMINATION OF THE EFFECTS OF CULTURAL, CLIMATIC,

STRUCTURAL, AND TECHNOLOGICAL FACTORS ON

KNOWLEDGE MANAGEMENT EFFECTIVENESS

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AN EXAMINATION OF THE EFFECTS OF CULTURAL, CLIMATIC, STRUCTURAL, AND TECHNOLOGICAL FACTORS ON KNOWLEDGE MANAGEMENT EFFECTIVENESS

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A Dissertation

Submitted to

the Graduate Faculty of

Auburn University

in Partial Fulfillment of the

Requirements for the

Degree of

Doctor of Philosophy

Auburn, Alabama
December 15, 2006

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VITA

Todd A. Peachey, son of Roger and Connie Peachey, was born on December 20, 1963, in Lewistown, Pennsylvania. He graduated from Kishacoquillas High School in 1982. He enlisted in the Air Force in 1984 and served four years in Charleston, South Carolina. After this enlistment, he graduated from Penn State University in 1993 with a Bachelor of Science degree in Finance with a minor in Economics. After receiving a commission in the Air Force, he attended the Air Force Institute of Technology in Dayton, Ohio where he graduated with a Master of Science degree in Information Resource Management.

DISSERTATION ABSTRACT

AN EXAMINATION OF THE EFFECTS OF CULTURAL, CLIMATIC, STRUCTURAL, AND TECHNOLOGICAL FACTORS ON KNOWLEDGE MANAGEMENT EFFECTIVENESS

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117 Typed Pages

Directed by Dianne Hall

This study examined the effects of culture, climate, intrinsic motivators, structure and technological capabilities on knowledge management effectiveness when structure is moderated by technological capabilities. Knowledge workers were surveyed to collect data on their perceptions of culture, climate, structure and technological capabilities within the organization. Partial Least Squares Modeling was used to analyze the data. This research found evidence that climatic factors including fairness and affiliation, in addition to intrinsic motivators and technology, affect knowledge management effectiveness.

ACKNOWLEDGEMENTS

I would like to thank Dr. Dianne Hall for her guidance throughout the program. Without her tireless efforts, I would not have succeeded. During my three years at Auburn, she was a mentor, advisor, and friend. I would also like to thank Drs. Byrd and Cegielski for their contributions to my dissertation. Dr. Byrd challenged me throughout my studies to improve my research. I was initially very hesitant to even enroll in a PhD program, but a conversation with Dr. Cegielski gave me the confidence to pursue this degree.

In 1997 I had a chance to return to school full time at the Air Force Institute of Technology (AFIT) for my Master's Degree. I was somewhat intrigued by the idea, but also very hesitant given my prior track record as a student. Colonel Sue Slavec encouraged me to embrace the opportunity. While attending AFIT, Dr. Alan Heminger was very supportive and key in helping me complete my degree and eventually offered me the opportunity to earn my PhD. Without the respect and value the U.S. Air Force places on education, I doubt I would have ever had the chance to earn this degree.

Finally, I would like to thank my family for their constant support. They have always reminded me of the value of education and provided constant encouragement.

Style manual or journal used *Publication Manual of the American Psychological Association, 5th Edn.*

Computer software used Microsoft Word 2003, Endnote 8.

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CHAPTER ONE

INTRODUCTION

Knowledge management (KM) has become a key initiative in many organizations seeking to better manage "what they know" and as a source of competitive advantage (Nidumolu, Subramani & Aldrich, 2001; Teece, 1998). KM has become an integral part of many different organizations (Grover & Davenport, 2001) and based on the increasing level of activity in both academic and practitioner journals, research activity is also increasing. Given the importance of knowledge to an organization (Davenport, Delong & Beers, 1998), the increase is not surprising.

KM refers to management's conscientious efforts to use tools and approaches to locate, refine, transfer, and apply the knowledge and experience available to the company (von Krogh, 1998). Generally, KM refers to the overall effort to manage knowledge within an organization. In contrast, a KM system (KMS) is the information technology component of a KM program (Alavi & Leidner, 2001). Technology is extremely important to KM through the capabilities it provides in the form of communications, collaboration, and the storage of vast amount of data, information, and knowledge. While technology is certainly a critical enabler of KM programs (Alavi & Leidner; Davenport & Prusak, 2000; O'Dell & Grayson, 1998), climate (Bock, Zmud, Kim & Lee, 2005), culture, and structure (Gold, Malhotra & Segars, 2001) are also

important aspects of KM. In a similar view, KM is a deeply social process that must take into account human and social factors (Mason & Pauleen, 2003). For the purposes of this study, KM refers to the entire scope of social issues and technology under examination.

Theoretical research focuses on the universal aspects of a problem as opposed to its particulars (McGrath, 1982). Frameworks are especially useful in better understanding the *universal* in a discipline and help guide the work of researchers (Palvia, Mao, Salam & Soliman, 2003). Prior to 2001, there were reports of 26 KM frameworks in the literature (Rubenstein-Montano, Liebowitz, Buckwalter, McCaw, Newman & Rebeck, 2001). Many of these frameworks were designed to provide a better understanding of the concepts of KM with an emphasis on social issues in addition to technological capabilities. Four frameworks, outlined briefly below, are examples of the frameworks that emphasize the social aspects of KM that have been published since 2001 in leading information systems journals. A third framework examines the effects of incentive alignment on users and organizational effectiveness in the contexts of decision support systems, KM, and supply chain coordination (Ba, Stallaert & Whinston, 2001). The relationship between strategy, structure, people, and technology with individuals, groups, and organizations as key elements in the KM process is the basis for another framework (Grover & Davenport, 2001). One framework suggests that more research is needed on how informal networks (networks of people, rather than technology) affect knowledge transfer and whether or not some organizational structures are more effective than others (Argote, McEvily & Reagans, 2003). Argote et al. used KM outcomes in the forms of creation, retention, and transfer versus KM context in the

form of properties of units, knowledge, and relationships between units to better understand the current state of KM research. In one of the most frequently cited articles in KM (Jennex & Croasdell, 2005), Alavi and Leidner (2001) describe knowledge processes in organizations and pose a variety of research questions including:

- What conditions facilitate knowledge creation in organizations?
- Do certain organizational cultures facilitate knowledge creation?
- What social, cultural, or technical strategies are effective in facilitating knowledge transfer?
- What organizational practices can help bridge the knowledge application gap?
- Can IT enhance knowledge creation?
- What incentives are effective in encouraging knowledge contribution and sharing in organizations?

This sample of research questions posed by Alavi and Leidner (2001) illustrate the desire of researchers to better understand many of the socio-cultural issues in KM today. Although technology allows us to communicate in real time from any place on the planet, social and organizational issues still limit our ability to communicate with people in our organization.

One common theme in the frameworks described above is the discussion of the social and organizational issues prevalent in KM systems. The dominant issues in these frameworks are based on cultural, climatic, and structural factors in organizations. Culture refers to the values, beliefs, and assumptions held by organizational members (Dennison, 1996). Climate refers to a specific situation, at a certain point in time, to

describe the thoughts, feelings, and actions of people in an organization (Bock et al., 2005). Chandler noted "structure is the design of organization through which the enterprise should be administered" (1962, p. 14), or in another similar view, structure can be understood to be the set of rules and resources represented in recurrent social practice (Orlikowski, 2000). Technology has been noted as a critical enabler of KM programs (Alavi & Leidner, 2001; Davenport & Prusak, 2000; Grover & Davenport, 2001). In this project, the focus is on technological capabilities that a KMS can provide such as those that enable collaboration, group learning, and knowledge mapping (Gold et al., 2001).

The objective of this research is to determine if cultural, climatic, motivational and structural factors, in addition to technological capabilities, affect KM effectiveness at the individual level. Other research has examined these factors in isolation with respect to a specific construct in KM in the context of how a particular construct affects KM processes such as knowledge creation or knowledge transfer. This study will examine KM in a more holistic sense and examine the factors individually and collectively together with their relationship to effectiveness.

Effectiveness

The implementation of an effective KM system will often require people to change the way they interact with other people in the organization and their perceptions of the benefits of a knowledge friendly culture (Davenport et al., 1998). Several factors thought to be related to KM effectiveness are: specific links to performance, technical and organizational infrastructure, knowledge-friendly culture, change in motivational practices, and senior management support (Davenport et al., 1998). Other researchers

have examined KM effectiveness by analyzing the results of financial or other organizational measures (Lee, Lee & Kang, 2005; Tanriverdi, 2005). One issue in measuring IS effectiveness, and similarly KM effectiveness, is matching the levels of the dependent variables, as described by Markus and Robey (1988). Researchers must use caution to ensure that the level of the dependent variable matches what is actually being examined. If researchers are examining factors within the organization at the individual level, effectiveness should be measured at a similar level (Markus & Robey). In this study, all variables are examined at the individual level. One study suggested that effectiveness should not be measured by asking a user if something was effective or not (Davenport et al.), while another adapted an instrument from another KM effectiveness measure that asked users about their satisfaction with different aspects of the system (Becerra-Fernandez & Sabherwal, 2001).

Primary Factors

Effective KM is a component of sound management (Davenport et al., 1998). Without extensive behavioral, cultural, and organizational change, KM cannot be effective (Davenport & Prusak, 2000). Yet, as will be discussed in more detail in the next chapter, culture is very difficult to change. Elements of strategy, structure, and people exist in a duality in that they can influence a context and or be influenced by the context of the problem (Grover & Davenport, 2001). This suggests that we are aware of the changes to these factors; however, we do not know if the effects are significant predictors of KM effectiveness. Culture, climate, motivators, structure, and technology are the key factors in this research.

An organization's culture is an interesting phenomenon in that it can be unique, critical for KM success, and yet exceedingly difficult to change. Many companies create their own unique corporate culture that determines how an organization thinks and behaves and is shared by members of the organization (Nonaka & Takeuchi, 1995). Adjusting culture is critical to a firm's ability to effectively manage knowledge (Davenport et al., 1998; Davenport & Klahr, 1998) yet changing a company's information sharing culture is difficult (Davenport, 1994; Holsapple & Joshi, 2001; Weber & Pliskin, 1996). Changing an aspect of an organization that has been formed over years of operations is exceedingly challenging and may lead to unforeseen consequences for the organization.

In a study of 431 organizations, culture was found to be the largest single impediment to knowledge transfer, with 54% of respondents identifying it as a critical impediment (Ruggles, 1998). Likewise, it was posited that organizational culture may be the most significant obstacle to effective KM (Gold et al., 2001). Specifically, one study found that culture can inhibit a knowledge initiative from being successful (Nidumolu et al., 2001). This is especially troubling given the difficulties in changing an organization's culture. If an organization has a culture that is not conducive to KM, can it still be effective at KM?

Climate is often described as the match between individual attitudes and organizational culture (Schwartz & Davis, 1981) in addition to the thoughts and feelings that drive a person's actions (Bock et al., 2005). To be successful, KM projects often require organizational and personal attitudes toward knowledge sharing to change from the common situation of hoarding knowledge (O'Dell & Grayson, 1998). Effective

organizations should encourage employees to communicate more effectively through different techniques such as talk rooms or game rooms where employees are encouraged to congregate and discuss matters important to the organization (Davenport & Prusak, 2000; Desouza, 2003; Gray, 2001). Most managers have adequate power in an organization to encourage the behaviors described above, at least to some degree.

Incentives in the form of extrinsic or intrinsic rewards are posited to affect many aspects of KM. Bock et al. (2005) examined how rewards affect users' intention to share knowledge. Motivational factors from both the source and the recipient were examined with regard to their affect on knowledge transfer (Ko, Lirsch & King, 2005). The process of sharing and knowledge transfer should be inherently rewarding, celebrated, and supported by the organization (O'Dell & Grayson, 1998). One theme that is consistent throughout this research stream is that extrinsic rewards in the form of cash and other tangible items have not been effective (Al-Busaidi & Olfman, 2005; Bock et al., 2005; Ko et al., 2005, O'Dell & Grayson, 1998). In this research, incentives will be measured only on an intrinsic level based on the lack of evidence that extrinsic motivators predict effectiveness.

Managers have focused on adapting their organizational operating processes to new information technologies and executives must rethink the strategic fundamentals of their businesses (Evans & Wurster, 1997). New forms of business organization are critical for modern organizations (Teece, 1998). Specifically, organizations with flatter hierarchies enable quicker decision making and usually have fewer bureaucratic restrictions on knowledge sharing between individuals and entities within the

organization. An organizational structure with fewer levels of hierarchy should be positively associated with KM effectiveness.

For the purposes of this research, technology is defined as a technological capability to accomplish a certain task. Because knowledge and the desire to capture it have always existed, it is possible that the availability of new technologies have increased this capability (Davenport & Prusak, 2000). Technological innovations have allowed organizations to be much more efficient at sharing, capturing, storing, and retrieving knowledge. Technology enables a variety of knowledge and communications activities (Gold et al., 2001). In new organizational structures, technology can facilitate the necessary control required by management. Improved communications technologies that span time and distance allow organizations much more control with improved flexibility than previously available.

KM programs have suffered through many of the same cultural, climatic, and structural issues that have plagued other information systems implementations in the past. While the need for a combination of human and technical factors is something that KM projects share with other information systems projects, in KM projects the level of complexity of human factors is much greater than for most data or information management projects (Davenport et al., 1998). One factor that highlights the difference between KM systems and other systems is that enterprise cultures need to change from treating knowledge solely as an object that is not dependent on the humans who use it to understanding and accepting that critical knowledge may be a human capacity that cannot always be codified and transferred mechanically (Sutton, 2001).

It is unlikely that any organization will find itself with an optimal environment for effective KM, and therefore all must adjust at least some aspect of their culture, climate, or structure. Given the speed of change in today's business environment, it is important for managers to be proactive in addressing these factors when possible.

Research Questions

Specifically, the research questions formulated to guide this study are as follows:

RQ1. Do cultural factors affect KM effectiveness?

RQ2. Do climatic factors affect KM effectiveness?

RQ3. Do intrinsic motivators affect KM effectiveness?

RQ4. Does structure affect KM effectiveness?

RQ5. Do technological capabilities affect KM effectiveness?

RQ6. Do technological capabilities moderate structure?

Chapter 2 discusses the literature in the field that serves as the foundation for this research. A detailed examination of the relevant research in culture, climate, structure, technology, systems maturity, and effectiveness is presented and the research model and relevant hypotheses are discussed. Chapter 3 describes the methodology that was used to collect and analyze the data and goes on to describe the instrument development, concluding with a justification for the use of Partial Least Squares Modeling. In Chapter 4, the findings are discussed, along with a presentation of the raw data analysis, validity, and results. Chapter 5 outlines the interpretations and conclusion of the dissertation and presents an explanation of the results, the theoretical and practical implications, and the limitations of this research.

The results of this research indicate how important it is to understand the cultural, climatic, motivational, structural, and technological issues in a KM initiative. Research suggests that corporate culture is not easily changed (Davenport, 1994); conversely, other research suggests managers can be proactive and adjust the organization's current climate and structure (Bock et al., 2005). Proactive actions on the part of the managers can help move the people in the organization from adoption (behaving in a new way on a trial basis) to institutionalization (a commitment to the post-change state of the system) (Armenakis, Harris & Feild, 1999).

