UNDERSTANDING KNOWLEDGE MANAGEMENT AND ORGANIZATIONAL

ADAPTATION AND THE INFUENCING EFFECTS OF TRUST AND INDUSTRIAL

CLUSTER

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Due to rapid environmental change, today's business requires a more collaborative management to ensure positive performance. One of the important means that can help firms adapt successfully to a changing environment is knowledge management. The management of information and knowledge as key to retaining competitive advantage and has recently evolved into a more strategically focused research topic for both business and academic study.

Managing knowledge, however, is deemed difficult because many companies recognize the importance of their proprietary knowledge and are not willing to share it freely. Recognizing this weakness, many countries have promoted the development of regional clusters where firms can co-develop their competences and competitive advantage against the world's best competitors by sharing knowledge, resources, and innovative capabilities.

Other than industrial clusters, trust is also considered an important factor in knowledge management study. Trust reduces the need to monitor others' behaviors, formalize procedures, and it lowers transaction costs. At the macro level, trust can enhance organizations' core competencies and sustain their competitive advantages through co-evolution. This may occur through the development of group collaborations, cooperative relationships, and networks.

The study adopted a field survey research method and used multiple regressions

as the data analysis technique. The dependent variable in the study was organizational adaptation, while the independent variables were knowledge management, trust and industrial cluster. Data were collected using survey of key informants from 943 companies. The results of the analysis suggested that knowledge management does have significant influence on organizational adaptation and both industrial cluster and trust impact on organizational learning activities. The major contribution of this study is that it offers a more holistic approach in studying knowledge management by adding a new element: knowledge applying. Moreover, this study offers an initial attempt to test industrial cluster in hopes of advancing the research in management related fields.

ACKNOWLEDGEMENTS

provided me with a great foundation, which is to believe I can accomplish whatever I decide to do.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Research Background

Due to rapid environmental change, business today requires a collaborative

management to ensure positive performance. Business executives are encountering

intense competition from a variety of global competitors, which blurs organizational and

geographical boundaries (Ohmae, 1995). Although globalization and continuing

technological innovations provide challenges to companies in the 21st century, it has

also provided many opportunities. To successfully adapt to today's changing

environment, executives continuously attempt to differentiate their firms from the

competition.

Organizations need the capability to adapt to increasing complexity and high-

velocity change in the market place (Brown & Eisenhardt, 1998; McGrath, 2001;

Schumpeter, 1950). One of the primary means that can help firms adapt successfully to

a constantly changing environment is knowledge management. The knowledge-based

economy has changed the managerial philosophy from worrying about tangible assets

to attention to managing assets that are invisible. Managing intangible assets and

knowledge is considered a solution to strengthening competitiveness, and has recently

developed into a more purposefully-focused research topic for both business and

academic communities.

Organizational adaptation requires the creation of variety, and it can be facilitated

by learning (March, 1991; McGrath, 2001; Levinthal, 1991). The transfer and creation of

knowledge allows an organization to innovate and cooperate more effectively and

efficiently (Kogut & Zander, 1992; Tsai & Ghoshal, 1998). Both March (1991) and Levinthal (1991) suggest that organizational learning and knowledge are influential in organizations' adaptive attempts toward change. Especially in highly novel environments, organizations need to gain knowledge to improve what they already know, which is termed competency enhancement, as well as to invent something new (Burns & Stalker, 1995). Therefore, with this greater degree of environmental uncertainty and complexity, organizations must have superior capabilities to manage knowledge, and be more capable of adapting to environmental changes (McGrath, 2001). Organizational learning is considered an early stage of knowledge management in the dynamic context of organizational change (Hannan & Freeman, 1984; Levitt & March, 1988). It leaves open a question about what other stages or activities in the knowledge management process might affect organizational adaptation.

The main logic of knowledge management is associated with the design of systems that engage the most effective components and required assets, including the recognition of the importance of communication with and coordination of organizational units to make strategically important decisions (McGrath, 2001). Since the 21st century has been widely recognized as the knowledge-based economic era, one of the most distinctive features of a knowledge-based economy is that knowledge has become a strategically significant resource that organizations need to acquire to sustain competitive advantage (DeGeus, 1988). Natural resources have become less important in today's knowledge explosion era. An organization must find a way to survive and further succeed in the midst of dramatic and rapid changes in the business environment. Since the input and output that are needed for organizational survival are

associated with various kinds of knowledge resources, knowledge obtaining, organizing, and applying have become major components of an organization's routine.

The research field of knowledge management is not new, and it is believed to be derived from organizational learning. Organizations have always had some practices in place to effectively blend their know-how and integrate it with knowledge obtained from either inside or outside organizational boundaries (DeGeus, 1998). However, theories and means are needed for managing and creating valuable knowledge and knowledge bases to create innovation, sustain competitive advantage, and ultimately convert the new learning into successful organizational adaptations (Corno et al., 1999; Marshall, 1997).

As organizations depend increasingly on obtaining, disseminating, and using or reusing knowledge, many organizations have begun to emphasize the subject of knowledge management. Knowledge management is considered a dynamic process that encompasses creating, capturing, and applying knowledge to achieve an organization's objectives (Zucker, 1986).

The purpose of knowledge management is to establish a favorable setting in which an organization can leverage all its knowledge assets (Trepper, 2000). By leveraging knowledge assets, an organization is more capable of increasing profit, reducing costs, and enhancing research and development (R&D) capacity (DeTienne & Jackson, 2001; Drucker, 1994). Moreover, knowledge management contributes significantly to the accumulation and articulation of organization-specific skills and knowledge, as well as strengthening executive's decision- making processes (Cohen & Levinthal, 1990; March & Simon 1958; Nelson & Winter, 1982). Hence, by addressing

knowledge management, an organization can enhance competence over time, lower risks, and sustain competitive advantage (Hannan & Freeman, 1984, 1989; Levinthal, 1991; Porter, 1985).

Obtaining Knowledge and Learning

As discussed previously, obtaining knowledge or learning is considered an early stage of the knowledge management process. Inevitably, organizations need to initiate knowledge obtaining practices before knowledge can proceed to a stage of organization and application. For many companies, however, knowledge obtaining is deemed difficult because many companies recognize the importance of their proprietary knowledge and are not willing to share it freely. This challenge is particularly true for companies in smaller countries that may lack the domestic knowledge pool necessary for growth, and for companies in developing countries that have weaker informational capabilities and limited support industries. Recognizing this weakness, many countries have promoted the development of regional clusters where firms can co-develop their competences and competitive advantage against the world's best competitors by sharing knowledge, resources, and innovative capabilities. A number of researchers have acknowledged the value of industrial clusters in many countries around the world (e.g., Bresnahan et al., 2001; Porter, 1998; Saxenian, 1994; Zucker et al., 1998) and pointed to the advantages that result in the development, transfer, and application of knowledge necessary for continued innovation.

