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Organizational Characteristics, Knowledge Management Strategy, Enablers and Process Capability: Knowledge Management Performance in U.S. Software Companies

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ORGANIZATIONAL CHARACTERISTICS, KNOWLEDGE MANAGEMENT STRATEGY, ENABLERS, AND PROCESS CAPABILITY: KNOWLEDGE MANAGEMENT PERFORMANCE IN U.S. SOFTWARE COMPANIES

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ABSTRACT

Currently, the effect of knowledge management has not been clearly defined or understood and a proper framework for assessing the status of knowledge management is lacking. Most studies examined the relationships among critical factors of knowledge management separately and the empirical research is based on only a few cases or small samples where generalizing the results is significantly reduced. The development of a universal model is necessary as a means to measure relevant constructs.

This correlational (explanatory) online survey research is the first to explore the relationships among organizational characteristics, knowledge management strategy, knowledge management enablers, knowledge management process capabilities, and knowledge management performance. Two research questions and 14 hypotheses and related sub-hypotheses were examined. The survey consisted of an 8-item *Knowledge Management Strategy Scale*, a 26-item modified *Knowledge Management Enablers Scale*, a 27-item *Knowledge Management Process Capability Scale*, and a 5-item *Knowledge Management Scale*. Using a simple random sampling plan, 212 participants from U.S software companies completed an online survey. Multiple regression, moderated multiple regression, and two way ANOVA were used to analyze the data. Of the 14 hypotheses and sub-hypotheses, ten were supported, one was partially supported, and three were not supported.

Findings indicated that (a) system orientation and human orientation strategies are significant positive explanatory variables of knowledge management process capability, knowledge management enablers, and knowledge management performance; (b) technology and organizational culture of knowledge management enablers are significant

positive explanatory variables of knowledge management process capability and knowledge management performance; (c) the decentralization dimension may inversely affect knowledge management process capability and knowledge management performance; (d) annual sales in dollars was a significant positive explanatory variable of knowledge management strategy and knowledge management process capability; (e) knowledge management process capability is a mediator between knowledge management strategy and organizational characteristics, and knowledge management performance; and (f) companies with a balance of a high degree of human orientation and system orientation strategies have a positive significant relationship with knowledge management performance. The limitations of the study regarding generalization, and recommendations for future research to replicate the study in other countries, are also included.

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CHAPTER I

INTRODUCTION TO THE STUDY

Introduction and Background to the Problem

In the current climate of increasing global competition, there is no doubt about the value of knowledge and learning in improving organizational competence (Prieto & Revilla, 2004). Managers need to consider how knowledge can affect their company's competitive position. Managers are attempting to use knowledge to sustain organizational performance and to gain market share. Effective knowledge management is indeed critical, as organizations strive to enhance their competency and to gain an economic edge. Knowledge management can be used to create business value, generate competitive advantage, achieve business goals, and develop greater value from the core competencies of the business (Tiwana, 2001). An increasing number of firms realize that knowledge management is a key resource for competitiveness, and a resource they can create and use to achieve greater value from core competencies. In this sense, firms have become much more interested in stimulating knowledge, which is considered as the greatest asset for their decision making and strategy formulation (Keskin, 2005). In the 21st century, those who master knowledge will control their competitive future. However, failed programs far outnumber successful ones because most companies experience unexpected challenges in developing knowledge management strategies and processes. These challenges include measuring knowledge management and identifying its effect on organizational performance (Darroch & McNaughton, 2002).

It is necessary to manage knowledge effectively in the new economy, because a sustained competitive advantage depends on a firm's capacity to develop and to deploy

its knowledge-based resources effectively (Perez & Pablos, 2003). Knowledge management research is fragmented across a variety of disciplines. It is also fragmented conceptually, particularly with respect to knowledge concepts that organizations identified as significant. Examples are knowledge management strategy, knowledge management enablers, and knowledge management process capability, and their relationship to knowledge management performance. However, most empirical research only examined the relationships among knowledge management strategy, knowledge management enablers, knowledge management process capability and knowledge management performance separately. For example, some research focused on the relationship between knowledge management strategy and performance (Keskin, 2005; Singh & Zollo, 1998) and some focused on the relationship among knowledge management enablers, knowledge management process capability, and knowledge management performance (Malhotra, & Segars, 2001; Park, 2006). No studies were found that investigated the relationship among organizational characteristics, knowledge management enablers, knowledge management process capability, and knowledge management performance. There is a need to develop theoretical formulations of the knowledge management model to further understand the relationship among knowledge management strategy, knowledge management enablers, process capability, and performance. Moreover, most of the studies reported in the literature come from a few cases or small samples where the possibility of generalizing results is significantly reduced. The researchers only used simple regression analysis to show the influence of one variable on another. The development of a universal model is necessary, especially if it leads to a means to measure relevant constructs.

Purpose of Study

While this study's focus on software companies is limited to a single industry, examining knowledge management in software companies should also yield insights for firms that are in other industries (Teubner & Nietsch, 2000). The general purpose of this research is to develop an integrated framework that can explain and guide successful knowledge management. Such a framework may benefit research in knowledge management, and also solve the dilemma of where an organization should direct its knowledge management efforts. Specific purposes of this non-experimental, quantitative and correlational (explanatory) research are to:

1. Describe U.S software companies in terms of organizational characteristics, knowledge management strategies, knowledge management enablers, knowledge management process capabilities, and knowledge management performance.
2. Explore the relationships among knowledge management strategy, knowledge management enablers, knowledge management process capability, organizational characteristics, and knowledge management performance in U.S. software companies.
3. Examine the effects of the degree of balance between human and system orientation strategies on knowledge management performance in U.S. software companies.
4. Examine the mediating impact of knowledge management process capability on the relationships among knowledge management strategy, knowledge

management enablers and organizational characteristics and knowledge management performance.

Definitions of Terms

Knowledge Management Strategy

Theoretical Definition

Knowledge management strategy is defined as a high-level plan that describes and outlines the processes, tools, and infrastructure (organizational and technological) required to manage knowledge gaps or excesses, and to permit knowledge to flow effectively in corporations (Zack, 2002).

Operational Definition

There are two dimensions of knowledge management strategy focus: system orientation and human orientation (Choi and Lee, 2002). In this study, knowledge management strategy is measured by Choi's (2002) 8-item *Knowledge Management Strategy Scale* (Appendix C).

Knowledge Management Enablers

Theoretical Definition

Knowledge management enablers refer to organizational infrastructure to enhance efficiencies of knowledge management activities, such as codifying and sharing knowledge assets among individuals (Chan & Chau, 2005; Sarvary, 1999).

Operational Definition

Existing studies agree that technology, structure, and culture are three of the most powerful enabling factors (Gold, Malhotra, & Segars, 2001). In general, technology focuses on information technology support within an organization (Choi, 2002). Two

critical dimensions determine structure, centralization and formalization (Tata & Prasad, 2004). Organizational culture is composed of collaboration, trust, and incentives that achieve knowledge sharing and transfer (DeTienne, Dyer, Hoopes, & Harris, 2004). In this study, the *Knowledge Management Enablers Scale* developed by Lee and Choi (2003) is used to measure knowledge management enablers. The *Knowledge Management Enablers Scale* consists of 27 items and is shown in Appendix C.

Knowledge Management Process Capability

Theoretical Definition

Knowledge management process is an ongoing, persistent, purposeful network of interactions among people aimed at managing other people, components, and activities participating in the basic knowledge processes (Firestone, 2001). Knowledge management process creates a planned, directed, and unified whole that produces, maintains, enhances, acquires, and transmits the enterprise's knowledge base (Firestone, 2001).

Operational Definition

Park (2006) described four dimensions of the knowledge management process: knowledge acquisition, knowledge protection, knowledge conversion, and knowledge application. In this study, knowledge management process capability is measured by 26 items of the *Knowledge Management Process Capability Scale* (Appendix C) developed by Park (2006).

Knowledge Management Performance

Theoretical Definition

Knowledge management performance consists of the benefits that can be reaped by appropriate knowledge management outcomes, such as productivity and profitability (Argot et al., 2000).

Operational Definition

Based on a review of management literature, indicators for measurement of performance can be categorized into financial and non-financial indicators (Allen & Helms, 2002; Van Buren, 1999). In this study, knowledge management performance is measured by a benchmarking approach with five items from a scale developed by Choi (2002).

Organizational Characteristics

Theoretical Definition

Organizational characteristics identify, distinguish, or describe an organization (Park, 2006).

Operational Definition

In this study, organizational characteristics are measured by four items of the *Organizational Characteristics Profile* (Appendix C) developed by Park (2006).

Software Companies

Theoretical Definition

A software company can be defined as an enterprise with more than 50% of its revenues in software and software services (Tebner & Nietsch, 2000).

Operational Definition

The American Electronics Association (AEA) uses 8 North American Industrial Classification System (NAICS) codes to classify the software companies into three broad categories: (a) software publishers, (b) computer systems design and related services, and (c) internet services.

Assumptions

This study is conducted based on the following assumptions that cannot be verified:

1. The quality of internet service providers and respondents' computers does not influence the respondent's willingness to complete the online survey.

2. Respondents are assumed to be truthful, knowledgeable, and willing to participate in the online survey.

3. The list of respondents on the Lead411 web site is assumed to be accurate and recently updated.

Justification

This study is justified on the basis of its significance, the fact that this is a researchable topic, and the feasibility of conducting the research. Today, the success of an organization depends more on its intellectual assets rather than its physical assets. Furthermore, knowledge is not only the most important resource that firm possesses but also a principle source of their value creation (Ngoc, 2005). Meso, Troutt, and Rudnicka (2002) indicated that knowledge management has a strategic significance for the sustainable competitive position of a firm. Effective knowledge management is considered key to the success of contemporary organizations because it can create and

achieve greater value from core competencies (Tiwana, 2001). Although much has been written, and many theories have been offered regarding knowledge management and its implementation, little empirical research has been conducted to support these theories. This study integrated several constructs into a single conceptual model and examined various conflicts between existing theories and the results of earlier studies. In addition to the value of theory development for future scholarly inquiry, the results of the study should contribute to organizational practice. Managers might use the research instruments to find gaps in the application of organizational knowledge.

The topic is researchable because the study asks scientific questions and all of the variables can be measured. Moreover, theoretical frameworks, research questions, and hypotheses can all be defined and tested. The research is feasible because the participants and subjects are available, and the survey can be conducted over the internet using e-mail. The study also establishes a reasonable deadline and budget. Finally, the research has the approval of the Lynn University Institutional Review Board (IRB) to protect the rights of human subjects.

Delimitations and Scope

This study was based on the following delimitations which served as its boundaries:

1. The geographic area is limited to the continental United States to promote a more homogeneous sample, and to limit the influence of other extraneous variables such as culture that may impact the knowledge management process.

2. The participants' companies were limited to the three major categories defined by the American Electronic Association (AEA): software publishers, computer systems design and related services, and internet services.
3. As knowledge management is important for software companies and their executives play key roles, the participants must be an executive that is a chief executive officer, chief operating officer, chief financial officer, president, or someone in charge of a principal business unit or function.
4. Respondents are listed in the web site of Lead411 (http://www.lead411.com/), and must have at least one e-mail account.
5. The participants are able to read, write, and speak English, and they are at least 18 years of age.
6. The participants have been employed at their companies for at least the past six months.

Chapter I provided an overview to the study. The introduction discusses current problems in, and the importance of knowledge management. In the second section, the purpose of the study is described. Terms for this study are theoretically and operationally defined, and delimitations of the study are identified in the third section. The fourth section explains that the study is justified because it is significant, researchable, and feasible. Finally, the delimitations and scope of this study are defined. Chapter II presents the literature review, theoretical framework, research questions and hypotheses identified for this study about the relationships among organizational characteristics, knowledge management strategy, enablers, process capability, and performance. Chapter III presents the methodology for testing the proposed model. It includes the research design,

population and sampling plan, the instruments, procedures and ethical aspects, methods of data analysis, and evaluation of the research methodology. Chapter IV reports descriptive characteristics of the final data-producing sample and the results of hypothesis testing. Chapter V provides a discussion of the findings and interpretations In addition, implications for theory and practice are discussed. The limitations and recommendations for future research are also included.

CHAPTER II

LITERATURE REVIEW, THEORETICAL FRAMEWORK, RESEARCH QUESTIONS, AND RESEARCH HYPOTHESES

Over the past ten years, knowledge management has progressed from a prominent topic to an increasingly common function within organizations. To improve organizational performance and to compete successfully in global markets, organizations need to have effective knowledge management. Knowledge management strategy, knowledge management enablers, knowledge management process capability, and knowledge management performance have been identified because of practical problems that have already occurred, or are currently occurring in many organizations. Although the need to manage knowledge efficiently is generally accepted, knowledge management is still an intangible concept, and much of the literature continues to explore these intangible issues (Darroch & McNaughton, 2002). Up to now, the effect of knowledge management has not been clearly defined or understood. Moreover, the relationship among knowledge management strategy, knowledge management enablers, knowledge management process capability and knowledge management performance is complex, dynamic, and multilevel. A lack of a proper framework for assessing the current status of knowledge management has cast doubt over the basic concept itself. Examining the emerging theories, models and frameworks for knowledge management is a primary reason for selecting this topic area and offering a critical analysis of the literature. It follows that it is significant to understand critical success factors and the contexts in which they have been presented to date. Therefore, there is a strong rationale for the presentation of the review of the literature that follows. This literature review provides an

overview and a critical analysis of related theoretical and empirical literature about the relationship among knowledge management strategy, knowledge management enablers, knowledge management process capability and knowledge management performance. Also, this literature review serves to establish a theoretical framework for this study and the research questions to be answered and the research hypotheses to be tested.

Literature Review

Knowledge and Knowledge Management

Definition of Knowledge

Although many of us have an intuitive feel for what the term knowledge means, knowledge is a difficult concept to define. Organizational scholars still argue that knowledge is a multifaceted concept with multi-layered meanings for different circumstances and for different people. In the knowledge management literature, a formal definition of knowledge is lacking (Hlupic, Pouloudi, & Rzevski, 2002). However, attempts have been made to refer to knowledge as the set of justified beliefs that enhance an entity's capability to take effective action (Alavi & Leidner, 2001; Nonaka, 1994). Drucker (1993) defined knowledge as the only meaningful resource in a knowledge-based society, emphasizing that:

> Knowledge is not impersonal, like money. Knowledge does not reside in a book, a databank, a software program; they contain only information. Knowledge is always embodied in a person; carried by a person; created, augmented, or improved by a person; applied by a person; taught by a person, and passed on by a person. (p. 210)

Davenport and Prusak (1998) provided the following detailed definition of knowledge:

> Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms. (p. 21)

Al-hawari (2004) conducted an empirical study examining the link between knowledge management styles and performance and provided the following description:

> Organizational knowledge, as an object, should be codified, distributed, understood and applied to achieve a set of goals, such as decision-making, problem-solving, and performance. Further, knowledge can be acquired from different resources, such as human and organization systems. (p. 22)

Table 2-1 presents a summary of the different definitions of knowledge that were drawn from the literature.

Table 2-1

Definitions of Knowledge

Authors	Knowledge Definitions
Nonaka and Takeuchi (1994)	Justified true belief
Wiig (1994)	Truths and beliefs, perspectives and concepts, judgments and expectations, methodologies, and know-how
Liebeskind (1996)	Information of which validity has been established through tests of proof
Ruggle (1996)	A fluid mix of framed experience, value, contextual information, and expert insight
Allee (1997)	Experience or information that can be communicated or shared
Sveiby (1997)	The capacity for effective action
Davenport and Prusak (1998)	Framed experiences, values, expert insights, and contextual information
Fahey and Prusak (1998)	Imbuing data and information with decision- and action-relevant meaning
Leonardo and Sensiper (1998)	Relevant, actionable information based at least partially on experience
Wijnhoven (1998)	Collection of concrete experiences or a set of abstract conceptualizations
Den and Huizenga (2000)	A collection of rules and information to fulfill a specific function
Raisinghani (2000)	Formatted information
Al-hawari (2004)	An object that can be codified, distributed, understood, and applied in order to achieve a set of goals

To address the question of how to define knowledge, a researcher must distinguish among knowledge, information, and data. If knowledge is not something that is different from either data or information, then there is nothing new or interesting about knowledge management (Fahey & Prusak, 1998). It is obvious that numerous authors are becoming more sensitive to the distinctions among data, information, and knowledge. A commonly held view is that data represent raw facts, information is organized data, and

knowledge is formatted information (Raisinghani, 2000). Data are simple observations of states of the world; information is data endowed with relevance and purpose; and knowledge is valuable information (Davenport, 1997). The most common representation of knowledge is placed atop a conceptual pyramid, the foundation of which is data (Davenport & Prusak, 1998). The knowledge pyramid represents the usual concept of knowledge transformations, where data is transformed into information, and information is transformed into knowledge.

This explanation is not to say that the relationship among knowledge, data, and information has been resolved. Tuomi (1999) argued that knowledge must exist before information can be formulated and before data can be measured to form information later. Tuomi (1999) used the development of computer systems as an example and argues that data emerges as a result of adding value to information. Information in turn is knowledge that has been structured, articulated, and verbalized. When articulated, verbalized, and structured, knowledge is stored in computer memory for automatic manipulation. The meaning of information within the knowledge must be represented. Information is then split into atoms that have no meaning to allow automatic processing. Finally, when information is assigned a fixed representation and standard interpretation, data is created. Critical to this argument is the concept that knowledge does not exist outside of an agent or knower, and is indelibly shaped by one's needs as well as one's initial stock of knowledge (Alavi & Leidner, 2001).

Wiig, de Hodg, and van der Spek (1997) listed some of the most important characteristics that set knowledge apart from other resources: (a) knowledge is intangible and difficult to measure; (b) knowledge is volatile and can disappear overnight; (c)

knowledge is most of the time embodied in agents with will; (d) knowledge is not consumed in a process and sometimes increases through use; (e) knowledge has wide-ranging impacts in organizations (e.g. knowledge is power); (f) knowledge cannot be bought in the market place at any time, it often has long lead times; and (g) knowledge is an element, that is not subject to rivalry, and can be used by different processes at the same time for different intents.

Taxonomies of Knowledge

The concept of knowledge and knowledge taxonomies is important because theoretical developments in the knowledge management area are influenced by the distinction among the different types of knowledge (Alavi & Leidner, 2001). There are many different opinions on the taxonomies of knowledge. However, it is commonly agreed that knowledge can be split into two types: explicit and tacit (Hubert, 1996; Nonaka & Takeuchi, 1995; Tiwana, 2002). Explicit knowledge is a component of knowledge that can be codified and transmitted through systematic and formal language (Nonaka & Takeuchi, 1995). Tacit knowledge is personal, context-specific knowledge that is difficult to formalize, record, or articulate, and is stored in the heads of people (Tiwana, 2002). Hubert (1996) defined explicit knowledge as articulated knowledge - the words spoken, the books read, the reports written, the data compiled and tacit knowledge as unarticulated knowledge - intuition, perspectives, beliefs, and values that people form as a result of personal experiences. Nonaka and Takeuchi (1995) provided characteristics of explicit and tacit knowledge. Examples of explicit knowledge are (a) formal and systematic, (b) knowledge of rationality (mind), (c) expressed in words and numbers, (d) easily communicated and shared in the form of hard data, formula, codified procedures,

or universal principles, and (e) expressed in computer code, chemical formula, sets of general principles. Tacit knowledge is described as (a) insights, intuitions, and hunches, (b) knowledge of experience (body), (c) not easily visible and expressible, (d) highly personal, hard to formalize, difficult to communicate or share with others, and (e) rooted in individual actions and experiences, including ideals, values, or emotions.

Hasan and Al-hawari (2003) developed a broader concept of knowledge based on Nonaka's (1995) original work in which the authors added semi-explicit and semi-tacit to the knowledge categories Nonaka created. This change added four knowledge processes to be discerned and developed through knowledge management using the model. Semi-tacit has the highest rating on the scale of diffusion and the lowest rating on the scale of codification (Hasan & Al-hawari, 2003). On the contrary, semi-explicit has the lowest rating on the scale of diffusion and the highest rating on the scale of codification (Hasan & Al-hawari, 2003). To Nonaka and Takeuchi's (1995) originally proposed four processes (socialization, externalization, combination, and internalization), Hasan and Al-hawari added articulation to convert knowledge from explicit to semi-tacit forms; adoption to convert knowledge from semi-tacit to tacit forms; standardization to convert knowledge from tacit to semi-explicit forms; and systemization to convert knowledge from semi-explicit to explicit forms.

In addition to explicit and tacit knowledge, various other types of knowledge exist within an organization. Other models include Boisot's (1987) knowledge model, which considers knowledge to be either codified (knowledge that can be readily prepared for transmission purposes) or uncodified (knowledge that cannot be readily prepared for

transmission purposes), or diffused (knowledge that is readily shared) or undiffused (knowledge that is not readily shared), within an organization.

De Long and Fahey (2000) argued that a major source of confusion in discussions about knowledge and knowledge management in organizations is the failure to recognize that there are at least three distinct types of knowledge; human knowledge, social knowledge, and structured knowledge. Human knowledge constitutes what individuals know or know how to do and it is manifested in skill or expertise, and combines both explicit and tacit knowledge. Social knowledge exists only in relationships between individuals or within groups and it is largely tacit, shared by group members, and develops only as a result of working together. Structured knowledge is embedded in an organization's systems, processes, tools, and routines, and it is explicit and rule-based.

Quinn, Anderson, and Finkelstein (1996) divided knowledge into cognitive knowledge (know-what), advanced skill (know-how), systems understanding (know-why), and self-motivated creativity (care-why). Millar, Dermaid, and Quintas (1997) concentrated on what knowledge is about and specified catalogue knowledge (know-what), explanatory knowledge (know-why), process (know-how), social knowledge (know-who), and experiential knowledge (what was). Blackler (1995) focused on where the knowledge is situated and thus categorized knowledge as embrained (cognitive), embodied (perceptual), encultured (social), embedded (systematized), and encoded (formal or symbolic). Table 2-2 is a summary of these different taxonomies of knowledge.

Table 2-2

Taxonomies of Knowledge

Authors	Classification
Boisot (1987)	Codified, not coded, diffused, undiffused knowledge
Blackler (1995)	Encoded knowledge, embedded knowledge, embrained knowledge, encultured knowledge, and embodied knowledge
Nonaka & Takeuchi (1995)	Explicit and tacit knowledge
Hubert (1996)	Explicit and tacit knowledge
Ruggles (1996)	Process, catalog, and experiential knowledge
Quinn, Anderson, and Finkelstein (1996)	Cognitive knowledge, advanced skill, systems understanding, and self-motivated creativity
Demarest (1997)	Scientific, philosophical, and commercial knowledge
Fleck (1997)	Formal knowledge, contingent knowledge, informal knowledge, meta knowledge, tacit knowledge, and instrumentalities
Probst (1998)	Individual and collective knowledge
De Long and Fahey (2000)	Human, social, and structured knowledge
Housel & Bell (2001)	Label, process, skill, and people knowledge
Tiwana (2002)	Explicit and tacit knowledge

Definition of Knowledge Management

Knowledge management is a debatable and emerging term and has many different definitions. The term knowledge management was first introduced in a 1986 keynote address to a European management conference. Alternative definitions have been proposed since that attempt to capture the complexities of knowledge management. The

American Productivity and Quality Center defined knowledge management as "the strategies and processes of identifying, capturing and leveraging knowledge" (Atefeh et al., 1999, p. 172). Knapp (1998) defined knowledge management as "the art of transforming information and intellectual assets into enduring value for an organization's clients and its people" (p. 3). Darroch (2003) defined knowledge management as "the process that creates or locates knowledge and manages the sharing, dissemination, and use of knowledge within the organization" (p. 41).

The traditional emphasis in knowledge management has been on knowledge that is recognized and already articulated in some form. However, increasingly, knowledge management is also incorporating the managing of important tacit knowledge (Sabherwal & Becerra-Fernandez, 2003). Davenport and Prusak (1998) defined knowledge management as the management of a corporation's knowledge through a systematic and organizational specified process for acquiring, organizing, sustaining, applying, sharing, and renewing both tacit and explicit knowledge from employees to improve organizational performance and to create value.

Wiig (1994) suggested that knowledge management in an organization must be considered from three perspectives, each with different scopes and purposes: (a) a business perspective - focusing on why, where, and to what extent the organization must invest in or exploit knowledge, and which strategies, products and services, alliances, acquisitions, or divestments should be considered from a knowledge-related point of view; (b) a management perspective - focusing on determining, organizing, directing, and monitoring knowledge-related activities required to achieve the desired business

strategies and objectives; and (c) a hands-on operational perspective - focusing on applying the professional skill to conduct explicit knowledge-related work and tasks.

In fact, knowledge management is a principle that is aimed at satisfying and exceeding the customer's expectations (Keskin, 2005). Table 2-3 presents a summary of the different definitions of knowledge management.

Table 2-3

Definitions of Knowledge Management

Authors	Knowledge Management Definitions
Hannabuss (1987)	What information users know, their knowledge and attitudes, and their decision making when interacting with others
Gopal and Gagnon (1995)	The categories of knowledge needed to support the overall business strategy, assess the firm's current knowledge and transfer the knowledge base to be more powerful and to fill gaps.
APQC (1996)	The strategies and processes of identifying, capturing and leveraging knowledge
Demarest (1997)	Systematic underpinning, observation, instrumentation, and optimization of a firm's knowledge
Bair (1997)	Aim to capture the knowledge that employees really need in a central repository and filter out the surplus.
Knapp (1998)	The art of transforming information and intellectual assets into enduring value for an organization's clients and its people
Holsapple & Joshi (2000)	Make needed knowledge available to appropriate processes effectively and timely to perform activities
Darroch (2003)	The process that creates or locates knowledge and manages the sharing, dissemination, and use of knowledge within the organization
Park (2006)	Identification and sharing of required knowledge that is controlled and protected, and fulfill organizational objectives

Critical Success Factors of Knowledge Management

Knowledge Management Strategy

Knowledge management strategies can encapsulate and identify strategic directions in managing knowledge activities and knowledge management enablers are the vehicles that can facilitate these activities (Chan & Chau, 2005). The right strategic decision for a firm is to find the proper balance of internal and external knowledge management that best meets that firm's needs and fits its resources most precisely (Bierly & Chakrabarti, 1996). However, there is a lack of common comprehension of the concept of strategy, especially as the concept relates to knowledge and knowledge management. Zack (2002) argued that the terms knowledge management strategy and knowledge strategy are different. Knowledge strategy is defined as a competitive strategy built around a firm's intellectual resources and capabilities. Knowledge strategy is oriented toward understanding which knowledge is most strategic and will have the greatest impact on the key business performance of a company (Zack, 2002). In contrast, knowledge management strategy is defined as a high-level plan that describes and outlines the processes, tools, and infrastructures (organizational and technological) required in managing any knowledge gaps or surpluses. Knowledge management strategy is the means by which the exact knowledge determined by a knowledge strategy can flow effectively in corporations (Zack, 2002).

Various researchers have described different knowledge management strategies. Jordan and Jones (1997) explored the key dimensions of organizational knowledge and split the known knowledge management strategies into two types: tacit-oriented strategy and explicit-oriented strategy. This split of two strategies was designed to emphasize the

proper balance between the strategies, and to expand innovative ideas to get better results. The purpose of tacit-oriented strategy is to acquire internal and opportunistic knowledge and share its aspects informally. Conversely, explicit-oriented strategy is used primarily to acquire external and focused knowledge and to share that knowledge formally. The focus of tacit-oriented strategy is the sharing of knowledge through mutual interactions, one-to-one connections, and social networks. The focus of explicit-oriented strategy is to manage and store the knowledge assets of the firm in a systematic fashion (Keskin, 2005).

Zack (1999) analyzed the concept of a knowledge gap, namely the gap between what a firm must know and what that firm actually knows about managing knowledge. Knowledge management is categorized into aggressive and conservative strategies. Firms that concentrate on internal knowledge exhibit a conservative strategy while aggressive firms tend to explore knowledge without regard to any organizational boundaries. Zack (1999) concluded that firms using an aggressive strategy tend to outperform those who utilize less aggressive strategies.

In 1999, Hansen and Nohria investigated several management consulting firms and found two very different knowledge management strategies in place in these firms; a codification strategy and a personalization strategy. Codification strategy indicates that knowledge is carefully codified and stored in databases and then accessed and used easily by anyone in the company. In contrast, personalization strategy means that knowledge is closely tied to the person who developed that knowledge and is shared primarily through direct person-to-person contacts. The benefits of codification and personalization strategies are dual. Sharing of codified knowledge can improve task efficiency and a sharing of personalized knowledge can improve task quality and signal competence to

clients (Hansen & Haas, 2001). The researchers argued that companies should seek either a codification strategy or a personalization strategy in isolation to utilize corporate knowledge most effectively.

Swan, Newell, and Robertson (2000) criticized information technology-driven (IT-driven) knowledge management through a discussion of two case studies in which cognitive and community strategies were presented. Cognitive strategy emphasizes linear information flow and knowledge that is codified through information technology. Community strategy emphasizes dialogue and knowledge sharing through social networks that include occupational groups and teams. Swan et al.'s (2000) findings provide conclusive evidence that community strategy is more effective in an organization.

Bohn (1994) defined technological knowledge and introduced a framework for mapping and evaluating levels of knowledge. The author illustrated knowledge management strategy by measuring how much an organization knows and doesn't know about its production processes. The author divided knowledge into eight stages that ranged from complete ignorance to complete knowledge. He also defined the range of the degree of procedure from pure procedure to pure expertise. Those portions of processes at the lower stages of knowledge should be completed by using a high degree of expertise and little automation. On the contrary, if a process is at a higher stage of knowledge, automation is more appropriate.

Bierly and Chakrabarti (1996) studied the U.S. pharmaceutical industry and classified generic knowledge strategies into innovators, explorers, exploiters, and loners. Innovators are the most aggressive learners in the sense that they most effectively combine internal and external learning, and concentrate on both aspects of learning.