CHAPTER TWO

LITERATURE REVIEW

Research into the theoretical aspects of KM has focused extensively on the importance of the social and management aspects. One study of 431 firms suggested that if people issues do not arise, the initiative is not KM (Ruggles, 1998). These social aspects range from concepts such as culture and climate to more organizationally oriented factors such as structure and the technological capabilities provided to the workers. Recent research suggests that while the social and organizational issues are critical, technology is an enabling factor in successful KM (Alavi & Leidner, 2001; Davenport & Prusak, 2000). Although efforts at managing knowledge certainly predate the computer, computers have enabled the current era of KM (Holsapple, 2005). Generally, if technology solved the problem, knowledge was not the problem (Ruggles). Technology alone does not support KM, yet through the capabilities it provides, technology in some form of a KMS is critical to the effort.

Measures of effectiveness are still limited in KM research. KMS suffer from many of the same problems that plague evaluation of other technological systems. A variety of approaches have been suggested, including financial, productivity, and customer related indicators. In a study of 223 articles, researchers found that human, financial, process, and customer indicators were the key drivers in evaluation of KM

(Loermans & Fink, 2005). This supports previous research that found that success indicators in terms of growth of resources, people, senior management support, and financial return are critical (Davenport et al., 1998). One critical aspect of IS effectiveness evaluation is that people will tend to not admit failure. Asking managers about the absence or presence of specific indicators removes this aspect of subjectivity in the analysis (Davenport et al., 1998).

A knowledge infrastructure, from an organizational capabilities perspective, consists of technology, structure, and culture (Gold et al., 2001). No one element is adequate to describe the construct and each contributes uniquely to organizational effectiveness (Gold et al.). Of the top ten impediments to knowledge transfer, eight items are mapped to culture, climate, or structural issues in KM (Ruggles, 1998). To understand the effects on knowledge creation, other authors have divided KM enablers into the social perspective, defined by culture, structure, and people, and the technological perspective, defined by the organization's information technology. They found cultural factors to be the dominant factor (Lee & Choi, 2003). Each of these dimensions of knowledge infrastructure, social issues and technological issues, contributes to the overall capability of an organization to effectively manage their knowledge (Gold et al.).

Culture, climate, motivators, and other organizational factors, such as management support and resources, have been hypothesized as key issues in a successful KM implementation. The cultural, climatic, structural, and technological challenges resulting from a knowledge focus in an organization are often immense. These challenges include such items as choosing appropriate incentive systems, developing an

appropriate structure, and understanding what effects technology can have on an organization.

One key difference between culture and climate is that organizational culture is rooted in history, whereas climate is temporal and subject to direct manipulation by people with power and influence (Bock et al., 2005). In other words, climate is transitory and manageable in the short term (Dennison, 1996; Schwartz & Davis, 1981). An organization's culture is long-term, strategic, and difficult to change (Dennison; Schwartz & Davis). The historical roots of culture somewhat explain the challenges in changing it in the short time horizon of a new information system, or in this case, a new KM system. Managers and executives will come and go, yet an organization's culture can take much longer to change, if it changes at all. This is not to say it is impossible to change an organization's culture. An exceptional leader can, in rare cases, change culture to meet current conditions, yet this is certainly the exception rather than the rule.

Another conflict in the literature is the classification of innovation as a cultural or climatic factor. Some research has included innovation as a cultural factor (Davenport et al., 1998; Schwartz & Davis, 1981), while others have operationalized innovation as a part of climate (Bock et al., 2005). Dennison (1996) argues that culture and climate may differ with respect to the interpretation rather than the phenomena.

Effectiveness

Measuring IS effectiveness has been a somewhat elusive topic in MIS research. Three common approaches, namely user attitudes, IS productivity, and cost-benefit analysis, have been frequently researched. Two of the earlier works in evaluating IS effectiveness examined the user viewpoints and the evaluation approaches. Evaluations

tend to be subjective and influenced by the perceptions of the system objectives (Hamilton & Chervany, 1981b). Additionally, IS effectiveness assessments tend to be controversial and a source of disagreement between functional groups (Hamilton & Chervany, 1981b). Two views of measuring effectiveness are the goal-centered view and the systems-resource view (Hamilton & Chervany, 1981a). The goal-centered view examines how the system meets specific objectives, while the systems-resource view examines effectiveness in terms of user satisfaction or usage (Hamilton & Chervany, 1981a). The concepts posed in these two works formed the basis for a large majority of the IS effectiveness research that followed. Recent research in IS effectiveness has brought more granularity to the factors. In describing the factors most critical to IS effectiveness, researchers found improving systems integration, facilitating information retrieval, increased user satisfaction, and improving the quality of product/service were the most critical of fourteen factors (Kanungo, Duda & Srinivas, 1999).

Given the youth of KM, there have been limited attempts at specifically evaluating systems effectiveness in this context. One recent paper developed and tested a KM Performance Index (KPMI) in 101 firms (Lee et al., 2005). This index examines the factors of knowledge creation, accumulation, sharing, utilization, and internalization against the financial indicators of stock price, price earnings ratio, and R&D expenditure (Lee et al.). The authors found that as the KPMI increases, management performance also increases as measured by the financial indicators (Lee et al.). In a similar study, IT relatedness significantly effects KM capability which in turn has significant effects on corporate performance operationalized as industry performance, diversification, firm size, structure and risk level (Tanriverdi, 2005).

Two recent studies examine KM effectiveness in a very specific area. Knowledge creation and investment decisions were examined through a simulation that suggested organizations receive the most financial benefit from alignment of knowledge creation tasks and investments with short term objectives (Chen & Edgington, 2005). In another study, content ratings and credibility indicators were found to improve the KM search and evaluation process and therefore the decision making process (Poston & Speier, 2005). These studies found evidence of very specific situational measures of factors that increase effectiveness of KM. Failure to address and understand user and organizational requirements has been shown to reduce KM effectiveness and the related business advantages inherent in an effective KMS (Damodaran & Olphert, 2000).

Davenport, Delong, and Beers (1998) used success indicators as a proposed measure of KM effectiveness. They avoided asking respondents to gauge success but instead asked them about indicators that the presence or absence of would indicate effective KM (Davenport et al.). This technique removed the political pressure to only admit to success (Davenport et al.). Davenport et al. proposed specific success factors. This article is well known in the discipline and is one of the most frequently cited works in KM (Jennex & Croasdell, 2005):

- Link to performance factors including revenue or other economic benefits
- Technical and organizational infrastructure featuring common technologies and appropriate roles and skills
- Standard, flexible knowledge structure that ensures the knowledge is available to users but allows for continual evolution of the system

- Knowledge friendly culture that values learning and that places expertise, experience, and innovation above hierarchical demands
- Clear purpose and language to ensure that only knowledge and not data is maintained in the system
- Change in motivational practices to remove trivial rewards that only encourage short term support to significant rewards that tie into compensation and promotion
- Multiple channels for knowledge transfer are managed that include both technological and social exchange
- Senior management support that provides appropriate visibility, commitment, and advocacy for the program

One of the noted problems in IS research is that many studies mix the unit of analysis levels between individuals, groups, and organizations and therefore reduce the generalizability of the study (Markus & Robey, 1988). Much of the research described above was conducted at the organizational level of analysis. If the levels of analysis are inappropriate for the theoretical propositions, problems of inference may persist (Markus & Robey). Given that this research examines how the factors of culture, climate, structure, and technology affect knowledge worker effectiveness, the measures used in these studies would not be appropriate for this project. Often in IS research, technology is introduced at the organizational level while affecting skills and the work environment of the individual (Markus & Robey). In this research, technology is studied through the capabilities it provides to the individual knowledge worker. KMS is usually a department- if not organization-wide initiative, at least for knowledge workers.

However, the individual knowledge worker's perceptions of these capabilities are the critical issue for this research. In this study, the factors are studied at the individual level, specifically in how individuals perceive certain aspects of the factors. To properly understand this phenomenon, we must examine individual knowledge worker's satisfaction.

Individual satisfaction and usefulness have been a commonly researched topic in IS research. Perceived usefulness and ease of use were found to be important antecedents to system usage (Davis, 1989). A wide variety of studies have further examined and applied Davis' work. In a comprehensive taxonomy of IS success, the concept of individual impact was introduced (DeLone & McLean, 1992). The authors suggested that individual impact would directly affect organizational impact (DeLone & McLean). These works formed the foundation for a proposed KM success model (Jennex & Olfman, 2003). In this KM success model, system quality, knowledge/information quality, use/user satisfaction, intent to use/perceived benefit, and net benefits were posed to affect KM success (Jennex & Olfman). The authors suggest that KM impacts are specific to an organization and are influenced by the use of the KMS (Jennex & Olfman).

In a prior study, researchers found that knowledge management processes, when moderated by task characteristics, positively affected KM satisfaction (Becerra-Fernandez & Sabherwal, 2001). Specifically, the researchers tried to determine if there was evidence that KM processes impact knowledge effectiveness (Becerra-Fernandez & Sabherwal). The nature of the task was found to positively affect KM effectiveness (Becerra-Fernandez & Sabherwal). While the concept of knowledge effectiveness is

slightly different than that of KM effectiveness, the difference is not critical. The end result of KM is that knowledge should be effectively applied by individuals and the organization. For knowledge to be effective on more than a random basis, it must be appropriately managed to support both the knowledge worker and the organization.

Social, Organizational and Technological Factors

Culture

Culture is the collection of central norms that characterize an organization (Schwartz & Davis, 1981). A corporate culture is reflected in the attitudes and values, management style, and problem-solving behavior of its employees (Schwartz & Davis). An organization's values, principles, norms, mores, and procedures are its cultural knowledge resource (Holsapple & Joshi, 2001). An organization's culture is one of the most important factors in effective KM. As will be discussed below, most researchers believe it is difficult to change, yet almost an a priori requirement for effective KM.

Two common aspects of culture that have been extensively researched are culture in the national sense of the word, and culture in organizations often referred to as corporate culture. Several researchers have looked at culture in the national sense of the word to better understand how differences in national culture affect information systems (Hofstede, Neuijen, Ohayv & Sanders, 1990; Martinsons & Westwood, 1997; Straub, 1994; Tan, Smith, Keil & Montealegre, 2003). Other researchers have examined culture with respect to the norms and mores within an organization. This research will focus on the second aspect of organizational culture and its interaction with KM programs.

Culture and climate were often studied as one issue in the 1980s and 1990s. A debate in the field evolved and Dennison (1996) describes the difference between

climate and culture. Originally, culture was restricted to qualitative studies in contrast to climate that was more often studied using quantitative methods (Dennison, 1996; Xenikou & Furnham, 1996). This has since changed, as Dennison observed that more quantitative studies of culture are being published. Innovation, support, rules, and goals were the foundation of a cultural questionnaire focusing on description and evaluation of organizational culture (van Muijen, Koopman, De Witte, De Cock, Susanj & Lemoine, 1999). A study of four survey instruments for organizational culture found the following five factors: *satisfaction needs* to include behavioral norms and values, *task-oriented organizational growth* defined as a technocratic approach to organizational development, *people orientation* defined as the human factor in a bureaucratic culture, *task orientation* defined as the resistance to new ideas, and *positive social relations* in the work place (Xenikou & Furnham). This and other research using survey instruments for organizational cultural studies has somewhat gained acceptance with many scholars in the discipline (Dennison).

If an organization's culture is not appropriate for a knowledge project, no amount of technology, content, or project management skills will make the project successful (Davenport et al., 1998). In a study of 71 practitioners at a KM presentation, culture was perceived to be the biggest barrier to KM implementation (Mason & Pauleen, 2003). In their study, Mason and Pauleen operationalized culture as organizational culture, trust, sharing, and communication. A culture that supports knowledge is one that values learning and rates experience, expertise, and innovation higher than hierarchy (Davenport et al., 1998). Organizational culture can influence the adoption of technology (Huang, Newell, Galliers & Pan, 2003) while cultural drag can dramatically

inhibit organizational change efforts (Robey & Boudreau, 1999). A culture aligned with organizational objectives benefits all change projects (Davenport et al.). To gain the critical support of employees, change projects must be aligned with organizational culture (Davenport et al.; Schwartz & Davis, 1981). Organizations with a more innovative culture will be more likely to adapt more quickly to new technology. Given the consistent definitions in the literature of culture as a longer term phenomena versus the short term orientation of climate, this research classifies innovativeness as a cultural phenomena.

Culture is separate from infrastructure (structural and technological), yet culture can still be influenced by infrastructure, as infrastructure can constrain or promote cultural evolution (Holsapple & Joshi, 2001). Information technology induced cultural change can be dangerous to an organization when there is a mismatch between the organization's culture and the proposed system (Doherty & Doig, 2003). However, the difficulties in changing an organization's culture suggest the cultural limitations on structure and technology may be higher than the infrastructure's limitations on culture.

An appropriate knowledge oriented culture should show a positive orientation toward knowledge sharing and an innovative nature (Davenport et al., 1998). A knowledge sharing culture should already exist if a KMS is to be effective (Damodaran & Olphert, 2000). In one study, the authors operationalized culture based on the organization's encouragement of knowledge sharing between employees (Al-Busaidi & Olfman, 2005). It is important to consider that in other technological innovations, culture did not adapt to the technology, but instead the technology was integrated into the pre-existing culture (Grote & Baitsch, 1991). An appropriate culture may be an a

priori requirement for effective KM. If an organization's culture is not one that readily accepts change, the best KM program implementation may well fail.

Attitudes are often ingrained in the organization and difficult to change, at least in the short term. Recall that many elements between culture and climate are similar. Perspective rather than substance is another difference between organizational culture and climate (Dennison, 1996). Certain employee attitudes regarding their approach to problem solving are developed over a long period of time. Factors such as an organization's attitudes toward on the job learning and knowledge transfer are key elements in organizational culture (Gold et al., 2001) yet are also resistant to change.

Another important aspect of corporate culture is a shared vision (Gold et al., 2001; Leonard, 1995). This vision should be communicated by management and shared by the employees throughout the organization. In a study of small and medium sized companies, senior leadership was found to be the highest ranked factor in KM success (Wong & Aspinwall, 2005). Senior leadership must be effective in communicating the shared vision to the rest of the organization. A clear organizational vision provides employees with a needed sense of purpose (Gold et al.). The corporate vision should consist minimally of the future direction of the organization and organization's values (Gold et al.).

Given the differentiation between culture and climate since Gold et al.'s (2001) study, this research will also attempt to differentiate between the two concepts. Considering the a priori requirement for a culture appropriate for knowledge projects, it is posed that culture will directly affect KM effectiveness. Potential indicators for the

aspects of culture pertinent to this study include a well known corporate vision, recognition of expertise, and innovativeness. Therefore, this study posits that:

Hypothesis 1. The combination of vision, expertise and innovativeness is a significant predictor of KM effectiveness.

Hypothesis 1a. Vision is a significant predictor of KMS effectiveness.

Hypothesis 1b. Expertise is a significant predictor of KMS effectiveness.

Hypothesis 1c. Innovativeness is a significant predictor of KMS effectiveness.