Industrial Clusters

The successful development of industrial clusters may prove problematic in many places. Porter (1990) highlighted four attributes necessary for the development of a

cluster within a country as factor conditions, demand, supporting industries, and competition. Promotion and interaction among the above four attributes helps clustering firms enhance their competitiveness in today's global economy. Even with the development of industrial clusters, bringing each of these areas to a level that supports globally competitive businesses may be difficult for firms in smaller or developing nations. As a result, firms are persistently looking outside their own industrial clusters for partners that can provide necessary resources and capabilities.

Through the development of industrial clusters and the emergence of networks both within and among clusters, a number of firms have quickly risen to global prominence. These firms have clearly made use of knowledge resources and capabilities in their own countries, and have also extended their networks into the clusters of other countries. Porter (1990) indicated that international competitive advantage is developed and sustained through a highly localized process that includes the divergence of national values, cultures, economic structures, institutions, and histories. By networking within cultures, firms may be able to stimulate continued innovation and leverage resources and capabilities quickly that might not otherwise be available.

Although both clusters and networks have received attention in the literature, networking between clusters across national boundaries is an under-explored area. Due to globalization, rising environmental uncertainty and complexity, and industrial heterogeneity, organizations are facing an unprecedented challenge to maintain their collaborative relationships. Organizations need to survive and succeed in the midst of

dramatic and rapid environmental changes, thus, inevitably, they need to cooperate with partners, and sometimes even competing firms.

Inter-Organizational Relationships

As detailed in the management literature, a growing number of firms are involved in developing long-term inter-organizational relationships (Bradach & Eccles, 1989; Gulati, 1995a, 1995b; Gulati et al., 2000; Miles & Snow, 1984; Miles et al., 2000; Ohmae, 1989; Pennings & Harianto, 1992; Porter, 1986, 1996; Schmitz, 1999; Thorelli, 1986). Many have argued that social networks and economic ties with all the participating units at both intra- and inter-organizational levels are essential for inducing economic activities (Fichman & Levinthal, 1991; Granovetter, 1985; Jarillo, 1988; Larson, 1992). Further, research suggests that operational effectiveness within a coordinated structure and boundary can be optimized if all the organizational units work collectively (McAllister, 1995).

Interdependent relationships may be achieved in a variety of forms, such as joint venture, direct investment, strategic alliance, networks, and industrial clusters. Recent research in inter-organizational relationships has shifted the focus to the central role of trust in such cooperation, and views it as a determinate of cooperative relationships inside and outside of organizations (Doney & Cannon, 1997; Gulati, 1995b; Miles & Creed, 1995; Miles & Snow, 1992; Rousseau et al., 1998; Smith et al., 1995; Zaheer et al., 1998).

Trust

Trust is considered a key determinant in many studies related to organizational behavior, organizational theory, and strategic management. It has also become an

important factor for emerging global economic networks and industrial clusters. At the individual level, Gambetta (1988) posits that trust helps people cope with environmental challenges and is present in a variety of diverse social interactions. Consequently, trust is valuable social capital that facilitates cooperation and coordination in both social and economic interactions.

Trust also brings important value to the organization. It lowers the need to monitor employee and executive behaviors, to formalize procedures, and ultimately lowers transaction costs (Blau, 1964; Coleman, 1990; Macauley, 1963; Powell, 1990; Williamson, 1985; Zucker, 1986). At the macro level, trust can further enhance organizations' core competencies and sustain their competitive advantages through co-evolution (Shapiro et al., 1992; Zucker, 1986). This occurs through the development of group collaborations, cooperative relationships, and networks. Therefore, inter-firm collaborations can facilitate organizations to co-explore new sources of profit, share knowledge, and exchange resources.

Statement of the Problem

Currently, there is no shared dominant or convincing notion of trust and its application across disciplines. Researchers who study trust create specific definitions to fit their needs. Frequently these definitions are not generalizable, but rather focused on their own domains such as management, politics, and sociology (Rousseau et al., 1998). In addition, the differences in cross-disciplinary assumptions of trust are embedded in the divergent use of language (Bates, 1997; Rousseau et al., 1998). For the purpose of this dissertation, a generalizable model based on the theoretical foundations of trust was needed to enhance our understanding of the relationship

between trust and knowledge management. A suitable development of trust at the inter-organizational level for this study includes both intrinsic and extrinsic components, social functions, consistent language, and also unifying factors that significantly affect its formation. Creating such a model advances our understanding of trust at the inter-organizational level.

Purpose of the Study

Many have recognized that business today is a knowledge-based endeavor. Knowledge management becomes a business practice that is of great strategic importance. Though theories have developed to support the notion that knowledge management facilitates organizational performance, it is currently incomplete. This study was designed to develop a holistic knowledge management system that may assist firms to better adapt to the changing environment. What stages/activities should be included in the knowledge management process? What practices and aspects should be included in organizational adaptation? Moreover, trust and industrial clusters should also be seen as important facilitators that can help organizations further implement their knowledge management practices. This study was designed to determine the effects of knowledge management on organizational adaptation, with special attention to the advantages of inter-organizational trust and industrial clusters. A structured instrument and survey was conducted to uncover the impact of knowledge management processes on organizational adaptation, as well as the influence of trust and industrial clusters on knowledge management.

Research Objectives and Questions

The purpose of the study has been stated in the previous section. Following are the objectives of this research study

1. The literature review summarizes the constructs, determinants, and antecedents for the research areas (i.e., organizational adaptation, knowledge management, trust, and industrial clusters).

2. Related theories cited enable the development of a hypothesized model for empirical testing.

3. From the results of empirical testing, the hypothesized relations are compared and verified.

There are four major theoretical foundations in this dissertation: organizational adaptation, knowledge management, trust, and a firm's industrial cluster involvement. The central research scheme is the examination of the relationship between knowledge management and organizational adaptation. Although the focus on information and knowledge is nothing new, there have been several misunderstandings that need to be further clarified. For instance, some researchers have equated organizational learning to knowledge management and developed instruments for empirical testing and they are somewhat misleading. On the other hand, other researchers have omitted knowledge applying as an essential stage in the knowledge management process, and it is considered incomplete in studying knowledge management. This gap has existed until the recent attention shifted toward the efforts of utilizing a more holistic approach to knowledge management. Both the academic and business communities have become increasingly interested in the research of a complete knowledge management system

with emphasis on the value of knowledge within organizations. Further, it is necessary to include knowledge applying in the equation of knowledge management. This issue of including knowledge applying in the knowledge management process leads to the first research question:

1. Is there a relationship between a complete knowledge management system and organizational adaptation?

Knowledge obtaining is considered the first stage in the knowledge management process. Without obtaining knowledge, the subsequent knowledge management stages might not be triggered. Therefore, knowledge obtaining is of a great importance. As discussed previously, both trust and a firm's industrial cluster involvement might facilitate more effective and efficient knowledge obtaining. Firms are exposed to a knowledge pool in a unique and well-structured environmental setting in an industrial cluster, which might grant firms easier access to necessary knowledge. Trust can also be a prominent coordination mechanism in inter-organizational relationships, and might streamline the knowledge exchange. Thus, this leads to the second research question in this study:

2. Are there relationships among knowledge management, trust, and industrial clusters?

In this study, it is intended to find and validate the relationships among organizational adaptation, knowledge management, trust, and industrial cluster involvement. Figure 1 presents the conceptual framework of this dissertation.
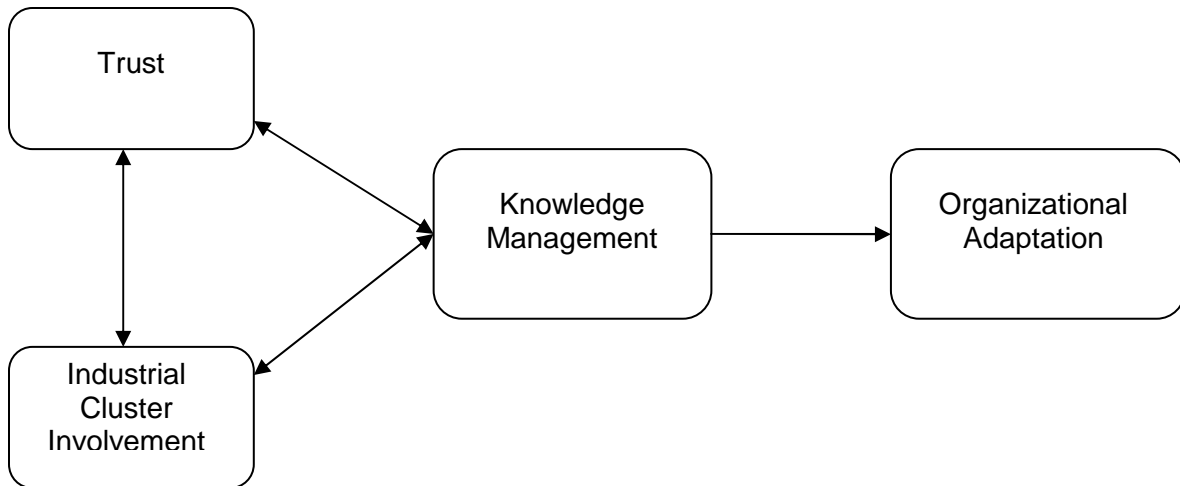
Figure 1. Conceptual framework of the dissertation.

Importance of the Research

This study of organizational adaptation, knowledge management, trust, and industrial cluster addresses the needs of both the academic and business communities. General contributions to academic research include (a) an enhanced understanding of knowledge management as a dynamic process, (b) initial empirical testing of industrial cluster with a global focus, and (c) an insightful examination of trust. In addition, general contributions to business and industry may include a clearer understanding of trust and industrial cluster, as well as the concept of applying knowledge to value creation. The specific benefits of this study follow.

Benefits for Academic Research

Research about knowledge management has been underspecified for quite some time, and often people equate it to organizational learning. This study adopts a different approach by viewing knowledge management as a dynamic process with the addition of a new element: knowledge applying. If knowledge cannot encourage organizations to create value, then "knowledge" is simply "information" or "data" at most.

Information is mainly "descriptive" and it is contained in answers from *who, what, where, which, how many,* and *when* questions. Knowledge, by contrast, is "instructive;" it is conveyed by answers to *how-to* questions (Gharajedaghi & Ackoff, 1984). Information must be further processed in a systematic manner to become useful knowledge (Nooteboom, 1996). Applying knowledge is essential for organizations to transform the *how-to* vernaculars into sustainable value within the entire knowledge management process (Pfeffer & Sutton, 2000; Zack, 2000). By adding an additional element, knowledge management is examined in a holistic manner.

Industrial clusters have always been a research area that received little attention. However, from observation of many emerging countries such as China, or countries in Latin America, one can always find the existence of industrial clusters, and inevitably it creates questions about their effect on the organizations within them. This study is an initial attempt to empirically examine industrial clusters to enhance understanding of the field. On the other hand, trust has received increasing attention, but the lack of study of inter-organizational relationships is an insufficiency in this research field. The research in this study also attempts to synthesize a theory of trust.

Benefits for Business and Industry

The study provides the empirical evidence needed to advance and refine the framework for studying the relationships between organizational adaptation, knowledge management, trust, and industrial cluster. Theoretically, knowledge management leads to successful organizational adaptation, and empirical evidence would further confirm this relationship. Moreover, the study takes both trust and industrial cluster into consideration, and it offers a new insight to the study of inter-organizational

relationships. Therefore, the investigation of all the above elements should yield valuable information for business and industry.

<div align="center">Structure of the Study</div>

This study contains five chapters and the summary of each is as follows:

1. Chapter I outlines the research background, objectives, conceptual framework, structure, and flow path of the study.

2. Chapter II reviews the related literature relevant to the study. This chapter includes four major research areas: organizational adaptation, knowledge management, trust, and industrial cluster. Key constructs and their relationships are identified. In addition, research hypotheses will be developed. Finally, a hypothesized research model for the study is proposed.

3. Chapter III illustrates construct measures and provides an index of questionnaire items and the research design for the study. Further in this chapter, the research design, data collection procedures, sampling methods, and data analysis plan are presented. A pilot study is conducted for validating the newly developed questionnaire instrument.

4. Chapter IV presents the statistical results of the study, which are analyzed through statistical inference (i.e., structural equation modeling), and the results and comparisons lead to the conclusion of the study in the following chapter.

5. Chapter V addresses the summary of significant findings and conclusions. Strategic implications and suggestions for future research are presented in this chapter.

Summary

There are four major theoretical foundations briefly discussed in the previous section. They are organizational adaptation, knowledge management, trust, and industrial cluster. Each is considered a research-worthy field. This study focused on the interactions between organizational adaptation, knowledge management, trust, and industrial cluster, which has not been done previously. Hypotheses were drawn from each of the above theoretical foundations. The results will provide a more holistic and insightful body of knowledge about organizational adaptation, knowledge management, trust, and industrial cluster. The research procedures for this study are shown in Figure 2.

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│   Identify research objectives and research structure (Ch. I)  │
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│                   Literature review (Ch. II)                   │
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│      Develop the theoretical foundations and constructs (Ch. II)│
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│     Develop the hypothesized model of this dissertation (Ch. II)│
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│       Research Design and instrument development (Ch. III)     │
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│         Survey distribution and data collection (Ch. IV)       │
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│                    Data analysis (Ch. IV)                      │
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│      Testing hypotheses and proposed relationships (Ch. IV)    │
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│              Conclusion and suggestions (Ch.V)                 │
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Figure 2. Flow path of the research process in the study.