Internal learning occurs when members generate and distribute new knowledge within the boundaries of the organization. External learning occurs when members bring in knowledge from an outside source. Incremental learning is manifested in small changes in the observed pattern of behavior. Radical learning is manifested in radical changes of behavior. Explorers keep a good balance between internal and external learning, but are less aggressive learners than innovators. Exploiters place more emphasis on external learning than internal learning and more emphasis on incremental learning than radical learning. Loners are viewed as mostly ineffective learners because they are not able to integrate different streams of knowledge effectively. The authors found that innovators or explorers are the two types of learners that can produce greater profits for a firm.

Singh and Zollo (1998) investigated the impact of tacit and codified knowledge accumulation strategies on the performance of corporate acquisitions. The authors showed that tacit-oriented knowledge management strategy had a positive influence on organizational performance if task characteristics are highly homogeneous or similar. However, Singh and Zollo (1998) found that codified knowledge management strategy appeared to be an important factor when task characteristics are of low homogeneity. The study indicated that firms should align their knowledge strategies with their task characteristics.

Many researchers asserted that there are two dimensions of any knowledge management strategy focus, system orientation and human orientation (Choi and Lee, 2002). System orientation emphasizes codified knowledge in knowledge management processes, focuses on codifying and storing knowledge via information technology, and attempts to share that knowledge formally (Choi and Lee, 2002). On the contrary, human

orientation emphasizes dialogue via social networks and person-to-person contacts, focuses on acquiring knowledge through an experienced and skilled person, and attempts to share knowledge informally (Choi and Lee, 2002).

Keskin (2005) argued that each firm should adopt an appropriate knowledge management strategy that relates to its specific knowledge entity. Different situations can also require different knowledge management strategies. However, the range of different knowledge management strategies is often confusing and where to begin in choosing a strategy for a particular situation may at first tend to be unclear (Haggie & Kingston, 2003). In general, knowledge management strategies are implemented by using three perspectives: focused view, balanced view, and dynamic view. The studies of a focused view proposes that companies should pursue one strategy predominantly; the balanced view suggests that companies should strike a balance between the two knowledge management strategies; and the dynamic view suggests that firms align their strategies to the characteristics of their knowledge (Choi & Lee, 2002). These different knowledge management strategy categories and views are compared in Table 2-4 by author and strategy characteristics.

Table 2-4

Different Knowledge Management Strategies by Type and Author

Views	Authors	Knowledge Management Strategy
Focused	Hansen et al. (1999)	Codification and personalization
	Swan et al. (2000)	Cognitive and community
Balanced	Bierly and Chakrabarti (1996)	Innovators, explorers, exploiters, and loners
	Jordan and Jones (1997)	Explicit-oriented and tacit-oriented
	Zack (1999)	Conservative and aggressive
Dynamic	Bohn (1994)	Pure procedure and pure expertise
	Singh and Zollo (1998)	Codification and experience accumulation
	Choi and Lee (2002)	Systems-oriented and human-oriented

Knowledge Management Enablers

Knowledge enablers, also characterized as influencing factors, can facilitate such knowledge management activities as codifying and sharing knowledge assets among individuals (Chan & Chau, 2005). Gold, Malhotra, and Segars (2001) conducted an empirical study of knowledge management capabilities and organizational effectiveness and collected data from 323 senior executives. Using this theoretical framework, the researchers identified three key knowledge management enablers: technology, structure, and culture. The research presented strong evidence regarding the impact of knowledge management enablers and knowledge management process on knowledge effectiveness. However, the research was limited as its sample was restricted to large firms only.

Laupase (2002) conducted a study exploring the processes of converting consultants' tacit knowledge to organizational explicit knowledge. In the study, three case studies were conducted on three management consulting firms in Australia. Two were internationally recognized management consulting firms and one was a national

consulting firm. Two senior management personnel and one middle management person were interviewed. The interview questionnaires focused on the knowledge conversion process to uncover an organizational perspective of how knowledge conversion was supported. To address the research question, the author identified three factors that support the conversion processes, which were organizational structure, culture, and information technologies. All three firms indicated that technology was not the first priority of the consulting practice when considering knowledge conversion. The most important issue was to develop an effective organizational structure and culture to assist the conversion processes.

Syed-Ikhsan and Rowland (2004) conducted a study exploring the relationship between organizational elements and the performance of knowledge transfer in the public sector. The researchers studied 204 respondents from the Ministry of Entrepreneur Development (MED) of Malaysia for their case study. Five main enablers were identified: organizational culture, organizational structure, technology, people/human resources and political directives. The researchers used bivariate analysis and Spearman's rank-order correlation to test the hypotheses. The authors found the study identified a number of opportunities for further examination regarding enablers that could influence the success in implementing knowledge management as a whole. One of the enablers that needed further research according to the authors was the effect of organization structure on knowledge transfer.

Ngoc (2005) conducted a study on knowledge transfer issues in Vietnam's IT companies. The study was carried out in five large IT companies in Hanoi in January 2005. The 104 respondents were executive managers, line managers, and technical staff

personnel working in five companies at that time. In this study, the researcher suggested that an organizational communication system, communal culture, transformational leadership, and information technology were essential knowledge management enablers. The researcher developed a questionnaire using prior measurements that corresponded to each variable in the literature and taking the background of Vietnam's IT firms into account. The results of this research supported the positive relationship between organizational communication systems, communal culture, transformational leadership, information technology, and knowledge transfer. Moreover, communal culture and transformational leadership were the two strongest predictors of knowledge transfer. The application of information technology had the lowest influence on knowledge transfer. The limitation of the study was the quota sampling method the researcher used, so the sample might not have truly been representative of the entire population. Furthermore, the small sample size in the context of IT companies in Hanoi, limited the statistical power of the findings.

The following sections further develop the content and theoretical grounding of knowledge management enablers. These primarily focus on technology, structure, and organizational culture.

Technology. Lee and Choi (2003) referred to technology as the presence of information technology support within an organization. Information technology plays a crucial role in eliminating boundaries to communication that often inhibit the interaction between different parts of the organization. The important role of information technology is its ability to support communication, collaboration and the search for knowledge, and enable collaborative learning (Ngoc, 2005). Devenport and Prusak (1998) regarded

information technology as both a key contributor and an enabler in the field of knowledge management. Marwick (2001) proposed that a number of information technology tools be applied to the different knowledge creation processes. Information technology that is a part of effective knowledge management can thus be classified into two types: Communication technologies (e.g., e-mail, video conferencing, electronic bulletin boards, and computer conferencing) and decision-aiding technologies (e.g., decision-support systems, expert systems, and executive information systems) (Song et al., 2001).

Communication technologies provide ways to enable, intensify, and expand the interactions of organizational members and departments (Kendall, 1997). Communication technologies enable companies to overcome time and space constraints in communication, increase the range and depth of information access, and promote the knowledge to be shared rapidly and conveniently (Marwick, 2001). Decision-aid technologies are defined as the information technology that provides ways to increase the capacity of an individual, organization, or team to create models effectively, to develop alternatives and solutions, and to make more effective decisions (Kendall, 1997). Decision-aid technologies enable companies to store and to retrieve large amounts of information rapidly, and then to combine and reconfigure information accurately to create new information (Song et al., 2001). Therefore, information technology can help individuals create models and develop alternatives and solutions for tasks (Ngoc, 2005). In addition to creating, transferring, and storing knowledge through technological infrastructure, an organization must take steps to ensure that its knowledge is not stolen or used inappropriately (Gold, Malhotra, & Segars, 2001).

Structure. An organizational structure that promotes individualistic behavior where locations, divisions and functions are rewarded for hoarding information, inhibits effective knowledge management within the organization (O'Dell & Grayson, 1998). The structure of an organization can be defined as the formal relationships and allocation of activities and resources among people (McKenna, 1999). Most studies examine organizational structure from a traditional viewpoint, with centralization and formalization as the two critical structural dimensions (Tata & Prasad, 2004). Centralization refers to a hierarchical level that has the authority to make a decision within an organization. Formalization refers to written documentation, rules, and procedures in the organization that affect the communication of knowledge (Schminke, Ambrose, & Cropanzano, 2000).

Centralization is generally considered to hinder interdepartmental communication, frequent sharing of ideas, and knowledge application (Kohli & Jaworski, 1990; Woodman, Sawyer, & Griffin, 1993). To the contrary, decentralization is a structural factor that aids the sharing of knowledge through an emphasizing of empowerment and information sharing with other employees (Hurley & Green, 2005). However, decentralization may make it difficult to avoid chaos, inconsistency and duplicated efforts (Adler, 1999). There are two opposing views regarding the relationship of formalization and knowledge application in a firm (Lin & Germain, 2003). Formalized structures can be less flexible, prohibiting the acquisition and utilization of knowledge. The absence of a formal structure tends to allow organization members to communicate and interact with one another to create knowledge (Jarvenpaa & Staples, 2000). Conversely, formalization

systemizes information collection and dissemination, and helps to identify storage of strategic issues (Segars, Grover, & Teng, 1998).

Organizational culture. Organizational culture is the set of values, beliefs and norms, meanings and practices shared by personnel within an organization (Robbin, 2004). An organization's culture is shaped by the people inside that organization, by the ethics of the organization, by the employment rights given to employees, and by the type of structure used by the organization to run the organization. Like organizational structure, organizational culture shapes and controls behavior within an organization. Organizational culture influences how people respond to a situation and how the environment encompassing the organization is interpreted (Mavondo & Farrell, 2004).

Organizational culture is believed to be the most significant factor in effective knowledge management (Gold, Malhotra, & Segars, 2001). An effective organizational culture can provide support and incentives as well as encourage knowledge-related activities by creating suitable environments for knowledge exchange and accessibility (Janz & Prasarnphanich, 2003). An organization must have a strong culture that values trust, openness, and sociability to stimulate people's interactions and knowledge sharing (Ngoc, 2005).

According to the findings of scholars and practitioners, collaboration, trust, and incentives are the three essential components of organizational culture (DeTienne, Dyer, Hoopes, & Harris, 2004). Slater (2004) argued that collaboration includes the following components: (a) common goals, joint work, and interdependence; (b) parity or equality in relationships; and (c) voluntary collaboration. A collaborative environment creates opportunities for knowledgeable people to share knowledge openly and have more

successful knowledge management programs (Alavi & Leidner, 2001). Therefore, many firms use collaborative involvement to enable their organizational cultures to foster more innovation and to get necessary knowledge to the appropriate people at the best time (DeTienne et al., 2004). Finally, firms gain the greatest benefits from knowledge sharing when their members are given the opportunity to contribute to and to learn from the specific knowledge that affects the decisions and practices in each area of the company.

The second cultural factor is trust. Trust is a complex and multidimensional concept. Cook and Wall (1980) have distinguished two components of trust, faith and confidence. Trust refers to the faith in the trustworthy intentions of others and confidence in the ability of others (Cook & Wall, 1980). A strong sense of trust can create the same standard, a mutual interest, and a shared goal for all people in the organization and produce both commitment and loyalty (Goffee & Jones, 1996). Critical to the development of knowledge-based trust are recurring face-to-face interactions that allow members to know one another and to be able to predict how the other party will behave in various circumstances (DeTienne et al., 2004). Davenport and Prusak (1998) stated that regardless of how thoroughly firms are supported by technology and rhetoric, knowledge initiatives will fail without trust. Undoubtedly, trust encourages any environment to be conducive to the sharing of knowledge between organizational groups (Nelson & Cooprider, 1996).

In addition to policy and process, a reward system or incentives can determine the channels from which knowledge is accessed and flows (Leonard, 1995). Park (2006) argued that incentive systems can support the knowledge management activities as a structural capability. Tangible and intangible incentives are all integral parts of the

knowledge management process and can be used to motivate employees to share knowledge (Hansen, Nohria, & Tierney, 1999). An organization's system of rewards is also a critical structural factor to use to affect employee behavior and influence employee decisions regarding knowledge creation and knowledge transfer activities (Hurley & Green, 2005).

Knowledge Management Process Capability

Researchers have identified many key aspects of the knowledge management process, including creation, transfer, and use (Skyme & Admidon, 1998; Spender, 1996); capture, transfer, and use (DeLong, 1997); and identification, acquisition, development, sharing/distribution, utilization, and retention (Probst, Raub, & Romhardt, 2000). Avai and Leidner (2001) examined these various characteristics and produced four broad dimensions of process, namely, creation, storage/retrieval, transfer, and application. As presented in Table 2-5, Shin, Holden, and Schmidt (2001) integrated different terminologies used by various authors in describing the knowledge management process and then categorized the knowledge management process as creation, storage, distribution, and application.

Table 2-5

Classification of Knowledge Management Process

	Creation	Storage	Distribution	Application
Holzner etc. (1979)	Consciousness	Extension	Transformation	Implementation
Pentland (1995)	Construction	Organization Storage	Distribution	Application
Nonaka etc. (1995)	Creation	Access	Dissemination	Application
Demarest (1997)	Construction	Embodiment	Dissemination	Use
Daal etc. (1998)	Creation	Draw-up	Dissemination	Apply Evaluate
Davenport etc. (1998)	Creation		Transference	Asset management
Liebowitz (1999)	Identify Capture	Store	Share	Apply Sell

In recent years, some authors concluded that there are four broad dimensions of knowledge management process: knowledge acquisition, knowledge protection, knowledge conversion, and knowledge application (Gold et al., 2001; Park, 2006). The following sections develop the content and theoretical grounding of the primary process capabilities.

Knowledge acquisition capability. Organizational knowledge acquisition is the process of developing new content and replacing existing content within the organization's tacit and explicit knowledge base (Pentland, 1995). Many terms also have been used to describe this process: capture, creation, construction, identification, and generation. In 2000, Nonaka, Toyama and Konno suggested that the essential question for knowledge acquisition is establishing an organization's "ba" (defined as a common place or space for creating knowledge). The authors identify four types of ba: originating ba, interacting ba, cyber ba, and exercising ba. Originating ba is a common place where individuals share experiences primarily through face-to-face interaction. Interacting ba is associated with the externalization mode of knowledge creation and refers to space where

tacit knowledge is converted to explicit knowledge and shared among individuals through dialogue and collaboration. Cyber ba refers to a virtual space of interaction and corresponds to the combination mode of knowledge creation. Finally, exercising ba involves the conversion of explicit to tacit knowledge through the internalization process.

In accordance with Nonaka and Tackeuch's (1995) SECI model, knowledge is created using four processes to convert tacit and explicit knowledge. The four types of knowledge processes are socialization, externalization, combination, and internalization. Nonaka and Takeuchi (1995) posited that tacit knowledge could be made explicit and vice-versa, through social interaction. The authors proposed a cyclical translation process that encapsulated the four knowledge conversion processes as follows: (a) tacit knowledge transfer through socialization; (b) tacit knowledge to explicit knowledge conversion through externalization; (c) generation of new explicit knowledge through a combination of existing explicit knowledge; and (d) the acquisition by individuals of tacit knowledge through internalization of explicit knowledge. Understanding the characteristics of the various ba and their relationship with the modes of knowledge creation is important to enhance organizational knowledge creation capability (Alavi & Leidner, 2001). For example, the use of information technology in cyber ba is advocated to enhance the efficiency of the combination mode of knowledge creation (Nonaka & Konno, 1998).

Park (2006) argued that an organization should acquire knowledge throughout the organization and exchange knowledge even with external partners so that knowledge upgrade can happen constantly through bench-marking, best practices, and feedback of projects experience to improve subsequent projects. Once these practices and variances

have been identified, the organization can then capture the knowledge for use internally (Gold, Malhotra, & Segars, 2001).

Knowledge protection capability. Alavi (2000) asserted that creating new knowledge is not enough; people and organizations forget, and mechanisms are needed to store acquired knowledge and to retrieve it when needed. The concept of organizational memory aims for the same goal. Organizational memory includes knowledge residing in various component forms that may include written documentation, structured information stored in electronic databases, codified human knowledge stored in expert systems, documented organizational procedures and processes, and tacit knowledge acquired by individuals and networks of individuals (Tan et al., 1998). Organizational memory includes individual memory (a person's observations, experiences, and actions) as well as shared knowledge and interactions, organizational culture, transformations (production processes and work procedures), structure (formal organizational roles), ecology (physical work setting) and information archives (both internal and external to the organization) (Walsh & Ungson, 1991).

Probst, Raub, and Romhardt (2000) found that organizations wishing to manage their knowledge for accessibility in the future must master at least three basic processes of knowledge management. First, the organization must select from the many organizational events, persons and processes those that are worth retaining. Second, the organization must store experience in a suitable form. Finally, the organization must ensure that organizational memory is updated.

In addition, an organization should develop security-oriented technology that restricts or tracks access to vital knowledge (Gold, Malhotra, & Segars, 2001). To protect

knowledge, the following activities are necessary: protecting knowledge from inappropriate use or being leaked in and outside the organization, restricting access to some sources of knowledge by password technology, identifying restricted knowledge easily, protecting tacit knowledge, and most importantly, communicating the importance of knowledge protection on a corporate level.

Knowledge conversion capability. When organizations become cognizant of a lack of specific knowledge within the organization, a "knowledge gap" is created. Therefore organizations need to bring in or to transfer in knowledge (Gilbert & Gordey-Hayes, 1996). Marshall (1997) defined knowledge conversion as the transfer of knowledge and expertise throughout the organization to departments, plants, and countries and across national borders. Knowledge conversion is a two-part process that involves both the transmission of information to a recipient, and absorption and transformation by that person or group (Davenport & Prusak, 1998). These two kinds of conversion can be distinguished as internal knowledge conversion and external knowledge conversion. Internal conversion refers to the transfer of knowledge within the organization, and external conversion addresses knowledge exchange between the organization and its environment. Park (2006) listed some of the most important activities that perform knowledge conversion: (a) converting competitive intelligence into action plans, (b) filtering and evaluating knowledge, (c) transferring organizational knowledge to individuals, (d) absorbing individual knowledge into the organization, (e) absorbing partner knowledge into the organization, (f) integrating different sources of knowledge, and (g) replacing outdated knowledge.

Gupta and Govindarajan (2000) have conceptualized knowledge conversion in terms of five dimensions: (a) perceived value of the source unit's knowledge; (b) motivational disposition of the source; (c) existence and richness of the transmission channels; (d) motivational disposition of the receiving unit; and (e) the absorptive capacity of the receiving unit. Because effective communication between organization and environment directly concerns knowledge transfer, this process is the most important factor to manage.

While earlier debates on knowledge management tended to revolve around using information and communication technologies and procedures, attention is increasingly extended to examining the role of social structures and cultures in promoting or inhibiting knowledge conversion (Bresnen et al., 2003). This concept raises the question of whether successful knowledge transfer depends on social and cultural aspects or on technologies and procedures.

Knowledge application capability. The most essential point in knowledge management is to make sure that the knowledge present in an organization is applied productively to benefit the organization (Probst, Raub, & Romhardt, 2000). Davenport and Klahr (1998) noted that the effective application of knowledge helps companies increase efficiency and reduce costs. In most of the literature, organizations assume that knowledge will be applied effectively once created (Gold et al., 2001). Unfortunately, successful identification and distribution of important knowledge does not guarantee its utilization in the company's every day activities. Grant (1996) identified three mechanisms to use to integrate knowledge into an organization. First there are directives, seen in sets of rules, standards, procedures and instructions and converted from tacitly

held specialist knowledge into explicit forms for communication to non-specialists. Then there are organizational routines related to patterns for task performance and coordination, interaction protocols, and process specifications. Last there are self-contained task teams that refer to the creation of teams to attend to tasks where a high degree of uncertainty exists and where group synergy can be exploited. Group problem solving applied by the task teams often requires the coordination and inclusion of frequent interaction and intense collaboration. Park (2006) noted that the effective application of knowledge includes applying knowledge from past mistakes, using knowledge to solve new problems, matching sources of knowledge to problems, applying stored knowledge for improved efficiency, using knowledge to adjust strategic direction, and linking sources of knowledge available for solving problems.

Knowledge Management Performance

It is important to measure the impact of knowledge management processes and determine the benefits that can be reaped by appropriate knowledge management efforts. Based on a review of the articles and journals exploring management, indicators for measuring organizational performance can be categorized as financial indicators and non-financial indicators (Allen & Helms, 2002; Van Buren, 1999). The financial objective of knowledge management is to capitalize on knowledge assets to increase profit, make sure that improvements in activities are actually converted into reduced costs, and enhance the higher price of a larger sales volume without negative side effects (Kalling, 2003). The methodology of financial indicator analysis includes an analysis of financial statements, the payback period, the return on investment (ROI), the return on assets (ROA), the return on sales (ROS), the net present value (NPV), and other applicable financial tools

(Chen & Chen, 2005). To the contrary, non-financial performance is an intangible evaluation and differs from the examination of traditional financial performance. While the improvement of non-financial performance is also the purpose of knowledge management, such linkage is obscure and difficult to validate empirically due to an extremely large number of internal and external factors that can affect non-financial performance.

Yu, Kim, and Kim (2004) conducted an exploratory study on the link between knowledge management drivers and performance. Survey questionnaires were mailed to knowledge management team managers of 220 Korean firms with a brief description of the survey and a return envelope. Seventy-four completed survey questionnaires were returned to the researchers, representing a 33.6 percent response rate. Of these, 66 firms completed cases that could be used for analysis. In this study, the researchers adopted the immediate indicators of knowledge management performance, including knowledge quality and user knowledge satisfaction. The results supported the premise that each factor of knowledge management performance is associated with a different set of drivers. However, the small sample size reduced the power of the research model and limited the generalization of the study.

The Balanced Scorecard approach is one of several well-known ways to evaluate knowledge management performance by examining the gap between a target performance and a current performance value (Chen & Chen, 2005). The Balanced Scorecard, first developed by Kaplan and Norton in the 1992, encompasses financial and non-financial measures. The traditional Balanced Scorecard divides performance into four perspectives: financial, customer, internal process, learning and growth. Financial

perspective is measured by operating income, return on capital, and economic value-added. Customer perspective includes customer satisfaction, customer retention, new customer acquisition, customer profitability, loyalty of customers, and market share. Internal process perspective consists of quality, response time, cost, new product introductions, and innovation processes. Learning and growth perspective use employee-based measures such as employee satisfaction, retention, training and skills. Kennerley and Neely (2000) note that there are a number of shortcomings of the balanced scorecard which include: (a) the absence of a competitiveness dimension; (b) a failure to recognize the importance of such aspects as human resources, and supplier performance; and (c) no specification of the dimensions of performance that will determine success.

Benchmarking and best practices are referred to as the capability to measure an organization's knowledge management performance against benchmarked companies, primary competitors, or industry averages (Chen & Chen, 2005). Adoption of benchmarking and best practices can identify knowledge gaps, increase the operational performance of intellectual capital, and consequently improve capabilities of managing knowledge so as to attain sustainable competitive advantage in the marketplace (Marr, 2004; Wang & Ahmed, 2004). Researchers often use adopted subjective scales to ask respondents to rate how their organization compared to their competitors on a series of key objective performance indicators.

Choi and Lee conducted an empirical investigation of knowledge management styles and their effect on corporate performance. The researchers used documents obtained from the Annual Corporation reports compiled by Maeil Business Newspaper, selected 100 listed companies randomly, and identified middle managers as the primary

respondents. Responses were obtained from 63 of 100 listed companies (63% response rate). Of these, 44 companies completed cases that could be used for analysis. In the study, corporate performance was measured by a benchmarking approach with items from a scale developed by Deshpande, Jarley and Webster (1993), and Drew (1997). The questionnaire consisted of output items, such as overall success, market share, growth rate, profitability, innovativeness, and business size as compared with key competitors. The results found that knowledge management methods can be categorized into four styles: dynamic, system-orientation, human-orientation, and passive. The dynamic style resulted in higher performance. Human-orientation and system-orientation styles did not show any difference in terms of corporate performance; the passive style was less effective.

Relationships Among Knowledge Management Strategy, Enablers, Process Capability, and Performance

Keskin's Model

Keskin (2005) conducted an empirical study on the relationship between knowledge management strategy and firm performance and proposed a theoretical model. In Keskin's Model, knowledge management strategies are classified into two categories, explicit-oriented knowledge management strategy and tacit-oriented management strategy. Firm performance compared to key competitors is classified into six components: success, market share, growth, profitability, innovation, and size. The author hypothesized that explicit- and tacit-oriented knowledge management strategies positively affect firm performance. Both environmental hostility and intensity of market

competition further impact the relationship between explicit-oriented and tacit-oriented knowledge management strategies and firm performance.

In the study, there are three hypotheses: (a) explicit-oriented knowledge management strategy positively affects firm performance; (b) tacit-oriented knowledge management strategy positively affects firm performance; and (c) the greater the environmental hostility, the greater the relationship between explicit- and tacit- oriented knowledge management strategies, and a company's performance. To investigate the hypotheses empirically, small-medium enterprises (SMEs) located around Gebze, Turkey were surveyed. Using documents obtained from the Gebze Chamber of Commerce and the Kocaeli Chamber of Industry, 600 of the 1,000 firms were identified as the target group of the research. Middle managers were identified as the key sources of information. Responses were obtained from 128 of the 600 firms contacted, a 21% response rate.

Because the scales were used with a new sample, 13 items were submitted for exploratory analysis. The best fit of data was obtained through a principal factor analysis with varimax rotation. Using regression analysis, the researcher investigated the influences of explicit- and tacit- oriented knowledge strategies taken together on the company's performance. Results of the regression analyses demonstrated that both explicit and tacit knowledge strategies were significant positive explanatory variables of company's performance. The impact of explicit-oriented knowledge strategy was higher than the tacit-oriented strategy on a company's performance. Researchers also found that there is a stronger relationship between a company's performance and knowledge management strategies when environmental turbulence and intensity of market competition are greater.

Findings of this study primarily indicate that knowledge management strategy is an important element of a company's success. Indeed, formulating an effective knowledge strategy can lead companies to achieve higher performance levels. However, the study had several limitations: (a) the study was only conducted on SMEs; (b) the results reported emerged from a local area; (c) the study had a low response rate to the survey instrument; and (d) there was no industrial separation in data evaluation. Despite these limitations, this study did provide important implications from both theoretical and practical perspectives.

The Gold, Malhotra, and Segars Model

Gold, Malhotra, and Segars (2001) proposed a knowledge management effectiveness model based on combining organizational capability perspective theory and contingency perspective theory. The structural equation model defined knowledge effectiveness in terms of two main constructs, knowledge infrastructure capability (knowledge management enablers) and knowledge process capability. Knowledge infrastructure capability represents social capital, the relationships between knowledge sources and users, and is operationalized by technology, structure, and culture. Knowledge process capability represents the integration of knowledge processes into the organization, and is operationalized by acquisition, (the capturing of knowledge), conversion (making captured knowledge available), application (degree to which knowledge is useful), and protection (security of the knowledge).

To test this model, the researchers collected data using a formal survey of 1,000 senior executives. Of the responses analyzed, 58% of the 322 firms were from finance and manufacturing. The sales profile indicated a bias toward larger firms with 89% of the

sample having sales of more than $100 million. The respondents themselves had senior representation, with 86% holding the position of chief operating officer, chief financial officer, vice president, or chief executive officer. Of the 1,000 surveys, 323 were deemed usable. The responses were anchored by seven-point Likert scales, ranging from 1=strongly disagree to 7=strongly agree. Finally, the paths between infrastructure and process capabilities and the performance variable were positive and of high magnitude. These results seemed to underscore the importance of tightly aligned process and infrastructure capabilities in creating conditions favorable for a company's success.

Although this research presents strong evidence regarding the impact of knowledge management capabilities on knowledge effectiveness, the results should only be interpreted in light of the study's limitation. The preponderance of larger companies in the survey was a double-edged sword. On one hand, the limitation increased the diversity of knowledge management activities and, therefore, the difference in the variables of interest. On the other hand, the limitation narrowed the generalization of the result.

Gold, Malhotra, and Segars (2001) recommended that future research is needed to understand specific strategies and organizational programs for sustaining structures that balance both the content of organizational knowledge (tacit and explicit) and the capabilities to leverage knowledge (enablers and process). Further, the study did not investigate the link between knowledge infrastructure capability and knowledge process capability.

Laupase's Individual-to-Organizational Knowledge Conversion Research Model

Based on Nonaka and Takeuchi's (1995) SECI model, Laupase (2003) explored the conversion processes of consultant tacit knowledge to organizational explicit

knowledge by focusing on how organizational structure, culture, and information technologies support the knowledge conversion processes. To address the issue, three case studies of management consulting firms in Australia were conducted. Two were internationally recognized management consulting firms and the other was a national consulting firm. Two senior management personnel and one middle management person were interviewed. Each interview lasted between 45-60 minutes. The three interviews (one from each firm) were tape-recorded and later transcribed. During interviews, data were collected with respect to the five propositions: (a) Formal meetings encourage individuals to share tacit knowledge with others through a socialization process; (b) in internalizing tacit knowledge, metaphors, narratives and analogies are important as they assist individuals to articulate tacit knowledge; (c) hybrid organizational structure can support knowledge conversion processes; (d) reward systems, as part of a supportive organizational culture, will encourage knowledge conversion activities; and (e) information technologies will not support, facilitate and enable knowledge conversion processes. The findings of this study are briefly described as follows.

Being together in a formal meeting did not guarantee that tacit knowledge would be shared among the attendees. None of the firms created written documentation for their knowledge development that could be accessible by other members of the firms. Despite the hybrid structure proposed to support the conversion process, a loose structure and a network organizational structure emerged during the study and supported the knowledge conversion processes in management consulting firms. Reward systems, as part of a supportive organizational culture, encouraged the conversion process. However,

information technology facilitated the process only partially, because this technology was regarded as a tool to accelerate the activities of the consulting practice.

From the findings, the researcher established guidelines that could be used to assist consultants in converting their valuable tacit knowledge to organizational explicit knowledge. However, the study was limited because only three case studies were conducted.