Climate

Climate refers to a situation whereas culture refers to an evolved context (Bock et al., 2005). Climate measures the fit between the culture of an organization and the individual values of employees (Schwartz & Davis, 1981). Climate portrays organizational environments that are relatively temporary, subject to direct control, and mostly limited to how aspects of the organizational environment are perceived by organization members (Dennison, 1996). The aspects of the organizational environment include such factors such as pay and promotion plans in addition to other rewards in the organization. Scholars have examined a variety of aspects of climate including trust, tolerance of failure, pro-social norms, and incentives (Bock et al.). An organization's norms may affect knowledge sharing, i.e. transfer of knowledge between individuals or entities within the organization (Kolekofski & Heminger, 2003). Measures of climate often include compensation, promotion opportunities, and rewards (Schwartz & Davis). Previous research indicates that climate is controllable in the short term (Dennison; Schwartz & Davis). Many of these issues are among the top rated climatic issues including top management's failure to signal importance, lack of ownership of the

problem, and ineffective or missing incentive systems (Ruggles, 1998). A study of small and medium sized enterprises found that culture was the second highest rated factor in KM success (Wong & Aspinwall, 2005); however, the author's operationalization aligns more closely with climate in this research.

Bock et al. (2005) examined knowledge sharing intentions through the lens of the Theory of Reasoned Action, augmented by extrinsic motivators, social-psychological forces, and organizational climate. Climate, which was operationalized as fairness, affiliation, and innovativeness, was found to be a significant predictor of an employee's intention to share knowledge (Bock et al.). Fairness (a trusting climate), innovativeness (a climate tolerant of failure), and affiliation (a climate with pro-social norms), were all found to be significant factors of organizational climate (Bock et al.).

Workers' beliefs and attitudes toward sharing information may explain the reluctance to share information with colleagues (Kolekofski & Heminger, 2003). People share information and knowledge when they believe it is their own and when they derive personal satisfaction from doing so (Constant, Kiesler & Sproull, 1994). As will be discussed later, this points directly to the importance of intrinsic motivators when predicting knowledge sharing behavior. Using the Theory of Reasoned Action, a model was developed to examine the conflict between stewardship or ownership of information, instrumentality, and value of feelings (Kolekofski & Heminger). Managers should consider worker attitudes toward ownership versus stewardship of organizational information (Kolekofski & Heminger). An employee's attitude toward ownership or stewardship may be able to predict knowledge sharing (Kolekofski & Heminger). People who believe the information and knowledge belongs to the organization were

found to be less likely to share (Jarvenpaa & Staples, 2000). Instrumentality (the quantity of information requested, the value of the information, and the perceived beneficiary) is also an important factor in attitudes toward information sharing (Kolekofski & Heminger). Managerial control, group identification, and social value orientation were posed to have a positive influence on sharing valuable knowledge (Galletta, Marks, McCoy & Polak, 2003). They found support for the majority of their hypotheses. The hypotheses not supported were that group identification leads to greater sharing than no group identification, and that the interaction between pro-self value orientations and group identification has a greater influence than pro-self values without group identification. Galletta et al. noted that future research is needed to discover other important antecedents to knowledge sharing both singularly and in interaction with the variables in their study.

Ladd and Heminger (2003) examined the effects of relational channels, partner similarity, organizational self-knowledge, and divergence of interest versus openness to change/innovation, task-oriented organizational growth, bureaucratic, and competition/confrontation. They found correlation between some types of organizational knowledge transfer and factors hypothesized to influence knowledge transfer. One weakness of the study is the inability to prove causation between the correlated variables (Ladd & Heminger). Another weakness noted is that there is no empirical evidence to show that indicators of knowledge transfer actually predict any significant level of knowledge transfer (Ladd & Heminger).

Panteli and Sockalingham (2005) examined the effects of trust and conflict on knowledge sharing in the context of virtual alliances. Three types of trust, calculus-

based, knowledge-based, and identification-based, originally suggested by Lewicki and Bunker (1996), were analyzed. Calculus-based trust is based on the rewards to be gained from developing and maintaining a relationship, and the fear of sanction for violating trust (Panteli & Sockalingam). Knowledge-based trust is developed over time, and relies on information about the parties to the interaction (Panteli & Sockalingam). Identification-based trust is based on the mutual understanding between parties that their interests will be protected and that no monitoring is necessary (Panteli & Sockalingam). Conflict was analyzed in the context of task, relationship, and process. Virtual alliances were framed as either star-alliance where there is a single dominant party for task allocation, value-alliance where there is a single dominant party for process coordination, or co-alliance, where all parties share equal status/responsibility (Panteli & Sockalingam). In other studies, trust between employees is recognized as a key KM enabler (Lee & Choi, 2003).

Previous research has found that climate, when operationalized as fairness, affiliation, and innovation, serves as a significant predictor of knowledge transfer and the intention to transfer knowledge. Potential indicators of climate include fairness, affiliation, trust, and intrinsic motivators. Given the criticality of knowledge transfer to effective KMS, climate is posed to be a significant predictor of effective KM in mature systems. Therefore, this study posits that:

Hypothesis 2. Climatic factors such as fairness, affiliation and trust are significant predictors of KM effectiveness.

Hypothesis 2a. Fairness is a significant predictor of KM effectiveness.

Hypothesis 2b. Affiliation is a significant predictor of KM effectiveness.

Hypothesis 2c. Trust is a significant predictor of KM effectiveness.

Motivators

Rewards, incentives, and motivation can be extrinsic or intrinsic. Extrinsic motivation in the form of rewards or incentives is often based in some form of compensation (Ko et al., 2005); that is, the decision is motivated by economic self interest (Wasko & Faraj, 2000). Attitudes and ownership of knowledge are factors that management can adjust through different rewards and incentives. Many organizations have implemented monetary incentives and other incentives, such as points for promotion, as motivators for knowledge sharing (Bock et al., 2005). Previous research suggests that extrinsic motivators do not play an important role in knowledge transfer (O'Dell & Grayson, 1998) but people must be rewarded for their work (Bennett, 1996). In more recent research, reward structures, specifically extrinsic rewards, and motivating factors have been examined in several contexts related to knowledge sharing but have not been found to be significant predictors of an individual's intention to share or knowledge transfer (Bock et al.; Ko et al.; Wong & Aspinwall, 2005). To encourage attitudes that are more appropriate for knowledge sharing, managers must consider ways to increase the intrinsic motivators for employees to share knowledge.

Extrinsic motivators, such as pay and promotion were also not found to be significant predictors of knowledge transfer (Ko et al., 2005) or of KM success (Al-Busaidi & Olfman, 2005). Additionally, another study found that extrinsic rewards in the forms of organizational rewards, such as promotions and career advancement, were not significant predictors of knowledge sharing (Bock et al., 2005). Their findings suggest extrinsic motivators actually have a negative effect on knowledge sharing. One

possible explanation for this conflict is that an appropriate climate can remove the need for extrinsic motivators (Nahapiet & Ghoshal, 1998). Tangible rewards in the form of monetary incentives or promotion have been shown to promote self interested behavior and reduce intrinsic motivation (Deci, 1971, 1972). This type of behavior has been suggested to reduce organizational learning and undermine interest in the work itself (Kohn, 1993). Extrinsic rewards may not be the critical factor in knowledge sharing that previous work has suggested (Bock & Kim, 2002). In their analysis of data from an American Quality and Productivity Council (APQC) study, O'Dell and Grayson (1998) recommend against using cash or other formal rewards for professionals. The literature suggests there has been less study of intrinsic motivators relative to extrinsic motivators. Considering the previous research findings on extrinsic motivators, specifically the lack of a significant result (Al-Busaidi & Olfman, 2005; Ko et al., 2005) and the negative relationship in Bock et al. (2005), this study will focus on intrinsic motivators.

Intrinsic rewards and motivations occur when the action directly satisfies an employee's need (Ko et al., 2005) or is motivated by community interest or moral obligation (Wasko & Faraj, 2000). In contrast to the inability of researchers to find support for the theory that extrinsic motivators predict knowledge sharing, researchers have found that intrinsic motivators are significant predictors of knowledge transfer (Ko et al., 2005). Based on these findings, it appears that the most effective motivators for knowledge sharing are based on intrinsic motivators such as in individual's desire to appear intelligent or the satisfaction that results from the activity as previously suggested (Ko et al., 2005). Satisfaction from work can be reduced through inappropriate incentive programs (Kohn, 1993). Providing more support for the importance of intrinsic

motivators is a study of how knowledge self-efficacy and enjoyment from helping others were found to be significant predictors or contributions to electronic knowledge repositories (Kankanhalli, Tan & Wei, 2005). The research above offers strong evidence that intrinsic motivators are a much stronger predictor of knowledge sharing behavior than extrinsic motivators such as pay and promotion. Therefore, this study posits that:

Hypothesis 3. Intrinsic motivators are a significant predictor of KM effectiveness.

Structure

The quest to move from information management to KM requires development of structures that allow the firm to recognize, create, transform and distribute knowledge (Gold et al., 2001). In a survey of 431 organizations, organizational structure was the fourth highest rated item with 28% of respondents identifying it as an impediment to knowledge transfer (Ruggles, 1998).

To leverage technological architecture, an organization needs an appropriate structure (Gold et al., 2001). Casually formed personal networks are no longer adequate to diffuse best practices (Teece, 2000). Reducing hierarchies in organizations increases knowledge transfer between employees (Nonaka, 1994). Flexible and responsive firms should have shallow hierarchies to enable quick decision making (Teece, 2000). Instead of traditional hierarchical structures, organizations need a form and set of processes that encourages the flow and transfer of knowledge (Miles, Miles, Perrone & Edvinsson, 1998). New organizational designs are likely to share common factors such as being flatter than their historical predecessors, having a dynamic rather than a static structure, supporting empowerment of people, emphasizing the importance of competencies, and

recognizing intellect and knowledge as leveragable assets (Nonaka & Takeuchi, 1995). Two types of structures, a modular design and a hypertext organizational design, have received positive discussion for KM (Gold et al., 2001). A modular design has been shown to increase strategic flexibility (Sanchez & Mahoney, 1996), while Nonaka and Takeuchi's hypertext organization enables efficient knowledge creation. A hypertext organization, like a hypertext document, is posited to have multiple layers that are quickly adaptable to the current situation (Nonaka & Takeuchi). This should not be confused with a matrix organizational structure in that a matrix is designed to achieve multiple tasks while embedded in a conventional hierarchy (Nonaka & Takeuchi). The research described above suggests that a minimum of hierarchies is the best organizational structure to promote effective KM.

Technologies and organizational structures are undergoing dramatic changes in both form and function (Orlikowski, 2000). Examining how structures are changed shows that while users can use technology as designed, they can also use it for things other than for what it was implemented (Orlikowski). Users may use technology so that it supports their current structure instead of its intended purpose, so information on its organizational context is an important part of the knowledge context that contributes to how it forms a social system (Nidumolu et al., 2001). Organizational structures and procedures themselves represent codified knowledge and must be flexible to allow the enterprise to adapt as new knowledge is acquired (Sutton, 2001). This research outlines the linkage between organizational structure and technology and offers possible explanations for how technology might affect structure or how it might be used within the current structure.

Research has examined how organizations can or should change their structure to better facilitate knowledge sharing (Gold et al., 2001). Some authors even take this idea further by noting that KM must be accompanied by organizational change to be truly effective (Marshall, Prusak & Shpilberg, 1996). When an organization chooses to pursue a knowledge based strategy and implement a KMS, similarly its structure should adapt to this new strategy. To leverage a technological architecture, organizational structure is important (Gold et al.). Structures that result in individuals, locations, and divisions hoarding knowledge decrease KM effectiveness (O'Dell & Grayson, 1998). Encouraging the collective actions of individuals appears more likely to increase effective KM through an appropriate balance of technological and social effects.

The best organizational structure for a particular strategy depends on the complex interaction between culture, technology, and people (Schwartz & Davis, 1981). KM requires social support rather than technological solutions to facilitate critical aspects of KM (Butler, 2003). This is not to say that technology is not important to a KMS as it has been noted as a critical enabler (Alavi & Leidner, 2001; Davenport & Prusak, 2000). However, technology alone will not make a KMS effective. Information systems projects and knowledge projects have a common need for a combination of technical and human aspects (Davenport et al., 1998). In many ways this is consistent with the idea that information technology deals with data and information only and that other factors within the organization constitute organizational memory (Butler). This implies that technology may affect structure through the capabilities it can provide.

Others agree that it is also necessary for an organization's structure to change to facilitate effective KM. For example, Sutton (2001) suggests that enterprise cultures

need to understand that the ability to change internal structures and systems is actually a critical factor for success that facilitates the effective exploitation of their knowledge resources. If no cultural, climatic, and structural changes are implemented, a KM system is unlikely to be effective (Sutton). Without these changes, it is likely that the technological part of the KM system will degenerate into a corporate library.

Previous research has found that structure is a significant predictor of KMS effectiveness. An appropriate structure for effective KM would be one that has a minimum of hierarchies and promotes collective knowledge rather than individual behavior. Potential indicators include the ability to cross functional boundaries to obtain knowledge, knowledge sharing, and collective behavior among employees. Because a more hierarchical structure generally inhibits knowledge sharing and the KMS is unlikely to be effective, this study posits that:

Hypothesis 4. Structure is a significant predictor of KM effectiveness.

Technological Capabilities

By the mid 1990s, there was still little conclusive evidence that information technology contributed to a firm's effectiveness (Weber & Pliskin, 1996) or productivity (Hitt & Brynjolfsson, 1996). While information technology is a critical enabler of KM, there are barriers and limitations associated with its use. Technology cannot replace face to face contact in the exchange of knowledge and human interaction remains a key source of knowledge generation (Fahey & Prusak, 1998). Technology enables KM and more effective organizational structures by providing certain necessary functionality, yet comes with its own inherent risks. The focus of management on these systems should move away from the technological engineering perspective towards a focus on the

specific challenges and problems in a knowledge based organization (Hendriks & Vriens, 1999). The techno-centric approach to KM is not adequate to achieve the necessary organizational climate to promote organizational learning and, therefore, KM effectiveness (Damodaran & Olphert, 2000). Information access failures have been problematic for people in organizations with centralized headquarters (Warne, Hasan & Ali, 2005). However, this limitation in no way mitigates the requirement for an effective information technology infrastructure.

Technological support of an organization's KM program can take many forms depending on what the organization specifically wants to accomplish. There is no correct technology for KM (Alavi & Leidner, 2001; Davenport & Prusak, 2000). When assessing technology for a KMS, it is critical to first identify the required functionality and objectives of the KM program (Hendriks & Vriens, 1999). Ten categories of software may provide support to KM programs including, intranet-based systems, content-based systems, groupware, work flow, artificial intelligence systems, business intelligence systems, knowledge mapping systems, innovation support tools, competitive intelligence tools, and knowledge portals (de Carvalho & Ferreira, 2006). To avoid the need to understand each organization's particular needs, this study focuses on the capabilities the information technology provides to the organization.

Alavi and Leidner (2001) state that communication technologies are critical for all the key processes in KM. Collaboration allows employees to work together and communicate effectively (Gold et al., 2001). Collaboration is the key to effective knowledge creation and transfer (Alavi & Leidner, Leonard & Sensiper, 1998; O'Dell & Grayson, 1998), two of the most critical processes in KM. Other important

technological capabilities for effective KM are knowledge mapping and retrieval and collaboration. Knowledge mapping technologies allow individuals to find relevant knowledge within their organization (Gold et al.). Storage schemes should be consistent across the organization (Davenport & Klahr, 1998; O'Dell & Grayson). This allows employees in the organization to search and retrieve knowledge more effectively. Additional required technological functionality includes such aids as a robust communications network and usable storage and retrieval mechanisms (Gold et al.).