CHAPTER II

LITERATURE REVIEW AND HYPOTHESIS

Introduction

As discussed in Chapter I, knowledge management is essential for organizational adaptation, and knowledge management should be seen as a holistic, dynamic process. To facilitate the organizational knowledge management process, trust and a firm's industrial cluster involvement can be as important as other managerial activities such as strategic alliances and international joint ventures. Knowledge management practices can be observed in many industrial clusters because regional agglomeration encourages knowledge spillover, which allows firms to co-evolve to overcome external competitive pressures collectively (Porter, 2000). Industrial clusters also promote inter-firm collaboration to gain synergism. The establishment of an inter-organizational relationship requires a significant amount of trust beyond mere contractual control mechanisms (Gulati, 1995a). Moreover, the environmental setting of industrial clusters facilitates inter-firm collaboration and is considered influential in clustering firms' attempts to sustain competitiveness and adapt successfully to environmental changes (Porter, 1998).

To organize the effort, this review of literature contains two parts. In the first part, the theoretical foundations of organizational adaptation, knowledge management, the theory of trust, and industrial cluster are reviewed and discussed. The second is the justification of the chosen theoretical framework and development of the hypotheses for later data analysis.

Organizational Adaptation

Research about organization theory has been dominated by two paradigms. One line of research has emphasized organizational adaptation to environmental contingencies (Cyert & March, 1963; Lawrence & Lorsch, 1967), while Hannan and Freeman (1977, 1984) proposed the population ecology paradigm, arguing that organizational adaptation is often too slow to react successfully to environmental changes. The organizational adaptation perspective stems from traditional contingency theory, resource dependency, and transaction cost theory, which posits that there are multiple ways for organizations to adapt to environmental changes. By contrast, the population ecologists propose that organizational constructs with the best fit to essential environmental characteristics are selected and proliferate. A variety of constructs are created by natural selection. Some constructs are selected for better fit, and the organizational fit is retained through reproduction and duplication. Researchers in this domain contend that organizations usually do not change or adapt, but are replaced by organizations with constructs and fits that better adapt to their individual environments.

Many researchers, however, do not believe there is a conflict between organizational adaptation and environmental selection perspectives. Rather, they believe the two aspects are complementary (Astley & Van de Ven, 1983; Levinthal, 1991; Scott, 1992). Scott (1987) argues that an organizational adaptation perspective is useful when examining more peripheral features, larger organizations, and shorter time periods, while the selection process explains the core features of smaller organizations, and organizations examined over longer periods. Therefore, it is logical to assume that the organizational constructs that fit the environment the best are the consequence of

multiple adaptive attempts. Environmental changes are unpredictable, and organizations need to maintain the flexibility and capability to adapt to environmental contingencies quickly. Organizations must have an effective adaptive system in uncertain environments.

A central concern of an organizational adaptive system is the balance between the exploration of new possibilities (i.e., innovation) and the exploitation of existing certainties (i.e., competence enhancement), (Holland, 1975; Kuran, 1988; March, 1991; Schumpeter, 1934; Teece, 1986). As March (1991) contended, organizations must constantly attempt to find an appropriate adaptive process in relation to the exploitation of existing processes and/or knowledge and the exploration of new alternatives. Maintaining a balance between finding new possibilities and improving operational routines is essential for long term survival and prosperity (Levinthal, 1990, 1991; March, 1991).

In response to external environments, organizations tend to enhance existing competence when the environment is relatively stable because there is no immediate urgency to adopt new ways of doing business. When facing rapid environmental changes, however, organizations need to quickly adapt to external environments by exploring new alternatives that afford them an advantageous competitive position (March, 1991). An organization's existing operational routine through which managers can adjust the process, or even organizational structure, to best fit the requirements of a changing environment is essential. A failure to engineer these internal adjustments can be predicted to result in relative organizational inefficiency, and ultimately, in the inability to survive (Levinthal, 1991).

Exploration and Exploitation

Both exploration (innovation) and exploitation (competence enhancement) can happen at two levels: product and process. An organization may refine its existing operational process to more efficiently and effectively produce a certain type of product, and/or refine the features of a firm's existing products. In terms of exploration, a firm can either invent new products or introduce new services to meet an external market need, or it can find new elements (e.g., input materials, task specifications, and equipment/approach) and introduce them into a firm's production or service operations (Damanpour, 1991).

Knowing the importance of adapting to changing environments, researchers have begun to look for the means of successful adaptation by trying to answer the question of *how*. One stream of research has recently shifted focus to the importance of knowledge, and has emphasized the critical role of intelligent adaptation. Intelligent adaptation, also known as learning (March, 1991; Levinthal, 1991), is considered an important means to balance organizational exploration and exploitation, and to reconcile adaptation and selection perspectives (March, 1991; Levinthal, 1991). March (1991) models the development and articulation of organizational knowledge and suggests that learning constitutes intelligent adaptation, which leads to a balance between organizational exploration and exploitation. Effective selection among constructs, norms, and routines in turbulent environments is equally important to the generation of new alternative practices necessary for an organizations' survival (Zahra & George, 2002). Knowledge accumulation and development within an organization contributes significantly to both

exploratory and exploitative learning, and in turn, helps executives in organizations adapt to the environment in both the short and long term.

Summary

Effective knowledge management helps organizations enhance innovation as well as organizational competence. Intelligent adaptation and learning are similar in many ways (March, 1991; Levinthal, 1991) and are considered the very beginning of an entire knowledge management system (Huber, 1991; Zack, 1999). From previous discussion, clearly, organizational adaptation is related to knowledge management, and thus, in the following section, knowledge management will be discussed.

Knowledge Management

Knowledge management theory is concerned with finding a balance between developing, accessing and using information within a company, which helps each organizational unit apply appropriate knowledge to an existing knowledge base, and to create new additions (Marshall, 1997; Pfeffer & Sutton, 2000). The development of structures that include the proper techniques and tools, the circulation of constant human inputs, and an appropriate capability to make quick decisions becomes the indispensable antecedents of knowledge management (Raisinghani, 2000). Wilson and Asay (1999) defined knowledge management as providing rapid access to information and expertise throughout whole systems as needed to enhance individual and organizational learning and performance.

Knowledge management is also viewed as a managerial action that is a specific controlling and planning activity within a company aimed at achieving the strategic objectives by creating, capturing, internalizing, and using appropriate knowledge. From

the above definitions and views, it is evident that knowledge management has a strong

prescriptive element, which is to "manage learning" to achieve a positive impact on

performance. Executives have to develop the ability to leverage existing knowledge and

create new knowledge that favorably positions their organizations in the selected

markets to be competitive (Gold et al., 2001).

Extensive reviews of knowledge management literature exist (Cohen & Levinthal,

1990; Crossan et al., 1999; Levitt & March, 1988; Tsai, 2001; Vera & Crossan, 2003,

2004). Many researchers agree that the knowledge management field lacks integrative

works and empirical studies (Simon, 1991; Vera & Crossan, 2004; Weick, 1991). A

recent theoretical framework model of organizational learning by Crossan et al. (1999,

p. 41) proposes a coherent conceptualization of knowledge management. They view

organizational learning as part of organizational knowledge management process that

can be categorized into new learning and improvement of what has been learned. The

perspective of new learning and improving what has been learned is similar to March's

(1991) managing knowledgeable novelty and continuity perspective.