Choi's Model

Choi (2002) conducted empirical and extended research about the relationship among knowledge management strategy, knowledge creation process, and organizational performance. The study examined the impacts on the knowledge creation process and organizational performance on adopting a knowledge management strategy. In this study, knowledge management strategy was considered to be human orientation and system orientation. The knowledge creation process was classified into four categories, namely, socialization, externalization, combination, and internalization. Performance measurement combined financial indicators with non-financial indicators while comparisons to key competitors were made in six areas, namely market share, profitability, growth rate, innovativeness, successfulness, and business size. The item "business size" was deleted because its factor loading is lower than .4. To test this model, Choi (2002) used data from documents obtained from Annual Corporation Reports produced by the Maeil Business Newspaper, selected 441 companies randomly, and identified middle managers as the primary respondents. Responses were obtained from 58 of 441 firms contacted. A multiple-items method was used for the questionnaires, and each item was based on a six-point Likert scale from 1=very low to 6=very high.

The results indicated that system orientation strategy and human orientation strategy were significantly related to the knowledge creation process and organizational performance. Furthermore, human orientation strategy was more appropriate for socialization, and system orientation strategy was more appropriate for combination. The research was limited as its sample was restricted to only, relatively large and profitable listed companies, and the study had a very low response rate to the survey instrument.

The Lee and Choi Model

Lee and Choi (2003) conducted a study to examine the relationship among knowledge management enablers, processes, and organizational performance. The study included four enablers: culture, structure, people, and information technology and emphasized knowledge creation processes including socialization, externalization, combination, and internalization. To establish credibility between knowledge creation and performance, organizational creativity was incorporated into the model.

Lee and Choi (2003) collected data from companies listed on the Korean Stock Exchange. The researchers used both interviews and a mail survey. After the interview, a questionnaire-based survey was conducted. Questionnaires were sent to a total of 1,425 middle managers in 147 firms. Surveys collected from 58 firms were analyzed to test the model. Each item was based on a six-point Likert scale, from 1=very low to 6=very high.

The results indicated that the organizational culture variable is essential for knowledge creation. People and structure variables do not significantly affect knowledge creation. The information technology variable is the only significant variable related to the combination variable of knowledge creation. Moreover, knowledge creation is

positively related with organizational creativity, which is positively related to organizational performance.

These findings confirm that organizations can achieve the strategic benefits of knowledge management through effective knowledge management enablers and knowledge creation. The findings of this study are interesting, but they should be considered in light of its inherent limitations. The study focused only on relatively large and profitable firms, and the results may differ in small or venture firms.

Park's Model

Park (2006) conducted an empirical study examining the link among knowledge management enablers (infrastructure capability), knowledge management process capability, and knowledge management performance. Park's (2006) model provided a clear framework and construct about knowledge management enablers, knowledge management process capability, and knowledge management performance. In Park's (2006) model, knowledge management enablers are classified into four categories, organizational culture, technology, and structure. Knowledge management process capability is classified into four components, knowledge acquisition, knowledge conversion, knowledge application, and knowledge protection. There are two dimensions of knowledge management performance focus: knowledge management effectiveness and knowledge management satisfaction.

To test this model, Park (2006) collected data from the existing lists of Korean knowledge management experts updated by KOTRA (Korea Trade-Investment Promotion Agency). Based on the lists, a total of 162 knowledge management experts from 128 organizations was deemed usable. All items were measured by a five-point

semantic differential, agreement/disagreement scale anchored with 1=strongly disagree to 5=strongly agree. Findings of this study include: (a) technology was a significant positive explanatory variable of knowledge acquisition, knowledge conversion, and protection, (b) organizational culture was a significant positive explanatory variable of knowledge management performance, and knowledge application, (c) structure was a significant positive explanatory variable of knowledge management performance, knowledge acquisition, knowledge conversion, knowledge application, and knowledge protection, and (d) knowledge acquisition, knowledge application, and knowledge protection were significant positive explanatory variables of knowledge management performance.

Although this empirical study was conducted in all industries, the research was limited by its small sample size of 162 entries from 128 Korean companies, which influences the ability to generalize the findings from this study. Park (2006) recommended that future research is needed to use real data for financial performance such as ROI (Return on Investment), ROE (Return on Equity) or net revenue which can be connected with the criteria for knowledge management performance. Moreover, the author argued that knowledge management performance is regarded as a dependent variable, and both knowledge management enablers and process are dependent variables. Knowledge management performance might be able to impact on the knowledge management enablers and process capability through a feed-back mechanism. Enhanced productivity of customer satisfaction can stimulate the improvement of capability in both the aspect of enablers and process.

This literature review has provided a theoretical framework for this study and contributes new knowledge by providing a better, clearer, and more complete

understanding of the topic. Each of these research strategies is a researchable topic because the same or similar variables can be explored in the related literature. This review completes the critical analysis of the literature on the relationship among knowledge management strategy, enablers, process capability, and performance.

Theoretical Framework

The major theories that guide this study consist of Choi's (2002) extended model, the Lee and Choi model (2003), and Park's model (2006). Choi's (2002) extended model identified the constructs of knowledge management strategy and knowledge management performance. It also indicated that knowledge management strategy was positively related to the knowledge management process capability and knowledge management performance. The Lee and Choi model (2003) identified the construct of knowledge management enablers, and indicated that knowledge management enablers were related to the knowledge management process capability and knowledge management performance. In Choi's extended model (2002) and the Lee and Choi model (2003), the knowledge management process capability focused on knowledge creation (acquisition). Park's (2006) model identified the construct of knowledge management process capability, and indicated that knowledge management enablers and knowledge management process capability were positively related to knowledge management performance.

Choi's (2002) extended model provided this study with a theoretical framework applicable to knowledge management strategy, and knowledge management performance. In Choi's (2002) model, there are two dimensions of a knowledge management strategy focus: system orientation and human orientation. To measure knowledge management

performance, Choi combined financial indicators with non-financial indicators and made comparisons to key competitors in five areas (market share, profitability, growth rate, innovation, and success). This model indicated that the degree of the use of human orientation strategy, and system orientation strategy was positively related to knowledge creation capability and knowledge management performance. Moreover, Choi (2002) proposed that knowledge management strategies should not focus on only one strategy but should utilize both strategies depending upon knowledge characteristics. This balanced view argued that companies should strike a balance between the two knowledge management strategies.

The Lee and Choi model (2003) and Park's (2006) model focused on three knowledge management enablers, which are technology, structure, and organizational culture. Park's (2006) model integrated different terminologies used by various authors in describing the knowledge management process capability and then categorized the knowledge management process as knowledge acquisition, knowledge protection, knowledge conversion, and knowledge application. Park (2006) proposed that better knowledge management enablers (technology, structure and organizational culture) lead to greater knowledge management capability (knowledge acquisition, knowledge protection, knowledge conversion, and knowledge application). Moreover, knowledge management performance can be influenced by knowledge management enablers (technology, structure and organizational culture) and knowledge management process capability (knowledge acquisition, knowledge protection, knowledge conversion, and knowledge application).

Research Questions

Q1: What are the organizational characteristics (type of software company, number of employees, annual sales in dollars, and product/service life cycle) of U.S. software companies?

Q2: What are the knowledge management strategies, knowledge management enablers, knowledge management process capabilities, and knowledge management performance of U.S. software companies?

Research Hypotheses

H1: There is a significant explanatory relationship between knowledge management strategies (human orientation and system orientation) and knowledge management performance in U.S. software companies.

H2: There is a significant explanatory relationship between knowledge management enablers (technology, structure, and organizational culture) and knowledge management performance in U.S. software companies.

H3: There is a significant explanatory relationship between knowledge management process capability (knowledge acquisition, knowledge protection, knowledge conversion, and knowledge application) and knowledge management performance in U.S. software companies.

H4: There is a significant explanatory relationship between knowledge management enablers (technology, structure, and organizational culture) and the total score for knowledge management process capability in U.S. software companies.

H5: There is a significant explanatory relationship between knowledge management strategy (human orientation and system orientation) and the total score for knowledge management enablers in U.S. software companies.

H6: There is a significant explanatory relationship between knowledge management strategy (human orientation and system orientation) and the total score for knowledge management process capability in U.S. software companies.

H7: There is a significant explanatory relationship between organizational characteristics (type of software company, number of employees, annual sales in dollars, and primary product/service life cycle) and the total score for knowledge management strategy in U.S. software companies.

H8: There is a significant explanatory relationship between organizational characteristics (type of software company, number of employees, annual sales in dollars, and primary product/service life cycle) and the total score for knowledge management enablers in U.S. software companies.

H9: There is a significant explanatory relationship between organizational characteristics (type of software company, number of employees, annual sales in dollars, and primary product/service life cycle) and the total score for knowledge management process capability in U.S. software companies.

H10: There is a significant explanatory relationship between organizational characteristics (type of software company, number of employees, annual sales in dollars, and primary product/service life cycle) and knowledge management performance in U.S. software companies.

H11: Knowledge management process capability mediates the relationship among knowledge management strategy (human orientation and system orientation), knowledge management enablers (technology, structure, and organizational culture) and organizational characteristics (type of software company, number of employees, annual sales in dollars, and primary product/service life cycle), and knowledge management performance in U.S. software companies.

H12: Effects of the degree of balance between human and system orientation strategies on knowledge management performance in U.S. software companies.

H_{12a}: U.S. Software companies with a balance in human orientation and system orientation (low/low classifications) of knowledge management strategies, have significantly better knowledge management performance than corporations with less balance (low/high or high/low classifications).

H_{12b}: U.S. Software companies with a balance in human orientation and system orientation (high/high classifications) of knowledge management strategies, have significantly better knowledge management performance than corporations with less balance (low/high or high/low classifications).

H_{12c}: There is a significant interaction between the degree of human orientation knowledge strategy and the degree of system orientation strategy on knowledge management performance in U.S. software companies.

Table 2-6

Classification of Balance between Human Orientation and System Orientation for Hypothesis 12

	Low Human Orientation (HO) Score=4-11	High Human Orientation (HO) Score=12-20
Low System Orientation (SO) Score=4-11	*Low SO/Low HO KM Performance*	Low SO/High HO KM Performance
High System Orientation (SO) Score=12-20	High SO/Low HO KM Performance	*High SO/High HO KM Performance*

A hypothesized knowledge management model (See Figure 2-1) integrates and depicts the relationships among the major theories and variables in this study.

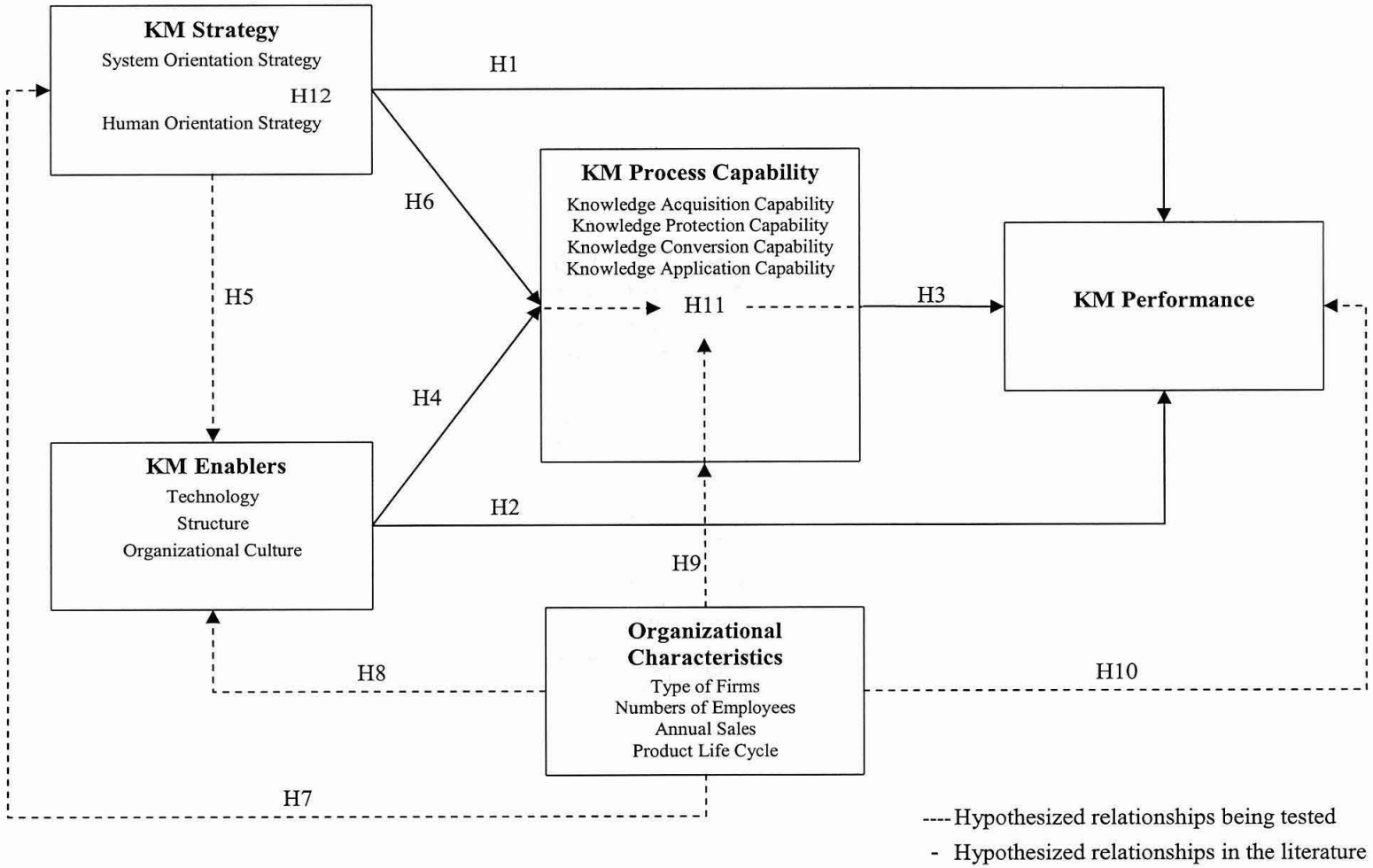

Figure 2-1. Hypothesized knowledge management model.

Chapter II provides an in-depth review of knowledge management strategy, knowledge management enablers, knowledge process capability, knowledge management performance, and other constructs examined in this study. A hypothesized conceptual model, research questions and research hypotheses are also presented in this chapter. Chapter III presents the research methods used to answer the research questions and test explanatory hypotheses.

CHAPTER III

RESEARCH METHODOLOGY

This chapter describes the methodology used to explore the relationship among knowledge management strategy, knowledge management enablers, knowledge management process capability, knowledge management performance, and organizational characteristics. The chapter also discusses the research design, the population and sampling plan, instrumentation, data collection procedures and ethical aspects, and the methods of data analysis. Finally, the chapter presents an evaluation of the research methodology regarding reliability and validity.

Research Design

This study posed two research questions and 12 hypotheses. A non-experimental, quantitative, correlational (explanatory), and causal-comparative research design was used to answer the research questions and test the hypotheses. For Hypotheses H1 to H3, the independent variables are knowledge management strategy (Hypothesis H1), knowledge management enablers (Hypothesis H2) and knowledge management process capability (Hypothesis H3), and the dependent variable is knowledge management performance. For Hypothesis H4, the independent variable is knowledge management enablers, and the dependent variable is the total score for knowledge management process capability. For Hypotheses H5 and H6, the independent variable is knowledge management strategy, and the dependent variable is the total score for knowledge management enablers (Hypothesis H5) and knowledge management process capability (Hypothesis H6). For Hypotheses H7 to H10, the independent variable is organizational characteristics, and the dependent variable is the total score for knowledge management

strategy (Hypothesis H7), total score for knowledge management enablers (hypothesis H8), total score for knowledge management process capability (hypothesis H9), and knowledge management performance (Hypothesis H10). In addition, knowledge management process capability is predicted to mediate the relationship among knowledge management strategy and knowledge management enablers, knowledge management performance, and organizational characteristics. In examining this relationship, for Hypothesis H11, there are three independent variables: knowledge management strategy, knowledge management enablers, and organizational characteristics. The moderator variable is knowledge management process capability and the dependent variable is knowledge management performance. Hypothesis H12 will test the effects of the degree of balance between human and system orientation strategies on knowledge management performance in U.S. software companies with three sub hypotheses. There are two levels, low and high, for each of the two independent variables. The first independent variable is system orientation. The second independent variable is human orientation. The three sub hypotheses test for the main effects of each of the independent variables on knowledge management performance (dependent variable), as well as predicting an interaction effect will be significant for balanced system orientations (low/low or high/high) and human orientations (low/low or high/high) on knowledge management performance.

In this study, a one-group, randomly selected sample of executives from software companies located in the U.S. was used to answer the research question and test the hypotheses. Data was collected using an online survey. To measure the knowledge management strategy, the study used Choi's (2002) 8-item *Knowledge Management Strategy Scale*. Knowledge management enablers were measured using 27 items from

Lee and Choi's (2003) *Knowledge Management Enablers Scale*. Knowledge management capability was measured using 26 items adopted from Park's (2006) *Knowledge Management Process Capability Scale*. Knowledge management performance used Choi's (2002) 5-item *Knowledge Management Performance Scale*. Organizational characteristics were assessed by using four items from Park's (2006) modified *Organizational Characteristics Profile*.

A research design using descriptive statistics (frequency distributions and measures of central tendency) was used to answer the research questions about the organizational characteristics of U.S. software companies and their knowledge management strategies, knowledge management enablers, knowledge management process capabilities, and knowledge management performance. A correlational (explanatory) research design using a multiple regression was used to test Hypotheses H1 to H10, about the causal relationships among the knowledge management strategy, knowledge management enablers, knowledge management process capability, knowledge management performance, and organizational characteristics. To test Hypothesis H11, moderated multiple regression was used. A factorial (causal-comparative) design using two-way ANOVA was used to test Hypothesis H12, the interaction of the degree of balance between human and system orientation strategies and knowledge management performance.

Population and Sampling Plan

Target Population

A target population is the entire group of people, events, or objects that the researcher wishes to study (Cavana, Delahaye, & Sekaran, 2001). An executive is a senior manager in a company or organization whose job is to make and to implement major decisions (MSN Encarta dictionary, 2006). Executives play key roles in knowledge management and they have a strong understanding of the organizational characteristics and environment. Therefore, the target population for this study was executives in software companies in the United States. In the 1990s, the former Standard Industrial Classification (SIC) was replaced by the new North American Industrial Classification System (NAICS). The NAICS is a hierarchical system, with 6-digit numbers assigned to the most specific industries. The American Electronics Association (AEA) uses eight North American Industrial Classification System (NAICS) codes to classify the software industry into three broad categories: software publishers, computer systems design and related services, and internet services.

In this study, an "executive" is a chief executive officer, chief operating officer, chief financial officer or someone in charge of a principal business unit or function. In 2002, the U.S. Census Bureau calculated that there were 134,252 software establishments in the United States. The AEA estimated that 1,420,300 people were working for U.S. software companies in 2005. The U.S. Department of Labor estimated in 2004 that 2.8% of the employees in a software publisher are executives. Therefore, the estimated number of executives in the target population is 39,769. This was based on the U.S. Department

of Labor metrics: x=1,420,300*2.8% where x=estimated numbers of executives in the target population.

Accessible Population

In this study, the accessible population was limited to "executives" from U.S software companies. The names and e-mail addresses of executives at software companies were available from the web site of Lead411 (http://www.lead411.com/). Lead411 lists approximately 17,811 software company executives.

Setting

The sources from which data was collected were limited to software companies in the U.S., as these firms required the existence of a knowledge management process. Executives completed the survey within their respective firm settings.

Sample Size

The return rates of mail questionnaires are typically low and a 30% response rate is considered acceptable (Cavana, Delahaye, & Sekaran, 2001). In Gold et al.'s (2001) research in the U.S., of the 1,000 mail surveys, the responses of 323 respondents (senior executives) were deemed usable. According to knowledge management research in the U.S., the percentage of responses may be as low as 20% in mailed questionnaire studies (Al-Hawari, 2004). Because online surveys are very similar to mailed questionnaires, the percentage of responses may also be as low as 20% in online surveys. A conservative rule of thumb for testing R-square is $n > 50 + 8m$, where: n = sample size, and m = number of predictors (Tabachnick & Fidell, 2001). Therefore, the minimum sample size in this study must be more than 186.

Eligibility Criteria and Simple Random Sampling Plan

Eligibility Criteria

The geographic area and setting of the sampling plan in this study was limited to the continental United States. The eligibility criteria of the sample are:

1. Respondents' companies belong to software publishers, computer systems design and related services, or internet services.
2. Respondents must be an executive that is a chief executive officer, chief operating officer, chief financial officer, president, or anyone in charge of a principal business unit or function.
3. Respondents were listed in the web site of Lead411 (http://www.lead411.com/)
4. Respondents were 18 years old or older.
5. Respondents were able to read and write English.
6. Respondents had been employed at their present companies for the at least past six months.
7. Respondents agreed to participate in this study and complete the questionnaire fully.

Simple Random Sampling Plan

Simple random sampling is an approach in which each member of a population has an equal probability of being selected (Cavana, Delahaye, & Sekaran, 2001). The sample was selected from the list of executives in each of software companies that appear on the Lead411 web site. The researcher coded 17,811 executives and used a computer generated random-number table. A sample of 6,000 executives was created for this study. The researcher sent out 6,000 e-mails to meet this requirement of obtaining more than 186 usable responses.

Instrumentation

The six-part, self-report survey was used to collect data and appears in Appendix C. Part 1 ensured that the respondents met eligibility requirements. Parts 2-5 measured the independent variables. Part 2 measured Organizational Characteristics using a checklist and fill in the blank format. Parts 3-6 used a five-point semantic differential scale and measured Knowledge Management Strategies (Part 3), Knowledge Management Enablers (Part 4), Knowledge Management Process Capabilities (Part 5), and the dependent variable of Knowledge Management Performance. The survey consisted of 72 questions and took approximately 10 minutes to complete.

Part 1: Filter Questions

In Part 1, three filter questions were designed to ensure that the respondents were eligible to answer the questions: having been employed at their companies for at least the past six months, understanding the firm's knowledge management process, and clearly understanding the dynamics of their companies and their competitors. All questions require yes/no responses.

Part 2: Organizational Characteristics Profile

The purpose of Part 2 was to identify the organizational characteristics of the respondents' firms. The questions in this part were checklist and fill-in-the blank using Park's (2006) modified *Organizational Characteristics Profile*. These parameters included the type of software companies, numbers of employees, annual sales, and product/service life cycle. Because the target population for this study focused on U.S software companies, type of software companies was modified and categorized as "software publishers", "computer systems design and related services", and "internet

services". Number of employees and annual sales in dollars were reported in numbers (fill-in-the-blank). Primary product/service life cycle contained four response categories; "introductory", "growing", "mature", and "declining".

Part 3: Knowledge Management Strategy

Description

Part 3 of the survey was knowledge management strategy, measured by the eight items on the *Knowledge Management Strategy Scale* developed by Choi (2002). The instrument consists of two dimensions including human orientation strategy (4 items) and system orientation strategy (4 items). A five-point semantic differential, agreement/disagreement scale was anchored with 1=strongly disagree to 5=strongly agree. A high score indicates a strong agreement on this item and a low item score indicated strong disagreement. A high dimension score represented strong agreement on this dimension and a low dimension score represented strong disagreement. In addition to receiving a score for its human orientation strategy and a score for its system orientation strategy, each company was assigned a low classification (score=4-11) or high classification (score=12-20) on human orientation strategy and system orientation strategy.

Reliability

Choi (2002) collected data using a formal survey of middle managers obtained from the Maeil Business Newspaper and assessed internal consistency as an estimate of reliability when they developed the *Knowledge Management Strategy Scale.* In this study, coefficient alpha as an estimate of internal consistency reliability was conducted for this scale. Coefficient alpha values ranged from .7902 (human orientation strategy) to .8268

(system orientation strategy), exceeding the minimum standard of .7 and thus providing good estimated reliability. Keskin (2005) identified middle managers in small-medium enterprises (SMEs) as the key sources of information and also used the *Knowledge Management Strategy Scale* to measure knowledge management strategy and obtained coefficient alpha values ranging from .75 (human orientation strategy) to .88 (system orientation strategy). In this study, coefficient alpha as an estimate of internal consistency reliability was conducted for this scale.

Validity

Factor loadings are of practical significance if they are .35 or greater (Hair et al., 1998). The factor loadings reported by Choi (2002) in the explanatory factor analysis ranged from .745 to .867 for the system orientation strategy, and from .705 to .837 for the human orientation strategy. The factor loadings reported by Keskin (2005) in the exploratory factor analysis ranged from .825 to .908 for system orientation strategy, and from .869 to .869 for the human orientation strategy. In this study, exploratory factor analysis was conducted on this scale to further establish construct validity.

Part 4: Knowledge Management Enablers

Description

Part 4 of the survey, knowledge management enablers, were measured by the *Knowledge Management Enablers Scale* developed by Lee and Choi (2003). The scale consisted of three dimensions of knowledge management enablers: technology (5 items), structure (10 items), and organizational culture (12 items). Each dimension and the total scale was measured by a five-point semantic differential, agreement/disagreement scale anchored with 1=strongly disagree to 5=strongly agree. A high score indicated a strong

agreement on this item and a low item score indicated strong disagreement. A high dimension score represented strong agreement on this dimension and a low dimension score represented strong disagreement.

Reliability

Lee and Choi (2003) established internal consistency with coefficient alpha. The coefficient alpha values of the *Knowledge Management Enablers Scale* were .8309 for technology, .8481 and 8475 for structure, and .8792 and .8932 for organizational culture, exceeding the minimum standard of .7, and thus providing good estimates of reliability. In this study, coefficient alpha as an estimate of internal consistency reliability was estimated for this scale and its dimensions.

Validity

The factor loadings reported by Lee and Choi (2003) in the explanatory factor analysis ranged from .732 to .897 for technology, from .669 to .868 for structure, and from .793 to .865 for organizational culture. In this study, exploratory factor analysis was conducted on this scale to further establish construct validity.

Part 5: Knowledge Management Process Capability

Description

Part 5 of the survey is knowledge management process capability, measured by Park's (2006) 26-item *Knowledge Management Process Capability Scale*. The Scale had four dimensions: (a) knowledge acquisition (8 items), (b) knowledge protection (5 items), (c) knowledge conversion (7 items), and (d) knowledge application (6 items). Each dimension and the total scale was measured by a five-point semantic differential agreement/disagreement scale anchored with 1=strongly disagree to 5=strongly agree. A

high score indicated a strong agreement on this item and a low item score indicated strong disagreement. A high dimension score represented strong agreement on this dimension and a low dimension score represented strong disagreement.

Reliability

Park (2006) selected the samples by using the lists of Korean knowledge management experts updated by Korea Trade Investment Promotion Agency (KOTRA). The researcher used coefficient alpha to examine the internal reliability of the *Knowledge Management Process Capability Scale*. The coefficient alpha values in *Knowledge Management Process Capability Scale* were .9356 for knowledge acquisition, .9428 for knowledge conversion, .8368 for knowledge protection, and .9444 for knowledge application, exceeding the minimum standard of .7, and thus providing good estimates of reliability. In this study, coefficient alpha as an estimate of internal consistency reliability was estimated for this scale and its dimensions.

Validity

The factor loadings reported by Park (2006) in the exploratory factor analysis ranged from .753 to .869 for knowledge acquisition, from .823 to .888 for knowledge conversion, from .850 to .914 for knowledge protection, and .625 to .851 for knowledge application. In this study, exploratory factor analysis will be conducted on this scale to further establish construct validity.

Part 6: Knowledge Management Performance

Description

Part 6 of the survey was knowledge management performance, which was measured by a benchmarking approach from the 5-items *Knowledge Management*

Performance Scale developed by Choi (2002). All items were measured by a five-point semantic differential, agreement/disagreement scale anchored with 1=strongly disagree to 5=strongly agree. A high score indicated a strong agreement on this item and a low item score indicated strong disagreement. A high dimension score represented strong agreement on this dimension and a low dimension score represented strong disagreement.

Reliability

Choi (2002) collected data using a formal survey of middle managers obtained from the Maeil Business Newspaper. In Choi's (2002) study, Coefficient alpha was used to examine the reliability of the knowledge management performance instrument. The coefficient alpha value in *Knowledge Management Performance Scale* was .8661, exceeding the minimum standard of .7, and thus providing good estimates of reliability. Al-Hawari (2004) conducted an empirical study of managers in Australia in different industries. The researcher used the *Knowledge Management Performance Scale* to measure knowledge management performance and coefficient alpha value was .8199. In this study, coefficient alpha as an estimate of internal consistency reliability was estimated for this scale and its dimensions.

Validity

For validity, items that have correlation scores lower than .4 were dropped. The factor loadings reported by Choi (2002) in the explanatory factor analysis ranged from .709 to .870. It was concluded that the 5-item scale measuring knowledge management performance is appropriate. In this study, exploratory factor analysis will be conducted on this scale to further establish construct validity. The factor loadings reported by Al-Hawari (2004) in the exploratory factor analysis ranged from .608 to .903.

In this study, exploratory factor analysis was conducted on this scale to further establish construct validity.

Procedures: Ethical Considerations and Data Collection Methods

1. Obtained permission via electronic mail to use scales adopted in this study (see Appendix E) is the first required action before collecting data.
2. Created an online survey and posted it on a web site. The web site contained consent information, purpose, procedure, possible risk, possible benefits, assurance of anonymity, access to consent from, instructions, and survey instrument. The web site was not accessible until the study was approved by the Institutional Review Board (IRB). The date of accessibility was November 21, 2006.
3. Submitted an application to the IRB and upon approval of IRB, the data collection process will be initiated.
4. Six thousand executives' names and their e-mail addresses were randomly obtained from the Lead411 directory.
5. The start date (November 21, 2006) was the date after this study is approved by the IRB and the completion date (December 21, 2006) was one month after the date for starting data collection.
6. An e-mail invitation was sent to selected executives with a consent form and the link of the online survey. The following process was used to send an e-mail to the selected sample.
    a. The invitation e-mail was sent by using the Blind Carbon Copy (Bcc) feature. When an e-mail is sent by Bcc, the recipients were unable to know who else has received the message.

b. The e-mail was sent in a plain text format, not as an e-mail attachment, to prevent recipients' mail servers from affecting any viruses or blocking e-mails.

c. If the subject agreed to participate in the online survey, the subject clicked the link of the online survey provided in the e-mail and then clicked the "Yes, I agree to participate in this study" option to start filling in the online survey in the online survey in the consent form page.

d. The online survey page showed up only if the respondent clicked the "Yes, I agree to participate in this study" option on the consent form page. The estimated time needed for participants to complete the online survey was approximately 10 minutes.

e. Participation in this study was voluntary and there were no personal identifiers of participants. The researcher did not know who completed the survey. The respondents submitted the survey by clicking a "submit" button after completing the survey.