Technology's relationship to organizational structures has long been of interest to researchers (Orlikowski, 2000). Technology in the form of communications networks can enable particular structures (Holsapple & Joshi, 2001). Technology can eliminate barriers between parts of the organization and allow collaboration between structurally and geographically separate parts of the organization by reducing these barriers (Gold et al., 2001; Teece, 1998). These linkages between parts of the organization provided by an appropriate technology can often overcome artificial or restrictive structural barriers due to restrictive hierarchies and bureaucracies. Technology can improve KM by getting the right knowledge to the right person by expanding access to knowledge and improving communication (Davenport & Prusak, 2000; Teece). The richness of communication available through today's networks allows knowledge workers to more effectively communicate with each other than they were able to even 10 years previously. This allows diverse and distributed organizational structures that can be more effectively mapped to the goals, vision, and objectives of an organization. Technology serves as a critical element in organizational structure specifically for the creation of new knowledge (Gold et al.). The linkage of information systems in an

organization allows integration of previously fragmented flows of knowledge (Gold et al.; Teece).

Previous research suggests that appropriate technological capabilities must be present in an effective KMS. Yet, there is no single technological tool or product that dominates KM (Alavi & Leidner, 1999). The technological capabilities suggested by Alavi and Leidner focus on the organization's ability to store and retrieve information and on communication. Technological capabilities can affect KM effectiveness through two paths. First, an appropriate technology must be in place for effective KM. Second, technology can enable the flatter organizational structures that have been suggested to increase KM effectiveness. Technology has also been seen to have an effect on structure by enabling a more flexible and supportive organizational structure (Miles et al., 2005; Orlikowski, 2000). Advanced technological infrastructures in the form of robust communications networks allow structures that are more appropriate for effective KM (Holsapple & Joshi, 2001). Potential indicators include knowledge mapping, knowledge retrieval, and collaboration. Therefore this study posits that:

Hypothesis 5. Technological capabilities are significant predictors of KM effectiveness.

Relationship Between Structure and Technological Capabilities

The relationship between flatter organizational structures may be moderated by technological capabilities. Technology may allow workers to circumvent or otherwise work around a restrictive organizational structure (Orlikowski, 2000). A moderator is a qualitative or quantitative variable that is posed to affect the strength of the relationship between an independent variable and a dependent variable (Baron & Kenny, 1986). A

moderator effect is nothing more than an interaction where the level of one independent variable affects the level of another independent variable (Frazier, Tix & Barron, 2004). Researchers may use this perspective when the foundational theory suggests the impact of the predictor varies depending on the level of the moderator (Venkatraman, 1989).

Hypothesis 6. Technological factors moderate the relationship between structure and KM effectiveness.

Model Development

Figure 1 shows the overall outline of the model adopted for this study. Cultural, climatic, intrinsic motivation, structure and technological capabilities indicators are posed to effect KM effectiveness directly, without any effect from technological capabilities. Structure is also posed to be moderated by technological capabilities.

The climate must be appropriate to encourage employee actions that enhance effectiveness. The structure should be devoid of needless hierarchies. Technology must provide the crucial communications links and capabilities to employees to both enable flatter structures and enhance effectiveness through richer communications in addition to the more traditional functions of technology within an organization, that of storage and retrieval.

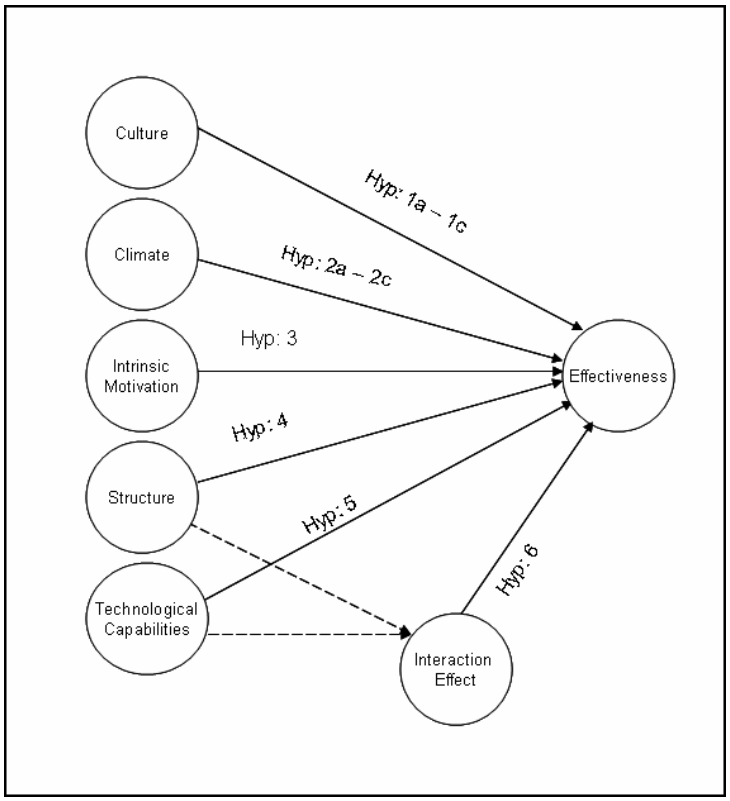

Figure 1 - Overall Model

This chapter provides the foundation for this study. Previous researchers have suggested that organizational factors such as culture, climate, motivators, and structure are significant predictors of KM effectiveness. The literature is currently inconclusive regarding the differences between culture and climate and whether or not these constructs will factor separately. The constructs of organizational structure and technological capabilities have support for being significant predictors of a variety of aspects of KM such as knowledge transfer. This study is the first to look at all these factors, along with KM effectiveness, at the individual level and the first to examine whether or not organizational structure is moderated by technological capabilities.

CHAPTER THREE

METHODOLOGY

This chapter will describe the research methodology for this research. The participants in this study will be knowledge workers. The instrument, consisting of 49 questions, was primarily developed from prior research. There are six foundation articles that comprise the majority of the instrument items. The data was collected via an Internet survey.

Participants

The persons most knowledgeable about the construct of interest should be chosen for data collection (Huber & Power, 1985). The positions of the CIO or CKO are fairly well defined, but the definition of a knowledge worker is somewhat less clear. "Knowledge workers have high degrees of expertise, education, or experience, and the primary purpose of their jobs involves the creation, distribution, or application of knowledge" (Davenport, 2005, page 10). Additionally, knowledge worker tasks include scanning for new knowledge inside or outside the organization for the pursuit of knowledge creation relevant to the organization (Chen & Edgington, 2005). Almost every organization has knowledge workers in some capacity, but depending on the effort within the organization to institutionalize KM, many of these workers may not understand their potential contributions to KM.

Malhotra and Grover (1998) suggest that appropriate survey items must be developed with respect to the following questions: (a) Is the unit of analysis clearly defined for the study? (b) Does the instrumentation consistently reflect that unit of analysis? (c) Is the respondent(s) chosen appropriate for the research question? In this study, the unit of analysis is clearly defined as knowledge workers, as defined by Davenport (2005). The instrument reflects these units as outlined in Tables 1 through 4. Knowledge workers' perceptions of these factors are appropriate given the nature of the questions.

The Instrument

Pinsonneault and Kraemer (1993) noted that less than 10% of research relies on multiple methods for data collection. Given that this study will only use the web survey to gather data, this study may suffer from common-method bias. However, there are several techniques for reducing common-method bias (Podsakoff, MacKenzie, Lee & Podsakoff, 2003). One technique suggested is to protect respondent anonymity and reduce evaluation apprehension (Podsakoff et al.). This survey did not collect data that could be traced to the respondents without their specific approval. Respondents were told that individual results would not be released in any form. That is, all data would be aggregated prior to release. Respondents were offered an executive summary on conclusion of the study and given the opportunity to receive this summary at an anonymous email address to preserve their anonymity.

Survey research is a means of gathering information about the characteristics, actions, or opinions of a large group of people (Pinsonneault & Kraemer, 1993). Survey research has three distinct characteristics: (a) it produces quantitative descriptions of

some aspects of the studied population, (b) it collects information by asking structured questions, (c) it collects information about a fraction of the study population, but this is collected in such a way as to permit generalizing the findings to the whole population (Pinsonneault & Kraemer).

The data collection method for this study will be a web survey. Web surveys, which are currently receiving a great deal of most attention from researchers, involve a computerized, self-administered questionnaire. The researcher announces the survey on a World Wide Web site where individuals can access and complete the questionnaire by using compatible web browsers (Simsek & Veiga, 2001). One difference from the web surveys described above is that in this study respondents were invited to respond by an email message containing a link to the survey. Several techniques can be used to increase response rate when using web surveys (Simsek & Veiga). The first is to notify sample members about the incoming questionnaire through prior email or postal notification. In the case of this study, direct telephone contact was made with potential respondents. Another technique to increase response rates in postal surveys is through follow-up mailings (Simsek & Veiga). This technique is also appropriate for web surveys and was used when necessary. The third technique to increase response rates is to solicit sponsorship. There were no attempts at sponsorship in this study. The fourth way to increase response rates is to employ incentives (Simsek & Veiga). An executive summary was offered to respondents upon completion of the study.

In developing the instrument for this survey, a careful balance was maintained between parsimony and sample size. Cronbach's alpha has a positive relationship with the number of measures on a scale (Hair, Anderson, Tatham & Black, 1998). However,

as the number of indicators increases, so does the required sample size. To balance this dilemma, previously validated instruments with between 3 and 5 indicators per construct were sought for use in this study. The common heuristic is that a sample size of 10 times the larger of the largest number of causal indicators for an item or the largest number of structural paths directed at a particular construct should be used (Chin et al., 2003). The most complex indicator has ten items.

Item Generation

Culture

The main aspects of culture that were thought by previous researchers to be pertinent to KM success are vision, expertise, and innovativeness. Higher scores in this measure indicate a more knowledge oriented culture that suggests higher levels of KM effectiveness. The specific items for vision and expertise were taken from Gold et al.'s (2001) study. Gold et al. started with 13 items that reduced to 11 items after the reliability and validity checks. However, many of these items were very similar to those used for climate, as discussed in the literature review, and were very similar to items used by Bock et al. (2005). When the duplicate questions were removed, five questions remained to measure vision and expertise. Gold et al. stated that all reliabilities were statistically different from zero and sufficiently high. Additionally, all of the composite reliabilities were above .80 (Gold et al.). Discriminant validity was adequate in that the correlation between all construct pairs was below .90 (Gold et al.). However, some literature reports suggest that innovativeness is more of a cultural issue than a climate issue, either directly or through the understanding of innovativeness as a longer term item (Davenport et al., 1998; Dennison, 1996). The people in an organization cannot be

told to be innovative with any realistic expectations that it will happen by executive decree alone. Bock et al. stated that the composite reliability of innovativeness was .87. The discriminant validity was tested by examining the square root of the average variance extracted as suggested by Fornell and Larker (1981). The average variance extracted of innovativeness was greater than the correlations between other constructs. Because these sub-constructs have been tested before, they are expected to meet the reliability limit of .70 for established measures (Hair et al., 1998).

Table 1. Cultural Construct Survey Items

Variable Name	Construct	Question
Cu1v	Vision	I understand the importance of knowledge to corporate success
Cu2v	Vision	I know my organization's vision
Cu3v	Vision	I know my organization's objectives
Cu4e	Expertise	My organization encourages on-the-job training
Cu5e	Expertise	My organization encourages learning
Cu6e	Expertise	I am valued for my individual expertise
Cu7i	Innovativeness	I am encouraged to take risks even if that turns out to be a failure
Cu8i	Innovativeness	I am encouraged to find new methods to perform a task
Cu9i	Innovativeness	I am encouraged to suggest ideas for new opportunities

Climate

The main aspects of climate are fairness, affiliation, and trust. Higher scores on these measures indicate a more knowledge oriented climate and therefore higher levels of KM effectiveness. The items of fairness and affiliation were taken from Bock et al. (2005), who stated that the composite reliability of fairness was .87 and affiliation was

.90. The discriminant validity was tested by examining the square root of the average variance extracted as suggested by Fornell and Larker (1981). The average variance extracted of fairness and affiliation was greater than the correlations between other constructs. The items for trust were originally used by Lee and Choi (2003). Trust showed a reliability (Cronbach's α) .89 and discriminant validity of .80. Lee and Choi measured the reliability against the score of .70 because their items were adopted from previous research. The discriminant validity was checked through factor analysis using varimax rotation and factors with loadings less than .5 were deleted. Lee and Choi did not report the original number of factors. Because these sub-constructs have been tested before, they are expected to meet the reliability limit of .70 for established measures (Hair et al., 1998).

Table 2. Climatic Construct Survey Items

Variable Name	Construct	Question
Cm1f	Fairness	The individual performance evaluation process is fair
Cm2f	Fairness	Objectives which are given to me are reasonable
Cm3f	Fairness	My organizations doesn't show favoritism towards specific employees
Cm4a	Affiliation	My coworkers keep close ties with each other
Cm5a	Affiliation	My coworkers consider other members' viewpoints
Cm6a	Affiliation	My coworkers have a strong feeling of "one team"
Cm7t	Trust	My coworkers are generally trustworthy
Cm8t	Trust	My coworkers believe in each others' intentions
Cm9t	Trust	My coworkers believe in each others' ability
Cm10t	Trust	My coworkers believe in other's intentions to work towards organizational goals
Cm11t	Trust	My coworkers have working relationships based on their belief in each other

Intrinsic Motivators

The items for intrinsic rewards were adapted from Ko et al. (2005), who reported the reliability as .97 and .90. Ko et al. used the same questions in two contexts (source and recipient) and therefore reported two scores. The discriminant validity was tested by examining the square root of the average variance extracted as suggested by Fornell and Larker (1981). The average variance extracted of intrinsic motivation (in both contexts) was greater than the correlations between other constructs. Because these sub-constructs have been tested before, they are expected to meet the reliability limit of .70 for established measures (Hair et al., 1998).

Table 3. Intrinsic Motivators

Variable Name	Question
IM1	I enjoy learning business knowledge
IM2	The more difficult it is to understand aspects of our business, the more I enjoy the challenge
IM3	I have to feel I'm personally benefiting from learning business knowledge before I will make the effort
IM4	I want to find out how good I really can be by learning business and technical knowledge
IM5	I'm more comfortable when I can set my own goals for learning business and technical knowledge

Structure

The main aspects of structure are flexible borders and a sharing enabled structure. Higher scores on these items would indicate a structure that is more conducive to effective KM. The items for flexible borders and collective behavior were adopted

from Gold et al (2001). They originally used all the items in one construct called Structural KM Infrastructure. They started with 12 items, going down to 7 in the final model after item reduction. As stated earlier, all items' composite reliabilities were above .80 (Gold et al.) and discriminant validity was adequate in that the correlation between all construct pairs was below .90 (Gold et al.). One possible reason for some of the item reduction is that the literature suggests further division of many of these items. In addition to the items adapted from Gold et al., one of the items they reduced from their original set of questions was also used here, as this item (St1f) appears to fit well with the sub-construct of flexible boarders. Because these sub-constructs have been tested before, they are expected to meet the reliability limit of .70 for established measures (Hair et al., 1998).