Crossan et al. (1999) indicate that organizational learning occurs at the

individual, group, or organization level. Knowledge perceived from similar sets of

information can be very different, not only in quality, but also in applicability, because

individuals, groups, and organizations have different mental models (Senge, 1990).

Crossan et al. (1999) argue that each level could obtain new knowledge, transfer

new/existing knowledge, or obtain and transfer new/existing knowledge simultaneously.

These three levels of obtaining and transferring knowledge are connected by four social

and psychological processes: intuiting, interpreting, integrating, and institutionalizing

(4I). The four levels occur within individual, group and organization levels respectively. Based on the previous literature in knowledge management, from intuiting and interpreting to integrating and institutionalizing, one can logically conclude that knowledge management is a dynamic process that encompasses the activities of absorbing and internalizing knowledge.

Researchers use various terms to describe the activity of absorbing knowledge, such as Nonaka's knowledge creation (1991), Huber's knowledge acquisition (1991), Cohen and Levinthal's absorptive capacity (1990), and March's knowledge exploration and exploitation (1991). The term "knowledge obtaining" throughout this study indicates the activity of absorbing knowledge.

Further, other researchers extend the need for organizations to organize the newly acquired knowledge by interpretation, storing, integration, and distribution (Crossan et al.*,* 1999; Duffy, 2000; Huber, 1991; Zack, 1999). However, it is argued in this study that if knowledge cannot assist organizations in creating value, then "knowledge" is simply "information" or "data" at most. Information is mainly "descriptive" and it is contained in answers from *who, what, where, which, how many, when* questions. Knowledge, by contrast, is "instructive;" it is conveyed by answers to *how-to* questions (Gharajedaghi & Ackoff, 1984). Information must be further processed in a systematic manner to become useful knowledge (Nooteboom, 1996).

Applying knowledge is essential for organizations to transform the *how-to* vernaculars into sustainable values within the entire knowledge management process (Pfeffer & Sutton, 2000; Zack, 1999). Beyond knowledge obtaining and organizing, firms must be able to apply knowledge to sustain competitive advantage in today's intense

competition. In the following section, the stages involved in the knowledge management process based on previous literature will be briefly discussed.

Knowledge Obtaining

Before knowledge can be effectively manipulated to meet the goal of an organization, knowledge must be obtained. The sources of knowledge that a firm can obtain is either from the external environment or the internal organization itself (Duffy, 2000). The process of acquiring knowledge from external sources is knowledge acquisition. Organizations frequently attempt to identify outstanding practices from well-positioned competitors as well as partners, and then evaluate the present situation with a scrupulous procedure to identify gaps or nuisances in managing the first stage of knowledge management. Once these variances are identified, organizations can capture the knowledge for internal use to improve performance (Porter & Millar, 1985). Three common methods used to achieve the objective that are related to knowledge acquisition are benchmarking, strategic alliances, and networking. Obtaining the complementary knowledge from partners and external sources can significantly enhance a firm's capability.

Organizations have unequal capability in integrating and reproducing knowledge gained from external sources (Duffy, 2000). This ability is labeled as "absorptive capacity" (Cohen & Levinthal, 1990). Cohen and Levinthal (1990) argued that absorptive ability allows organizations to accumulate and renew the existing knowledge and hence, actualize innovation. Cohen and Levinthal (1990) suggested that the ability to acquire and use external knowledge is often associated with R&D investment, the production of innovations, and performance. Organizations are required to enhance

their competency, as well as their capability for innovation, to survive in turbulent environments.

The process of creating knowledge inside an organization is called knowledge creation. A knowledge creation process focuses on the latent nature of knowledge, which resides inside the minds of different individuals or groups in an organization. Usually, organizations need to initiate a transformational process from tacit knowledge to explicit knowledge to enhance the applicability of more codified knowledge. Collaboration between employees, multi-unit project teams, and R&D departments are the most likely units to create new knowledge inside an organization.

New knowledge can be created or acquired either when existing knowledge is too obsolete to solve problems or when the necessity of new knowledge emerges. Typically people generate knowledge by comparing unfamiliar ideas, facts, or tools with familiar ones (McDermott, 1999). Nonaka and Takeuchi (1995) and Nonaka (1998) contend that knowledge can be created through the interaction of explicit knowledge and tacit knowledge within four different knowledge creation modes. Transforming latent knowledge into explicit knowledge, where individuals acquire new knowledge directly from others, is defined as socialization. It refers to the process of experience-sharing and implicit learning. In turn, tacit knowledge can transfer from one group to another.

The process of making tacit knowledge explicit is called externalization. It means the articulation of knowledge and transformation into a tangible form through dialogue. People can turn personal experiences, value concepts, and mental models into an explicit form with metaphor, analogy, and modeling. Internalization is defined as the process of understanding and transforming the explicit knowledge held by individuals

into tacit knowledge. It is the process of improving values, attitudes, and behaviors by constant education, learning, and reading. Explicit knowledge can be transferred through a process that is called combination. It is the process of turning explicit knowledge into another form. Analyzing, categorizing, sharing, and reconstruction of the existing explicit knowledge will produce new explicit knowledge (Nonaka & Takeuchi, 1995).

Knowledge Organizing

Knowledge organizing is the second stage after knowledge obtaining. This stage acts as an initial filtering mechanism for examining and identifying the potential pay-off and use of knowledge. This mechanism must exist in organizations to prevent the unnecessary absorption of valueless knowledge and to make valuable knowledge accessible for future use. Knowledge organizing encompasses three major activities: refinement, storage, and distribution (Duffy, 2000; Huber, 1991; Zack, 1999).

Knowledge refinement is a value-adding process before storage and distribution of the newly captured knowledge to the repository or knowledge base (Zack, 1999). After obtaining the knowledge, organizations need to systematically add value by labeling, cleansing, standardizing, and abstracting to a knowledge platform for reviewers to examine and search. Knowledge refinement is perceived as the first step of internalizing the newly obtained knowledge, and this mechanism can be useful to enhance the effectiveness and efficiency of organizations' knowledge management. Once the obtained knowledge has passed through the value adding process (i.e., refinement) and been examined for its potential usefulness, organizations benefit from developing mechanisms for storing this knowledge.

Knowledge storage in databases or data warehouses functions as the conduit between knowledge obtaining and distribution (Crossan et al., 1999; Duffy, 2000; Huber, 1991; Zack, 1999). The structure of knowledge storage needs to provide diversified content views so users can access it based on their needs. The content of knowledge storage will extend and grow over time if it is managed properly.