7. The online questionnaires were removed at 11: 59 p.m. Eastern time on the last day of data collection. Upon completion of data collection, the principal investigator submitted the IRB Report of Termination of Project, Form 8.
8. Data were analyzed using SPSS for Windows version 14.0.
9. The data and electronic file were kept confidential, stored electronically on a password protected computer.
10. The data will be destroyed after five years.

Methods of Data Analysis

The data collected from the mail survey was analyzed using the statistical software of SPSS 14.0. The methods of data analysis used to answer the research questions and test hypotheses included descriptive statistics, multiple regression, moderated multiple regression, and two-way ANOVA.

Coefficient Alpha and Exploratory Factor Analysis

In this study, the researcher provided estimates of internal consistency with coefficient alpha. All coefficient alpha values need to exceed the minimum standard of .7 level to provide good estimates and retain the items (Nunnally & Bernstein, 1994). Construct validity for this study was established through exploratory factor analysis that reduced data dimensionality and created appropriate dimensions for the hypothesized model. In general, factor loadings greater than .35 were considered to be of practical significance (Hair et al., 1998).

Descriptive Statistics: Questions Q1-Q2

For Research Question 1, descriptive statistics described the organizational characteristics: (a) type of software companies, (b) number of employees, (c) annual sales in dollars, and (d) product/service life cycle. For Research Question 2, descriptive statistics were used to explain the knowledge management strategies, knowledge management enablers, knowledge management process capabilities, and knowledge management performance of U.S. software industry used in the study. Descriptive statistics included measures of central tendency, variability, and frequency distributions.

Multiple Regression: Hypotheses H1-H10

Multiple regression analysis is a multivariate statistical technique used to examine the relationship between an outcome variable and several predictors (George & Mallery, 2003). Multiple regression analysis examines the relationships among variables, and the extent to which they are linked and explain the dependent variable (Gay, 1996). For Hypothesis H1, the independent variable is knowledge management strategies (human orientation and system orientation) and the dependent variable is knowledge management performance. For Hypothesis H2, the independent variable is knowledge management enablers (technology, structure, and organizational culture) and the dependent variable is knowledge management performance. For Hypothesis H3, the independent variable is knowledge management process capability (knowledge acquisition, knowledge protection, knowledge conversion and knowledge application) and the dependent variable is knowledge management performance. For Hypothesis H4, the independent variable is knowledge management enablers (technology, structure, and organizational culture) and the dependent variable is the total score for knowledge management process capability. For Hypothesis H5, the independent variable is knowledge management strategy (human orientation and system orientation) and the dependent variable is the total score for knowledge management enablers. For Hypothesis H6, the independent variable is knowledge management strategy (human orientation and system orientation) and the dependent variable is the total score for knowledge management process capability. For Hypothesis H7, the independent variable is organizational characteristics (type of software company, number of employees, annual sales in dollars, and product/service life cycle), and the dependent variable was the total score for knowledge management

strategy. For Hypothesis H8, the independent variable is organizational characteristics (type of software company, number of employees, annual sales in dollars, and product/service life cycle), and the dependent variable is the total score for knowledge management enablers. For Hypothesis H9, the independent variable is organizational characteristics (type of software company, number of employees, annual sales in dollars, and product/service life cycle), and the dependent variable is the total score for knowledge management process capability. For Hypothesis H10, the independent variable is organizational characteristics (type of software company, number of employees, annual sales in dollars, and product/service life cycle), and the dependent variable is the total score for knowledge management performance. Multiple regression analysis was used to test Hypotheses H1-H10. When the adjusted R-square value, the F statistic, t-statistics, and its significance level are known, the researcher can interpret the result.

Moderated Multiple Regression: Hypothesis H11

Mediation, or an indirect effect, is said to occur when the causal effect of an independent variable on a dependent variable is transmitted by a mediator (Preacher, Rucker, & Hayes, 2006). For Hypothesis H11, there were three independent variables: knowledge management enablers (technology, structure, and organizational culture), knowledge management strategy (human orientation and system orientation), and organizational characteristics (type of software company, number of employees, annual sales in dollars, and product life cycle). The moderator variable was knowledge process capability and the dependent variable was knowledge management performance. To test Hypothesis H11, a moderated multiple regression analysis was used. The researcher used

a Sobel test to determine whether a mediator variable influenced the effect of the independent variable on the dependent variable.

Two-way ANOVA: Hypothesis H12

Hypothesis H12 tested the effects of the degree of balance between human and system orientation strategies on knowledge management performance in the U.S. software industry with three sub hypotheses. According to the score of human orientation strategy and system orientation strategy (low level: score=4-11; high level: score=12-20), there were four classification of balance between human orientation (HO) and system (SO): Low SO/Low HO, Low SO/High HO, High SO/Low HO, and High SO/High HO. For Hypothesis H12, the independent variables were high and low levels of human orientation strategy and system orientation strategy, and the dependent variable was knowledge management performance. Two-way ANOVA was used to test Hypothesis H12. ANOVA attempts to find significant differences between groups by comparing the means of those groups on variables of interest (George & Mallery, 2003). The researchers computed F values and associated significance values. These values indicated if there were significant main effects on the dependent variable of knowledge management performance due to each independent variable (H_{12a} and H_{12b}), and if there were significant interactions between the independent variables of high and low levels of human orientation strategy and system orientation strategy and the dependent variable of knowledge management performance (H_{12c}).

Evaluation of Research Methods

This study was examined for internal validity and external validity by examining the strengths and weakness of research methods. Internal validity refers to the degree of

confidence in establishing a cause-and-effect relationship between the independent and dependent variables, and external validity of research refers to the ability to generalize findings from the study to other persons, settings, and times (Cavana, Delahaye, & Sekaran, 2001). The strengths and weaknesses of the research methods follow.

Internal Validity

Strengths

1. A quantitative and correlational (explanatory) research design strengthens the internal validity and was stronger than a descriptive or qualitative method in causal inference.
2. The instruments selected have evidence of good estimates of reliability and established validity, contributing to the internal validity for this study.
3. For data analysis, the statistical procedures used in this study are appropriate to answer the research questions and test the hypotheses, and further strengthen the internal validity of the study findings.
4. Sample size was large enough to conduct the statistical analysis.

Weaknesses

1. A non-experimental research design was a weakness in comparison to using an experimental design in drawing causal inferences.

External Validity

Strengths

1. The survey was completed within their respective firm settings, not a lab setting.

2. Using a simple random sampling technique in this study was appropriate because it has the least bias and offers the most generalizability (Cavana, Delahaye, & Sekaran, 2001).

Weaknesses

1. A single executive was the only respondent in each software firm and she or he might not be representative of the entire firms.
2. The survey questionnaire contained over 70 items, which may have reduced the return rate.
3. The final data-producing sample of the target population was self-selected, which had potential bias.

Chapter III presented the research methodology that posed the research questions and stated the hypotheses about the relationships among knowledge management strategy, knowledge management enablers, knowledge management process capability, knowledge management performance, and organizational characteristics. This chapter described the research design, the sampling plan, instrumentation, ethical consideration, data collection procedures, methods of data analysis, and evaluation of the research methods. Chapter IV presents the results of this study.

CHAPTER IV

RESULTS

Chapter IV presents the results of the study on the relationships among knowledge management strategy, knowledge management enablers, knowledge management process capability, knowledge management performance, and organizational characteristics in U.S software companies. The data collected from the online survey were analyzed using the statistical software of SPSS 14.0. Descriptive and inferential statistics were used as methods of data analyses to answer the research questions and hypotheses testing. The reliability and validity of the measurement scales were also examined and reported.

Final Data-Producing Sample

Six thousand invitation e-mails were sent to selected executives and 258 responses were received (4.3% response rate). Among the 258 respondents who participated in the online survey, 22 respondents had not been employed at their companies for the past six months, did not understand the knowledge management process in their companies, or did not clearly understand the dynamics of their companies and their key competitors. An additional 24 respondents did not finish the online survey. This resulted in a total of 212 valid responses used in the data analysis procedures. Table 4-1 presents the frequency and percentage of valid and invalid responses.

Table 4-1

Summary of Responses to the Online Survey

Responses	Frequency	Percentage
Valid	212	82.2%
Invalid		
Answered "no" to any of the screening questions	22	8.5%
Incomplete responses	24	9.3%
Total	258	100.0%

Validity and Reliability of Measurement Scales

Exploratory Factor Analysis and Internal Consistency Reliability Analysis of the Knowledge Management Strategy Scale

Principal components analyses using varimax rotation were conducted to establish construct validity of the *Knowledge Management Strategy Scale*. The number of factors actually extracted was determined by the number of items with eigenvalues greater than 1. For missing values, cases were excluded listwise. In this study, eigenvalues indicated two factors, explaining 38.98% of the total variance, while the scree plot depicted two factors. Both system orientation strategy and human orientation strategy had four items that loaded onto the same factor as expected.

The factor loadings in the exploratory factor analysis ranged from .728 to .919 for system orientation strategy, and from .620 to .897 for human orientation strategy. Because each factor loading on system orientation strategy and human orientation strategy were greater than .4 (Hair et al., 1998), the two-factor structure of the *Knowledge Management Strategy Scale* was established, providing evidence of construct validity.

Table 4-2 presents the factors, factor names, and factor loadings of the *Knowledge Management Strategy Scale*. The highest loading for each item is shown.

Table 4-2

Factor Item Loadings for the Knowledge Management Strategy Scale

Item#	Knowledge Management Strategy Scale	Loading for Factor 1	Loading for Factor 2
Factor 1: System Orientation Strategy (4 items)			
2	In our company, knowledge can be acquired easily through formal documents and manuals.	**.919**	-.006
3	In our company, results of projects and meetings are documented.	**.881**	.001
4	In our company, knowledge is shared in codified forms like manuals or documents.	**.764**	.068
1	In our company, knowledge like know-how, technical skill, or problem solving methods is well codified.	**.728**	.307
Factor 2: Human Orientation Strategy (4 items)			
6	In our company, it is easy to get face-to-face advice from experts.	-.029	**.897**
8	In our company, knowledge is acquired by one-to-one mentoring.	.048	**.795**
5	In our company, knowledge can be easily acquired from experts and co-workers.	.122	**.779**
7	In our company, informal conversations and meetings are used for knowledge sharing.	.125	**.620**

The internal consistency reliability of the *Knowledge Management Strategy Scale* was calculated by Cronbach's coefficient alpha. The coefficient alpha values exceeded the minimum standard of .7 (Nunnally & Bernstein, 1994), providing good estimates of internal consistency reliability. As shown in Table 4-3, the calculated Cronbach's alpha was .788 for system orientation strategy, and .848 for human orientation strategy. The two factors of system orientation strategy and human orientation strategy obtained an acceptable level of a coefficient alpha above .7, indicating that the 8-indicator *Knowledge Management Strategy Scale* was reliable.

Table 4-3

Cronbach's Alphas for the Factors of the Knowledge Management Strategy Scale

Factor	Number of Items	Cronbach's Alphas
1. System Orientation Strategy	4	.788
2. Human Orientation Strategy	4	.848

Table 4-4 presents item-total correlations and alpha if the item was deleted.

Table 4-4

Corrected Item-total Correlations for the Knowledge Management Strategy Scale

Item#	Knowledge Management Strategy Scale	Corrected Item-Total Correlation	Alpha if Item Deleted
Factor 1: System Orientation Strategy			
1	In our company, knowledge like know-how, technical skill, or problem solving methods is well codified.	.615	.726
2	In our company, knowledge can be acquired easily through formal documents and manuals.	.724	.666
3	In our company, results of projects and meetings are documented.	.452	.803
4	In our company, knowledge is shared in codified forms like manuals or documents.	.601	.733
Factor 2: Human Orientation Strategy			
5	In our company, knowledge can be easily acquired from experts and co-workers.	.609	.840
6	In our company, it is easy to get face-to-face advice from experts.	.816	.745
7	In our company, informal conversations and meetings are used for knowledge sharing.	.750	.784
8	In our company, knowledge is acquired by one-to-one mentoring.	.592	.844

Exploratory Factor Analysis and Internal Consistency Reliability Analysis of the Knowledge Management Enablers Scale

Principal components analyses using varimax rotation were conducted to test the emergence of three factors. The number of factors actually extracted was determined by

the number of items with eigenvalues greater than 1. For missing values, cases were excluded listwise. Factor loadings less than .4 were suppressed. The original *Knowledge Management Enablers Scale* had three dimensions, "technology", "structure", and "organizational culture". Eigenvalues indicated five factors (compared with the three currently identified), explained 40.39% of the total variance, while the scree plot depicted three factors.

The original Factor I, "technology", consisted of five items, and had a Cronbach's alpha of .758. The new Factor I retained four of the original five items, and item 4 "our company provides information technology support for simulation and prediction" was removed. When item 4 was removed, the Cronbach's alpha was .822. Factor loadings for the four items ranged from .691 to .715.

Factor II's remaining items loaded as two separate factors, named by the researcher. The first new factor contained five items: (a) item 6 "our employees can take action without a supervisor"; (b) item 7 "our employees are encouraged to make their own decisions"; (c) item 8 "our employees do not need to refer to someone else to make decisions"; (d) item 9 "our employees do not need to ask their supervisor before taking action"; and (e) item 10 "our employees can make decisions without approval". Factor loadings for the five items ranged from .620 to .781. All five items appeared to assess respondents' perception of authority to make a decision within an organization, and were named "decentralization" by the researcher. The second new factor consisted of five items: (a) item 11 "in our company, there are many activities that are covered by formal procedures"; (b) item 12 "in our company, contact with our company is on a formal or planned basis"; (c) item 13 "in our company, rules and procedures are typically written";

(d) item 14 "in our company, employees cannot ignore the rules and reach informal agreements to handle some situations"; and (e) item 15 "in our company, employees cannot make their own rules on the job". All five items appeared to assess respondents' perception of written documentation, rules, and procedures in the organization, and were named "formalization". Factor loadings for the five items ranged from .810 to .979.

The original Factor III, "organizational culture" consisted of 12 items, and had a Cronbach's alpha of .922. The new Factor retained 11 of the original 12 items, and removed the item 27 "our company has a standardized reward system for sharing knowledge". When item 27 was removed, the Cronbach's alpha for the new Factor III increased to .952. Factor loadings for the 11 items ranged from .649 to .877.

Factor V consisted of two items, from item 4 of the original Factor I "our company provides information technology support for simulation and prediction" and item 27 of original Factor III "our company has a standardized reward system for sharing knowledge". Factor loadings for the two items ranged from .598 for item 4 to .709 for item 27. However, Factor V was dropped because items 4 and 27 are different types of knowledge management enablers.

The present output yields a fairly interpretable pattern of four types of knowledge management enablers: technology, decentralization, formalization, and organizational culture. Table 4-5 shows factor item loadings for the modified *Knowledge Management Enablers Scale*. The highest loading for each item in the factor is displayed in rank order from high to low. Table 4-6 shows the calculated Cronbach's alphas for the new factors of the *Knowledge Management Enablers Scale*.

Table 4-5

Factor Item Loadings for the Modified Knowledge Management Enablers Scale

Item#	Modified Knowledge Management Enablers Scale	Loading for Factor 1	Loading for Factor 2	Loading for Factor 3	Loading for Factor 4	Loading for Factor 5
Factor 1: Technology (4 items)						
1	Our company provides information technology support for collaborative work regardless of time and place.	**.715**	.141	.267	.248	.230
3	Our company provides information technology support for searching for and accessing necessary information.	**.698**	.351	.061	.099	.328
5	Our company provides information technology support for systematic storing.	**.694**	-.065	.296	.077	-.059
2	Our company provides information technology support for communication among organization employees.	**.691**	.314	.156	.338	.160
Factor 2: Decentralization (5 items)						
10	Our employees can make decisions without approval.	.060	**.781**	.003	.296	-.219
6	Our employees can take action without a supervisor.	.235	**.763**	.022	.320	-.095
9	Our employees do not need to ask their supervisor before taking action.	.135	**.735**	.086	.439	-.016
7	Our employees are encouraged to make their own decisions.	.075	**.651**	.007	.600	.062
8	Our employees do not need to refer to someone else to make decisions.	.215	**620**	-.032	.527	.022
Factor 3: Formalization (5 items)						
11	In our company, there are many activities that are covered by formal procedures.	.087	-.021	**.979**	-.031	.100
15	In our company, employees cannot make their own rules on the job.	.061	.045	**.945**	-.066	.118

Table 4-5 (Continued)

Item#	Modified Knowledge Management Enablers Scale	Loading for Factor 1	Loading for Factor 2	Loading for Factor 3	Loading for Factor 4	Loading for Factor 5
14	In our company, employees cannot ignore the rules and reach informal agreements to handle some situations.	.193	-043	**.914**	.024	.021
12	In our company, contact with our company is on a formal or planned basis.	.140	-.058	**.879**	0.43	.129
13	In our company, rules and procedures are typically written.	.139	.140	**.810**	-.029	.081
Factor 4: Organizational Culture (11 items)						
22	Our employees have reciprocal faith in other members' intentions and behaviors.	.075	.246	.094	**.877**	.078
23	Our employees have reciprocal faith in each other's ability.	-.106	.062	-.076	**.852**	.099
17	Our employees are supportive.	.244	.201	-.071	**.837**	-.243
18	Our employees are helpful.	.292	.185	-.023	**.833**	-.247
16	Our employees are satisfied with the amount of collaboration.	.217	.172	-.074	**.833**	-.233
21	Our employees are generally trustworthy.	.243	.326	-.089	**.755**	-.206
24	Our employees have reciprocal faith in others' commitment to organizational goals.	.177	.433	.008	**.745**	.254
25	Our employees have reciprocal faith in others' commitment to the company as a whole.	.211	.354	.002	**.715**	.329
19	There is a willingness to collaborate across organizational units within our company.	.244	.147	.076	**.709**	-.099
20	There is a willingness within our company to accept responsibility for failure.	-.106	.307	.071	**.704**	.045
26	Our employees have relationships based on reciprocal faith.	-.087	.480	-.035	**.649**	.269

Table 4-5 (Continued)

Item#	Modified Knowledge Management Enablers Scale	Loading for Factor 1	Loading for Factor 2	Loading for Factor 3	Loading for Factor 4	Loading for Factor 5
Factor 5 (2 items) -dropped						
4	our company provides information technology support for simulation and prediction	.116	.314	.259	-.071	**.709**
27	Our company has a standardized reward system for sharing knowledge.	.248	.030	.123	-.040	**.598**

Table 4-6

Cronbach's Alphas for the New Factors of the Modified Knowledge Management Enablers Scale

Factor	Number of Items	Cronbach's Alphas
1. Technology		
With Item 4	5	.758
Without Item 4	4	.822
2. Decentralization	5	.912
3. Formalization	5	.954
4. Organizational Culture		
With Item 27	12	.922
Without Item 27	11	.952

The reliability of the modified *Knowledge Management Enablers Scale* was expressed by Cronbach's coefficient alpha. The coefficient alpha values exceeded the minimum standard of .7 (Nunnally & Bernstein, 1994), providing good estimates of internal consistency reliability. As shown in Table 4-6, coefficient alpha values were .822 for technology, .912 for decentralization, .954 for formalization, and .952 for organizational culture. All factors reached an acceptable level of a coefficient alpha above .7, indicating that the modified 25-indicator *Knowledge Management Enablers Scale* was reliable. Table 4-7 shows item-total correlations and alpha if the item was deleted.

Table 4-7

Corrected Item-total Correlations for the Modified Knowledge Management Enablers Scale

Item#	Modified Knowledge Management Enablers Scale	Corrected Item-Total Correlation	Alpha if Item Deleted
Factor 1: Technology			
1	Our company provides information technology support for collaborative work regardless of time and place.	.704	.748
2	Our company provides information technology support for communication among organization employees.	.763	.722
3	Our company provides information technology support for searching for and accessing necessary information.	.671	.767
5	Our company provides information technology support for systematic storing.	.473	.854
Factor 2: Decentralization			
6	Our employees can take action without a supervisor.	.776	.893
7	Our employees are encouraged to make their own decisions.	.799	.888
8	Our employees do not need to refer to someone else to make decisions.	.777	.893
9	Our employees do not need to ask their supervisor before taking action.	.804	.887
10	Our employees can make decisions without approval.	.732	.902
Factor 3: Formalization			
11	In our company, there are many activities that are covered by formal procedures.	.975	.926
12	In our company, contact with our company is on a formal or planned basis.	.840	.949
13	In our company, rules and procedures are typically written.	.755	.963
14	In our company, employees cannot ignore the rules and reach informal agreements to handle some situations.	.876	.943
15	In our company, employees cannot make their own rules on the job.	.923	.935
Factor 4: Organizational Culture			
16	Our employees are satisfied with the amount of collaboration.	.829	.946
17	Our employees are supportive.	.850	.945
18	Our employees are helpful.	.850	.945

Table 4-7 (Continued)

Item#	Modified Knowledge Management Enablers Scale	Corrected Item-Total Correlation	Alpha if Item Deleted
19	There is a willingness to collaborate across organizational units within our company.	.696	.951
20	There is a willingness within our company to accept responsibility for failure.	.695	.952
21	Our employees are generally trustworthy.	.820	.947
22	Our employees have reciprocal faith in other members' intentions and behaviors.	.876	.944
23	Our employees have reciprocal faith in each other's ability.	.746	.949
24	Our employees have reciprocal faith in others' commitment to organizational goals.	.832	.946
25	Our employees have reciprocal faith in others' commitment to the company as a whole.	.779	.948
26	Our employees have relationships based on reciprocal faith.	.703	.950

Exploratory Factor Analysis and Internal Consistency Reliability Analysis of the Knowledge Management Process Capability Scale

Principal components analyses using varimax rotation were used to establish construct validity of the *Knowledge Management Process Capability Scale*. The number of factors actually extracted was determined by the number of items with eigenvalues greater than 1. For missing values, cases were excluded listwise. Factor loadings less than .4 were suppressed and all items loaded onto a factor at .4 or greater. The original *Knowledge Management Process Capability Scale* had four dimensions, "knowledge acquisition", "knowledge protection", "knowledge conversion", and "knowledge application". Eigenvalues indicated six factors (compared with the four currently identified), explained 52.65% of the total variance, while the scree plot depicted four factors.

Knowledge protection had five items that loaded onto the same factor as expected. Factor loadings for the five items ranged from .594 to .862. The original knowledge conversion factor contained six items, and had a Cronbach's alpha of .929. The new knowledge conversion factor removed item 20 "our company has processes for replacing outdated knowledge with new knowledge", and had a Cronbach's alpha of .934. Factors loadings for the six items ranged from .600 to .810.

The original Factor I, "knowledge acquisition", consisted of eight items. The new Factor I removed item 2 "our company has process for using feedback from past experience to improve future projects" and loaded as three separate factors, named by the researcher. The first factor contained two items: (a) item 1 "our company has internal processes for generating new knowledge from existing knowledge"; and (b) item 3 "our company has processes for distributing knowledge throughout the organization". Factor loadings for the two items ranged from .819 to .821. Both items appeared to assess respondents' perception of acquiring knowledge within an organization, and were named "internal knowledge acquisition". The second factor consisted of three items: (a) item 4 "our company has processes for exchanging knowledge with external partners"; (b) item 5 "our company has processes for acquiring knowledge about new products and services within our industry"; and (c) item 6 "our company has processes for acquiring knowledge about competitors within our industry". Factor loadings for the three items ranged from .704 to .878. All three items appeared to assess respondents' perception of acquiring knowledge from external sources, and were named "external knowledge acquisition". The third factor has three items: (a) item 7 "our company has processes for benchmarking performance among employees and departments"; (b) item 8 "our company has processes

for identifying and upgrading best practices"; and (c) item 20 "our company has processes for replacing outdated knowledge with new knowledge". Factor loadings for the three items ranged from .597 to .867. Both items appeared to assess respondents' perception of knowledge improvement within an organization, and were named "knowledge upgrade".

An additional item, item 2 "our company has processes for using feedback from past experience to improve future projects" loaded on to a 6-item knowledge application factor. Item 2 would cause the new knowledge application factor Cronbach's alpha to increase from .931 to .941. Factor loadings for the seven items ranged from .604 to .786. Table 4-8 shows factor item loadings of the total sample for the modified *Knowledge Management Process Capability Scale.*

Table 4-8

Factor Item Loadings for the Modified Knowledge Management Process Capability Scale

Item#	Modified Knowledge Management Process Capability Scale	Loading for Factor 1	Loading for Factor 2	Loading for Factor 3	Loading for Factor 4	Loading for Factor 5	Loading for Factor 6
Factor 1: Internal Knowledge Acquisition (2 items)							
3	Our company has processes for distributing knowledge throughout the organization.	**.821**	.152	.170	.171	.194	.307
1	Our company has internal processes for generating new knowledge from existing knowledge.	**.819**	.059	.106	.147	.384	.218
Factor 2: External Knowledge Acquisition (3 items)							
6	Our company has processes for acquiring knowledge about competitors within our industry.	-.100	**.878**	.140	.228	.153	.157
5	Our company has processes for acquiring knowledge about new products and services within our industry.	.114	**.870**	.156	.168	.223	.098
4	Our company has processes for exchanging knowledge with external partners.	.425	**.704**	.072	.189	.203	.228
Factor 3: Knowledge Upgrade (3 items)							
8	Our company has processes for identifying and upgrading best practices.	.124	.103	**.867**	.199	.215	.291
7	Our company has processes for benchmarking performance among employees and departments.	.105	.199	**.853**	.169	.264	.285
20	Our company has processes for replacing outdated knowledge with new knowledge.	.224	.225	**.597**	.061	.391	.452

Table 4-8 (Continued)

Item#	Modified Knowledge Management Process Capability Scale	Loading for Factor 1	Loading for Factor 2	Loading for Factor 3	Loading for Factor 4	Loading for Factor 5	Loading for Factor 6
Factor 4: Knowledge Protection (5 items)							
10	Our company has technology such as a password system, to restrict access to particular sources of knowledge.	-.047	.060	.060	**.862**	.086	.255
13	Our company clearly communicates the importance of having knowledge protection on a corporate level.	.252	.275	.248	**.758**	.166	.012
9	Our company has processes to protect knowledge from inappropriate use or from being leaked in and outside the organization.	.222	.330	.266	**.689**	.027	.220
12	Our company has processes to identify restricted knowledge.	.172	.072	.172	**.616**	.497	.225
11	Our company has processes to protect knowledge from inappropriate use or from being leaked in and outside the organization.	.045	.130	-.032	**.594**	.362	.316
Factor 5: Knowledge Conversion (6 items)							
15	Our company has processes for filtering and evaluating knowledge.	.142	.262	.257	.215	**.810**	.229
19	Our company has processes for integrating different sources and types of knowledge.	.180	.042	3.94	.291	**.740**	.190
17	Our company has processes for absorbing individual knowledge into organizational knowledge.	.341	.131	.149	.051	**.739**	.353
18	Our company has processes for absorbing knowledge from partners into organizational knowledge.	.255	.204	.135	.326	**.639**	.257
16	Our company has processes for transferring organizational knowledge into individual knowledge.	.277	.478	.085	.018	**.630**	.229

Table 4-8 (Continued)

Item#	Modified Knowledge Management Process Capability Scale	Loading for Factor 1	Loading for Factor 2	Loading for Factor 3	Loading for Factor 4	Loading for Factor 5	Loading for Factor 6
14	Our company has processes for converting competitive intelligence into action plans.	-.037	.319	.267	.187	**.600**	.376
Factor 6 Knowledge Application (7 items)							
24	Our company has processes for applying stored knowledge to improve efficiency.	.302	.037	.260	.107	.107	**.786**
22	Our company has processes for using knowledge to solve new problems.	.038	.222	.128	.305	.305	**.758**
25	Our company has processes for using knowledge to adjust strategic directions.	.172	.193	.171	.253	.253	**.757**
23	Our company has processes for matching sources of knowledge to problems and challenges.	.316	.121	.123	.021	.021	**.717**
26	Our company has processes for quickly linking sources of knowledge (holder and type) available for solving problems.	.167	.096	.213	.254	.254	**.682**
2	Our company has processes for using feedback from past experience to improve future projects.	.089	.143	.414	.333	.333	**.650**
21	Our company has processes for learning from past mistakes.	.026	.168	.415	.326	.326	**.604**

The calculated Cronbach's alphas for the new factors of the modified *Knowledge Process Capability Scale* are presented in Table 4-9.

Table 4-9

Cronbach's Alphas for the New Factors of the Modified Knowledge Management Process Capability Scale

Factor	Number of Items	Cronbach's Alphas
1. Internal Knowledge Acquisition	2	.922
2. External Knowledge Acquisition	3	.889
3. Knowledge Upgrade	3	.939
4. Knowledge Protection	5	.876
5. Knowledge Conversion		
With Item 20	7	.929
Without Item 20	6	.934
6. Knowledge Application	7	
With Item 2	7	.941
Without Item 2	6	.931

In this study, coefficient alpha was used as an estimate of internal consistency reliability for the modified *Knowledge Management Process Capability Scale.* As presented in Table 4-9, coefficient alpha values were .922 for internal knowledge acquisition, .889 for external knowledge acquisition, .939 for knowledge upgrade, .876 for knowledge protection, .934 for knowledge conversion, and .941 for knowledge application. All factors obtained an acceptable level of a coefficient alpha above .7, indicating that the 26-indicator modified *Knowledge Management Process Capability Scale* was reliable. Table 4-10 presents item-total correlations and alpha if the item was deleted.