Table 4. Structure Survey Items

Variable Name	Question
St1	I feel my organization's structure encourages interaction
St2	I feel my organization's structure facilitates the transfer of new knowledge across structural boundaries
St3	My coworkers are readily accessible
St4	My organization has processes to facilitate coworkers' knowledge exchange across functional boundaries
St5	I am encouraged to share knowledge between project teams
St6	My organization's structure promotes collective rather than individualistic behavior
St7	My organization's structure encourages employees to go where they need for knowledge
St8	We improve our task efficiency by sharing our knowledge

Technological Capabilities

The items posed to measure structure were taken from Gold et al. (2001) and Lee and Choi (2003). Gold et al. proposed 12 indicators to measure technological KM infrastructure. Of those items, 10 met validity requirements and were used in their study. They stated that all reliabilities were statistically different from zero and sufficiently high. Additionally, all of the composite reliabilities were above .80 (Gold et al.). Lee and Choi used five questions under the construct of IT support. Four of these items were similar to questions Te2, Te3, Te7, and Te8 below and the other sought data about a subject outside the scope of this study. However, the overlapping coverage between these two studies adds somewhat to the construct validity through their consistency in technological items posited to affect an aspect of KM. Higher scores on these items would indicate technological capabilities that enable a more knowledge oriented structure and increased KM effectiveness. Because these sub-constructs have been tested before, they are expected to meet the reliability limit of .70 for established measures (Hair et al., 1998).

Table 5. Technological Capabilities Survey Items

Variable Name	Question
Te1	I have access to technology that allows me to locate specific knowledge that helps me in my job
Te2	I have access to technology that allows me to search for knowledge
Te3	I have access to technology that allows me to retrieve knowledge about my company's products and services
Te4	I have access to technology that allows me to use knowledge about my company's products and services
Te5	I have access to technology that allows me to access organizational knowledge
Te6	I have access to technology that allows me to systematically store knowledge
Te7	I have access to technology that allows me to collaborate with coworkers
Te8	I have access to technology that allows me to collaborate with people inside the organization
Te9	I have access to technology that allows me to collaborate with co-workers work regardless of location
Te10	I have access to technology that allows me to collaborate with people outside the organization

Effectiveness

Based on a qualitative study and previous research in KM, researchers developed 11 items to measure knowledge effectiveness at the individual level (Becerra-Fernandez & Sabherwal, 2001). Using factor analysis (principal components method with varimax rotation) the researchers found that the 11 questions loaded on a single factor. The items showed a reliability of .92 (Becerra-Fernandez & Sabherwal). Four of the items were very similar to other items, except they asked the question in a different context, i.e. one question at directorate level, and another at organization level. Given that this study will not differentiate between organizational levels within an organization, these duplicate

questions were dropped, leaving five questions to assess KM effectiveness at the individual level.

Table 6. Effectiveness Survey Items

Variable Name	Question
Eff1i	I am satisfied with the availability of knowledge for my tasks
Eff2i	The available knowledge in my organization improves my effectiveness in performing my tasks
Eff3i	I am satisfied with the management of knowledge I need to perform my job
Eff4i	I am satisfied with the knowledge sharing among individuals in my organization
Eff5i	I am satisfied with the management of knowledge in my organization

Table 7 outlines the sources of the item generation. As described above, many of the constructs and underlying items were taken verbatim from the original research. In other cases, items previously validated by other researchers were edited slightly to increase readability or precision in the question. This technique is common in many studies and was used in one of the key foundation articles for this research (Bock et al., 2005). In the earlier discussion, the challenges and confusion between climate and culture overlapping ideas were discussed. This lead to some sub-constructs being moved to constructs where the literature suggests they would be a better fit. Additionally, some of these articles were written at a time when the debate between culture and climate still raged. In some instances, this debate is still not settled and researchers use their items as supported by their literature review.

Table 7. Sources of Items

Construct	Subconstructs	Source
Culture	Vision	(Gold et al., 2001)
	Recognized Expertise	(Gold et al., 2001)
	Innovativeness	(Bock et al., 2005)
Climate	Fairness	(Bock et al., 2005)
	Affiliation	(Bock et al., 2005)
	Trust	(Lee & Choi, 2003)
Intrinsic Motivation	(single construct)	(Ko et al., 2005)
Structure	(single construct)	(Gold et al., 2001)
Technology	(single construct)	(Gold et al., 2001)
Effectiveness		(Becerra-Fernandez & Sabherwal, 2001)

The Model

The model shown in Figure 2 shows the constructs and indicators for this study. This figure shows the four main constructs of culture, climate, intrinsic motivation, structure, and technical capabilities in addition to the factors that reflect culture and climate. The construct of technological capabilities is posed to moderate structure. A moderating variable alters the direction or the strength of the relation between an independent and dependent variable (Frazier et al., 2004). KM effectiveness is the dependent variable. Each construct was a key factor in previous research in predicting some form of KM effectiveness. Additionally, many of the indicators' validity were examined previously. Recall from the literature review that there were issues separating culture from climate. In the Gold et al. study (2001), these two constructs were not separated. Questions used by Gold et al. that were similar in content to questions later

used by Bock et al. (2005) to measure climate were removed from the culture questions. This issue is explained in detail in the item generation section under each construct.

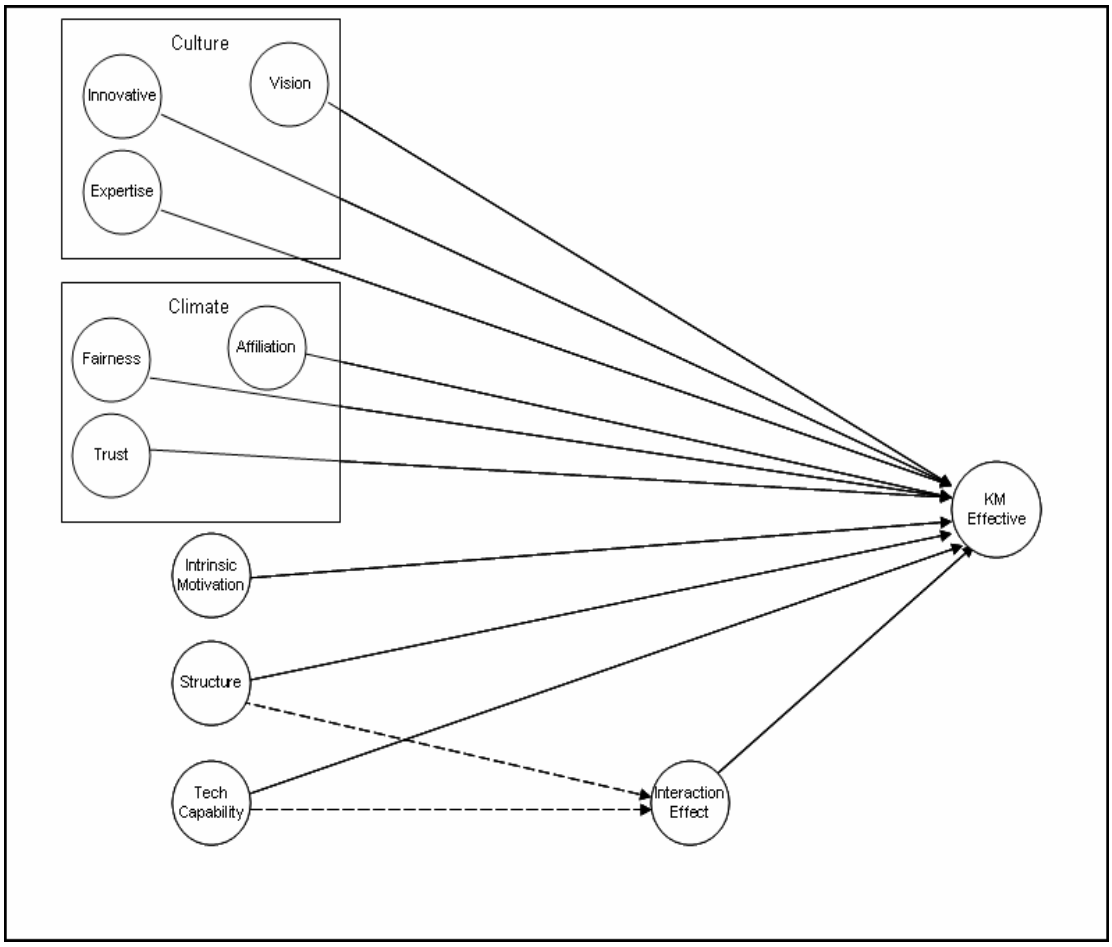

Figure 2. Detailed Model

Data Collection and Analysis

The data collection for this research project was conducted in two parallel phases. The first focused on the public sector, while the second focused on the private sector. The data was analyzed using Partial Least Squares Modeling using recently published techniques for assessing validity.

Phase I

Data collection in Phase I focused on public sector organizations. These organizations were identified by their participation in either of two conferences in KM primarily attended by federal government organizations. A total of 156 government organizations were contacted via email or telephone. Fifty-three had at least one KW responder for a response rate of 33%.

Phase II

Data collection in Phase II focused on private sector organizations. Requests for participation and surveys were sent to organizations chosen from the *Directory of Top Computer Executives - Eastern Edition*, published by Applied Computer Research, Inc. The organizations were selected based on the likelihood that they would have KMS in place based on factors provided in the directory such as the number of IS employees, the number of PCs in the company, and the organization's industry sector. The number of PCs in the organization suggests the depth of information technology in the operation of the business. In a study of 109 participants in an executive development program, more than half that were likely to engage in KM were from manufacturing, consulting, or financial services (Alavi & Leidner, 1999), so firms in those sectors were chosen as potential participants. Organizations from the manufacturing and service sector, which were not differentiated in the directory, with over 250 PCs were solicited for participation in this study. A total of 1,170 letters were sent to organizations in the southeastern United States. Twelve letters were returned as undeliverable, for a corrected total of 1,158. A total of 8 organizations responded, for a response rate of slightly less than 1%. A month after the surveys were sent, a random sample of

organizations were contacted to solicit their participation or to determine reasons for their non-response to the original letter. Fifty organizations were contacted via telephone. Of those fifty organizations, three agreed to participate. Three organizations responded that they did not participate in surveys and three organizations stated that they were too busy. In forty-one organizations, the researcher was unable to contact an individual by phone and left voice mails or messages with administrative assistants.

Statistical Power and Effect Size

Statistical power is the probability that a statistical test will correctly reject a null hypothesis (Baroudi & Orlikowski, 1989) or the probability that it will yield statistically significant results (Cohen, 1988). There are three factors that contribute to statistical power, namely significance criterion, precision of the sample estimates (reliability), and effect size (Baroudi & Orlikowski; Cohen; Mazen, Graf, Kellogg & Hemmasi, 1987). Of those three, the effect size is the most important factor in statistical power (Baroudi & Orlikowski). A common goal for statistical power is .80 (Baroudi & Orlikowski; Cohen). To determine the statistical power, an estimate of the effect size is needed.

Effect size can be the most difficult parameter to estimate (Baroudi & Orlikowski, 1989). A priori determination of effect size is preferred, but is only possible if there is extensive testing of the instrument or there has been extensive use of the instrument in previous research (Baroudi & Orlikowski). Given that the instrument used for this research was a composite of previously validated instruments, it was possible to develop an idea of the anticipated effect size from the previously published results. Without a specifically reported effect size, R^2 may be used as the proportion of variance explained as an estimate (Baroudi & Orlikowski). In the case of the instruments used to

develop the instrument for this study, the majority of the studies showed an R^2 in the range that suggests a medium effect or large effect by Cohen (1988). Specifically, two studies reported R^2 in the range of .402 to .879 (Lee & Choi, 2003) and .583 (Ko et al., 2005). The effect size in these studies is greater than the .5 suggested by Cohen and is therefore considered large. Two other studies reported R^2 in the range from .341 (Bock et al., 2005) to .432 (Becerra-Fernandez & Sabherwal, 2001). These are considered medium effects by Cohen.

Using a medium effect size is more restrictive and more appropriate because those effects must meet adequate power. Based on the tables in Cohen (1988), a sample of between 68 (for $p<.05$) and 108 ($p<.01$) is necessary.

Two other techniques that can increase power are increasing the homogeneity of the sample and increasing the reliability of the measures (Baroudi & Orlikowski, 1989). Increasing the homogeneity of the sample reduces the standard error, while increasing the reliability increases the power (Baroudi & Orlikowski). As will be discussed later, this sample shows a high degree of homogeneity. Additionally, by using previously validated measures, the reliability of all constructs is well above the suggested .7 (Hair et al., 1998).

Final Sample

This section summarizes the demographics of the organizations that participated in the survey. There were a total of 61 organizations that participated. Eight were from the private sector and fifty-one were from the public sector (government). The sample includes a total of 20 female and 97 male responders. Table 8 shows these results.

Table 8. Sector

Gender	Public	Private	Total
Female	18 (15%)	2 (2%)	20
Male	89 (76%)	8 (7%)	97
Total	*107*	*10*	*117*

The vast majority of respondents (108) had less than five years in their current position while nine respondents had more than three years. The range was from 0-20 years. Table 9 shows these results.

Table 9. Years in Present Position

Years	Total	Percentage
Less than 1	7	6%
1 to 2	74	63%
3 to 5	27	23%
6 to 10	7	6%
11 or more	2	2%
Total	*117*	*100%*

Fifty-one respondents had been with their organization for less than 2 years. Thirty-three respondents had between 3 and 10 years with their organization. Thirty-one respondents had between 11 and 28 years with their organization. Table 10 shows these results.

Table 10. Years With Organization

Years	Total	Percentage
Less than 1	1	1%
1 to 2	50	43%
3 to 5	18	15%
6 to 10	16	14%
11 to 15	12	10%
16 to 20	11	9%
20 or more	9	8%
Total	*117*	*100%*

This chapter described the methodology of this study. The items were developed based on prior research. Given that these instruments have been previously validated, the reliabilities and validities met the required standards. The data was collected through a survey of 117 knowledge workers. The survey was administered on-line. The vast majority of these people work in the public sector, i.e. for government agencies.

CHAPTER FOUR

RESULTS

Partial Least Squares (PLS) is gaining popularity among IS researchers because of its relaxed assumptions regarding normality and its ability to deal with small sample sizes in addition to being particularly useful for constructs with measurement error and covariance (Chin, Marcolin & Newstead, 2003; Gefen & Straub, 1997). The ability of PLS to handle a high degree of covariance is critical because of the homogeneity of this sample. PLS is widely used in information systems research and can be used to analyze structural models with multiple item constructs (Ahuja, Galletta & Carley, 2003; Chin & Todd, 1995; Sambamurthy & Chin, 1994). PLS simultaneously tests the validity and reliability of the data and estimates the differences between constructs (Chin & Newstead, 1999). PLS requires minimal sample sizes to validate a model compared with alternate structural equation modeling techniques (Bock et al., 2005) and requires a sample size of 10 times the number of predictors (Chin & Newstead). The number of predictors is the highest number of formative indicators on any one construct or the number of constructs affecting the dependent variable. This model required a sample of 90. PLS Graph Version 3 was used with a bootstrap resampling method (200 resamples).