Knowledge distribution refers to the methods of delivering knowledge to users, groups, and organizations (Crossan et al., 1999; Huber, 1991; Pfeffer & Sutton, 2000; Zack, 1999). Zack (1999) defined knowledge distribution as a mechanism that organizations adopt to make knowledge storage accessible. Knowledge distribution is usually mediated by organizational culture and frequency of communication (Buckman, 1998; Pfeffer & Sutton, 2000). Various organizational members and units that serve as knowledge acquirers also communicate and share knowledge to other organizational components (Huber, 1991). Knowledge needs to be readily available for users within organizations who are searching for information that could help generate solutions. The structure of the knowledge storage, organizational communications, well-developed indexing and abstracting, and user-friendly interfaces to disparate data sources greatly impacts the effectiveness and efficiency of knowledge distribution (Duffy, 2000; Huber, 1991; Zack, 1999).

The organizational ability to make quick and effective decisions is increased with an efficient distribution of knowledge because organizational units and individual employees in a firm have access to significant strategic information, as opposed to encountering vital knowledge that is sequestered with higher-level management.

Knowledge Applying

Knowledge applying is associated with the actual use of the knowledge. Pfeffer and Sutton (2000) argued that competitive advantage goes to organizations that use knowledge the best, not to those that have the best knowledge. They further contended that unless the final stage of knowledge management - knowledge applying - is achieved in the real world setting, the preceding stages of knowledge management are ineffective and will create a "knowing-doing gap" (Pfeffer & Sutton, 2000). Surprisingly, few discussions have been devoted to the results of effective applications of knowledge (Gold et al., 2001). For example, various scholars research the subject of knowledge acquisition and creation and explicitly assume that once knowledge is obtained it will be applied effectively (Nonaka, 1998; Nonaka & Takeuchi, 1995).

Wong and Radcliffe (2000) proposed a theoretical model of knowledge applying. It emphasized the relationship among different types of functional knowledge (i.e., from different departments, personnel), focal knowledge (i.e., knowledge needed to perform certain task), and the performance of the tasks. If the functional knowledge supports the focal knowledge involved in performing a task, organizations are likely to perform better. The following table summarizes the literature regarding the knowledge management process.

Table 1

Summary of Knowledge Management Related Research

Stages of Knowledge Management	Constructs of Knowledge Management Stages	Key Notions	Selected Research
Knowledge Obtaining	Acquisition	A firm's attempt to obtain information and/or knowledge from external sources	Duffy, 2000; Cohen and Levinthal, 1990; McDermott, 1999; Crossan et al., 1999; Levinthal, 1991; March, 1991; Huber, 1991
	Creation	A firm's attempt to create information and/or knowledge from internal sources	Nonaka and Takeuchi, 1995; Nonaka, 1998; Crossan et al., 1999; March, 1991
Knowledge Organizing	Refining	A firm's value-adding process to newly obtained information and/or knowledge by labeling, standardizing, and abstracting	Crossan et al., 1999; Zack, 1999; March, 1991; Huber, 1991
	Storing	A firm's attempt to store and save information and/or knowledge after refining for future use/re-use	Crossan et al., 1999; Duffy, 2000; Huber, 1991; Zack, 1999
	Distributing	A firm's internal information and/or knowledge sharing across functional units	Crossan et al., 1999; Huber, 1991; Pfeffer and Sutton, 2000; Zack, 1999; Buckman, 1998; Pfeffer and Sutton, 2000
Knowledge Applying	Applying	A firm's value creating activity by using information and/or knowledge	Pfeffer and Sutton, 2000; Gold, Malhotra and Segars, 2001; Wong and Radcliffe, 2000; Tushman and Romanelli, 1985

Summary

In sum, literature suggests that knowledge management is essential for improving efficiency, sustaining a competitive advantage, and reducing dependency on individual know-how. Knowing that creating knowledge inside an organization is usually more difficult than acquiring knowledge from external sources, it is intended to take into account how knowledge- management related activities can best be organized to be shared and applied across different contexts and environmental settings at the inter-organizational level. Since trust is heavily involved in the behavior of social exchange, it leads to an investigation of the connection between knowledge management and trust in this study.

Theory of Trust

To have an effective knowledge management process, trust is considered an important mechanism. Trust between two or more social units enables or disables their interaction. One usually makes decisions about trust based on interaction histories when assessing others' characters, purposes, and possible future actions. The understanding or knowledge of others, in turn, provides a basis for drawing conclusions regarding others' trustworthiness, and for making predictions about their future behavior (Kramer, 1993).

Trust does not simply require information and knowledge about others; it can also facilitate and ensure the fair social exchange of knowledge between two or more parties once the relationships have been established (Huber, 1991). Therefore, it is useful and valuable to investigate the relationship between knowledge management and trust. In the following section the concept of trust is discussed.

29

Interest in the research about trust has been growing throughout the 1980s and into the 2000s. According to Gambetta (1988), trust is a crucial social mechanism embedded in every social interaction that allows individuals to adapt to the social environment. As a matter of fact, society will not function properly if there is no trust (Gambetta, 1988). Among organizational researchers, trust has received attention as a mechanism of organizational control, and more specifically, as a necessary element in the operation in network forms of organizations (Kaser & Miles, 2002; Miles & Creed, 1995; Miles & Snow, 1992; Powell, 1990). Moreover, trust is able to sustain individual and organizational effectiveness by reducing costs associated with controlling, monitoring and negotiating (McAllister, 1995).

Convincing evidences from possible trustees often constitutes positive perceptions that may facilitate the development of trust. Trust, however, encompasses not only beliefs and expectations about others, but also a purposeful intent that is associated with mutual gains from trustworthy relationships (Blau, 1964). That is, trust is important because it encourages positive interactions between individuals, as well as between organizations, and frequently trust can be used to reduce transaction costs (Miles & Creed, 1995; Nooteboom, 1996). For the purpose of this research, the focus is to measure trust and examine its relation to knowledge management in cluster settings. In the following section, the development of trust research and dimensions of trust are discussed.

Development of Trust Research

Researchers originally viewed trust as a personality trait and tended to study trust at an individual level. More recently, the scope of trust research has been

expanded from the individual level to the organizational level (Gulati, 1995a, 1995b; Nooteboom, 1996). Typically, researchers study trust from two viewpoints. First, trust indicates the willingness to accept the risks that are associated within a relationship. Second, trust implies the expectation and acceptability of certain kinds of behavior. The willingness to accept the risks includes (a) belief that potential trustees will not act opportunistically (Cummings & Bromiley, 1996), (b) belief in trustees' goodwill (Ring & Van de Ven, 1992), and (c) authorization for an agent to act appropriately on one's behalf (Shapiro, 1987). On the other hand, expectation and acceptability include the assumption of honest communication (Cummings & Bromiley, 1996), and the belief that one will receive fair, just treatment from the trustee (Nooteboom, 1996).