Table 4-10

Corrected Item-total Correlations for the Modified Knowledge Management Process Capability Scale

Item#	Knowledge Management Process Capability Scale	Corrected Item-Total Correlation	Alpha if Item Deleted
Factor 1: Internal Knowledge Acquisition			
1	Our company has internal processes for generating new knowledge from existing knowledge.	.861	N/A
3	Our company has processes for distributing knowledge throughout the organization.	.861	N/A
Factor 2: External Knowledge Acquisition			
4	Our company has processes for exchanging knowledge with external partners.	.826	.808
5	Our company has processes for acquiring knowledge about new products and services within our industry.	.848	.782
6	Our company has processes for acquiring knowledge about competitors within our industry.	.686	.923
Factor 3: Knowledge Upgrade			
7	Our company has processes for benchmarking performance among employees and departments.	.943	.856
8	Our company has processes for identifying and upgrading best practices.	.919	.876
20	Our company has processes for replacing outdated knowledge with new knowledge.	.771	.987
Factor 4: Knowledge Protection			
9	Our company has processes to protect knowledge from inappropriate use or from being leaked in and outside the organization.	.729	.844
10	Our company has technology such as a password system, to restrict access to particular sources of knowledge.	.709	.849
11	Our company has processes to protect knowledge from inappropriate use or from being leaked in and outside the organization.	.615	.870
12	Our company has processes to identify restricted knowledge.	.716	.847
13	Our company clearly communicates the importance of having knowledge protection on a corporate level.	.763	.835

Table 4-10 (Continued)

Item#	Knowledge Management Process Capability Scale	Corrected Item-Total Correlation	Alpha if Item Deleted
Factor 5: Knowledge Conversion			
14	Our company has processes for converting competitive intelligence into action plans.	.711	.926
15	Our company has processes for filtering and evaluating knowledge.	.919	.899
16	Our company has processes for transferring organizational knowledge into individual knowledge.	.770	.919
17	Our company has processes for absorbing individual knowledge into organizational knowledge.	.821	.912
18	Our company has processes for absorbing knowledge from partners into organizational knowledge.	.714	.926
19	Our company has processes for integrating different sources and types of knowledge.	.825	.912
Factor 6: Knowledge Application			
2	Our company has processes for using feedback from past experience to improve future projects.	.820	.931
21	Our company has processes for learning from past mistakes.	.792	.933
22	Our company has processes for using knowledge to solve new problems.	.833	.930
23	Our company has processes for matching sources of knowledge to problems and challenges.	.772	.935
24	Our company has processes for applying stored knowledge to improve efficiency.	.769	.935
25	Our company has processes for using knowledge to adjust strategic directions.	.804	.932
26	Our company has processes for quickly linking sources of knowledge (holder and type) available for solving problems.	.861	.927

Exploratory Factor Analysis and Internal Consistency Reliability Analysis of the Knowledge Management Performance Scale

Principal components analyses using varimax rotation were conducted in order to establish construct validity of the *Knowledge Management Performance Scale*. The number of factors actually extracted was determined by the number of items with eigenvalues greater than 1. For missing values, cases were excluded listwise. The eigenvalues indicated one underling dimension, explained 57.92% of the total variance, while the scree plot depicted one factor. As shown in Table 4-11, the factor loadings of all items were .50 or higher. Factor loadings ranged from .538 to .855 on one factor. Therefore, the 5-item *Knowledge Management Performance Scale* measure was unidimensional.

Table 4-11

Factor Item Loadings for the Knowledge Management Performance Scale

Item#	Knowledge Management Performance Scale	Loading for Factor 1
Compared with key competitors, . . .		
1	our company is more successful.	.855
3	our company is growing faster.	.842
4	our company is more profitable.	.803
2	our company has a greater market share.	.722
5	our company is more innovative.	.538

The 5-item *Knowledge Management Performance Scale* had a coefficient alpha of .810 exceeding the minimum standard of .7, indicating this scale was reliable. Corrected item-total correlations for the *Knowledge Management Performance Scale* ranged from .380 to .727. Although a corrected item-total correlation value of .40 or

greater is generally acceptable (Gliem & Gliem, 2003), according to Nunnally (1970), a value above .20 may also be acceptable. Corrected item-total correlations for the *Knowledge Management Performance Scale* are shown in Table 4-12.

Table 4-12

Corrected Item-total Correlations for the Knowledge Management Performance Scale

Item#	Knowledge Management Performance Scale	Corrected Item-Total Correlation	Alpha if Item Deleted
Compared with key competitors, . . .			
1	our company is more successful.	.727	.738
2	our company has a greater market share.	.548	.792
3	our company is growing faster.	.706	.738
4	our company is more profitable.	.656	.754
5	our company is more innovative.	.380	.829

Convergent Validity of the Knowledge Management Scales and Related Subscales

Convergent validity was established between the knowledge management subscales (*KMS System Orientation*, *KMS Human Orientation*, *KME Technology*, *KME Decentralization*, *KME Formalization*, *KME Organizational Culture*, *KMPC Internal Knowledge Acquisition*, *KMPC External Knowledge Acquisition*, *KMPC Knowledge Upgrade*, *KMPC Protection*, *KMPC Conversion*, *KMPC Application*, and *Knowledge Management Performance*) using Pearson *r* correlation coefficients. As shown in Table 4-13, significant relationships were found between the *KMS System Orientation* subscale and all other subscales, the *KMS Human Orientation* subscale and all other subscale (except the *KME Formalization* subscale), the *KME Technology* subscale and all other subscales, the *KME Decentralization* subscale and all other subscale (except the *KMPC Internal Knowledge Acquisition* and *KME External Knowledge Acquisition* subscales),

the KME *Formalization* subscale and all other subscales (except the *KME Organizational Culture* and *KMPC Knowledge Application* subscales), and the *KME Organizational Culture* subscale and all other subscales. There were also significant correlations between the *Knowledge Management Performance Scale* and all other subscales.

Significant correlations between subscales ranged from .139 ($p \leq .05$) to .649 ($p \leq .000$). The strongest significant relationship was between the *KMPC Protection* subscale and the *KME Technology* subscale. The weakest significant relationship was between the *KMPC Upgrade* subscale and the *KME Decentralization* subscale. Therefore, convergent validity was established for the knowledge management subscales.

Table 4-13

Pearson r Inter Correlations to Establish Convergent Validity Between the Knowledge Management Subscales

	KMS Human	KME Technology	KME Decentralization	KME Formalization	KME Culture	KMPC Internal	KMPC External	KMPC Upgrade	KMPC Protection	KMPC Conversion	KMPC Application	KM Performance
KMS System		.435***	.143*	.326***	.241***	.340***	.186**	.503***	.302***	.295***	.437***	.399***
KMS Human		.384***	.409***	-.012	.505***	.268***	.379***	.383***	.562***	.313***	.464***	.303***
KME Technology						.405***	.485***	.341***	.649***	.434***	.582***	.510***
KME Decentralization						.077	-.005	.139*	.365***	.206**	.333***	.289***
KME Formalization						.157**	.377***	242***	.351***	.208**	.082	.185**
KME Culture						.172*	.150*	.374***	.507***	.387***	.549***	.596***
KMPC Internal												.305***
KMPC External												.426***
KMPC Upgrade												.392***
KMPC Protection												.436***
KMPC Conversion												.475***
KMPC Application												.490***

*$p \leq .05$, **$p \leq .01$, *** $p \leq .001$

The correlations between the total scores of the knowledge management scales ranged from .454 to .599 (p = .000), providing support for convergent validity of the scales that measure knowledge management. Table 4-14 presents the correlation matrix between the scales totals.

Table 4-14

Pearson r Inter Correlations to Establish Convergent Validity Between the Knowledge Management Scales Totals

	Knowledge Management Enablers	Knowledge Management Process Capability	Knowledge Management Performance
Knowledge Management System Strategy	.562***	.599***	.454***
Knowledge Management Enablers		.587***	.595***
Knowledge Management Process Capability			.535***

*$p \leq .05$, **$p \leq .01$, ***$p \leq .001$

Convergent Validity and Concurrent Validity of the Organizational Characteristics Profile

The *Organizational Characteristics Profile* items included the "type of software company", "number of employees", "annual sales in dollars", and "primary product/service life cycle". A Pearson r correlation coefficient was performed to determine the relationship between "number of employees" and "annual sales in dollars", and the knowledge management scales and related subscales. Concurrent validity was established between the "type of software company" and "primary product/service life

cycle", and the knowledge management scales and related subscales using ANOVA with post hoc comparisons.

As shown in Table 4-15, significant relationships were found between the number of employees, and *KMS System Orientation* subscale, *KME Formalization* subscale, *Knowledge Management Performance Scale* and the dimensions and the total score of KMPC. The range of significant correlations was between .145 ($p \leq .05$) to .258 ($p \leq .000$). The strongest significant relationship was between the number of employees and *KMPC Conversion* subscale. The weakest significant relationship was between the number of employees and *KMPC Application* subscale. There were also significant correlations between annual sales in dollars, and *KMS System Orientation* subscale, the total score of *KMS*, *KME Formalization* and total score and the dimensions of the *KMPC*. The range of significant correlations was between .133 ($p \leq .05$) to .276 ($p \leq .000$). The strongest significant relationship was between annual sales in dollars and *KMPC Conversion* subscale. The weakest significant relationship was between annual sales in dollars and the total score of *KMS*. Therefore, convergent validity was established for the knowledge management scales and the number of employees and annual sales in dollars.

Table 4-15

Pearson r Inter Correlations to Establish Convergent Validity Among Number of Employees, Annual Sales in Dollars, and Knowledge Management Scales and Related Subscales

	Number of Employees	Annual Sales in Dollars
KMS System	.147*	.143*
KMS Human	-.057	-.021
KMS Total	.056	.133*
KME Technology	.067	.038
KME Decentralization	-.098	-.120
KME Formalization	.209**	179**
KME Culture	-.017	-.021
KME Total	.052	.032
KMPC Internal	.188**	.164*
KMPC External	.162*	.194**
KMPC Upgrade	.173*	.214**
KMPC Protection	.243**	.257***
KMPC Conversion	.258***	.276***
KMPC Application	.145*	.165*
KMPC Total	.233**	.264***
KM Performance	.191**	.200**

*$p \leq .05$, **$p \leq .01$, ***$p \leq .001$

One-way ANOVA's were performed to measure differences for the knowledge management scales and related subscales according to categorical variables with three or more response groups. Knowledge management scale responses were each compared according to two categorical variables (type of software company and primary product/service life cycle) using ANOVA ($p \leq .05$), and if there were significant F values, Tukey's post hoc comparisons were conducted. Table 4-16 presents ANOVA

comparisons for knowledge management scales and related subscales. ANOVA showed a significant F value for *KMS System Orientation* subscale ($F = 3.105$, $p = .047$), *KMS Human Orientation* subscale ($F = 4.810$, $p = .009$), total score of *KMS* ($F = 6.660$, $p = .009$), and *KMPC Application* subscale ($F = 3.583$, $p = .030$) according to type of software company. Tukey's post hoc analyses indicated that Internet services companies rated *KMS System Orientation*, *KMS Human Orientation*, total score of *KMS*, and *KMPC Application* significantly higher than software publishers.

Table 4-16

ANOVA and Post Hoc Comparisons for Knowledge Management Scales and Related Subscales According to Type of Software Company

Variable	*F*	*p*	Post Hoc Comparison Tukey
KMS System	3.105	.047	
Internet services > Publishers			.038
KMS Human	4.810	.009	
Internet services > Publishers			.006
KMS Total	6.660	.002	
Internet services > Publishers			.001
KME Technology	.276	.759[a]	
KME Decentralization	.752	.473[a]	
KME Formalization	.623	.537[a]	
KME Culture	.748	.475[a]	
KME Total	.769	.465[a]	
KMPC Internal	.220	.802[a]	
KMPC External	.252	.777[a]	
KMPC Upgrade	.913	.403[a]	
KMPC Protection	.167	.846[a]	
KMPC Conversion	.058	.944[a]	
KMPC Application	3.583	.030	
Internet services > Publishers			.029
KMPC Total	.382	.683[a]	
KM Performance	.587	557[a]	

[a] Not Significant

As shown in Table 4-17, ANOVA showed a significant F value for the *KMS System Orientation* subscale ($F = 5.829$, $p = .003$), *KME Technology* subscale ($F = 4.619$, $p = .011$), *KME Decentralization* subscale ($F = 5.069$, $p = .007$), *KMPC Internal Knowledge Acquisition* subscale ($F = 4.529$, $p = .012$), *KMPC Protection* subscale ($F = 8.254$, $p = .000$), and *Knowledge Management Performance Scale* ($F = 3.072$, $p = .048$) according to primary product/service life cycle. Tukey's post hoc analyses indicated that companies whose primary product/service life cycle was at the mature stage rated *KMS System Orientation* significantly higher than those at the growing stage. Companies at the mature stage rated *KMPC Protection* significantly higher than those at the introductory stage. Companies at the growing stage rated *KME Technology*, *KMPC Protection*, and *Knowledge Management Performance* significantly higher than those at the introductory stage. Finally, companies at the growing stage rated *KME Decentralization* and *KMPC Internal Knowledge Management Acquisition* significantly higher than those at the mature stage.

Table 4-17

ANOVA and Post Hoc Comparisons for Knowledge Management Scales and Related Subscales According to Primary Product/Service Life Cycle

Variable	*F*	*p*	Post Hoc Comparison Tukey
KMS System	5.829	.003	
Mature > Growing			.002
KMS Human	.675	.510[a]	
KMS Total	1.001	.369[a]	
KME Technology	4.619	.011	
Growing > Introductory			.008
KME Decentralization	5.069	.007	
Growing > Mature			.007
KME Formalization	.142	.868[a]	
KME Culture	.910	.404[a]	
KME Total	1.250	.289[a]	
KMPC Internal	4.529	.012	
Growing > Mature			.011
KMPC External	.434	.548[a]	
KMPC Upgrade	2.202	.113[a]	
KMPC Protection	8.254	.000	
Growing > Introductory			.001
Mature > Introductory			.000
KMPC Conversion	2.082	.127[a]	
KMPC Application	.339	.713[a]	
KMPC Total	.912	.403[a]	
KM Performance	3.072	.048	
Growing > Introductory			.046

[a] Not Significant

Research Question 1

Q1: What are the organizational characteristics (type of software company, number of employees, annual sales in dollars, and primary product/service life cycle) of U.S. software companies?

Descriptive Analysis of Organizational Characteristics

The 4-item *Organizational Characteristics Profile* provided information about the background of each sampled company. The final data-producing sample consisted of 212 executives who completed the survey. Types of software companies of these executives included 48.1% internet services, 9.9% computer systems design and related services, and 42.0% software publishers. Among the respondents' companies, the average number of total employees was 358 and ranged from 2 to 3,700. The average total annual sales in dollars was 97,579,502 and ranged from 75,000 to 1,100,000,000. Their primary product/service life cycle included 11.8% introductory stage, 65.1% growing stage, 23.1% mature stage, and 0% declining stage. Table 4-18 presents the frequency distribution of type of software company, number of employees, annual sales in dollars, and primary product/service life cycle.

Table 4-18

Organizational Characteristics of Executives by Type of Software Companies, Numbers of Employees, Annual Sales and Product/Service Life Cycle (N= 212)

Factor / Item	Frequency	Valid Percentage	Mean
Type of software company			
Internet services	102	48.1%	
Computer systems design and related services	21	9.9%	
Software publishers	89	42.0%	
Number of employees			358
Annual sales in dollars			97,579,502
Primary product/service life cycle			
Introductory	25	11.8%	
Growing	138	65.1%	
Mature	49	23.1%	
Declining	0	0.0%	

Research Question 2

Q2: What are the knowledge management strategies, knowledge management enablers, knowledge management process capabilities, and knowledge management performance of U.S. software companies?

Descriptive Analysis of Knowledge Management Strategy

The *Knowledge Management Strategy Scale* consists of eight items, developed by Choi (2002). The scale contains two dimensions including system orientation strategy (4 items) and human orientation strategy (4 items). Respondents were asked to provide answers to each item, which was measured by a five-point semantic differential scale, ranging from 1 "strongly disagree" to 5 "strongly agree". Higher mean scores indicated strong agreement on this item and lower mean scores signified strong disagreement.

The average *Knowledge Management Strategy Scale* total score was 27.69, with a possible range of 8 to 40. The average item score for the *Knowledge Management Strategy Scale* was 3.46. The dimension with the highest means score was human orientation strategy. The score of the system orientation strategy was 12.15, with a possible range of 4 to 20, and the average item score for the system orientation strategy dimension was 3.04. The score of the human orientation strategy was 15.54, with a possible range of 4 to 20, and the average item score for the human orientation strategy dimension was 3.89.

The item with the highest average score was "In our company, informal conversations and meetings are used for knowledge sharing" (M = 4.24, SD = .944). The item with the lowest average score was "In our company, results of projects and meetings are documented" (M = 2.97, SD = 1.035). Table 4-19 presents the results of an analysis of the descriptive statistics for the knowledge management strategy items.

Table 4-19

Descriptive Analysis of Knowledge Management Strategy Items (N= 212)

Factor / Item	Mean	Standard Deviation
System Orientation Strategy	3.04	
1. In our company, knowledge like know-how, technical skill, or problem solving methods is well codified.	3.16	1.115
2. In our company, knowledge can be acquired easily through formal documents and manuals.	3.00	1.112
3. In our company, results of projects and meetings are documented.	2.97	1.035
4. In our company, knowledge is shared in codified forms like manuals or documents.	3.01	1.055
System Orientation dimension score (Possible range 4-20)	12.15	
Human Orientation Strategy	3.89	
5. In our company, knowledge can be easily acquired from experts and co-workers.	3.79	1.087
6. In our company, it is easy to get face-to-face advice from experts.	3.97	1.174
7. In our company, informal conversations and meetings are used for knowledge sharing.	4.24	.944
8. In our company, knowledge is acquired by one-to-one mentoring.	3.55	1.003
Human Orientation dimension score (Possible range 4-20)	15.54	
Average item score for the Knowledge Management Strategy scale	3.46	
Total score (possible range 8-40)	27.69	

Note. Knowledge management strategy was measured by a five-point semantic differential scale, with strongly disagree (1) and strongly agree (5) as anchors.

Descriptive Analysis of Knowledge Management Enablers

The modified *Knowledge Management Enablers Scale* contains 25 items explaining three subscale dimensions: technology (4 items), decentralization (5 items), formalization (5 items) and organization culture (11 items). Respondents were asked to indicate their answers to each item measured by a five-point semantic differential scale, anchored with 1 = "strongly disagree" and 5 = "strongly agree. Higher mean scores

indicated strong agreement on this item whereas lower mean scores denoted strong disagreement.

The average modified 25-items *Knowledge Management Enablers Scale* (item 4 and item 27 were deleted from the original scale) total score was 90.29, with a possible range of 25 to 125. The average item score for the modified *Knowledge Management Enablers Scale* was 3.61. The dimension with the highest means score was organizational culture and the dimension with the lowest mean score was structure. The score of the technology dimension was 15.05, with a possible range of 4 to 20, and the average item score for the technology dimension was 3.76. The score of the decentralization dimension was 18.31, with a possible range of 5 to 25, and the average item score for the decentralization dimension was 3.67. The score of the formalization dimension was 13.15, with a possible range of 5 to 25, and the average item score for the decentralization dimension was 2.63. The score of the organizational culture dimension was 43.78, with a possible range of 11 to 55, and the average item score for the organizational culture dimension was 3.98.

The item with the highest mean score was "Our employees are generally trustworthy" (M = 4.39, SD = .683), followed by "Our employees are helpful." (M = 4.22, SD = .843). The item with the lowest average score was "In our company, rules and procedures are typically written" (M = 2.47, SD = 1.004). The results of analysis of descriptive statistics for the modified knowledge management enablers items are presented in Table 4-20.

Table 4-20

Descriptive Analysis of Modified Knowledge Management Enablers Items (N=212)

Factor / Item	Mean	Standard Deviation
Technology	3.76	
1. Our company provides information technology support for collaborative work regardless of time and place.	3.85	1.158
2. Our company provides information technology support for communication among organization employees.	4.09	1.015
3. Our company provides information technology support for searching for and accessing necessary information.	3.77	.967
5. Our company provides information technology support for systematic storing.	3.34	1.092
Technology dimension score (Possible range 4-20)	15.05	
Decentralization	3.67	
6. Our employees can take action without a supervisor.	3.92	.796
7. Our employees are encouraged to make their own decisions.	3.94	.849
8. Our employees do not need to refer to someone else to make decisions.	3.62	.734
9. Our employees do not need to ask their supervisor before taking action.	3.48	.840
10. Our employees can make decisions without approval.	3.35	.804
Decentralization dimension score (Possible range 5-25)	18.31	
Formalization	2.63	
11. In our company, there are many activities that are covered by formal procedures.	2.75	.968
12. In our company, contact with our company is on a formal or planned basis.	2.61	.979
13. In our company, rules and procedures are typically written.	2.47	1.004
14. In our company, employees cannot ignore the rules and reach informal agreements to handle some situations.	2.62	.993
15. In our company, employees cannot make their own rules on the job.	2.69	.981
Formalization dimension score (Possible range 5-25)	13.15	
Organizational Culture	3.98	
16. Our employees are satisfied with the amount of collaboration.	4.07	.843
17. Our employees are supportive.	4.12	.876
18. Our employees are helpful.	4.22	.843
19. There is a willingness to collaborate across organizational units within our company.	3.96	.923

Table 4-20 (Continued)

Factor / Item	Mean	Standard Deviation
20. There is a willingness within our company to accept responsibility for failure.	3.36	1.018
21. Our employees are generally trustworthy.	4.39	.683
22. Our employees have reciprocal faith in other members' intentions and behaviors.	3.98	.800
23. Our employees have reciprocal faith in each other's ability.	3.88	.845
24. Our employees have reciprocal faith in others' commitment to organizational goals.	3.92	.775
25. Our employees have reciprocal faith in others' commitment to the company as a whole.	3.99	.770
26. Our employees have relationships based on reciprocal faith.	3.89	.845
Organizational Culture dimension score (Possible range 11-55)	43.78	
Average item score for the Knowledge Management Enablers scale	3.61	
Total score (possible range 25-125)	90.29	

Note. Knowledge management enablers were measured by a five-point semantic differential scale, with strongly disagree (1) and strongly agree (5) as anchors.

Descriptive Analysis of Knowledge Management Process Capability

The 26-item *Knowledge Management Process Capability Scale* developed by Park (2006), consisted of four dimensions: knowledge acquisition, knowledge protection, knowledge conversion, and knowledge application. Each item had a 5-point semantic differential scale, ranging from "strongly disagree" (1) to "strongly agree" (5). Higher mean scores indicate strong agreement on this item and lower mean scores implied strong disagreement.

As shown in Table 4-21, the average modified *Knowledge Management Process Capability Scale* total score was 85.12, with a possible total score range between 26 and 130, and an average item score of 3.27. The highest rated dimension was knowledge protection and the lowest rated dimension was knowledge upgrade. For the 2-items of the

dimension of internal knowledge acquisition, the dimension score was 6.39, with a possible range of 2 to 10, and an average item score of 3.20. For the 3-items of the dimension of external knowledge acquisition, the dimension score was 10.14, with a possible range of 3 to 15, and an average item score of 3.38. For the 3-items of the dimension of knowledge upgrade, the dimension score was 8.89, with a possible range of 3 to 15, and an average item score of 2.96. For the 5-items of the dimension of knowledge protection, the dimension score was 17.94, with a possible range of 5 to 25, and an average item score of 3.59. For the 6-items of the dimension of knowledge conversion, the dimension score was 17.97, with a possible range of 7 to 35, and an average item score of 3.00. For the 7-items of the dimension of knowledge application, the dimension score was 23.80, with a possible range of 7 to 35, and an average item score of 3.40.

The item with the highest mean score was "Our company has technology such as a password system, to restrict access to particular sources of knowledge" (M = 4.22, SD = 1.049), followed by "Our company clearly communicates the importance of having knowledge protection on a corporate level" (M = 3.64, SD = 1.145). The item with the lowest average score was "Our company has processes for converting competitive intelligence into action plans" (M = 2.77, SD = 1.069).

Table 4-21

Descriptive Analysis of Modified Knowledge Management Process Capability Items (N=212)

Factor / Item	Mean	Standard Deviation
Internal Knowledge Acquisition	3.20	
1. Our company has internal processes for generating new knowledge from existing knowledge.	3.06	1.100
3. Our company has processes for distributing knowledge throughout the organization.	3.33	.981
Internal Knowledge Acquisition dimension score (Possible range 2-10)	6.39	
External Knowledge Acquisition	3.38	
4. Our company has processes for exchanging knowledge with external partners.	3.42	1.021
5. Our company has processes for acquiring knowledge about new products and services within our industry.	3.44	1.080
6. Our company has processes for acquiring knowledge about competitors within our industry.	3.27	.958
External Knowledge Acquisition dimension score (Possible range 3-15)	10.14	
Knowledge Upgrade	2.96	
7. Our company has processes for benchmarking performance among employees and departments.	2.85	.984
8. Our company has processes for identifying and upgrading best practices.	2.91	1.038
20. Our company has processes for replacing outdated knowledge with new knowledge.	3.12	.936
Knowledge Upgrade dimension score (Possible range 3-15)	8.89	.066
Knowledge Protection	3.59	
9. Our company has processes to protect knowledge from inappropriate use or from being leaked in and outside the organization.	3.37	1.211
10. Our company has technology such as a password system, to restrict access to particular sources of knowledge.	4.22	1.049
11. Our company has processes to value and protect tacit knowledge embedded in individuals.	3.19	1.136
12. Our company has processes to identify restricted knowledge.	3.52	1.222
13. Our company clearly communicates the importance of having knowledge protection on a corporate level.	3.64	1.145
Knowledge Protection dimension score (Possible range 5-25)	17.94	

Table 4-21 (Continued)

Factor / Item	Mean	Standard Deviation
Knowledge Conversion	3.00	
14. Our company has processes for converting competitive intelligence into action plans.	2.77	1.069
15. Our company has processes for filtering and evaluating knowledge.	2.97	1.075
16. Our company has processes for transferring organizational knowledge into individual knowledge.	3.11	1.051
17. Our company has processes for absorbing individual knowledge into organizational knowledge.	3.15	1.069
18. Our company has processes for absorbing knowledge from partners into organizational knowledge.	2.94	.991
19. Our company has processes for integrating different sources and types of knowledge.	3.02	1.131
Knowledge Conversion dimension score (Possible range 6-30)	17.97	
Knowledge Application	3.40	
2. Our company has processes for using feedback from past experience to improve future projects.	3.49	.971
21. Our company has processes for learning from past mistakes.	3.43	1.080
22. Our company has processes for using knowledge to solve new problems.	3.50	.971
23. Our company has processes for matching sources of knowledge to problems and challenges.	3.22	1.097
24. Our company has processes for applying stored knowledge to improve efficiency.	3.24	1.037
25. Our company has processes for using knowledge to adjust strategic directions.	3.54	1.072
26. Our company has processes for quickly linking sources of knowledge (holder and type) available for solving problems.	3.38	.983
Knowledge Application dimension score (Possible range 7-35)	23.80	
Average item score for the Knowledge Management Process Capability scale	3.27	
Total score (possible range 26-130)	85.12	

Note. Knowledge management process capability was measured by a five-point semantic differential scale, with strongly disagree (1) and strongly agree (5) as anchors.

Descriptive Analysis of Knowledge Management Performance

The *Knowledge Management Performance Scale*, developed by Choi (2002), consisted of five items, measured by a benchmarking approach. The five items were measured by a five-point semantic differential scale, ranging from 1 "strongly disagree" to 5 "strongly agree". A high mean score indicated strong agreement on this dimension and a low mean score signified strong disagreement.

The average *Knowledge Management Performance Scale* total score was 17.39, with a possible range of 5 to 25. The average item score for the *Knowledge Management Performance Scale* was 3.48. The item with the highest mean score was "Compared with key competitors, our company is more innovative" (M = 3.79, SD = .891). The item with the lowest average score was "Compared with key competitors, our company has a greater market share" (M = 3.06, SD = 1.167). Table 4-22 provides an analysis of the result of the descriptive statistics of the knowledge management performance items.

Table 4-22

Descriptive Analysis of Knowledge Management Performance Items (N=212)

Factor / Item	Mean	Standard Deviation
Knowledge Management Performance	3.48	
Compared with key competitors, …..		
1. …our company is more successful.	3.72	.920
2. …our company has a greater market share.	3.06	1.167
3. …our company is growing faster	3.64	1.064
4. …our company is more profitable.	3.19	1.094
5. …our company is more innovative.	3.79	.891
Knowledge Management Performance score (possible range 5-25)	17.39	

Note. Knowledge management performance was measured by a five-point semantic differential scale, with strongly disagree (1) and strongly agree (5) as anchors.

Research Hypothesis 1

H1: There is a significant explanatory relationship between knowledge management strategies (human orientation and system orientation) and knowledge management performance in U.S. software companies.

Multiple regression analysis was used to measure the influences of human and system orientation strategies together on knowledge management performance. As shown in Table 4-23, the F value (28.247) for the regression model analyzing the two knowledge management strategy dimensions and knowledge management performance was significant (p= .000) for an explanatory relationship. The adjusted R^2 indicated that the human and system orientation strategies as a whole explained 20.5% (.205) of the variance in knowledge management performance. To analyze the individual predictors, the t-statistic, which is the regression coefficient divided by the standard error (*SE*), was used and found to be significant for both the dimensions of system orientation strategy (t = 5.664, p = .000), and human orientation strategy (t = 3.777, p = .000). In terms of the relative importance of these predictors, based on the values of the β coefficients, the order of importance was system orientation strategy (β = .354) and human orientation strategy (β = .236). In summary, the overall model is significant in supporting hypothesis 1. Both knowledge management strategies of system orientation and human orientation were significant, positive explanatory variables of knowledge management performance.

Table 4-23

Summarized Multiple Regression Analysis for Knowledge Management Strategy Dimensions Explaining Knowledge Management Performance

Variable	*B*	*SE*	*ß*	*t*	*p*
(Constant)	8.353	1.277			
System Orientation Strategy	.408	.072	.354	5.664	.000
Human Orientation Strategy	.263	.070	.236	3.777	.000

N = 212
$F = 28.247$ $df = 2$ $p = .000$ $R^2 = .213$ Adjusted $R^2 = .205$

Research Hypothesis 2

H2: There is a significant explanatory relationship between knowledge management enablers (technology, decentralization, formalization, and organizational culture) and knowledge management performance in U.S. software companies.