Reliability

Reliability is essentially an evaluation of measurement accuracy, for example, the extent to which the respondent can answer the same or approximately the same questions the same way each time (Cronbach, 1951). High correlations between alternative measures or large Cronbach alphas are usually signs that the measure is reliable (Straub, 1989). A commonly used standard for reliability is .70 (Hair et al., 1998). The reliability of the measure also affects the required number of indicators per construct. With more reliable measures (loadings of .80 or higher), requirements for sample size and 6 to 8 indicators per construct may be relaxed (Chin et al., 2003). The instrument showed an overall reliability of .974. This number is in excess of what is required of a basic research tool (Streiner, 2003). However, this score is a measure of the scores and not the instrument itself (Streiner) and must be considered in that context. Composite reliability is the principal measure used in assessing the measurement model (Hair et al.). A commonly used threshold is .70 (Hair et al.) as with other reliability measures such as Cronbach's alpha. As shown in Table 11, all composite reliability scores are adequate and range from a low of .831 for fairness to a high of .969 for technological capabilities.

Validity

Content validity is the degree to which items in an instrument reflect the content universe to which the instrument will be generalized. This validity is generally established through literature reviews and expert judges or panels (Boudreau, Gefen & Straub, 2001; Hinkin, 1998; Straub, 1989). In this research, the constructs were chosen after an extensive literature review. Each of the constructs in this study was already

posed to affect some aspect of knowledge management. Other key literature in the field was then used to justify the case that these constructs were relevant to this study and to KM effectiveness.

Construct validity is the extent to which an operationalization measures the concepts that it purports to measure (Straub, 1989). The focus on construct validity is on whether the selected items move together in such a way that they can be considered as an intellectual whole (Boudreau et al., 2001).

Factorial validity will be assessed using the technique described by Gefen and Straub (2005) focusing on convergent and discriminant validity. Convergent validity is demonstrated when items thought to measure a construct show high correlations with each other, particularly when compared with items thought to measure other constructs (Straub, Boudreau & Gefen, 2004). Convergent validity is shown when each measurement item loads on its latent construct with a significant t-value (Gefen & Straub). The outer model loadings of this research model generated in PLS show a T-value greater than 1.96 to demonstrate convergent validity (Gefen & Straub). Appendix D shows the loadings and T-values.

Discriminant validity is demonstrated when the measurement items that comprise a construct differ from those that comprise other constructs (Straub et al., 2004). Discriminant validity is shown when the correlation of the latent variables show a pattern of loading highly on their assigned construct and lower on other constructs (Gefen & Straub, 2005). This test is to determine if the correlation of the measurement items is larger than the correlation with other constructs (Gefen & Straub). For average variance extracted (AVE), a score of .5 is acceptable and the square root of the AVE

should be greater than the levels of correlations involving the construct (Fornell & Larker, 1981). Fairness had the lowest AVE of .623. Table 11 outlines these results.

Table 11. Reliabilities and AVE

Construct	Composite Reliability	AVE
Effectiveness	.940	.760
Vision	.945	.852
Expertise	.920	.793
Innovativeness	.936	.830
Fairness	.831	.623
Affiliation	.925	.805
Trust	.958	.819
Intrinsic Motivation	.881	.652
Structure	.925	.628
Technical Capabilities	.969	.756

Examining the square root of AVE can be used to verify the discriminant validity of an instrument (Fornell & Larker, 1981). The second requirement to test discriminant validity is to compare the correlations between constructs with the square root of the AVE (Gefen & Straub, 2005). The square root of the AVE should be much higher than the correlation with any other construct (Gefen & Straub). However, there is no guidance on how much higher the square root of the AVE should be (Gefen & Straub). Table 12 shows these scores.

Table 12. Correlations

	Effectiveness	Vision	Expertise	Innovative	Fairness	Affiliation	Trust	Intrinsic Motivation	Structure	Sqrt AVE
Effectiveness	1									0.8718
Vision	0.617	1								0.9230
Expertise	0.611	0.752	1							0.8905
Innovation	0.581	0.546	0.763	1						0.9640
Fairness	0.694	0.634	0.667	0.716	1					0.7899
Affiliation	0.572	0.452	0.575	0.673	0.614	1				0.8972
Trust	0.512	0.626	0.629	0.609	0.675	0.783	1			0.9050
Intrinsic Motivation	0.5	0.578	0.498	0.373	0.416	0.313	0.44	1		0.8075
Structure	0.723	0.664	0.695	0.681	0.725	0.7	0.686	0.477	1	0.7800
Technological Capabilities	0.731	0.672	0.572	0.413	0.531	0.419	0.471	0.399	0.690	0.8695

After convergent and discriminant validity checks and item reduction, this model ended with between three and nine items per construct which is similar to or in excess of other studies published in IS journals that have used between two and five indicators per construct (Ko et al., 2005; Wixom & Watson, 2001).

Hypothesis 1, that culture is a significant predictor of KM effectiveness was not supported. None of the underlying constructs of vision, expertise, or innovativeness were significant predictors of KM effectiveness. Hypothesis 2, that climate is a significant predictor of KM effectiveness was partially supported. Two of the underlying constructs, fairness and affiliation, were significant predictors of KM effectiveness at $p<.01$. The third indicator, trust, was significant, but it showed a negative coefficient. Hypothesis 3, intrinsic motivation is a significant predictor of KM effectiveness, was supported at $p<.05$. Hypothesis 4, that structure is a significant predictor of KM effectiveness was not supported. Hypothesis 5, that technological capabilities are a significant predictor of KM effectiveness was supported at $p<.01$. Hypothesis 6, that technological capabilities moderate the relationship between structure and KM effectiveness was not supported. This hypothesis was measured using an F-statistic to measure the ΔR^2 for significance. Five of the twelve hypotheses were either supported or partially supported. Table 13 summarizes these results.

Table 13. Hypotheses and T-Statistics of Path Loadings

	Construct	Path Loadings	Effectiveness (T-statistic)	Result
H1	Culture			Not Supported
H1a	Vision	-0.0070	.0539	Not Supported
H1b	Expertise	-0.0170	.1283	Not Supported
H1c	Innovativeness	.0400	.3750	Not Supported
H2	Climate			Partially Supported
H2a	Fairness	.3350	3.5170**	Supported
H2b	Affiliation	.2750	2.6215**	Supported
H2c	Trust	-.2810	2.4829*	Significant
H3	Intrinsic Motivation	.1820	2.4144*	Supported
H4	Structure	.0770	.6335	Not Supported
H5	Technological Capabilities	.4420	5.0375**	Supported
H6	Moderation	.007 (ΔR^2)	.178 (F-statistic)	Not Supported

* Significant at $p<.05$, ** Significant at $p<.01$

Moderation

Analyzing an interaction effect like the moderation of structure by technological capabilities, as in this research, requires that the data be centered or standardized before entering the data into PLS (Chin et al., 2003). The data was standardized using SPSS Version 13. To determine if a moderator is significant, the difference in the R^2 between the model with the moderator and the model without the moderator must be examined (Carte & Russell, 2003). The R^2 of the model without the moderator was .725. The R^2 after the interaction effect was added increased to .732. The result was a net increase in

the R^2 of .007. Specifically, the moderation effect increased the variance explained by .7%.

$$F_{(df_{mult}-df_{add},N-dfmult-1)} = \frac{\Delta R^2/(df_{mult}-df_{add})}{(1-R^2_{mult})/(N-df_{mult}-1)} \quad \text{.....(Eq. 1)}$$

(Carte & Russell, 2003)

Calculated as:

$$F_{(df_{mult}-df_{add},N-dfmult-1)} = \frac{.007/(109-108)}{(1-.725)/(117-109-1)} = .178$$

A significant F value (.05) with 1 and 109 degrees of freedom equals 3.928. Because .178<3.928, Hypothesis 6 is rejected; there is no evidence of a moderation effect.

The following two equations are used to first estimate the expected interaction effect size (ΔR^2) without measurement error and then to estimate the expected ΔR^2 under actual research conditions (Carte & Russell, 2003).

$$\rho_{x*y} = \frac{(\rho_x * \rho_x) * \rho^2_{x*y}}{1+\rho^2_{x*z}} \quad \text{.....(Eq. 2)}$$

(Carte & Russell, 2003)

Calculated as:

$$\rho_{x*y} = \frac{(.969*.925)*.69}{1+.69} = .929$$

$$\Delta R^2 = \frac{\rho_{x*y}[b_3^2 * s^2_{xy}]}{s^2_y} \quad \text{.....(Eq. 3)}$$

(Carte & Russell, 2003)

Calculated as:

$$\Delta R^2 = \frac{.929[.69 * 169.80]}{2.4} = .002$$

Where (Carte & Russell, 2003):

ρ_{x*y} = reliability from the x*z product term

ρ_x = reliability of x

ρ_z = reliability of z

$\rho_{x,y}$ = simple correlation between x and z

b_3 – regression coefficient for the product term in equation 2

s^2_{xz} = variance of the x*z product term

s^2_y = variance of the y product term

After calculating the expected R^2, we can insert this value back into Equation 1 (Equation 3 in Carte & Russell, 2003) and solve for the required N to detect this effect.

$$3.928 = \frac{.007/(109-108)}{(1-.725)/(N-109-1)} = 650$$

The N in this study was less than the 650 required to detect the observed ΔR^2 however, the N in this study seems more adequate than suggested by the result above. The N in this study is adequate to detect a small effect size of .2. If .2 is inserted into the equation, holding all else constant, the F value is 5.09 which is greater than F statistic at $p<.05$ (1,109 d.f.) = 3.98.

$$5.09 = \frac{.2/(109-108)}{(1-.725)/(117-109-1)}$$

One study that examined similar phenomena in KM found medium interaction effects (Becerra-Fernandez & Sabherwal, 2001). In their study the interaction effects ranged from .335 to .425. This suggests that if there was an interaction effect between technological capabilities and structure, this sample would be adequate to detect it.

Table 12 shows the significance of the path loadings for the constructs. The weights, loadings, and T-statistics of each indicator are shown in Appendix D. The path loadings can be interpreted in part in a manner similar to the coefficients in multiple regression. However, in the case where an interval scale is used, interpretation of these loadings is not appropriate (Carte & Russell, 2003). Specifically, we cannot say that a unit change in any of the constructs will result in a unit change in KM effectiveness. What we can gain from this data is whether or not the relationships between the variables are significant, and if so, in what direction. One rule of thumb is that path loadings greater than .20 are usually significant (Chin & Newstead, 1999; Chwelos, Benbasat & Dexter, 2001). All significant path loadings met this rule of thumb with the exception of intrinsic motivation which has a path loading of .1820. However, this path still shows a significance at $p<.05$.

This chapter discussed the results of the PLS analysis of the data. The data met common reliability and validity standards of .70 and .5 (for AVE measuring discriminant validity) respectively. The correlations between the constructs were examined to ensure no constructs showed a higher correlation with another construct than the square root of the construct's AVE. Path loadings and T-statistics were examined. All paths that passed the rule of thumb of a loading of .20 showed a significance at $p<.01$ or $p<.05$. The moderating effect of technological capabilities and structure was examined using the

change in R^2 as recommended by Carte and Russell (2003). There is evidence to suggest that the constructs of fairness, affiliation, trust (although in a negative direction), intrinsic motivation, and technological capabilities were significant predictors of KM effectiveness. There is no evidence that structure has any influence on KM whether moderated by technological capabilities or not.

CHAPTER FIVE

DISCUSSION AND CONCLUSIONS

This research produced interesting results for both researchers and practitioners. By developing and measuring the constructs with the dependent variable KM effectiveness, this study differs from other research that focused on one area of KM such as knowledge transfer. It is known that a company's employees play a critical role when it comes to generating and applying knowledge in their organizations (Garud & Kumaraswamy, 2005). Employees are the starting block for effective KM. This research suggests areas that an organization can focus on to facilitate this process.

Primary Findings

Previous research has suggested that an organization's culture is important to effective KM. For example, innovativeness was found to be a significant predictor (at $p<.10$) of intent to share knowledge (Bock et al., 2005). Likewise, Gold et al. (2001) found that culture, when operationalized around themes such as vision, expertise, the importance of knowledge, and the benefits of knowledge sharing, was a significant factor in knowledge infrastructure capability, which in turn was a significant predictor of organizational effectiveness. The difference between these conclusions could be the level of the dependent variable. The Gold et al. study was focused on organizational level effectiveness, but the study reported here measured the dependent variable of KM

effectiveness at the individual level. The divergence between the significance of culture at the organizational level (Gold et al.) and this study suggests an interesting conclusion. For an individual to perceive his or her KM as effective and important to their work, organizational culture may not matter. An organization may have a culture that is not one that is generally perceived as having a positive impact on KM, yet still be effective at KM at the individual level. This still has immense benefits for the organization in that if individuals are more effective at KM, the organization can still benefit from their efforts based on the results of Gold et al.

The climatic factors of fairness, affiliation, and trust were all shown to be significant predictors of KM effectiveness. Given the failure of culture to affect this KM effectiveness at the individual level, it seems reasonable that short term factors are the critical. This research suggests that as individuals have a higher perception of fairness and affiliation, they are more likely to engage in activities that are favorable to KM effectiveness. Fairness which was focused on areas such as performance evaluation, fair objectives, and a lack of favoritism was significant as it was in a previous study where Bock et al. (2005) found it as a significant factor ($p<.01$) in organizational climate which in turn was a significant predictor of the intention to share knowledge. Affiliation, which was posed to measure people's ties with each other in the organization showed similar results at $p<.01$ (Bock et al.).

The results for trust were somewhat confounding. The results showed trust was a significant predictor but with a negative coefficient. Trust was shown to be a significant factor in culture in a previous study (Lee & Choi, 2003) at $p<.01$. However, trust as operationalized in their study, seems to be more of a climate related item. Another

possible explanation for this unexpected result is that in this sample, 69% (Table 9) of the respondents had been in their position for less than two years and 59% (Table 10) of the respondents had less than 5 years with the organization. Many authors suggest that culture is more of a long term phenomena, whereas climate is related to current conditions in the organization. It would seem that trust at the individual level as measured in this study would be quite flexible in the short term based on other people's actions. Trust is an interesting phenomenon in that it may take time to build, but can be destroyed in an instant.

Intrinsic motivation was found to be a significant factor in knowledge transfer (Ko et al, 2005) and economic self interest (Wasko & Faraj, 2000). Similarly, in this study, intrinsic motivators were found to be significant. It seems that if people are motivated by selfless reasons, the dependent variable is not relevant. Conversely, recall that in two previous studies (Ko et al., 2005; Wasko & Faraj, 2005) extrinsic motivators were not significant. The previous studies and this one seem to suggest a trend that materialistic rewards are less effective than a person's own internal motivation to act in a certain way deemed desirable by management.

A knowledge friendly structure was not found to be a significant predictor of KM effectiveness. This is interesting in that many organizations have made extensive efforts to align their structure for certain purposes or generally reduce the number of hierarchies (Sutton, 2001; Teece, 2000). One possible explanation is that people are willing to circumvent the organization's structure in order to do their job (Orlikowski, 2000). Given the increases in the technology available to most people today, the organization's borders may be less important in facilitating KM effectiveness than in the past. People

find it much easier to collaborate with someone in the organization and almost anyplace else easier than in the past.