When studying trust at the organizational or inter-organizational level, it is important to consider the value of trust. Generally, trust can have extrinsic or economic value as a basis for achieving social or economical goals. Trust, on the other hand, can also have intrinsic value, as a dimension of relations that are evaluated in a relatively non-rational fashion (Luhmann, 1979; Nooteboom, 1998; Sako, 1992). From the psychological perspective, people may perceive trust as a means to interact or to refuse to interact with others (Blau, 1964; Jarillo, 1988). However, from the economic perspective, people may think of trust as something that exists dependent on the goal setting of the transaction (Gulati, 1995a; Powell, 1990). However, the distinctions between intrinsic and extrinsic value are not necessarily distinguishable, because, after all, the decision to trust or distrust is always made at the individual level. Therefore, it is a necessity to provide a coherent framework to analyze trust at organizational and inter-organizational levels.

According to the literature, trust has been often equated with cooperation and confidence, which is inappropriate and needs clearer definition for the purpose of this study. Even though trust might be significant in cooperative relationships, cooperation does not necessarily mean trust. Trust implies a calculation of risk, but simple confidence does not necessarily mean the calculation of risk (Luhmann, 1979, 1986). To clearly define trust in this study is deemed critical for empirical testing, and the process of defining trust for this study is discussed in the following section.

Definition of Trust and Inter-Organizational Trust

From the previous discussion, trust has been identified as an important prerequisite for developing inter-organizational relationships (Fukuyama, 1995; Morgan & Hunt, 1994). Although there is a general agreement that trust is an effective and efficient factor in establishing cooperative relationships inside and outside organizations (Gambetta, 1988; Kaser & Miles, 2002; Miles & Snow, 1992; Rousseau et al., 1998), there is no universally accepted definition of trust across disciplines. Gambetta (1988) defines trust as the subjective probability by which an individual (a) expects that another individual can be trusted, and (b) performs a given action on which one's welfare depends. McAllister (1995) defines trust as confidence and argues that trust enables people to take risks. Deutsch (1958) posits that trust is based on the expectation that one will find what is expected rather than what is feared. Luhmann (1979) views trust as the willingness and faith to take actions with certain degrees of risk. Although previous research offered various definitions of trust, there is an agreement regarding its dimensions. Trust, for this reason, implies people's intrinsically perceived confidence in other parties in the face of risk (Lewis & Weigert, 1985).

Trust is also a social phenomenon that makes work within organizations easier, and collaboration among organizations possible (Gulati, 1995a; Nooteboom, 1996). In a world of increasing uncertainty and complexity, trust is considered a more appropriate mechanism for controlling collective organizational actions and reducing transaction cost than hierarchical power or direct monitoring (Hosmer, 1995; Nooteboom, 1998; Zaheer & Venkatraman, 1995). Beyond trust within organizations, the increasingly close and frequent cooperation and collaboration among organizations (as in cases of joint research and development, just-in-time manufacturing, or relationship marketing) requires high degrees of trust among different organizations (Dodgson, 1993).

In terms of Inter-organizational cooperation, trust is believed to have several extrinsically economic advantages. Trust may serve as an alternative control mechanism in inter-organizational relationships where it may substitute, or at least complement, market prices and hierarchical authority (Bradach & Eccles, 1989), especially since legal remedies or contractual relationships are considered to be weak institutional substitutes for trust (Sitkin & Roth, 1993). Moreover, inter-organizational trust is likely to enhance collective efficiency (Schmitz, 1995; 2000) when it encourages the sharing and disclosure of organizational information and knowledge, and reduces transaction costs (Sako, 1992). Once established, trust stabilizes exchange relationships, which, in turn, considerably increase chances to enhance trust over time (Ring & Van de Ven, 1992, 1994). In modern organizational forms, such as an inter-firm network (Miles & Snow, 1986; Powell, 1990), trust is purposefully regarded as an important control mechanism and mostly assumed to:

- Support the formation of collective strategies (Astley & Fombrun, 1983).

- Facilitate the coordination of economic activities (Miles & Snow, 1986).

- Promote the open exchange of information and knowledge, and inter-organizational learning (Hamel, 1991),

- Reduce the management of inter-organizational conflicts.

- Contribute to a significant reduction of transaction costs (Pfeffer & Salancik, 1978).

- Support organizational change and adaptation (Cohen & Levinthal, 1990; March, 1991).

In the literature about inter-organizational relationships, trust is mostly considered to be a constitutive feature of collaborative relations (Gulati, 1995a; Kumar, 1996; Morgan & Hunt, 1994; Powell, 1990, 1996). In fact, there are many indications or "signals" of trust building in inter-organizational relationships. Trust, which may be of a more extrinsic, rational, self-interested, calculative nature or, conversely, a more intrinsic, non-rational, cultural or social nature, is always associated with a particular risk on the side of the trusting party (Mayer et al., 1995; Nooteboom, 1996; 1998). Willingness to take such risks and to accept vulnerability reflects the confidence of an organization in the reliability of other organizations concerning a given set of expected goals and outcomes that both trustor and trustee agreed upon (Nooteboom, 1996, 1999). Based on the previous discussion, inter-organizational trust in this study is defined as the intrinsically perceived willingness to take risks based on confidence in trustees' behavior to achieve extrinsically strategic objectives. In the following section, different types of inter-organizational trust based on the literature will be discussed.

Types of Inter-Organizational Trust

The multidimensional nature of trust makes the study of the constitution of trust more complex. Many scholars have used a number of terms to describe the very nature of trust such as knowledge-based trust, cognition-based trust, competence-based trust, etc. In this dissertation, however, it is argued that trust is the product of a decision-making process. To trust or distrust, one must have "indicators" or "signals" to facilitate the decision. For instance, competence-based trust actually means that one decides to trust or distrust based on a trustee's competence in accomplishing a task. In the following section, several recent studies to illustrate the types of trust that pertain to inter-organizational trust are provided.

Calculation-based trust. According to agency theory (e.g., Axelrod, 1984; Coleman, 1998; Dasgupta, 1988), as well as in transaction cost economics (e.g., Chiles & McMackin, 1996), trust involves expectations about others by using a cost-benefit analysis about a certain course of action (Aulakh et al., 1996; Williamson, 1993). Stemming from social exchange theory (Blau 1964; Gouldner, 1960; Kaser & Miles, 2002; Smith & Barclay, 1997), the calculative view of trust suggests that trustworthy relationships may lead to rewards or organizational gains due to an equitable exchange (Coote et al., 2003; Kaser & Miles, 2002).

In transaction cost economics (Williamson, 1975, 1996), the key behavioral assumptions are bounded rationality and opportunism. The agent copes with the risk of opportunistic behavior of a potential business partner by employing control mechanisms, and by making opportunism costly. Only if an agent expects calculation of the balance of costs and benefits derived from either opportunistic or cooperative behavior to favor cooperative behavior is the agent willing to trust (Williamson, 1993).