Multiple regression analysis was employed to examine the relationship between three knowledge management enablers variables (technology, decentralization, formalization, and organizational culture), and the knowledge management performance variable. The F value (57.857) for the overall regression equation was significant (p=.000). The adjusted R^2 indicated the regression equation using the three knowledge management enablers variables explained 51.9% (.519) of the variation in knowledge management performance. To analyze the individual predictors, the t-statistic, which is the regression coefficient divided by the standard error (*SE*), was utilized. The results were significant for technology (t = 5.746, p = .000), decentralization (t = -6.118, p = .000), and organizational culture (t = 10.692, p = .000).

In terms of the relative importance of these predictors, based on the values of the β coefficients, the order of importance was organizational culture (β = .794), followed by "technology" (β = .336), and decentralization (β = -.450). In summary, the overall model was significant in supporting hypothesis 2. However, of the four knowledge management enablers, only technology and organizational culture were significant, positive explanatory variables of knowledge management performance. Decentralization was a significant inversely related explanatory variable of knowledge management performance. Formalization was not a significant explanatory variable of knowledge management performance. Table 4-24 summarizes the results of analysis of the relative contribution of modified knowledge management enablers in explaining knowledge management performance.

Table 4-24

Summarized Multiple Regression Analysis for Modified Knowledge Management Enablers Dimensions Explaining Knowledge Management Performance

Variable	*B*	*SE*	β	*t*	*p*
(Constant)	2.330	1.244			
Technology	.382	.066	.336	5.746	.000
Decentralization	-.505	.083	-450	-6.118	.000
Formalization	.063	.045	.073	1.389	.166
Organizational Culture	.405	.038	.794	10.692	.000

N = 212
F = 57.857 df = 4 p = .000 R^2 = .528 Adjusted R^2 = .519

Research Hypothesis 3

H3: There is a significant explanatory relationship between knowledge management process capability (internal knowledge acquisition, external knowledge acquisition, knowledge upgrade, knowledge protection, knowledge conversion, and knowledge application) and knowledge management performance in U.S. software companies.

The researcher used multiple regression analysis to examine the relationship between four independent variables (internal knowledge acquisition, external knowledge acquisition, knowledge upgrade, knowledge protection, knowledge conversion, and knowledge application) and the dependent variable of knowledge management performance. As shown in Table 4-25, the F value (14.875) for the regression model analyzing the four dimensions of knowledge management process capability and knowledge management performance was significant (p = .000) for an explanatory relationship. The adjusted R^2 indicated the regression equation using the four knowledge management process dimensions explained 28.3% (.283) of the variation in knowledge management performance. To analyze the individual predictors, the t-statistic, which is the regression coefficient divided by the standard error (*SE*), was significant for external knowledge acquisition (t = 2.386, p = .018) and knowledge application (t = 2.575, p = .011). In terms of relative importance of these predictors, based on the values of the ß coefficients, the order of importance was knowledge application (β = .265) and external knowledge acquisition (β = .178). In summary, the overall model was significant in supporting hypothesis 3. However, of the six knowledge management process capability

dimensions, only external knowledge acquisition and knowledge application were significant, positive explanatory variables of knowledge management performance.

Table 4-25

Summarized Multiple Regression Analysis for Modified Knowledge Management Process Capability Dimensions Explaining Knowledge Management Performance

Variable	*B*	*SE*	*ß*	*t*	*p*
(Constant)	8.218	1.068			
Internal Knowledge Acquisition	-.116	.148	-.060	.782	.435
External Knowledge Acquisition	.251	.105	.178	2.386	.018
Knowledge Upgrade	-.024	.124	-.017	-.101	.849
Knowledge Protection	.096	.067	.118	1.447	.150
Knowledge Conversion	.106	.073	.150	1.447	.149
Knowledge Application	.166	.064	.265	2.575	.011

N = 212
$F = 14.875$ $df = 6$ $p = .000$ $R^2 = .303$ Adjusted $R^2 = .283$

Research Hypothesis 4

H4: There is a significant explanatory relationship between knowledge management enablers (technology, decentralization, formalization, and organizational culture) and the total score for knowledge management process capability in U.S. software companies.

Multiple regression analysis was used to examine the relationship between three knowledge management enablers variables (technology, structure, and organizational culture), and the total score for knowledge management process capability. The F value (51.747) for the overall regression equation was significant ($p = .000$). The adjusted R^2 indicated the regression equation using the three knowledge management enablers variables explained 49.0% (.490) of the variation in the total score for knowledge

management process capability. Using the *t*-statistic, which is the regression coefficient divided by the standard error (*SE*), to analyze the individual predictors, revealed significance for technology (t = 8.161, p = .000), decentralization (t = -4.465, p = .000) and organizational culture (t = 7.057, p = .000). In terms of the relative importance of these predictors, based on the values of the β coefficients, the order of importance was organizational culture (β = .539), followed by technology (β = .493) and decentralization (β = -.338). Technology and organizational culture were positively associated with the total score for knowledge management process capability. In summary, the overall model was significant in supporting hypothesis 4. However, of the four knowledge management enablers dimensions, only technology and organizational culture were significant, positive explanatory variables of the total score of knowledge management process capability. Decentralization was a significant inversely related explanatory variable of the total score of knowledge management process capability. Table 4-26 summarizes the results of analysis of the relative contribution of knowledge management enablers in explaining the total score for knowledge management process capability.

Table 4-26

Summarized Multiple Regression Analysis for Modified Knowledge Management Enablers Dimensions Explaining the Total Score for Knowledge Management Process Capability

Variable	*B*	*SE*	*ß*	*t*	*p*
(Constant)	10.706	6.525			
Technology	2.854	.349	.493	8.181	.000
Decentralization	-1.933	.433	-.338	-4.465	.000
Formalization	.415	.237	.095	1.751	0.81
Organizational Culture	1.402	.199	.539	7.057	.000

N = 212
$F = 51.747$ $df = 4$ $p = .000$ $R^2 = .500$ Adjusted $R^2 = .490$

Research Hypothesis 5

H5: There is a significant explanatory relationship between knowledge management strategy (human orientation and system orientation) and the total score for knowledge management enablers in U.S. software companies.

Multiple regression analysis was used to measure the influences of human and system orientation strategies together on the total score for knowledge management enablers. As shown in Table 4-27, the F value (49.033) for the regression model analyzing the two knowledge management strategy dimensions and the total score for knowledge management enablers was significant (p = .000) for an explanatory relationship. The adjusted R^2 indicated that the human and system orientation strategies together explained 31.3% (.313) of the variance in the total score for knowledge management enablers. To analyze the individual predictors, the t-statistic, the regression coefficient divided by the standard error (*SE*) was used and was found significant for two dimensions: system orientation strategy (t = 5.306, p = .000), and human orientation

strategy (t = 7.203, p = .000). Based on the values of the β coefficients, the relative order of importance of these predictors was human orientation strategy (β = .419) and system orientation strategy (β = .308). In summary, the overall model was significant in supporting hypothesis 5. Both knowledge management strategies of system orientation and human orientation were significant, positive explanatory variables of the total score for knowledge management enablers.

Table 4-27

Summarized Multiple Regression Analysis for Knowledge Management Strategy Dimensions Explaining the Total Score for Knowledge Management Enablers

Variable	*B*	*SE*	β	*t*	*p*
(Constant)	49.674	4.174			
System Orientation Strategy	1.249	.235	.308	5.306	.000
Human Orientation Strategy	1.637	.227	.419	7.203	.000

N = 212
F = 49.033 df = 2 p = .000 R^2 = .319 Adjusted R^2 = .313

Research Hypothesis 6

H6: There is a significant explanatory relationship between knowledge management strategy (human orientation and system orientation) and the total score for knowledge management process capability in U.S. software companies.

Multiple regression analysis was used to measure the influences of human and system orientation strategies together on the total score for knowledge management enablers. As shown in Table 4-28, the F value (59.085) for the regression model analyzing the two knowledge management strategy dimensions and the total score for knowledge management process capability was significant (p = .000) for an explanatory

relationship. The adjusted R^2 indicated tat the human and system orientation strategies as a whole explained 35.5% (.355) of the variance in the total score for knowledge management process capability. To analyze the individual predictors, the *t*-statistic, which is the regression coefficient divided by the standard error (*SE*), was utilized and found to be significant for the two dimensions of system orientation strategy ($t = 6.028$, $p = .000$), and human orientation strategy ($t = 7.739$, $p = .000$). In terms of the relative importance of these predictors, based on the values of the β coefficients, the order of importance was human orientation strategy ($\beta = .436$) and system orientation strategy ($\beta = .339$). In summary, the overall model was significant in supporting hypothesis 6. Both knowledge management strategies of system orientation and human orientation were significant, positive explanatory variables of the total score for knowledge management process capability.

Table 4-28

Summarized Multiple Regression Analysis for Knowledge Management Strategy Dimensions Explaining the Total Score for Knowledge Management Process Capability

Variable	*B*	*SE*	β	*t*	*p*
(Constant)	22.488	5.866			
System Orientation Strategy	1.994	.331	.339	6.028	.000
Human Orientation Strategy	2.471	.319	.436	7.739	.000

N = 212
$F = 59.085$ $df = 2$ $p = .000$ $R^2 = .361$ Adjusted $R^2 = .355$

Research Hypothesis 7

H7: There is a significant explanatory relationship between organizational characteristics (type of software company, number of employees, annual sales in dollars, and primary product/service life cycle) and the total score for knowledge management strategy in U.S. software companies.

Multiple regression analysis was used to examine the relationship between four organizational characteristic variables (type of software company, number of employees, annual sales in dollars, and primary product/service life cycle), and the total score for knowledge management strategy. The F value (4.912) for the regression model analyzing the organizational characteristic variables and the total score for knowledge management strategy was significant (p = .001) for an explanatory relationship. The adjusted R^2 indicated that organizational characteristics of the U.S software companies accounted for 6.9% (.069) of the variance in the total score for knowledge management strategy. To analyze the individual predictors, the t-statistic, which is the regression coefficient divided by the standard error (SE), was used and found to be significant for two of four dimensions: type of firms (t = 4.009, p = .000), and annual sales in dollars (t = 2.022, p = .044). In terms of the relative importance of these predictors, based on the values of the β coefficients, the order of importance was annual sales (β = .496) and type of firms (β = .272). In summary, the overall model was significant in supporting hypothesis 7. However, of the four organizational characteristics dimensions, only type of software company and annual sales in dollars were significant, positive explanatory variables of the total score for knowledge management strategy

Table 4-29

Summarized Multiple Regression Analysis for Organizational Characteristic *Dimensions Explaining the Total Score for Knowledge Management Strategy*

Variable	*B*	*SE*	*ß*	*t*	*p*
(Constant)	23.403	1.539			
Type of Software Company	1.521	.379	.272	4.009	.000
Number of Employees	-.003	.002	-.418	-1.692	.092
Annual Sales in Dollars	.000	.000	.496	2.022	.044
Primary Product/Service Life Cycle	.550	.659	.060	.834	.405

N = 212
$F = 4.912$ $df = 4$ $p = .001$ $R^2 = .087$ Adjusted $R^2 = .069$

Research Hypothesis 8

H8: There is a significant explanatory relationship between organizational characteristics (type of software company, number of employees, annual sales in dollars, and primary product/service life cycle) and the total score for knowledge management enablers in U.S. software companies.

Multiple regression analysis was used to examine the relationship between four organizational characteristic variables (type of software company, number of employees, annual sales in dollars, and primary product/service life cycle), and the total score for knowledge management enablers. As shown in Table 4-30, using organizational characteristics as the dependent variable, the F value (.837) for the overall regression equation was not significant ($p = .503$). The adjusted R^2 indicated that the regression equation using the four organizational characteristic dimensions explained less than 1% (-.003) of the variation in total score for knowledge management enablers. To analyze the individual predictors, the t-statistic, which is the regression coefficient divided by the standard error (*SE*) was employed, and was not significant for any of these variables. The

numbers of employees (β = .300) had the greatest impact on the model, followed by annual sales in dollars (β = -.218), primary product/service life cycle (β = -.084), and type of software company (β = .061). In summary, the overall model was not significant in supporting hypothesis 8. The type of software company, numbers of employees, annual sales in dollars, and primary product/service life cycle were not significant explanatory variables of knowledge management enablers.

Table 4-30

Summarized Multiple Regression Analysis for Organizational Characteristic *Dimensions Explaining the Total Score for Knowledge Management Enablers*

Variable	*B*	*SE*	β	*t*	*p*
(Constant)	91.835	4.120			
Type of Software Company	.872	1.015	.061	.859	.392
Number of Employees	.006	.005	.300	1.169	.244
Annual Sales in Dollars	.000	.000	-.218	-.856	.393
Primary Product/Service Life Cycle	-1.976	1.765	-.084	-1.119	.264

N = 212
F = .837 df = 4 p = .503 R^2 = .016 Adjusted R^2 = -.003

Research Hypothesis 9

H9: There is a significant explanatory relationship between organizational characteristics (type of software company, number of employees, annual sales in dollars, and primary product/service life cycle) and the total score for knowledge management process capability in U.S. software companies.

Multiple regression analysis was used to examine the relationship between four organizational characteristic variables (type of software company, number of employees, annual sales in dollars, and primary product/service life cycle), and the total score for knowledge management process capability. As shown in Table 4-31, the F value (5.001)

for the regression model analyzing the organizational characteristic variables and total score for knowledge management process capability was significant (p = .001) for an explanatory relationship. The adjusted R^2 indicated organizational characteristics of the U.S software companies accounted for 7.0% (.070) of the variance in the total score for knowledge management process capability. To analyze the individual predictors, the *t*-statistic, which is the regression coefficient divided by the standard error (*SE*), was only significant for annual sales in dollars (t = 2.347, p = .020). However, in terms of relative importance of these predictors, based on the values of the β coefficients, the order of importance was annual sales (β = .575), number of employees (β = -.288), type of software company (β = .110), and primary product/service life cycle (β = -.054). In summary, the overall model was significant in supporting hypothesis 9. However, of the four organizational characteristics dimension, only annul sales in dollars was a significant, positive explanatory variable of the total score of knowledge management process capability.

Table 4-31

Summarized Multiple Regression Analysis for Organizational Characteristic *Dimensions Explaining the Total Score for Knowledge Management Process Capability*

Variable	*B*	*SE*	β	*t*	*p*
(Constant)	82.317	5.753			
Type of Software Company	2.290	1.418	.110	1.615	.108
Number of Employees	-.008	.007	-.288	-1.168	.244
Annual Sales in Dollars	.000	.000	.575	2.347	.020
Primary Product/Service Life Cycle	-1.851	2.465	-.054	-.751	.453

N = 212
F = 5.001 df = 4 p= .001 R^2 = .088 Adjusted R^2=.070

Research Hypothesis 10

H10: There is a significant explanatory relationship between organizational characteristics (type of software company, number of employees, annual sales in dollars, and primary product/service life cycle) and knowledge management performance in U.S. software companies.

Multiple regression analysis was used to examine the relationship between four organizational characteristic variables (type of software company, number of employees, annual sales in dollars, and primary product/service life cycle), and knowledge management performance. As shown in Table 4-32, the F value (2.472) for the regression model analyzing the organizational characteristic variables and knowledge management performance was significant (p = .046) for an explanatory relationship. The adjusted R^2 indicated the four organizational characteristic dimensions account for 4.6% (.046) of the variance in knowledge management performance. To analyze the individual predictors, the t-statistic, which is the regression coefficient divided by the standard error (SE), was not significant for any of these variables. The annual sales in dollars (β = .211) had the greatest impact on the model, followed by primary product/service life cycle (β = .068), type of software company (β = -.045), and numbers of employees (β = -.043). In summary, the overall model was significant in supporting hypothesis 10. However, the type of software company, number of employees, annual sales, and primary product/service life cycle were not significant explanatory variables of knowledge management performance.

Table 4-32

Summarized Multiple Regression Analysis for Organizational Characteristic *Dimensions Explaining the Total Score for Knowledge Management Performance*

Variable	*B*	*SE*	*ß*	*t*	*p*
(Constant)	16.538	1.154			
Type of Software Company	-.182	.285	-.045	-.641	.522
Number of Employees	.000	.001	-.043	-.169	.866
Annual Sales in Dollars	.000	.000	.211	.840	.402
Primary Product/Service Life Cycle	.454	.495	.068	.918	.360

N = 212
$F = 2.472$ $df = 4$ $p = .046$ $R^2 = .046$ Adjusted $R^2 = .027$

Research Hypothesis 11

H11: Knowledge management process capability mediates the relationship among knowledge management strategy (human orientation and system orientation), knowledge management enablers (technology, decentralization, formalization, and organizational culture) and organizational characteristics (number of employees and annual sales in dollars), and knowledge management performance in U.S. software companies.

As shown in Tables 4-16 and 4-17, there were no significant correlations between knowledge management process capability, and type of software company or primary product/service life cycle. There was also no significant relationship between the type of software company and knowledge management performance. Therefore, type of software company and primary product/service life cycle were not included in the regression model. The four-step process (Baron & Kenny, 1986) was used to test whether knowledge management process capability is a mediator of the relationship between knowledge management strategy, knowledge management enablers and organizational

characteristics, and knowledge management performance. At Step 1, knowledge management performance was regressed onto *KMS System*, *KMS Human*, *KME Technology*, *KME Decentralization*, *KME Formalization*, *KME Organizational Culture*, number of employees, and annual sales in dollars. Significant standardized coefficients (β) ranged from .185 (p = .007) to .596 (p = .000). Table 4-33 summarizes the results of analysis of the relative contribution of knowledge management strategy, knowledge management enablers and organizational characteristics in explaining knowledge management performance.

Table 4-33

Summarized Simple Regression Analysis for the Dimensions of Knowledge Management Strategy, Knowledge Management Enablers, and Organizational Characteristics Explaining Knowledge Management Performance

Variable	*B*	*SE*	β	*t*	*p*
KMS System	.460	.073	.399	6.302	.000
KMS Human	.337	.073	.303	4.611	.000
KME Technology	.579	.067	.510	8.582	.000
KME Decentralization	.325	.074	.289	4.379	.000
KME Formalization	.159	.058	.185	2.733	.007
KME Culture	.304	.028	.596	10.760	.000
Number of Employees	.000	.000	.191	2.813	.005
Annual Sales in Dollars	.000	.000	.200	2.961	.003

At Step 2, knowledge management process capability was regressed onto *KMS System*, *KMS Human*, *KME Technology*, *KME Decentralization*, *KME Formalization*, *KME Organizational Culture*, number of employees, and annual sales in dollars. Significant standardized coefficients (β) ranged from .233 (p = .001) to .614 (p = .000). 4-34 summarizes the results of analysis of the relative contribution of knowledge

management strategy, knowledge management enablers and organizational characteristics in explaining knowledge management process capability.

Table 4-34

Summarized Simple Regression Analysis for the Dimensions of Knowledge Management Strategy, Knowledge Management Enablers, and Organizational Characteristics Explaining Knowledge Management Process Capability

Variable	*B*	*SE*	*ß*	*t*	*p*
KMS System	2.480	.368	.422	6.746	.000
KMS Human	2.836	.339	.500	8.370	.000
KME Technology	3.558	.315	.614	11.279	.000
KME Decentralization	1.576	.380	.275	4.150	.000
KME Formalization	1.182	.291	.270	4.061	.000
KME Culture	1.278	.156	.491	8.174	.000
Number of Employees	.000	.002	.055	3.479	.001
Annual Sales in Dollars	.000	.000	.233	3.960	.000

At Step 3, knowledge management performance was the criterion variable in a regression equation and knowledge management strategy, knowledge management enablers and organizational characteristics, and knowledge management process capability were used as predictors. As shown in Table 4-35, when knowledge management strategy was also a predictor of knowledge management performance, the unstandardized regression coefficient (*B*) for the association between knowledge management process capability and knowledge management performance was .082; the standard error (*SE*) for this coefficient was .014 (p = .000). Therefore, knowledge management strategy must be controlled in establishing the effect of knowledge management process capability on the knowledge management performance.

Table 4-35

Summarized Multiple Regression Analysis between the Total Score of Knowledge Management Process Capability and Knowledge Management Performance Using Knowledge Management Strategy As A Predictor of Knowledge Management Performance

Variable	*B*	*SE*	*ß*	*t*	*p*
(Constant)	6.506	1.227			
System Orientation Strategy	.244	.027	.212	3.371	.001
Human Orientation Strategy	.060	.073	.054	.815	.416
Total Score of Knowledge Management Process Capability	.082	.014	.419	5.874	.000

N = 212
$F = 33.350$ $df = 3$ $p = .000$ $R^2 = .325$ Adjusted $R^2 = .315$

As shown in Table 4-36, when knowledge management enablers was also a predictor of knowledge management performance, the unstandardized regression coefficient (*B*) for the association between knowledge management process capability and knowledge management performance was .017; the standard error (*SE*) for this coefficient was .013 ($p = .207$). Therefore, knowledge management enablers must not be controlled in establishing the effect of knowledge management process capability on knowledge management performance.

Table 4-36

Summarized Multiple Regression Analysis between the Total Score of Knowledge Management Process Capability and Knowledge Management Performance Using Knowledge Management Enablers As A Predictor of Knowledge Management Performance

Variable	*B*	*SE*	*ß*	*t*	*p*
(Constant)	2.151	1.250			
Technology	.334	.076	.294	4.375	.000
Decentralization	-.472	.086	-.421	-5.476	.000
Formalization	.056	.045	.065	1.227	.221
Organizational Culture	.382	.042	.748	9.056	.000
Total Score of Knowledge Management Process Capability	.017	.013	.085	1.267	.207

N = 212
$F = 46.742$ $df = 5$ $p = .000$ $R^2 = .532$ Adjusted $R^2 = .520$

As shown in Table 4-37, when organizational characteristics (number of employees and annual sales in dollars) was also a predictor of knowledge management performance, the unstandardized regression coefficient (*B*) for the association between knowledge management process capability and knowledge management performance was .102; the standard error (*SE*) for this coefficient was .012 (p = .000). Therefore, organizational characteristics (number of employees and annual sales in dollars) must be controlled in establishing the effect of knowledge management process capability on knowledge management performance.

Table 4-37

Summarized Multiple Regression Analysis between the Total Score of Knowledge Management Process Capability and Knowledge Management Performance Using Organizational Characteristic As A Predictor of Knowledge Management Performance

Variable	*B*	*SE*	*ß*	*t*	*p*
(Constant)	8.549	1.026			
Number of Employees	.001	.001	.112	.528	.600
Annual Sales in Dollars	.000	.000	-.044	-.207	.836
Total Score of Knowledge Management Process Capability	.102	.012	.521	8.577	.000

N = 212
$F = 28.444$ $df = 3$ $p = .000$ $R^2 = .291$ Adjusted $R^2 = .281$

At Step 4, a Sobel test was used to determine whether a mediator variable (knowledge management process capability) influenced the independent variables (system orientation and human orientation strategies) and the dependent variable (knowledge management performance). If the *p* value was less than .05, then inclusion of the mediator in the model indicated there was evidence of mediation. The value of the test statistic for the Sobel test among knowledge management strategy (human orientation and system orientation), knowledge management process capability, and knowledge management performance was 3.208, with an associated *p*-value of .001. The fact that the observed *p*-value fell below the established alpha level of .05 indicated that the association between knowledge management strategy (system orientation and human orientation) and knowledge management performance was significant by the inclusion of the knowledge management process capability in the model. Table 4-38 presents the results of the analysis of the Sobel test of the influence of the mediator variable of knowledge management process capability between knowledge management strategy and knowledge management performance.

Table 4-38

Summarized Moderated Regression Analysis for the Effect of the Mediator of Knowledge Process Capability between Knowledge Management Strategy and Knowledge Management Performance

					Sobel test	
Variable	*Ba*	SE_a	*Bb*	SE_b	*t*	*p*
Knowledge Management Strategy (Human Orientation and System Orientation)	22.488	5.866	.082	.014	3.208	.001

As shown in Tables 4-39, the value of the test statistic for the Sobel test among organizational characteristics (numbers of employees and annual sales in dollars), knowledge management process capability, and knowledge management performance was 8.405, with an associated *p*-value of 0.000. Since the observed *p*-value fell below the established alpha level of .05, the association between the organizational characteristics (numbers of employees and annual sales in dollars) and knowledge management performance was significant by the inclusion of knowledge management process capability.

Table 4-39

Summarized Multiple Regression Analysis for the Modified Organizational Characteristics Dimensions Explaining the Total Score of Knowledge Management Process Capability

Variable	*B*	*SE*	*ß*	*t*	*p*
(Constant)	17.063	.303			
Number of Employees	.000	.001	-.026	-.105	.917
Annual Sales in Dollars	.000	.000	.225	.913	.362

N = 212
$F = 4.369$ $df = 2$ $p = .014$ $R^2 = .040$ Adjusted $R^2 = .031$

From the regression results, it is clear that the relationship between knowledge management performance and knowledge management strategy (system orientation and human orientation) and knowledge management performance and organizational characteristics (number of employees and annual sales in dollars) became significant by the inclusion of knowledge management process capability as a mediating variable. Therefore, hypothesis 11 was partially supported.

Research Hypothesis 12

H12: Effects of the degree of balance between human and system orientation strategies on knowledge management performance in U.S. software companies.

H_{12a}: U.S. Software companies with a balance in human orientation and system orientation (low/low classifications) of knowledge management strategies, have significantly better knowledge management performance than corporations with less balance (low/high or high/low classifications).

H_{12b}: U.S. Software companies with a balance in human orientation and system orientation (high/high classifications) of knowledge management strategies, have significantly better knowledge management performance than corporations with less balance (low/high or high/low classifications).

H_{12c}: There is a significant interaction between the degree of human orientation knowledge strategy and the degree of system orientation strategy on knowledge management performance in U.S. software companies.

For Hypothesis H_{12a} and H_{12b}, ANOVA statistics were used to find significant differences between groups by comparing the means of those groups on several variable of interest. Where there were significant differences (significant *F*-values), post hoc tests were conducted using the Least Significant Difference (LSD) and the more rigorous Scheffe test to detect which groups were different. According to the score on the 4-item human orientation strategy (HO) and the 4-item system orientation strategy (SO), there are four classifications: Low SO/Low HO, Low SO/High HO, High SO/Low HO, and High SO/High HO (low level scores=4-11; high level scores=12-20). As shown in Table 4-41, ANOVA showed a significant difference according to human orientation and system orientation balance ($F = 13.430$, $p = .000$), however, post hoc comparisons using the Least Significant Difference (LSD) and the more rigorous Scheffe test, showed that software companies with Low SO/ Low HO have no significant differences in knowledge management performance comparisons. Respondents with High SO/High SO balance had significantly higher scores on knowledge management performance than respondents whose companies had less balance (low/high or high/low classifications).

Table 4-41

ANOVA and Post Hoc Comparisons of Significant Differences in Knowledge Management Performance According to Human Orientation and System Orientation Balance

Variable	KM Performance Mean	F	P	Post Hoc Comparisons p Scheffe	Post Hoc Comparisons p LSD
		13.430	.000		
Low SO/Low HO (N=13)	14.23				
Low SO/High HO (N=66)	16.11				
High SO/Low HO (N=8)	14.00				
High SO/High HO (N=125)	18.62				
High SO/High HO> Low SO/High HO				.000	.000
High SO/High HO> High SO/Low HO				.007	.001
Low SO/High HO> High SO/Low HO				ns[a]	ns[a]
High SO/High HO> Low SO/Low HO				.001	.000
Low SO/High HO> Low SO/Low HO				ns[a]	ns[a]
High SO/Low HO> Low SO/Low HO				ns[a]	ns[a]

[a] Not Significant

For Hypothesis H_{12c}, two-Way ANOVA was used to indicate if there were significant interactions between the independent variables of high and low levels of human orientation strategy and system orientation strategy and the dependent variable of knowledge management performance. As shown in Table 4-42, there was no significant main effect for the degree of system orientation strategy ($F = 1.795$, $p = .182$). However, there was a marginally significant main effect for the degree of human orientation strategy ($F = 13.991$, $p = .000$). Moreover, there were no marginally significant interactions between the degree of human orientation knowledge strategy and the degree

of system orientation strategy on knowledge management performance (F = 2.593, p = .109). Therefore, H_{12b} was supported, but H_{12a} and H_{12c} were not supported.

Table 4-42

Two-way ANOVA of Significant Differences in Knowledge Management Performance According to Human Orientation and System Orientation Interaction

Source	Type III Sum of Squares	*df*	Mean Square	*F*	*Sig.*
Corrected Model	511.652	3	170.551	13.223	.000
Intercept	17490.829	1	17490.829	1356.054	.000
SO	23.158	1	23.158	1.795	.182
HO	180.463	1	180.463	13.991	.000
SO* HO	33.449	1	33.449	2.593	.109
Error	2682.852	208	12.898		
Total	67317.000	212			
Corrected Total	3194.505	211			

Chapter IV presented descriptive statistics of the sample, psychometric qualities of scales, and reported the results of the examination of research questions and hypothesis testing. Additional analyses related to the research questions and hypotheses were also reported. Chapter V provides a discussion of the findings in terms of interpretation, implications, conclusion, and recommendations to this study.

CHAPTER V

DISCUSSION

Chapter V presents a discussion of the results reported in Chapter IV. This study was the first to examine and explore the relationships among organizational characteristics, knowledge management enablers, knowledge process capability, and knowledge management performance. The specific purposes of this non-experimental, quantitative, correlational (explanatory), and causal-comparative research of U.S. software companies were (a) to describe the companies in terms of organizational characteristics, knowledge management strategies, knowledge management enablers, knowledge management process capabilities, and knowledge management performance; (b) to explore the relationships among organizational characteristics, knowledge management enablers, knowledge management process capabilities, and knowledge management performance; (c) to examine the effects of the degree of balance between human and system orientation strategies on knowledge management performance; and (d) to examine the mediating impact of knowledge management process capability on the relationships among knowledge management strategy, knowledge management enablers and organizational characteristics and knowledge management performance. A total of two research questions and 12 hypotheses were developed and tested.