Technological capabilities are a significant predictor of KM effectiveness. This is consistent with previous research (Gold et al., 2001) that found technology is a significant factor in knowledge infrastructure capability which in turn was a significant predictor of organizational effectiveness. Weber and Pliskin (1996) stated that evidence that information technology contributions to effectiveness were rare. The authors were talking about effectiveness at the organizational level so the results here are not in conflict with the prior study. While technology may not be specifically linked to organizational effectiveness, the results of this study suggest that technology does affect KM effectiveness. In another study (Lee & Choi, 2003), IT support was found to be a significant predictor of combination (defined as degree of acquisition and integration, synthesis and processing and dissemination). In their study, Lee and Choi operationalized IT support around the themes of collaboration, storage, and retrieval of information. This is very similar to the operationalization in this study and consistent with the results.

The moderated relationship between structure and technological capabilities may be explained by another fairly common phenomenon. Moderating relationships are those where the level of one variable increases with the level of another variable. However, there may be diminishing returns in increasing the level of technological capabilities. Could the lack of significance of the hypothesized relationship be due to that once a capability is in place such as the ability to collaborate or effectively store and retrieve data that the benefits start to show diminishing returns? The data suggests that

once a capability is in place, time and effort may be better spent trying to understand the effects of climatic factors on KM effectiveness.

Corollary Findings

This study also showed that cultural factors will factor separately from climatic factors. Some have suggested that culture and climate are actually different views of the same phenomena (Dennison, 1996). In this sample, the constructs factored separately. If one agrees with the literature that culture and climate are similar in context but different in their time frame then Dennison's (1996) conclusion that culture and climate address a common phenomenon is not supported by this research. This may prove useful to other researchers that want to examine these factors separately and share the belief that in general, culture is focused on long term traits of the organization while climate focuses on short term traits.

One possible reason for this is the debate on the difference between culture and climate and whether or not they can be measured separately or quantitatively (Dennison, 1996). An argument was presented that the difference between the two factors was the length of term and the degree of flexibility. Cultural factors are usually not flexible in the short run whereas climatic factors are flexible and adjustable by management. The factors also factored separately suggesting that it is possible to measure each quantitatively. Whereas none of the cultural factors were significant predictors of KM effectiveness, every climatic factor was significant.

Limitations

One limitation of this study is the lack of participation from the private sector. The results are biased toward public organizations such as government organizations that

have inherently less flexibility with their structure. In the last 20 years, government organizations have undergone a significant change by reducing layers of bureaucracy, yet they still lack the flexibility of private section organizations. This may partially explain the rejection of the hypothesis that structure affects KM Effectiveness.

Another limitation of this study is that the variables employed to measure the latent constructs are not all inclusive. That is, there are other factors that may affect these constructs. Specifically, culture has been operationalized in a variety of ways including collaboration, trust, and learning (Lee & Choi, 2003), and as expertise, interaction, vision, and objectives (Gold et al., 2001) among many others. However, based on the literature review the variables used in this study are indicative of the constructs if not universally complete.

The sample size may be another limiting factor in this study. While the sample size was certainly adequate to detect the main affects (Chin & Newstead, 1999), it may not have been adequate to detect the interaction between technological capabilities and structure. However, even if the interaction effect was small as defined by Cohen (1988) the sample is adequate to detect the hypothesized effect.

Conclusions

Theoretical Implications

Researchers in MIS have used the terms climate and culture interchangeably and with a high degree of overlap between the concepts. Given that culture and climate are posited to affect KM effectiveness, we as a community of researchers must be more precise in our use of these terms. The terms are often used interchangeably, with some

constructs used for both concepts. This has the potential to cause confusion for practitioners as they often have strong perceptions of what the constructs measure.

Practical Implications

This research showed no evidence that an appropriate knowledge sharing culture is required for effective KM. In this sample where government organizations were strongly represented, the findings on culture may be very different than if more private organizations had participated. Government organizations can take relief in the fact that this research suggests that they can be effective at KM regardless of their organizational culture.

Climatic factors, particularly those of fairness and affiliation, were significant predictors of KM effectiveness. Organizations can take this to mean that key factors in KM effectiveness are somewhat under their control. As this research measured climatic items by knowledge workers' perceptions of these phenomena, organizations using KM should focus on how to ensure knowledge workers perceive the climate as fair and work to establish strong affiliation between these workers. There are a variety of instruments posed to measure fairness and affiliation. Organizations must measure these constructs and take appropriate actions to ensure their employees' perceptions are positive, i.e. they believe the organization is fair to them and feel affiliation with their fellow employees. These actions should serve to increase KM effectiveness for individuals and in turn for the organization.

This study provided additional support for the idea that intrinsic motivators are important for effective KM. Knowledge workers, who are predominantly professionals, do not seem to be motivated by extrinsic rewards but instead gain more satisfaction from

intrinsic sources. Organizations that are heavily dependent on knowledge management must find a way to employ people who are self motivated and professional in the sense that they are dedicated to their work.

A flatter organizational structure was posited by other research (Gold et al., 2001; Miles at al., 1998) to facilitate KM effectiveness. However, this research did not find evidence that this type of structure was a significant predictor of KM effectiveness. It is quite possible that technological capabilities such as collaboration, mapping, and retrieval can overcome the barriers present heavily bureaucratic organizations.

Technological capabilities were significant predictors of KM effectiveness as found in other research (Gold et al., 2001). This research suggests, through the lack of a significant interaction effect between technological capabilities and organizational structure, that technological capabilities can overcome the barriers to effective KM present in heavily bureaucratic organizations. Even organizations with very hierarchical and bureaucratic structures can benefit from knowledge management by using technology to overcome any artificial or imposed structural barriers.

Research Implications

Future research should continue to examine the constructs of culture and climate and seek to ground this research in the management literature where the constructs were first examined in the organizational context. It is possible that culture would be a significant predictor of KM effectiveness in a sample based on private organizations. The range of organizational cultures seems much broader in private organizations in contrast to government organizations which are much more restricted. Certain organizations such as Apple seem to be at the forefront of innovation in their respective

industries. While some government organizations have a reputation for innovativeness, it seems less common than in the private sector. Government organizations are constrained by less flexible budgets, public law, and other factors that tend to increase bureaucracy.

This is the third research effort (Bock et al., 2005; Ko et al., 2005) since 2005 to support the idea that intrinsic motivators are important for KM effectiveness. Researchers should investigate this phenomenon by trying to identify more of the key factors of intrinsic motivation. Techniques to screen people that are driven by intrinsic motivation may prove beneficial to many organizations. If there were techniques to better identify these people, organizations that are heavily knowledge oriented may be able to make better decisions regarding their human resources.

Additional research into organizational structures should focus on the interaction with technology. Orlikowski (2000) offered an extensive foundation to study this phenomenon. Her theories on this interaction should be studied more extensively to try to better understand how people circumvent restrictive structures with technology. This is somewhat of a double-edged sword in that there are reasons for these structures in certain circumstances. For example, organizations may want to ensure their employees do not use technology to overcome the restrictive structure. In contrast, organizations that are required to have a more bureaucratic structure by law or other environmental factors can use technology to increase their effectiveness. Both of these phenomena require further investigation.

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APPENDIX A

REQUEST FOR PARTICIPATION

Auburn University is conducting a research project and your firm has been selected to participate. I want to better understand how technology affects knowledge in different types of organizations, primarily in the creation and transfer of knowledge between employees. Your participation, and that of a few others in your firm, will greatly increase our understanding of these phenomena.

Data will be collected by a survey instrument which takes very little time to complete. The responses are anonymous and require simple answers regarding your perception of areas important to knowledge management. The survey is based on a Likert scale of Strongly Disagree to Strongly Agree; no detailed answers are required and it should take no more than 15-20 minutes to complete.

We greatly appreciate your willingness to participate in this project. You can access the survey at http://business.auburn.edu/surveyBuilder/surveys/KnowledgeWorkers2.cfm.

I sincerely appreciate your participation in this project. We believe it will provide meaningful results for both practitioners and academics. If you have any questions, please contact me. Your participation, or lack thereof, will have no bearing on any current or future relationship with Auburn University.

Sincerely,

TODD A. PEACHEY
peachta@auburn.edu, 334-821-8443

APPENDIX B

INSTRUMENT

Your responses to the questionnaire will be anonymous. Complete instructions are on the site. The questionnaire contains 50 short questions and should take less than 20 minutes of your time.

If you would like an executive summary of the results, you may enter an email address at the end of the survey. This email address does not need to have any identifying information about you or your organization. You are welcome to use an anonymous email address from Yahoo, Hotmail, or another source. I will only release aggregated results of the study. No responses will be traceable to an individual or organization. I will forward the summary on completion of the research, which I estimate to be in August 2006.

I will not collect employee names, IP addresses, or any other data that would allow anyone to track a specific response to a participant in the survey which will be stored on a secure server. Additionally, you may forward the link to your home computer and take the survey from there. Your decision whether or not to participate will not effect your future relations with Auburn University. As stated above, I will not track responses to specific individuals or organizations. For more information regarding your rights as a research participant you may contact the Office of Human Subjects Research by phone or e-mail. The people to contact there are Executive Director E.N. "Chip" Burson (334) 844-5966 (bursoen@auburn.edu) or IRB Chair Dr. Peter Grandjean at (334) 844-1462 (grandpw@auburn.edu).

I'm looking forward to receiving your completed questionnaire by February 25, 2006 and sincerely appreciate your participation in this study.

You can access the questionnaire at:
http://business.auburn.edu/surveyBuilder/surveys/KnowledgeWorkers2.cfm

Your organization ID is:_____

	Question 7 Point Likert Scale – Strongly disagree (1) through strongly agree (7).	
Cu1v	I understand the importance of knowledge to corporate success	1 2 3 4 5 6 7
Cu2v	I know my organization's vision	1 2 3 4 5 6 7
Cu3v	I know my organization's objectives	1 2 3 4 5 6 7
Cu4e	My organization encourages on-the-job training	1 2 3 4 5 6 7
Cu5e	My organization encourages learning	1 2 3 4 5 6 7
Cu6e	I am valued for my individual expertise	1 2 3 4 5 6 7
Cu7i	I am encouraged to take risks even if that turns out to be a failure	1 2 3 4 5 6 7
Cu8i	I am encouraged to find new methods to perform a task	1 2 3 4 5 6 7
Cu9i	I am encouraged to suggest ideas for new opportunities	1 2 3 4 5 6 7
Cm1f	The individual performance evaluation process is fair	1 2 3 4 5 6 7
Cm2f	Objectives which are given to me are reasonable	1 2 3 4 5 6 7
Cm3f	My organizations doesn't show favoritism towards specific employees	1 2 3 4 5 6 7
Cm4a	My coworkers keep close ties with each other	1 2 3 4 5 6 7
Cm5a	My coworkers consider other members' viewpoints	1 2 3 4 5 6 7
Cm6a	My coworkers have a strong feeling of "one team"	1 2 3 4 5 6 7

Cm7t	My coworkers are generally trustworthy	1 2 3 4 5 6 7
Cm8t	My coworkers believe in each others' intentions	1 2 3 4 5 6 7
Cm9t	My coworkers believe in each others' ability	1 2 3 4 5 6 7
Cm10t	My coworkers belief in other's intentions to work towards organizational goals	1 2 3 4 5 6 7
Cm11t	My coworkers have working relationships based their belief in each other	1 2 3 4 5 6 7
IM1	I enjoy learning business knowledge	1 2 3 4 5 6 7
IM2	The more difficult it is to understand aspects of our business, the more I enjoy the challenge	1 2 3 4 5 6 7
IM3	I have to feel I'm personally benefiting from learning business knowledge before I will make the effort	1 2 3 4 5 6 7
IM4	I want to find out how good I really can be by learning business and technical knowledge	1 2 3 4 5 6 7
IM5	I'm more comfortable when I can set my own goals for learning business and technical knowledge	1 2 3 4 5 6 7
St1	I feel my organization's structure encourages interaction	1 2 3 4 5 6 7
St2	I feel my organization's structure facilitates the transfer of new knowledge across structural boundaries	1 2 3 4 5 6 7
St3	My coworkers are readily accessible	1 2 3 4 5 6 7
St4	My organization has processes to facilitate coworkers' knowledge exchange across functional boundaries	1 2 3 4 5 6 7
St5	I am encouraged to share knowledge between project teams	1 2 3 4 5 6 7
St6	My organization's structure promotes collective rather than individualistic behavior	1 2 3 4 5 6 7
St7	My organization's structure encourages employees to go where they need for knowledge	1 2 3 4 5 6 7
St8	We improved our task efficiency by sharing our knowledge	1 2 3 4 5 6 7

Te1	I have access to technology that allows me to locate specific knowledge that helps me in my job	1 2 3 4 5 6 7
Te2	I have access to technology that allows me to search for knowledge	1 2 3 4 5 6 7
Te3	I have access to technology that allows me to retrieve knowledge about my company's products and services	1 2 3 4 5 6 7
Te4	I have access to technology that allows me to use knowledge about my company's products and services	1 2 3 4 5 6 7
Te5	I have access to technology that allows me to access organizational knowledge	1 2 3 4 5 6 7
Te6	I have access to technology that allows me to systematically store knowledge	1 2 3 4 5 6 7
Te7	I have access to technology that allows me to collaborate with coworkers	1 2 3 4 5 6 7
Te8	I have access to technology that allows me to collaborate with people inside the organization	1 2 3 4 5 6 7
Te9	I have access to technology that allows me to collaborate with co-workers work regardless of location	1 2 3 4 5 6 7
Te10	I have access to technology that allows me to collaborate with people outside the organization	1 2 3 4 5 6 7
Eff1i	I am satisfied with the availability of knowledge for my tasks	1 2 3 4 5 6 7
Eff2i	The available knowledge in my organization improves my effectiveness in performing my tasks	1 2 3 4 5 6 7
Eff3i	I am satisfied with the management of knowledge I need to perform my job	1 2 3 4 5 6 7
Eff4i	I am satisfied with the knowledge sharing among individuals in my organization	1 2 3 4 5 6 7
Eff5i	I am satisfied with the management of knowledge in my organization	1 2 3 4 5 6 7

Demographic information.