In this study, the two dimensions of knowledge management strategy (system orientation strategy and human orientation strategy) were measured by an 8-indicator *Knowledge Management Strategy Scale*. Knowledge management enablers were measured by identifying the level of technology, decentralization, formalization, and organizational culture, using a 25-item modified *Knowledge Management Enablers Scale*.

Knowledge management process capability was established by measuring the level of internal knowledge acquisition, external knowledge acquisition, knowledge upgrade, knowledge protection, knowledge conversion, and knowledge application, using a 26-item modified *Knowledge Management Process Capability Scale*. Knowledge management performance was measured by a benchmarking approach using a five-item *Knowledge Management Performance Scale*. Organizational characteristics of selected U.S companies were measured by the type of software company, numbers of employees, annual sales in dollars, and primary product/service life cycle.

Using simple random sampling, 6,000 e-mail invitations were distributed, and 258 responses were received. Because 46 responses were invalid, a total of 212 valid responses were used in the data analysis procedures. Findings indicated that there were significant explanatory relationships between knowledge management strategy, and knowledge management performance, knowledge management enablers and knowledge management process capability. The study also found that there were significant explanatory relationships between knowledge management enablers, and knowledge management performance and knowledge process capabilities. There were significant explanatory relationships between organizational characteristics, and knowledge management strategy, knowledge management performance and knowledge management process capability. Moreover, there was a significant explanatory relationship between knowledge management process capability and knowledge management performance. Knowledge management process capability was a significant variable that mediated the relationships among organizational characteristics and knowledge management strategy,

and knowledge management performance. Chapter V presents a discussion of the results reported in Chapter IV.

Interpretations

Descriptive Characteristics of the Sample

Based on the data collected in the *Organizational Characteristic Profile*, the major software companies of this study were Internet services companies (48.1%). The majority of U.S software companies were in the growing stage. The average annual sales in dollars were $97,579,502 and the average number of employees was 358.

According to Choi and Lee's (2002) study, knowledge management strategy consisted of two dimensions: system orientation strategy and human orientation strategy. In this study, eight items of the knowledge management strategy scale were rated on a 5-point scale. According to the data analyzed in Chapter IV, the majority U.S. software companies used human orientation strategy (mean=3.89). The finding was consistent with Choi's (2002) and Keskin's (2005) studies, which reported that human orientation strategy was the highest rated dimension in all industries.

In this study, each of the knowledge management enablers items were rated on a 5-point scale. The researcher divided knowledge management enablers into four dimensions, technology, decentralization, formalization, and organizational culture. The finding was consistent with Park's (2006) study, which reported that organizational culture was the highest rated dimension, technology was the second highest rated dimension, and structure was the lowest rated dimension. The finding was partially consistent with Lee and Choi's (2003) findings that technology had the highest mean score, organizational culture had the second highest, and structure had the lowest.

The researcher divided knowledge management process capability into six dimensions, internal knowledge acquisition, external knowledge acquisition, knowledge upgrade, knowledge protection, knowledge conversion, and knowledge application. The dimension with the highest rated score was knowledge protection, followed by knowledge application, external knowledge acquisition, internal knowledge acquisition, knowledge conversion, and knowledge upgrade. The finding was partially consistent with Park's (2006) findings that knowledge protection had the highest mean score, knowledge application had the second highest, knowledge acquisition had the third highest, and knowledge conversion had the lowest.

To measure the various dimensions of knowledge management performance, this study used Al-hawari's (2004) and Choi's (2002) 5-item, 5-point *Knowledge Management Performance Scale*. The finding about knowledge management performance in this study (item mean=3.48), was different than the studies by Al-hawari's and Choi where the average item mean was greater than 4.0 in all industries.

Hypotheses Testing

To test Hypotheses 1 to 10, the researcher used multiple regression analysis, where more than one predictor is jointly regressed against the dependent variable. The F statistic and its significance level are known tests of the significance of the overall regression model, and the R^2 providesd the proportion of the variance in the dependent variable that can be explained by the independent variables. For significant models, the t-statistic value was examined for the importance of each individual predictor. For hypothesis 11, the Sobel test was a more direct test of the mediation hypothesis because it examines the combined effects of the path between the dependent variable and the

moderator and the path between the moderator and the independent variable. For hypothesis 12, the results of ANOVA showed whether or not the means of the various groups were significantly different from one another, as indicated by the *F* statistic and its significance level. Moreover, the researcher also used Least Significant Difference (LSD) and Sheffe test to detect exactly where the mean differences lie.

Out of 14 hypotheses (H12 was divided into three sub-hypotheses), ten were supported, one was partially supported, and three were not supported. Table 5-1 summarizes the research purposes, corresponding hypotheses, and whether or not the hypothesis was supported based on the results in Chapter IV.

Table 5-1

Research Purposes, Hypotheses, and Results

Hypotheses	Results
H1: There is a significant explanatory relationship between knowledge management strategies (human orientation and system orientation) and knowledge management performance in U.S. software companies.	Supported
H2: There is a significant explanatory relationship between knowledge management enablers (technology, decentralization, formalization and organizational culture) and knowledge management performance in U.S. software companies.	Supported
H3: There is a significant explanatory relationship between knowledge management process capability (Internal knowledge acquisition, external knowledge acquisition, knowledge upgrade, knowledge protection, knowledge conversion, and knowledge application) and knowledge management performance in U.S. software companies	Supported
H4: There is a significant explanatory relationship between knowledge management enablers (technology, decentralization, formalization and organizational culture) and the total score for knowledge management process capability in U.S. software companies.	Supported
H5: There is a significant explanatory relationship between knowledge management strategy (human orientation and system orientation) and the total score for knowledge management enablers in U.S. software companies.	Supported
H6: There is a significant explanatory relationship between knowledge management strategy (human orientation and system orientation) and the total score for knowledge management process capability in U.S. software companies.	Supported

Table 5-1 (Continued)

Hypotheses	Results
H7: There is a significant explanatory relationship between organizational characteristics (type of software company, number of employees, annual sales in dollars, and primary product/service life cycle) and the total score for knowledge management strategy in U.S. software companies.	Supported
H8: There is a significant explanatory relationship between organizational characteristics (type of software company, number of employees, annual sales in dollars, and primary product/service life cycle) and the total score for knowledge management enablers in U.S. software companies.	Not Supported
H9: There is a significant explanatory relationship between organizational characteristics (type of software company, number of employees, annual sales in dollars, and primary product/service life cycle) and the total score for knowledge management process capability in U.S. software companies.	Supported
H10: There is a significant explanatory relationship between organizational characteristics (type of software company, number of employees, annual sales in dollars, and primary product/service life cycle) and knowledge management performance in U.S. software companies.	Supported
H11: Knowledge management process capability mediates the relationship among knowledge management strategy (human orientation and system orientation), knowledge management enablers (technology, decentralization, formalization and organizational culture) and organizational characteristics (number of employees and annual sales in dollars), and knowledge management performance in U.S. software companies.	Partially Supported
H12: Effects of the degree of balance between human and system orientation strategies on knowledge management performance in U.S. software companies.	
$H12_a$: Software companies in the U.S. with a balance in human orientation and system orientation (low/low classifications) of knowledge management strategies, have significantly better knowledge management performance than corporations with less balance (low/high or high/low classifications).	Not Supported
$H12_b$: Software companies in the U.S. with a balance in human orientation and system orientation (high/high classifications) of knowledge management strategies, have significantly better knowledge management performance than corporations with less balance (low/high or high/low classifications).	Supported
$H12_c$: There is a significant interaction between the degree of human orientation knowledge strategy and the degree of system orientation strategy on knowledge management performance in U.S. software companies.	Not Supported

Knowledge Management Process Capability in Explaining Knowledge Management Performance

In this study, there were six dimensions of the knowledge management process: internal knowledge acquisition, external knowledge acquisition, knowledge upgrade, knowledge protection, knowledge conversion, and knowledge application. Based on the regression models tested, the findings indicated that external knowledge acquisition and knowledge applications were significant positive explanatory variables of knowledge management performance. This partially supported Park's (2006) findings of positive and significant links among knowledge application, knowledge acquisition and knowledge protection, and knowledge management performance. This also confirmed the finding by Lee and Choi (2003) that the knowledge creation (acquisition) process was significantly related with knowledge management performance.

Knowledge Management Strategy in Explaining Knowledge Enablers, Knowledge Management Process Capability, and Knowledge Management Performance

Regarding the knowledge management strategy, the findings indicated that both system orientation and human orientation strategies were positive and significant explanatory variables of knowledge management enablers, knowledge process capability, and knowledge management performance. The findings were consistent with Choi's (2002) and Keskin's (2005) findings. The results also revealed that the influence of system orientation strategy was higher than human orientation strategy on knowledge management performance. This finding supported Keskin (2005), who found that system orientation strategy was more important for knowledge management performance than human orientation strategy.

This study was the first that examined the relationships among system orientation and human orientation strategies, and knowledge management enablers and knowledge management process capability. The results showed that the influence of human orientation strategy was higher than system orientation strategy on knowledge management enablers and knowledge management process capability.

Knowledge Management Enablers in Explaining Knowledge Management Process Capability, and Knowledge Management Performance

Findings about the relationship between knowledge management enablers (technology, decentralization, formalization, and organizational culture), and knowledge management process capability indicated that two dimensions of technology, and organizational culture were significant positive explanatory variables of knowledge management process capability. The decentralization dimension was a significant inversely related explanatory variable of knowledge management process capability. The findings did not support Hurley and Green's (2005) proposition that decentralization aids the sharing of knowledge through an emphasizing of empowerment and information sharing with other employee. The formalization dimension was not a significant variable. A possible explanation for this unexpected finding may be that formal structure helps to identify storage of knowledge but it also tends to prohibit organization members from communicating and interacting with one another to create knowledge. Moreover, the results showed that the influence of organizational culture is greater than the technology on knowledge management process capability.

In this study, the results also indicated that the dimensions of technology, decentralization, and organizational culture were all associated with knowledge

management performance. Besides the technology and organizational culture dimensions, the decentralization dimension was a significant negative explanatory variable of knowledge management performance. Moreover, organizational culture was the most significant dimension in knowledge management performance. This supported Gold, Malhotra, and Segars's (2001) proposition that organizational culture was the most significant factor in effective knowledge management.

Organizational Characteristics in Explaining Knowledge Management Strategy, Knowledge Management Enablers, and Knowledge Management Performance

No previous study had investigated the relationships among organizational characteristics, and knowledge management strategy, knowledge management enablers and knowledge management performance. Therefore, this study provided new knowledge in this area. In this study, organizational characteristics were measured by type of software company, number of employees, annual sales in dollars, and primary product/service life cycle. The findings showed that in U.S. software companies, there was a positive correlation between total annual sales in dollars, and knowledge management strategy and knowledge management process capability.

Knowledge Management Process Capability in Explaining the Relationships among Organizational Characteristics, Knowledge Management Strategy and Knowledge Management Enablers, and Knowledge Management Performance

The study was the first study to hypothesize that knowledge management process capability mediates the relationships among organizational characteristics, knowledge management strategy knowledge management enablers, and knowledge management performance. The results indicated that knowledge management process capability was

found to be not only a mediator between knowledge management strategy (system orientation and human orientation strategy) and knowledge management performance but also between organizational characteristics (number of employees and annual sales in dollars) and knowledge management performance.

Effect of Degree of Balance between System and Human Orientation Strategies on Knowledge Management Performance

No studies were found that investigated the effects on knowledge management performance due to the degree of balance between human and system orientation strategies. This study found that the influence on U.S. software companies both with a high degree of system orientation (SO) and human orientation (HO) strategy was higher than corporations with less balance (Low SO/High HO or High SO/Low SO). This study also found that corporations with both a low degree of system orientation and human orientation strategy had no significant difference in knowledge management performance comparisons. Therefore, this partially supported the view suggesting that companies should have a balance between the two knowledge management strategies. Furthermore, this finding indicated that there was a significant main effect for the degree of human orientation strategy. However, there are no significant interactions between the high and low levels of system orientation and human orientation strategies, and knowledge management performance.

Practical Implications

Throughout this study, a number of knowledge management concepts and ideas have been explained, tested, and analyzed. In addition to adding to the professional literature, this study helps managers to define their knowledge management strategies and

knowledge management enablers more clearly, to understand knowledge management process in real organizations in greater depth, and to lead them to knowledge management performance strategies more effectively. Some examples of this are now presented.

1. To enhance knowledge management performance, managers could place greater emphasis on improving seven dimensions: human orientation strategy, system orientation strategy, technology, centralization, organizational culture, external knowledge acquisition, and knowledge application.
2. Human orientation strategy is more important for knowledge management enablers and knowledge management process capability than system orientation strategy. However, the influence of system orientation strategy is higher than human orientation strategy on knowledge management performance. Furthermore, companies with a balance in high system orientation strategy and high human orientation strategy should lead them to greater knowledge management performance. According to these findings, managers should strengthen both strategies and should not pursue one strategy predominantly.
3. It is important for managers to understand that it is not enough to influence knowledge management performance by merely making knowledge available, upgrade, codified, and protective. Managers should develop a policy to apply the knowledge that has been created, made available or continually codified.
4. Although less centralized organizational structure allow teams with high levels of self-management to communicate and interact with other employees to

create and share knowledge, the study found that in U.S. software companies, more centralization was helpful for organizations and managers to raise knowledge management performance.

5. Technology provides an excellent medium for the sharing and application of knowledge. If managers pay too much attention to technology but ignore organizational culture, knowledge management performance may decline. Organizational culture was the most significant dimension in knowledge management performance. Moreover, organizational culture can support linkages between technology adoption and knowledge management performance growth (Chatman & Jehn, 1994).

Conclusions

This section presents specific conclusions that relate to the research questions and hypotheses.

1. System orientation and human orientation strategy were significant positive explanatory variables of knowledge management process capability, knowledge management enablers, and knowledge management performance. This result marginally supported the empirical findings reported by Lee and Choi (2003).
2. Technology and organizational culture dimensions of knowledge management enablers were significant positive explanatory variables of knowledge management process capability and knowledge management performance. However, the decentralization dimension may inversely affect knowledge management performance and may not be an important factor influencing

knowledge management process capability. These findings were partially consistent with a recent study by Park (2006). Moreover, this study found that a modified four-dimension, 25-indicator *Knowledge Management Enablers Scale* was more appropriate for measuring knowledge management enablers than the original three-dimension, 27-indicator scale.

3. An annual sales in dollars was a significant positive explanatory variable of knowledge management strategy and knowledge management process capability.
4. Knowledge management process capability was a mediator between knowledge management strategy and organizational characteristics, and knowledge management performance. Furthermore, this study showed that a modified six-dimension and 26-indicator *Knowledge Management Process Capability Scale* was more appropriate for measuring knowledge management enablers than the original four-dimension scale.
5. Companies with a balance in a high degree of human orientation coupled with a high degree of system orientation, had a positive significant relationship with knowledge management performance.

Limitations

The present study appears to be one of the more comprehensive studies about knowledge management in U.S software companies, using instruments having acceptable reliability and validity, a sufficient sample size, probability sampling, and sound data analyses. However, this study has several limitations.

1. This study was limited to measuring attitudes of respondents who could be reached through e-mail, and who were willing to respond to an online survey about knowledge management in their companies.
2. This study was primarily a "one-time survey" study due to the constraints of cost and time, although a longitudinal approach is very important for a study of knowledge management process.
3. The design is non-experimental which threatens internal validity.
4. The very low response rate and a self-selected final data-producing sample pose threats to external validity. Generalizing to software companies should only be done with caution.
5. Knowledge about the relationships between the variables examined in this study was based on the findings obtained using multiple regression analyses. Structural equation modeling and hierarchical linear modeling (HLM) might have provided additional information about the relationship between the variables.
6. The questionnaire contained too many items compared to prior studies, and similarity in content between items may have confused participants or made them lose patience and not give accurate answers.
7. The study adopted the breakdown of the American Electronic Association (AEA) using North American Industrial Classification System (NAICS) codes to classify the software industry into three categories. There may be major differences in the population of the software industry as it is composed of diverse groups.

8. As this study was conducted in U.S software companies, the findings may only be generalized to similar U.S. high-tech industries but cannot be generalized to other groups, industries or countries.

Recommendations for Future Study

This study suggests the following research recommendations where additional investigation may be fruitful.

1. Future research may cover financial performance data such as ROI (Return on Investment), ROE (Return on Equity), net revenue, or other financial indicators that can be connected with knowledge management performance.
2. Future research may try to access a single organization to examine related research topics. Research also can determine whether the variables and their relationship are consistent over time in a longitudinal case study.
3. The study should be replicated in different industries or countries as this would most likely strengthen and validate the findings of some of the hypotheses.
4. The current study was conducted only in the U.S., and future cross-cultural research would be valuable. Future studies should be directed toward examining the behavior of personnel from different ethnic backgrounds.
5. The sample of this study focused on company executives. Future research samples can select middle managers or knowledge workers from various departments or specific departments such as R&D.

6. Future studies may add other variables, such as reward systems and top management support, into the knowledge management model and make the model more complete.
7. Future studies should add socio-demographic characteristics of participants. This information can be used to explore other intervening variables such as gender, age, ethnicity, length of service, etc.

Chapter V discussed the results of the analyses related to answering the research questions and testing the hypotheses that flowed from the research purposes of this study. Findings were interpreted in light of the reviews of the literature and instrumentation. Implications for theory and practice as well as the conclusions drawn from interpretations were also discussed. The limitations of the study and recommendations for future study were also included.

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APPENDIX A

Authorization for Informed Consent

Institutional Review Board for the Protection of Human Subjects
Lynn University
3601 N. Military Trail Boca Raton, Florida 33431

AUTHORIZATION FOR VOLUNTARY CONSENT

PROJECT TITLE: Integration of Organizational Characteristics, Knowledge Management Strategy, Enablers, and Process Capability, and its Effect on Knowledge Management Performance in U.S. Software Companies

Project IRB Number: _____ Lynn University 3601 N. Military Trail Boca Raton, Florida 33431

2006-039

I, Hsin-Jung Hsieh, am a doctoral student at Lynn University. I am studying Global Leadership, with a specialization in Corporate and Organizational Management. One of my degree requirements is to conduct a research study.

DIRECTIONS FOR THE PARTICIPANT:

You are being asked to participate in my research study. Please read this form carefully. This form provides you with information about this study. The principal investigator (Hsin-Jung Hsieh) will answer all of your questions. Please ask questions about anything you don't understand before deciding whether or not to participate. You are free to ask questions at any time before or after your participation in this study. Your participation is entirely voluntary and you can refuse to participate without penalty or loss of benefits to which you are otherwise entitled.

PURPOSE OF THIS RESEARCH STUDY: The study is about organizational characteristics, knowledge management strategy, enablers, and process capability, and knowledge management performance in U.S. software companies. According to the North American Industrial Classification System (NAICS), U.S. software companies include software publishers, computer systems design and related service, and internet services. There will be approximately 3,000 executives participating in this study. All participants must be at least 18 years old. Participants must be fluent in English. Participants must have been employed at their present companies for the past six months.

PROCEDURE: The invitation e-mail is sent by using the Blind Carbon Copy (Bcc) feature. When an e-mail is sent by Bcc, the recipients are unable to know who else has received the message. The survey is completed electronically and begins by clicking the link below. You are prompted to answer questions based on your beliefs about knowledge management in your firm. These surveys should take about 10 minutes to complete.

POSSIBLE RISKS OR DISCOMFORT: This study involves minimal risk. Your may find that some of the questions are sensitive in nature. In addition, participation in this study requires a minimal amount of your time and effort.

POSSIBLE BENEFITS: There may be no direct benefit to you in participating in this research. However, in addition to the value of the theory development for future scholarship, the results of the study should contribute to organizational practice. Managers might use the research instruments to find gaps in the use of organizational knowledge.

FINANCIAL CONSIDERATIONS: There is no financial compensation for your participation in this research. There are no costs to you as a result of your participation in this study.

Institutional Review Board for the Protection of Human Subjects
Lynn University
3601 N. Military Trail Boca Raton, Florida 33431

ANONYMITY: Anonymity will be maintained to the degree permitted by the technology used. Specifically, no guarantees can be made regarding the interception of data sent via the internet by any third parties. The researcher will not identify you and data will be reported as "group" responses. Participation in this survey is voluntary and proceeding with the completion of the survey will constitute your informed consent to participate. Your e-mail address, IP address, and individual responses will neither be identified nor tracked as part of data collection.
The results of this study may be published in a dissertation, scientific journals or presented at professional meetings. However, your individual privacy will be maintained in all publications or presentations resulting from this study.

RIGHT TO WITHDRAW: You are free to choose whether or not to participate in this study. There will be no penalty or loss of benefits to which you are otherwise entitled if you choose not to participate.

CONTACTS FOR QUESTIONS/ACCESS TO CONSENT FORM: Any further questions you have about this study or your participation in it, either now or in the future, will be answered by Hsin-Jung Hsieh who may be reached a[redacted] or at [redacted] and Dr. Eldon Bernstein, faculty advisor who may be reached a[redacted] For any questions regarding your rights as a research subject, you may call Dr. Farideh Farazmand, Chair of the Lynn University Institutional Review Board for the Protection of Human Subjects, at [redacted] If any problems arise as a result of your participation in this study, please call the principal investigator (Hsin-Jung Hsieh) and the faculty advisor (Dr. Bernstein) immediately. You are free to print a copy of this consent form.

INVESTIGATOR'S AFFIDAVIT: I have carefully explained to the subject the nature of the above project. The person participating has represented to me that he/she is at least 18 yeas of age, and that he/she does not have a medical problem or language or educational barrier that precludes his/her understanding of my explanation. I hereby certify that to the best of my knowledge the person participating in this project understands the nature, demands, benefits, and risks of his/her participation.

[redacted]
Signature of Investigator

Date of IRB Approval: 11/20/2006
Date of IRB Expiration: 11/20/2007

Yes, I agree to participate in this study.

No, I don't agree to participate in this study.

APPENDIX B

Print Outs of Online Authorization for Informed Consent

Consent Form Exit this survey >>

Yes, I agree to participate in this study

No, I do not agree to participate in this study

Institutional Review Board for the Protection of Human Subjects
Lynn University
3601 N. Military Trail Boca Raton, Florida 33431

AUTHORIZATION FOR VOLUNTARY CONSENT

PROJECT TITLE: Integration of Organizational Characteristics, Knowledge Management Strategy, Enablers, and Process Capability, and its Effect on Knowledge Management Performance in U.S. Software Companies
Project IRB Number: 2006-39 Lynn University 3601 N. Military Trail Boca Raton, Florida 33431

I, Hsin-Jung Hsieh, am a doctoral student at Lynn University. I am studying Global Leadership, with a specialization in Corporate and Organizational Management. One of my degree requirements is to conduct a research study.

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You are being asked to participate in my research study. Please read this form carefully. This form provides you with information about this study. The principal investigator (Hsin-Jung Hsieh) will answer all of your questions. Please ask questions about anything you don't understand before deciding whether or not to participate. You are free to ask questions at any time before or after your participation in this study. Your participation is entirely voluntary and you can refuse to participate without penalty or loss of benefits to which you are otherwise entitled.

PURPOSE OF THIS RESEARCH STUDY: The study is about organizational characteristics, knowledge management strategy, enablers, and process capability, and knowledge management performance in U.S. software companies. According to the North American Industrial Classification System (NAICS), U.S. software companies include software publishers, computer systems design and related service, and internet services. There will be approximately 3,000 executives participating in this study. All participants must be at least 18 years old. Participants must be fluent in English. Participants must have been employed at their present companies for the past six months.

PROCEDURE: The invitation e-mail is sent by using the Blind Carbon Copy (Bcc) feature. When an e-mail is sent by Bcc, the recipients are unable to know who else has received the message. The survey is completed electronically and begins by clicking the link above. You are prompted to answer questions based on your beliefs about knowledge management in your firm. These surveys should take about 10 minutes to complete.

POSSIBLE RISKS OR DISCOMFORT: This study involves minimal risk. Your may find that some of the questions are sensitive in nature. In addition, participation in this study requires a minimal amount of your time and effort.

POSSIBLE BENEFITS: There may be no direct benefit to you in participating in this research. However, in addition to the value of the theory development for future scholarship, the results of the study should contribute to organizational practice. Managers might use the research instruments to find gaps in the use of organizational knowledge.

FINANCIAL CONSIDERATIONS: There is no financial compensation for your participation in this research. There are no costs to you as a result of your participation in this study.

ANONYMITY: Anonymity will be maintained to the degree permitted by the technology used. Specifically, no guarantees can be made regarding the interception of data sent via the Internet by any third parties. The researcher will not identify you and data will be reported as "group" responses. Participation in this survey is voluntary and proceeding with the completion of the survey will constitute your informed consent to participate. Your e-mail address, IP address, and individual responses will neither be identified nor tracked as part of data collection.
The results of this study may be published in a dissertation, scientific journals or presented at professional meetings. However, your individual privacy will be maintained in all publications or presentations resulting from this study.

RIGHT TO WITHDRAW: You are free to choose whether or not to participate in this study. There will be no penalty or loss of benefits to which you are otherwise entitled if you choose not to participate.

CONTACTS FOR QUESTIONS/ACCESS TO CONSENT FORM: Any further questions you have about this study or your participation in it, either now or in the future, will be answered by Hsin-Jung Hsieh who may be reached at: [redacted] or at [redacted], and Dr. Eldon Bernstein, faculty advisor who may be reached at [redacted]. For any questions regarding your rights as a research subject, you may call Dr. Farideh Farazmand, Chair of the Lynn University Institutional Review Board for the Protection of Human Subjects, at [redacted]. If any problems arise as a result of your participation in this study, please call the principal investigator (Hsin-Jung Hsieh) and the faculty advisor (Dr. Bernstein) immediately. You are free to print a copy of this consent form.

INVESTIGATOR'S AFFIDAVIT: I have carefully explained to the subject the nature of the above project. The person participating has represented to me that he/she is at least 18 yeas of age, and that he/she does not have a medical problem or language or educational barrier that precludes his/her understanding of my explanation. I hereby certify that to the best of my knowledge the person participating in this project understands the nature, demands, benefits, and risks of his/her participation.

[redacted]

Signature of Investigator

Date of IRB Approval: November 20, 2006
Date of IRB Expiration: November 20, 2007

APPENDIX C

Survey Instrument

Part 1: Filter Questions

If you answered "yes", to each of the questions below, proceed to the survey. If you answered "no" to any of the questions, there is no need for you to complete the survey.

1. Have you been employed at your company for the past six months?
   _____ Yes _____ No
2. Do you understand the knowledge management process in your company?
   _____ Yes _____ No
3. Do you clearly understand the dynamics of your company and your key competitors?
   _____ Yes _____ No

Part 2: Organizational Characteristics Profile

1. Type of software company (Check one):
   _____ Software publisher
   _____ Computer system design and related service
   _____ Internet service
2. Numbers of employees: _____
3. Annual Sales in dollars: _____
4. At what stage is your primary product/service life cycle (Check one):
   _____ Introductory _____Growing _____Mature _____ Declining

Part 3: Knowledge Management Strategy

Instructions: The following questions relate to your beliefs about the knowledge management strategy in your firm. Please show the extent to which you think the knowledge management strategy has the feature described by the statement. If you **strongly agree** that the knowledge management strategy has that feature, choose the number **5**. If you **strongly disagree** that the knowledge management strategy has that feature, choose the number **1**. Choose the number between 1 and 5 that shows how strong your belief is.

	Strongly Disagree				Strongly Agree
1. In our company, knowledge like know-how, technical skill, or problem solving methods is well codified.	1	2	3	4	5
2. In our company, knowledge can be acquired easily through formal documents and manuals.	1	2	3	4	5
3. In our company, results of projects and meetings are documented.	1	2	3	4	5
4. In our company, knowledge is shared in codified forms like manuals or documents.	1	2	3	4	5

	Strongly Disagree				Strongly Agree
5. In our company, knowledge can be easily acquired from experts and co-workers.	1	2	3	4	5
6. In our company, it is easy to get face-to-face advice from experts.	1	2	3	4	5
7. In our company, informal conversations and meetings are used for knowledge sharing.	1	2	3	4	5
8. In our company, knowledge is acquired by one-to-one mentoring.	1	2	3	4	5

Note. The Knowledge Management Strategy Scale is from "Knowledge management enablers, process, and organizational performance: An integration and empirical examination," by B. Choi, 2002, Unpublished doctoral dissertation, Korea Advanced Institute of Science and Technology, Korea. Adopted with permission of the author.

Part 4: Knowledge Management Enablers

Instructions: The following questions relate to your beliefs about the knowledge management enablers in your firm. Please show the extent to which you think the knowledge management enablers have the feature described by the statement. If you **strongly agree** that the knowledge management enablers have that feature, choose the number **5**. If you **strongly disagree** that the knowledge management enablers have that feature, choose the number **1**. Choose the number between 1 and 5 that shows how strong your belief is.

	Strongly Disagree				Strongly Agree
1. Our company provides information technology support for collaborative work regardless of time and place.	1	2	3	4	5
2. Our company provides information technology support for communication among organization employees.	1	2	3	4	5
3. Our company provides information technology support for searching for and accessing necessary information.	1	2	3	4	5
4. Our company provides information technology support for simulation and prediction.	1	2	3	4	5
5. Our company provides information technology support for systematic storing.	1	2	3	4	5
6. Our employees can take action without a supervisor.	1	2	3	4	5
7. Our employees are encouraged to make their own decisions.	1	2	3	4	5
8. Our employees do not need to refer to someone else to make decisions.	1	2	3	4	5
9. Our employees do not need to ask their supervisor before taking action.	1	2	3	4	5

	Strongly Disagree				Strongly Agree
10. Our employees can make decisions without approval.	1	2	3	4	5
11. In our company, there are many activities that are covered by formal procedures.	1	2	3	4	5
12. In our company, contact with our company is on a formal or planned basis.	1	2	3	4	5
13. In our company, rules and procedures are typically written.	1	2	3	4	5
14. In our company, employees cannot ignore the rules and reach informal agreements to handle some situations.	1	2	3	4	5
15. In our company, employees cannot make their own rules on the job.	1	2	3	4	5
16. Our employees are satisfied with the amount of collaboration.	1	2	3	4	5
17. Our employees are supportive.	1	2	3	4	5
18. Our employees are helpful.	1	2	3	4	5
19. There is a willingness to collaborate across organizational units within our company.	1	2	3	4	5
20. There is a willingness within our company to accept responsibility for failure.	1	2	3	4	5
21. Our employees are generally trustworthy.	1	2	3	4	5
22. Our employees have reciprocal faith in other members' intentions and behaviors.	1	2	3	4	5
23. Our employees have reciprocal faith in each other's ability.	1	2	3	4	5
24. Our employees have reciprocal faith in others' commitment to organizational goals.	1	2	3	4	5
25. Our employees have reciprocal faith in others' commitment to the company as a whole.	1	2	3	4	5
26. Our employees have relationships based on reciprocal faith.	1	2	3	4	5
27. Our company has a standardized reward system for sharing knowledge.	1	2	3	4	5

Note. The Knowledge Management Enablers Scale is from "Knowledge management enablers, process, and organizational performance: An integrative view and empirical examination," by H. Lee and B. Choi, 2003, Journal of Management Information systems, 20(1), p. 179-288. Adopted with permission of the authors.

Part 5: Knowledge Management Process Capability

Instructions: The following questions relate to your beliefs about the knowledge management process capability in your firm. Please show the extent to which you think the knowledge management process capability has the feature described by the statement. If you **strongly agree** that the knowledge management process capability has that feature, choose the number **5**. If you **strongly disagree** that the knowledge management process capability has that feature, choose the number **1**. Choose the number between 1 and 5 that shows how strong your belief is.

	Strongly Disagree				Strongly Agree
1. Our company has internal processes for generating new knowledge from existing knowledge.	1	2	3	4	5
2. Our company has processes for using feedback from past experience to improve future projects.	1	2	3	4	5
3. Our company has processes for distributing knowledge throughout the organization.	1	2	3	4	5
4. Our company has processes for exchanging knowledge with external partners.	1	2	3	4	5
5. Our company has processes for acquiring knowledge about new products and services within our industry.	1	2	3	4	5
6. Our company has processes for acquiring knowledge about competitors within our industry.	1	2	3	4	5
7. Our company has processes for benchmarking performance among employees and departments.	1	2	3	4	5
8. Our company has processes for identifying and upgrading best practices.	1	2	3	4	5
9. Our company has processes to protect knowledge from inappropriate use or from being leaked in and outside the organization.	1	2	3	4	5
10. Our company has technology such as a password system, to restrict access to particular sources of knowledge.	1	2	3	4	5
11. Our company has processes to value and protect tacit knowledge embedded in individuals.	1	2	3	4	5
12. Our company has processes to identify restricted knowledge.	1	2	3	4	5
13. Our company clearly communicates the importance of having knowledge protection on a corporate level.	1	2	3	4	5
14. Our company has processes for converting competitive intelligence into action plans.	1	2	3	4	5
15. Our company has processes for filtering and evaluating knowledge.	1	2	3	4	5

	Strongly Disagree				Strongly Agree
16. Our company has processes for transferring organizational knowledge into individual knowledge.	1	2	3	4	5
17. Our company has processes for absorbing individual knowledge into organizational knowledge.	1	2	3	4	5
18. Our company has processes for absorbing knowledge from partners into organizational knowledge.	1	2	3	4	5
19. Our company has processes for integrating different sources and types of knowledge.	1	2	3	4	5
20. Our company has processes for replacing outdated knowledge with new knowledge.	1	2	3	4	5
21. Our company has processes for learning from past mistakes.	1	2	3	4	5
22. Our company has processes for using knowledge to solve new problems.	1	2	3	4	5
23. Our company has processes for matching sources of knowledge to problems and challenges.	1	2	3	4	5
24. Our company has processes for applying stored knowledge to improve efficiency.	1	2	3	4	5
25. Our company has processes for using knowledge to adjust strategic directions.	1	2	3	4	5
26. Our company has processes for quickly linking sources of knowledge (holder and type) available for solving problems.	1	2	3	4	5

Note. The Knowledge Management Process Capability Scale is from "A review of the knowledge management model based on an empirical survey of Korean experts," by K. Park, 2006, Unpublished doctoral dissertation, University of Kyushu, Korea. Adopted with permission of the author.

Part 6: Knowledge Management Performance

Instructions: The following questions relate to your beliefs about the knowledge management performance in your firm. Please show the extent to which you think the knowledge management performance has the feature described by the statement. If you **strongly agree** that the knowledge management performance has that feature, choose the number **5**. If you **strongly disagree** that the knowledge management performance has that feature, choose the number **1**. Choose the number between 1 and 5 that shows how strong your belief is.

	Strongly Disagree				**Strongly Agree**
Compared with our key competitors, …					
1. …our company is more successful.	1	2	3	4	5
2. …our company has a greater market share.	1	2	3	4	5
3. …our company is growing faster	1	2	3	4	5
4. …our company is more profitable.	1	2	3	4	5
5. …our company is more innovative.	1	2	3	4	5

Note. The Knowledge Management Performance Scale is from "Knowledge management enablers, process, and organizational performance: An integration and empirical examination," by B. Choi, 2002, Unpublished doctoral dissertation, Korea Advanced Institute of Science and Technology, Korea. Adopted with permission of the author.

APPENDIX D

Print Outs of Online Survey Scales Adopted for Study

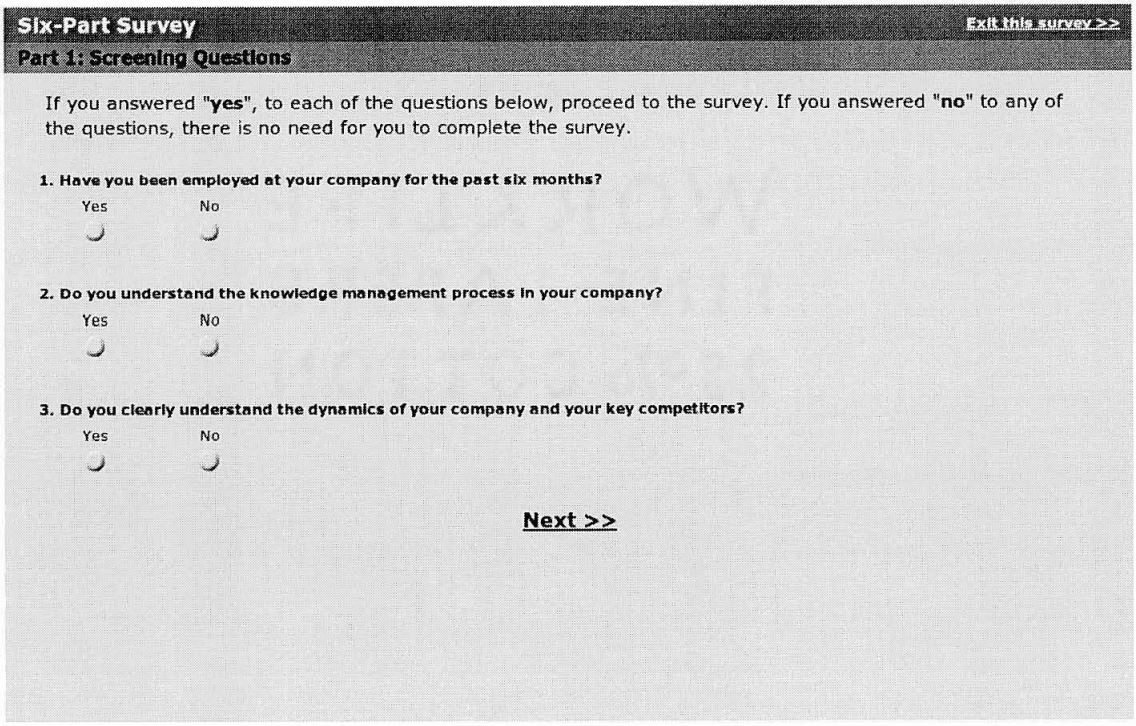


Figure D1. Print out of the screening question of online survey from SurveyMonkey

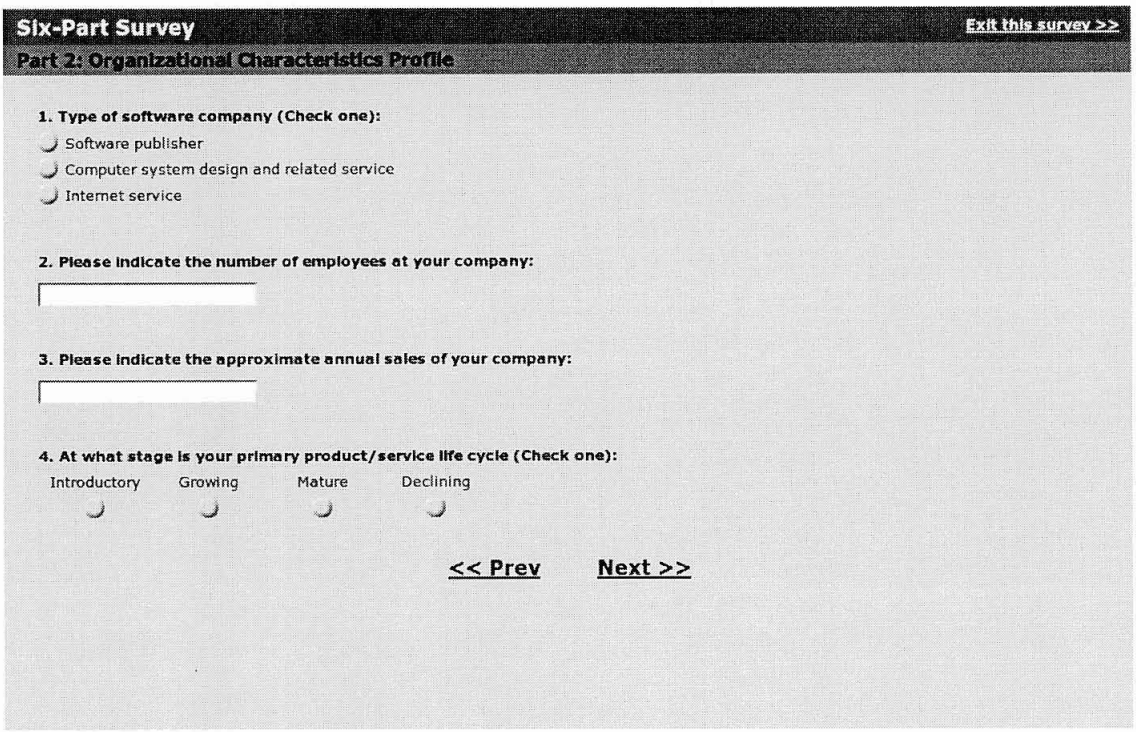
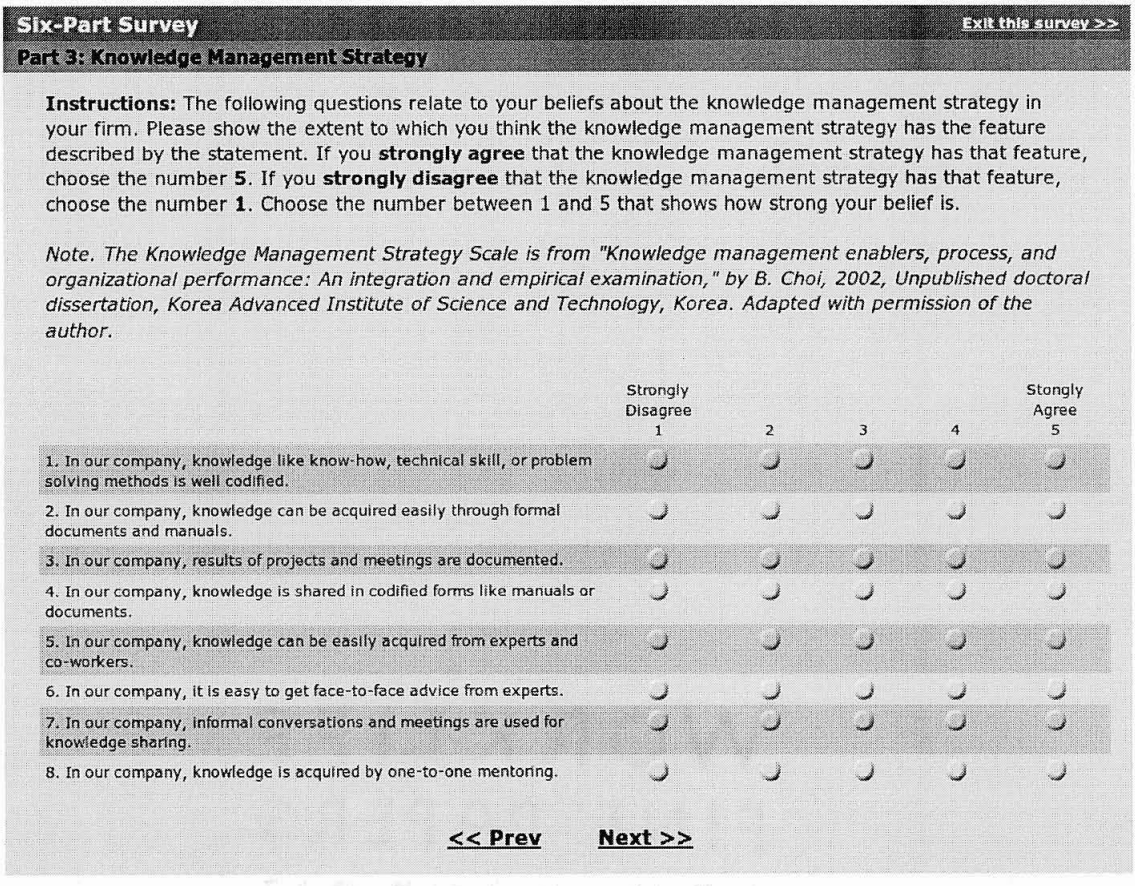


Figure D2. Print out of the *Organizational Characteristics Profile* from SurveyMonkey



Six-Part Survey Exit this survey >>

Part 3: Knowledge Management Strategy

Instructions: The following questions relate to your beliefs about the knowledge management strategy in your firm. Please show the extent to which you think the knowledge management strategy has the feature described by the statement. If you **strongly agree** that the knowledge management strategy has that feature, choose the number **5**. If you **strongly disagree** that the knowledge management strategy has that feature, choose the number **1**. Choose the number between 1 and 5 that shows how strong your belief is.

Note. The Knowledge Management Strategy Scale is from "Knowledge management enablers, process, and organizational performance: An integration and empirical examination," by B. Choi, 2002, Unpublished doctoral dissertation, Korea Advanced Institute of Science and Technology, Korea. Adapted with permission of the author.

	Strongly Disagree 1	2	3	4	Stongly Agree 5
1. In our company, knowledge like know-how, technical skill, or problem solving methods is well codified.					
2. In our company, knowledge can be acquired easily through formal documents and manuals.					
3. In our company, results of projects and meetings are documented.					
4. In our company, knowledge is shared in codified forms like manuals or documents.					
5. In our company, knowledge can be easily acquired from experts and co-workers.					
6. In our company, it is easy to get face-to-face advice from experts.					
7. In our company, informal conversations and meetings are used for knowledge sharing.					
8. In our company, knowledge is acquired by one-to-one mentoring.					

<< Prev Next >>

Figure D3. Print out of the *Knowledge Management Strategy Scale* from SurveyMonkey

Six-Part Survey Exit this survey >>

Part 4: Knowledge Management Enablers

Instructions: The following questions relate to your beliefs about the knowledge management enablers in your firm. Please show the extent to which you think the knowledge management enablers have the feature described by the statement. If you **strongly agree** that the knowledge management enablers have that feature, choose the number **5**. If you **strongly disagree** that the knowledge management enablers have that feature, choose the number **1**. Choose the number between 1 and 5 that shows how strong your belief is.

Note. The Knowledge Management Enablers Scale is from "knowledge management enablers, process, and organizational performance: An integrative view and empirical examination," by H. Lee and B. Choi, 2003, Journal of Management Information systems, 20(1), p. 179-288. Adapted with permission of the authors.

	Strongly Disagree 1	2	3	4	Stongly Agree 5
1. Our company provides information technology support for collaborative work regardless of time and place.	○	○	○	○	○
2. Our company provides information technology support for communication among organization employees.	○	○	○	○	○
3. Our company provides information technology support for searching for and accessing necessary information.	○	○	○	○	○
4. Our company provides information technology support for simulation and prediction.	○	○	○	○	○
5. Our company provides information technology support for systematic storing.	○	○	○	○	○
6. Our employees can take action without a supervisor.	○	○	○	○	○
7. Our employees are encouraged to make their own decisions.	○	○	○	○	○
8. Our employees do not need to refer to someone else to make decisions.	○	○	○	○	○
9. Our employees do not need to ask their supervisor before taking action.	○	○	○	○	○
10. Our employees can make decisions without approval.	○	○	○	○	○
11. In our company, there are many activities that are covered by formal procedures.	○	○	○	○	○
12. In our company, contact with our company is on a formal or planned basis.	○	○	○	○	○
13. In our company, rules and procedures are typically written.	○	○	○	○	○
14. In our company, employees can not ignore the rules and reach informal agreements to handle some situations.	○	○	○	○	○
15. In our company, employees can not make their own rules on the job.	○	○	○	○	○
16. Our employees are satisfied with the amount of collaboration.	○	○	○	○	○
17. Our employees are supportive.	○	○	○	○	○
18. Our employees are helpful.	○	○	○	○	○
19. There is a willingness to collaborate across organizational units within our company.	○	○	○	○	○
20. There is a willingness within our company to accept responsibility for failure.	○	○	○	○	○
21. Our employees are generally trustworthy.	○	○	○	○	○
22. Our employees have reciprocal faith in other members' intentions and behaviors.	○	○	○	○	○
23. Our employees have reciprocal faith in each other's ability.	○	○	○	○	○
24. Our employees have reciprocal faith in others' commitment to organizational goals.	○	○	○	○	○
25. Our employees have reciprocal faith in others' commitment to the company as a whole.	○	○	○	○	○
26. Our employees have relationships based on reciprocal faith.	○	○	○	○	○
27. Our company has a standardized reward system for sharing knowledge.	○	○	○	○	○

<< Prev Next >>

Figure D4. Print out of the *Knowledge Management Enablers Scale* from SurveyMonkey

Six-Part Survey Exit this survey >>

Part 5: Knowledge Management Process Capability

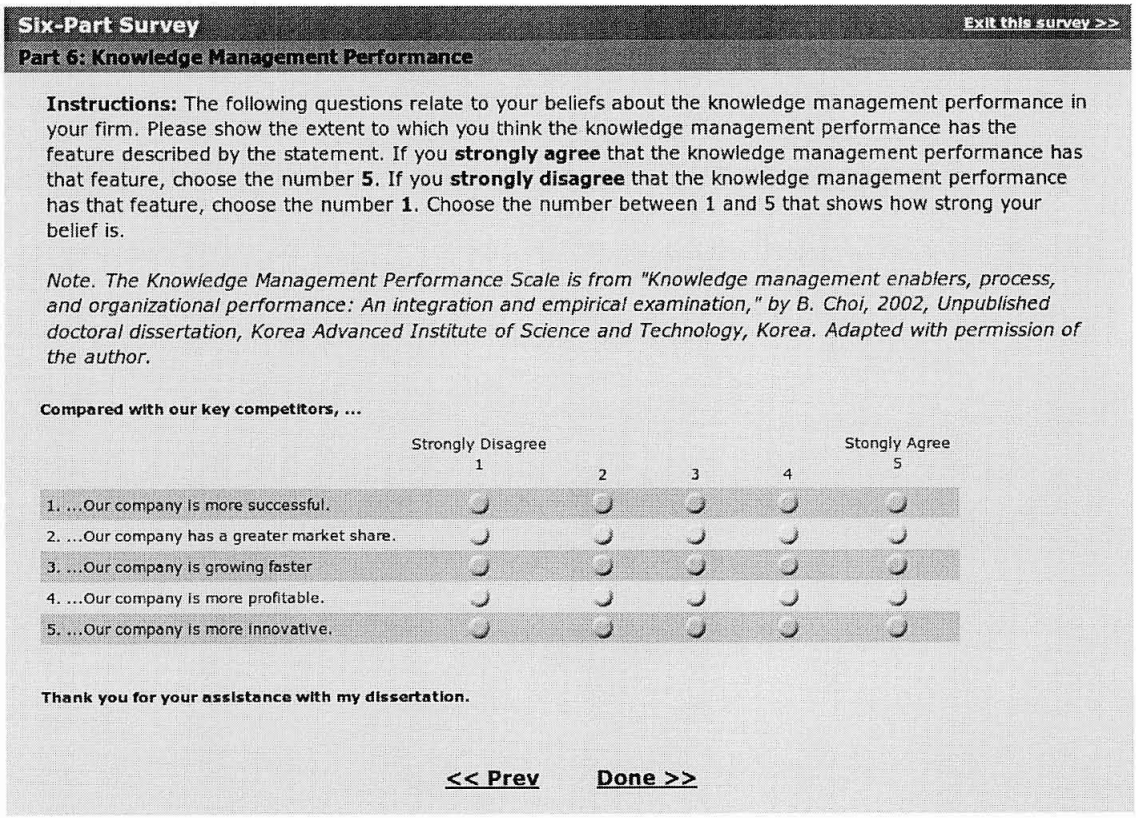
Instructions: The following questions relate to your beliefs about the knowledge management process capability in your firm. Please show the extent to which you think the knowledge management process capability has the feature described by the statement. If you **strongly agree** that the knowledge management process capability has that feature, choose the number **5**. If you **strongly disagree** that the knowledge management process capability has that feature, choose the number **1**. Choose the number between 1 and 5 that shows how strong your belief is.

Note. The Knowledge Management Process Capability Scale is from "A review of the knowledge management model based on an empirical survey of Korean experts," by K. Park, 2006, Unpublished doctoral dissertation, University of Kyushu, Korea. Adapted with permission of the author.

	Strongly Disagree 1	2	3	4	Stongly Agree 5
1. Our company has internal processes for generating new knowledge from existing knowledge.	○	○	○	○	○
2. Our company has processes for using feedback from past experience to improve future projects.	○	○	○	○	○
3. Our company has processes for distributing knowledge throughout the organization.	○	○	○	○	○
4. Our company has processes for exchanging knowledge with external partners.	○	○	○	○	○
5. Our company has processes for acquiring knowledge about new products and services within our industry.	○	○	○	○	○
6. Our company has processes for acquiring knowledge about competitors within our industry.	○	○	○	○	○
7. Our company has processes for benchmarking performance among employees and departments.	○	○	○	○	○
8. Our company has processes for identifying and upgrading best practices.	○	○	○	○	○
9. Our company has processes to protect knowledge from inappropriate use or from being leaked in and outside the organization.	○	○	○	○	○
10. Our company has technology such as a password system, to restrict access to particular sources of knowledge.	○	○	○	○	○
11. Our company has processes to value and protect tacit knowledge embedded in individuals.	○	○	○	○	○
12. Our company has processes to identify restricted knowledge.	○	○	○	○	○
13. Our company clearly communicates the importance of having knowledge protection on a corporate level.	○	○	○	○	○
14. Our company has processes for converting competitive intelligence into action plans.	○	○	○	○	○
15. Our company has processes for filtering and evaluating knowledge.	○	○	○	○	○
16. Our company has processes for transferring organizational knowledge into individual knowledge.	○	○	○	○	○
17. Our company has processes for absorbing individual knowledge into organizational knowledge.	○	○	○	○	○
18. Our company has processes for absorbing knowledge from partners into organizational knowledge.	○	○	○	○	○
19. Our company has processes for integrating different sources and types of knowledge.	○	○	○	○	○
20. Our company has processes for replacing outdated knowledge with new knowledge.	○	○	○	○	○
21. Our company has processes for learning from past mistakes.	○	○	○	○	○
22. Our company has processes for using knowledge to solve new problems.	○	○	○	○	○
23. Our company has processes for matching sources of knowledge to problems and challenges.	○	○	○	○	○
24. Our company has processes for applying stored knowledge to improve efficiency.	○	○	○	○	○
25. Our company has processes for using knowledge to adjust strategic directions.	○	○	○	○	○
26. Our company has processes for quickly linking sources of knowledge (holder and type) available for solving problems.	○	○	○	○	○

<< Prev **Next >>**

Figure D5. Print out of the *Knowledge Management Process Capability Scale* from SurveyMonkey



Six-Part Survey Exit this survey >>

Part 6: Knowledge Management Performance

Instructions: The following questions relate to your beliefs about the knowledge management performance in your firm. Please show the extent to which you think the knowledge management performance has the feature described by the statement. If you **strongly agree** that the knowledge management performance has that feature, choose the number **5**. If you **strongly disagree** that the knowledge management performance has that feature, choose the number **1**. Choose the number between 1 and 5 that shows how strong your belief is.

Note. The Knowledge Management Performance Scale is from "Knowledge management enablers, process, and organizational performance: An integration and empirical examination," by B. Choi, 2002, Unpublished doctoral dissertation, Korea Advanced Institute of Science and Technology, Korea. Adapted with permission of the author.

Compared with our key competitors, ...

	Strongly Disagree 1	2	3	4	Stongly Agree 5
1. ...Our company is more successful.					
2. ...Our company has a greater market share.					
3. ...Our company is growing faster					
4. ...Our company is more profitable.					
5. ...Our company is more innovative.					

Thank you for your assistance with my dissertation.

<< Prev **Done >>**

Figure D6. Print out of the *Knowledge Management Performance Scale* from SurveyMonkey

APPENDIX E

Permission Letters from Instrument Developers

Knowledge Management Strategy Scale, Knowledge Management Enablers Scale, and Knowledge Management Performance Scale

Re: Request your permission (dissertation) Sent: Sun 9/17/2006 9:39 PM
[redacted] on behalf of Byounggu Choi
To: Hsin-Jung Hsieh

Dear Hsieh,

Thank you for your query. I hope it helps your dissertation.

Regards,

Byounggu

2006/9/18, Hsin-Jung Hsieh <[redacted]>:

Dear Dr. Choi,

I am a PhD student at Lynn University in Boca Raton, Florida in the United States. I am writing my dissertation and writing to request your permission to use the three instruments in your dissertation: Knowledge Management Strategy Scale, Knowledge Management Enablers Scale, and Knowledge Management Performance Scale.

I thank you in advance for your cooperation. Should you have any questions or suggestions, please feel free to write to me.

Best regards,

Hsin-Jung Hsieh

Knowledge Management Process Capability Scale and Organizational Characteristics Profile

Re: Request your permission (dissertation) Sent: Wed 9/20/2006 7:58 PM
park kisik [redacted]

Dear Hsin-Jung Hsieh

Thank you for your request of permission to use instruments in my dissertation. With pleasure I cordially accept it as long as you clarify the source of instruments (my dissertation).
Anyway, I am currently working as a director general of Planning & Coordination Dept. of KOTRA (Korea Trade Investment Promotion Agency) in our headquarters in Seoul. My dissertation was completed while I was stationed in Fukuoka, Japan when I was head of Korea Trade Center Fukuoka.
I am more than happy to continue to give any advice on your project. It seems that you must be Asian Origin. For our smooth future contacts, would you please let me know more about yourself. Also let me know how you come to know my dissertation and my Seoul contact details.
If you have any plan to visit Seoul, please let me know it as well so that we can possibly meet together.
Hope that you will achieve your project in not-too-distant a future, I remain,

Yours sincerely
Ki-Sik, Park

--- Hsin-Jung Hsieh [redacted]> wrote:

Dear Dr. Park Ki-Sik

I am a PhD student at Lynn University in Boca Raton, Florida in the United States. I am writing my dissertation and writing to request your permission to use the two instruments in your dissertation: Knowledge Management Process Capability Scale and Organizational Characteristics Profile. I thank you in advance for your cooperation. Should you have any questions or suggestions, please feel free to write to me.
Sincerely,

Hsin-Jung Hsieh

APPENDIX F

E-Mail Invitation

Dear Executive:

I am a doctoral student at Lynn University in Boca Raton, Florida. I am in the process of researching my dissertation, which explores the relationship among organizational characteristics, knowledge management strategy, enablers, and process capability, and its effect on knowledge management performance in U.S. software companies.

This e-mail invites you to participate in an online survey about knowledge management in you firm. You must be at least 18 years of age and have been employed by your company for six months to participate in the study.

Please click the following link to enter a web page, which describes the survey and provides information about your consent to participate. This is followed by a link to the online survey. Please do not leave any identifying information. It should take approximately 10 minutes to complete the online survey.

http://www.surveymonkey.com/s.asp?u=412162875703

Thank you for your assistance with my dissertation.

Hsin-Jung Hsieh
[redacted]
Phone: [redacted]
E-mail: [redacted]

APPENDIX G

IRB Approval

Lynn University

Principal Investigator: Hsin-Jung Hsieh

Project Title: Integration of Organizational Characteristics, Knowledge Management Strategy, Enablers and Process Capability, and its Effect on Knowledge Management Performance in U.S Software Companies

IRB Project Number 2006-039:
APPLICATION AND PROTOCOL FOR REVIEW OF RESEACRH INVOLVING HUMAN SUBJECTS OF NEW PROJECT: Request for Exempt Status__Expedited Review__Convened Full-Board _X_

IRB ACTION by the CONVENED FULL BOARD

Date of IRB Review of Application and Research Protocol: 11/20/06

IRB ACTION: Approved X Approved w/provision(s) __ Not Approved __Other __

COMMENTS:

Consent Required: No _____Yes _X__Not Applicable _____ Written __X__Signed__

Consent forms must bear the research protocol expiration date of 11/20/07

Application to Continue/Renew ieluding an update consent, is due:

1) For a Convened Full-Board Review, two months prior to the due date for renewal X
2) For an Expedited IRB Review, one month prior to the due date for renewal __
3) For review of research with exempt status, one month prior to the due date for renewal __

Name of IRB Chair Farideh Farazmand

Signature of IRB Chair [redacted] Date: 11/20/06

Ce. Dr. Bernstein

Institutional Review Board for the Protection of Human Subjects
Lynn University
3601 N. Military Trail Boca Raton, Florida 33431