My gender is (check one): Male_____ Female _____

My position within the organization is (check one):

Senior Management _____

Middle Management_____

Professional_____

Other_____

My email address is:_____

APPENDIX C

DISCRIMINANT VALIDITY

	effect	*vision*	*expert*	*innovat*	*fairness*	*affiliation*
u1v	0.451248	0.857309	0.607485	0.371984	0.465763	0.322181
u2v	0.614147	0.944623	0.70816	0.590593	0.640629	0.478127
u3v	0.618984	0.962127	0.752963	0.522524	0.628396	0.431173
u4e	0.554573	0.682753	0.904078	0.555757	0.565288	0.411852
u5e	0.545148	0.703658	0.93326	0.683087	0.587089	0.534975
u6e	0.53083	0.621245	0.831581	0.805198	0.629347	0.593028
u7i	0.464778	0.408123	0.627637	0.853298	0.611768	0.551946
u8i	0.533477	0.535273	0.713856	0.944937	0.694528	0.635118
u9i	0.579806	0.537189	0.736956	0.931669	0.650146	0.645493
m1f	0.451675	0.48113	0.523797	0.595876	0.794617	0.478503
m2f	0.698958	0.67802	0.635282	0.604782	0.866121	0.500387
m3f	0.432562	0.260086	0.378782	0.497738	0.699254	0.491088
m4a	0.446763	0.298335	0.403852	0.498531	0.452017	0.845305
m5a	0.575171	0.470014	0.59114	0.670685	0.599078	0.92528
m6a	0.505463	0.429514	0.534294	0.626159	0.589527	0.919494
m7t	0.428604	0.583912	0.532155	0.445961	0.573174	0.643959
m8t	0.461487	0.525423	0.468016	0.453445	0.624749	0.671118
m9t	0.465733	0.596863	0.577811	0.578672	0.591584	0.707596
m10t	0.490633	0.592562	0.672919	0.646362	0.633201	0.74932
im1	0.46484	0.535447	0.586965	0.617024	0.627727	0.765662

	effect	*vision*	*expert*	*innovat*	*fairness*	*affiliation*
im2	0.437547	0.583114	0.480079	0.354204	0.385059	0.304179
im3	0.434078	0.363759	0.299715	0.293688	0.33504	0.317226
im4	0.402486	0.468258	0.455603	0.331045	0.381853	0.220878
im5	0.322548	0.452857	0.374011	0.206197	0.220232	0.13826
t1f	0.581445	0.497078	0.529421	0.572108	0.646076	0.491491
t2f	0.642041	0.47449	0.547759	0.547486	0.598208	0.549985
t3f	0.55202	0.535635	0.552673	0.497412	0.552351	0.537668
t4f	0.569543	0.47933	0.500849	0.443639	0.536532	0.518392
t6s	0.58415	0.64176	0.638398	0.660155	0.605815	0.559983
t7s	0.509535	0.383321	0.544946	0.504183	0.471526	0.637574
t8s	0.522064	0.471522	0.538726	0.587088	0.617529	0.622829
t9s	0.537159	0.634897	0.482277	0.439089	0.49231	0.468266
e1m	0.596396	0.582362	0.479171	0.368706	0.485751	0.426804
e2m	0.636181	0.668651	0.508987	0.397439	0.501899	0.472004
e3m	0.602153	0.678934	0.509165	0.375223	0.513162	0.353398
e4m	0.591817	0.639247	0.511864	0.371415	0.488271	0.37621
e5m	0.650697	0.661957	0.531918	0.370892	0.526469	0.380795
e6m	0.57638	0.59865	0.469733	0.310266	0.425884	0.24599
e7c	0.65688	0.550751	0.517651	0.368231	0.43325	0.374653
e8c	0.667067	0.52661	0.513405	0.38058	0.428763	0.377097
e9c	0.68209	0.468268	0.471363	0.336581	0.409359	0.322204
e10c	0.693087	0.473802	0.466437	0.318768	0.404654	0.314668
f1i	0.846489	0.594235	0.566479	0.502339	0.573847	0.462767
f2i	0.84627	0.554806	0.50032	0.424147	0.564614	0.400037
f3i	0.9193	0.564157	0.571214	0.571439	0.677427	0.519366
f4i	0.854947	0.498967	0.53702	0.531806	0.575929	0.601619
f5i	0.888811	0.462619	0.485099	0.504844	0.630468	0.51739

	trust	*intrinmot*	*struct*	*techcap*
u1v	0.544936	0.585826	0.50678	0.606885
u2v	0.576836	0.512762	0.651203	0.602055
u3v	0.611713	0.526998	0.66	0.65651
u4e	0.495797	0.404479	0.608403	0.596893
u5e	0.607555	0.435553	0.675669	0.531686
u6e	0.579105	0.492186	0.570885	0.394833
u7i	0.466316	0.291634	0.513786	0.266344
u8i	0.605488	0.348227	0.64778	0.399924
u9i	0.582876	0.372381	0.685401	0.445777
m1f	0.529093	0.275167	0.48768	0.362498
m2f	0.593692	0.491479	0.698403	0.571386
m3f	0.465129	0.138108	0.484894	0.253977
m4a	0.56556	0.142528	0.546278	0.298998
m5a	0.763751	0.34607	0.692942	0.475256
m6a	0.761441	0.330382	0.631353	0.334791
m7t	0.89132	0.42059	0.543705	0.426317
m8t	0.901948	0.41409	0.583507	0.415784
m9t	0.904793	0.328712	0.617776	0.467719
m10t	0.895491	0.430479	0.699312	0.413173
m11t	0.931726	0.398834	0.647106	0.406905
im1	0.419098	0.894723	0.493657	0.411003
im2	0.371055	0.764322	0.329804	0.233249
im3	0.360071	0.850523	0.413158	0.342489
im4	0.248268	0.705814	0.281593	0.300556
t1f	0.499007	0.325168	0.759964	0.526398
t2f	0.453866	0.375845	0.842791	0.532609
t3f	0.655619	0.478053	0.71904	0.468449
t4f	0.452383	0.263199	0.793891	0.619877

	trust	*intrinmot*	*struct*	*techcap*
t6s	0.586644	0.455059	0.843013	0.618798
t7s	0.55703	0.287276	0.768953	0.486622
t8s	0.635353	0.399008	0.770808	0.446092
t9s	0.472747	0.396329	0.727203	0.577415
e1m	0.456856	0.288174	0.651693	0.788606
e2m	0.561979	0.4427	0.626253	0.859379
e3m	0.440997	0.384539	0.598072	0.886897
e4m	0.476454	0.426884	0.588776	0.858595
e5m	0.466421	0.391692	0.63724	0.885574
e6m	0.356751	0.392799	0.569024	0.862739
e7c	0.386551	0.298425	0.606394	0.916639
e8c	0.367784	0.284109	0.594604	0.910155
e9c	0.306082	0.278397	0.560808	0.853842
e10c	0.275603	0.296274	0.576197	0.872614
f1i	0.397168	0.428811	0.63631	0.750892
f2i	0.431669	0.528509	0.584698	0.641476
f3i	0.493256	0.525861	0.671402	0.626463
f4i	0.498756	0.332395	0.664771	0.59573
f5i	0.412513	0.357389	0.59654	0.560386

APPENDIX D

INDICATOR WEIGHTS, LOADINGS, AND T-STATISTICS

	Primary Model			*Interaction Model*		
	Weight	Loading	T-Statistic	Weight	Loading	T-Statistic
Effectiveness						
f1i	0.2448	0.8462	30.5918	0.2445	0.8465	29.5183
f2i	0.2212	0.8463	17.2335	0.2217	0.8458	17.5568
f3i	0.2421	0.9192	52.0933	0.2411	0.9192	44.9848
f4i	0.2191	0.8553	25.8845	0.2186	0.8552	25.5943
f5i	0.2201	0.8892	32.0125	0.2214	0.8891	30.9149
Vision						
u1v	0.2884	0.8584	13.1807	0.2574	0.7941	6.2957
u2v	0.393	0.9446	51.2903	0.4157	0.9462	51.3197
u3v	0.3961	0.9621	94.6403	0.4187	0.9608	92.9932
Expertise						
u4e	0.3821	0.9041	41.0215	0.3815	0.9039	39.2213
u5e	0.3755	0.9332	55.7296	0.3755	0.9332	54.9909
u6e	0.3657	0.8316	19.2057	0.3664	0.8318	19.8028
Innovativeness						
u7i	0.3226	0.8533	24.6086	0.3227	0.8536	28.6579
u8i	0.3702	0.9449	59.7909	0.3702	0.9448	60.3187
u9i	0.4024	0.9317	38.1317	0.4022	0.9317	45.0654

	Primary Model			*Interaction Model*		
	Weight	Loading	T-Statistic	Weight	Loading	T-Statistic
Fairness						
m1f	0.3566	0.7946	16.1335	0.3566	0.7949	13.203
m2f	0.5518	0.8661	44.7239	0.5511	0.8659	42.3761
m3f	0.3415	0.6992	10.187	0.342	0.6997	11.2429
Affiliation						
m4a	0.325	0.8453	26.0066	0.3243	0.8452	21.0409
m5a	0.4184	0.9253	74.9736	0.4186	0.9254	63.1236
m6a	0.3677	0.9195	41.8327	0.3682	0.9195	48.2316
Trust						
m7t	0.2048	0.8913	22.3276	0.2044	0.8912	21.6474
m8t	0.2205	0.9019	22.4002	0.2201	0.9019	21.0411
m9t	0.2226	0.9048	35.5672	0.2228	0.9049	34.0514
m10t	0.2348	0.8954	36.7121	0.2353	0.8958	31.003
m11t	0.2221	0.9319	62.2086	0.2221	0.9317	56.3424
Intrinsic Motivation						
im1	0.3383	0.8947	29.0247	0.3384	0.8948	29.838
im2	0.3357	0.7643	13.0801	0.3355	0.7642	14.451
im3	0.3112	0.8505	21.7696	0.311	0.8503	22.957
im4	0.2494	0.7058	7.9779	0.2497	0.7061	6.6613
Structure						
t1	0.1618	0.76	16.2377	0.1615	0.7598	13.6651
t2	0.1718	0.8428	29.206	0.1719	0.8429	30.0833
t4	0.1734	0.7939	21.6651	0.1735	0.7942	25.1205
t3	0.1492	0.719	9.0814	0.1494	0.7191	8.998
t6	0.1754	0.8446	24.9287	0.1752	0.843	26.323
t7	0.1454	0.769	16.3012	0.1457	0.7691	15.6292

	Primary Model			*Interaction Model*		
	Weight	Loading	T-Statistic	Weight	Loading	T-Statistic
t8	0.1415	0.7708	18.0165	0.1419	0.7715	19.514
t9	0.1625	0.7272	13.1555	0.1623	0.7268	11.7437
Technological Capabilities						
e1m	0.1152	0.7825	12.0656	0.1158	0.7883	13.0263
e2m	0.1177	0.8594	26.5474	0.1174	0.8599	28.3885
e3m	0.1119	0.8869	28.2248	0.1115	0.8869	31.0936
e4m	0.109	0.8553	20.4347	0.1098	0.8588	22.6438
e5m	0.1201	0.8855	26.2686	0.1197	0.8853	30.2387
e6m	0.1068	0.8627	20.1127	0.1064	0.8629	23.0032
e7c	0.1179	0.9167	45.8751	0.1176	0.9164	52.3079
e8c	0.1178	0.9102	40.7184	0.1175	0.9101	41.3768
e9c	0.1162	0.8539	23.5668	0.1158	0.8535	22.9727
e10c	0.1186	0.8726	27.0846	0.1183	0.8726	29.2753
Interaction Terms						
t1e1				0.0104	0.6762	4.005
t1e2				0.0142	0.8849	8.0177
t1e3				0.0158	0.8959	10.5285
t1e4				0.0147	0.8978	10.8126
t1e5				0.0133	0.8816	9.4331
t1e6				0.0113	0.7657	4.5646
t1e7				0.0145	0.8081	7.9981
t1e8				0.0144	0.803	7.8324
t1e9				0.014	0.7502	7.1073
t1e10				0.0141	0.7451	6.5756
t2e1				0.0115	0.8911	10.1731
t2e2				0.012	0.9124	13.7014

	Primary Model			*Interaction Model*		
	Weight	Loading	T-Statistic	Weight	Loading	T-Statistic
t2e3				0.0099	0.8869	9.9644
t2e4				0.0116	0.8719	12.511
t2e5				0.0101	0.731	5.6464
t2e6				0.0127	0.8152	10.7815
t2e7				0.0128	0.8061	9.9657
t2e8				0.0118	0.7551	9.0356
t2e9				0.0112	0.7576	8.8186
t2e10				0.0136	0.7775	9.7721
t3e1				0.0147	0.8188	4.9461
t3e2				0.0127	0.7813	4.0007
t3e3				0.0134	0.8107	4.9571
t3e4				0.0113	0.757	3.5064
t3e5				0.0133	0.8183	5.2577
t3e6				0.0108	0.7181	3.1927
t3e7				0.0113	0.7309	3.1344
t3e8				0.0081	0.7226	3.2222
t3e9				0.0076	0.7191	3.2412
t3e10				0.0097	0.7117	3.1682
t4e1				0.016	0.8996	10.6816
t4e2				0.0158	0.9101	12.8111
t4e3				0.0146	0.8761	10.0593
t4e4				0.0153	0.8718	13.4431
t4e5				0.0142	0.7647	6.2065
t4e6				0.0161	0.8219	11.1444
t4e7				0.016	0.8125	10.5623
t4e8				0.0122	0.7654	8.8608
t4e9				0.0125	0.7648	9.0041

	Primary Model			*Interaction Model*		
	Weight	Loading	T-Statistic	Weight	Loading	T-Statistic
t4e10				0.0142	0.8145	11.4362
t5e1				0.0158	0.8996	10.9688
t5e2				0.0163	0.9266	13.443
t5e3				0.0146	0.9021	10.9291
t5e4				0.0157	0.89	13.9727
t5e5				0.0145	0.7719	6.0384
t5e6				0.0154	0.8287	11.3834
t5e7				0.0155	0.8185	10.531
t5e8				0.0117	0.7684	8.421
t5e9				0.0119	0.7674	8.526
t5e10				0.0129	0.8313	11.9341
t6e1				0.0168	0.9044	8.7016
t6e2				0.0175	0.9267	11.0133
t6e3				0.0167	0.9129	10.6132
t6e4				0.0165	0.9108	11.3384
t6e5				0.0151	0.8404	5.3483
t6e6				0.0151	0.8828	10.967
t6e7				0.0149	0.8849	10.4802
t6e8				0.0124	0.8693	10.3052
t6e9				0.0122	0.8768	10.1605
t6e10				0.0144	0.8733	12.4423
t7e1				0.017	0.8694	8.1672
t7e2				0.0162	0.8756	9.9624
t7e3				0.0156	0.8523	8.4268
t7e4				0.0153	0.8721	11.3384
t7e5				0.0137	0.754	5.5639
t7e6				0.0146	0.8169	9.7743

	Primary Model			*Interaction Model*		
	Weight	Loading	T-Statistic	Weight	Loading	T-Statistic
t7e7				0.015	0.829	9.9417
t7e8				0.01	0.7873	8.7483
t7e9				0.0102	0.7721	8.3234
t7e10				0.0104	0.787	8.8437
t8e1				0.0158	0.859	6.8613
t8e2				0.0143	0.8749	9.3605
t8e3				0.0146	0.847	8.4781
t8e4				0.0139	0.8477	8.1887
t8e5				0.0126	0.7673	5.0732
t8e6				0.0133	0.8152	7.7883
t8e7				0.0136	0.8336	7.6041
t8e8				0.0092	0.7876	7.1365
t8e9				0.0085	0.7908	7.3007
t8e10				0.0121	0.7802	8.6852
t9e1				0.0138	0.6905	3.8629
t9e2				0.0153	0.8268	6.681
t9e3				0.0146	0.8126	7.0589
t9e4				0.0139	0.7969	6.4291
t9e5				0.0155	0.8584	10.2194
t9e6				0.0132	0.7137	4.262
t9e7				0.0135	0.7768	7.0899
t9e8				0.0138	0.8244	8.8525
t9e9				0.0115	0.8235	8.5344
t9e10				0.0099	0.7585	5.9876