Bradach and Eccles (1989), by contrast, argue that the assumption of trust in the transaction costs approach is not always the case. They do not assume that the risk of opportunism is always present in economic transactions.

Bradach and Eccles (1989) adopt a sociologically informed notion of economic exchange where economic relations and exchanges are embedded in trustworthy relations (Bradach & Eccles, 1989). This view of trust is offered in contrast to trust provided by transaction-cost economics. The transactions between organizations may not be limited to physical goods; they could also encompass invisibles such as knowledge and competency (Nooteboom, 1999). This more sociological understanding of economic relations permits researchers to view trust as an alternative mechanism of social control/governance, which is seen as both functionally equivalent to the market and hierarchy, and often as a complement to them (Ganesan, 1994; Gassenheimer & Manolis, 2001; Nooteboom, 1996; Sako, 1992; Zucker, 1986).

Rational assessment of calculation-based trust entails an evaluation and assessment of a trustee's capabilities, goals, motives, inclinations, and opportunities for actions (Gulati, 1995a; Nooteboom et al., 1997; Parkhe, 1993; Zucker, 1986). This depends on certain conditions such as the transparencies of actions, competitive moves, social conditions, or personal ties or other factors. It can also be based on knowledge obtained from others, or on one's own experience. Therefore, calculation-based trust is not limited in the sense of pure economic value, and it implies that there is a need for integrating signals for assessing trustworthiness.

The debate of calculation-based trust concludes that trusting behavior within and between organizations is not completely free of rational, economic calculation.

Calculation-based trust can mean that trustworthiness is mainly based on calculated

self-interest, and that the trustor knows that this is the case. Calculation-based trust also

implies the need for possible rewards and even punishments (Nooteboom, 1992; Reed,

2001). Moreover, it could possibly mean trust that is based on a rational assessment of

a partner's trustworthiness. Either one of the above assumptions require knowledge and

understanding to assess trustworthiness (Larson, 1992; Macaulay, 1963; Shapiro, 1987,

1989; Zaheer & Venkatraman, 1995).

As pointed out by Kramer (1993) and Zucker (1986), the invisible mental

calculation of cost and benefit exists in most decisions to trust, but the importance of the

element changes with the conditions and objects of trusting relationships, and thus

there should be alternative or non-calculation-based elements that can facilitate

decision making by trust. In the following section, the second type of trust will be

discussed.

Process-based trust. As discussed above, complete rational or calculation-based

trust can be misleading in researching trust. Process-based trust develops from

concrete experience of past social and/or economic exchange and is brought as an

expectation to future transactions (Gulati, 1995a). This kind of trust seems to emerge

particularly when the quality of exchanged goods or services is uncertain (Deutsch,

1958, 1960; Kollock, 1994), as in the case of some kinds of financial services. Process-

based trust may be firsthand or transferred through the hands of a "trust intermediary"

(Coleman, 1990). The relevance of firsthand experience of trust for the development

and maintenance of inter-organizational relationships has often been demonstrated

(e.g., Gulati, 1995a; Uzzi, 1997). This type of earned trust is deeply rooted within social

relationships, and hence the social embeddedness of economic action (Granovetter, 1985).

Social relationships are important to the formation of trust, even if trust is experienced second hand. Uzzi (1996) finds, in his study of the New York apparel industry, referral networks to be as important a source of social embeddedness as direct personal ties. Intermediaries, such as insurance brokers in financial service networks, often act as "trust intermediaries." Given these relationships, even third-party gossip may contribute to the constitution of trust relations (Bearman, 1997).

Some researchers (e.g., Deutsch, 1962, 1973; Larson, 1992; McAllister, 1995; Parkhe, 1993) have used the term "affect-based trust" that is similar to the notion of process-based trust, which includes feelings of friendship or empathy, that influences one's cognitive state when making a trust decision. This non-rational, cognitive basis of trust can include blind faith and routine behavior. It is likely that one might ignore the possibility that he or she is at risk and things might go wrong due to blind faith. Or, one may not be aware of the possibility that things might go wrong due to a habit or routine. These cognitive orientations are examined in motivation, attribution, leadership, and cognitive-dissonance-related decision heuristics research (e.g., Butler, 2001; Heckathorn, 1984; Lindenberg, 2000). In all the above cases, trust is based on processes of interaction that accept a trustor's firsthand experience, and affect perceived values, feelings of friendship, empathy, loyalty and other cognitive mechanisms.

Process-based trust influences both a trustor and a trustee's cognitive states over time, and may finally accumulate into a trustworthy reputation (Dore, 1983). A set

of attributes ascribed to a particular person or organization, typically inferred from past practices, makes it significantly easier to enter into new relationships for both a person and an organization (Cook et al., 1983). Trust or lack of trust between individuals might enhance or dissolve existing relationships (Sako, 2000). Usually, one needs to have sufficient knowledge about others, such as history, intentions, and characters, when making decision to trust (Ganesan, 1994). This knowledge or understanding, as a consequence, sets up a bottom line for an individual to predict other's future behaviors when making a decision to trust (Kramer, 1999; Zaheer et al., 1998). Once a reputation has been established, it operates as an effective safeguard, especially within dense social networks and inter-organizational relationships.

Reputation, as much as trust, may be transferred from one organization to another, given the existence of other trust determinants (Gulati, 1995a). It is similar to the "halo effect" in psychology that refers to a cognitive bias that cumulatively and repeatedly affects an individual's assessment of other's quality (Thorndike, 1920). As discussed in calculation-based trust, reputation can be an important signal for assessing trustworthiness, and thus it indicates the potential overlapping nature and synergy between calculation-based (rational) and process-based (non-rational, cognitive) trust.

Institution-based trust. The third type of trust transcends the social exchange and does not depend upon the exchange of a partner's capability and reliability. Institution-based trust is thought to be generated more diffusely in network relationships (Nooteboom et al., 1997). As Zucker (1986) suggests, institution-based trust is the most important mechanism when residing in an economic environment where commonly shared culture or beliefs could be quite influential.

Sources of institution-based trust are more social-cultural, such as traditions, professions, certifications, licenses, brand names, geographical similarities and memberships in certain associations and agglomerations (Deutsch, 1973; Nooteboom et al., 1997). McKnight and Chervany (2002) contended that institution-based trust is a critical part of a network environment, and they identify two types of institution-based trust that are important to make a decision to trust. The two types are (a) situational normality, which McKnight and Chervany (2002) defined as the belief that success is likely because the situation that networking partners share is similar and normal, and (b) structural assurance, which they defined as the belief that success is likely because there are established, co-shared goals, regulations, infrastructures, and social similarities in place.

Institutional similarity among organizations influences trust decisions and usually enhances trust over time (Zucker, 1986). Organizations with similar backgrounds and characteristics positively influence the creation of trusting relations (McAllister, 1995). Further, institution-based trust can transfer from one organization to others due to strong social network ties, which create trust relations at third-person or organizational levels while participating parties themselves have to rely on trust relationships with interaction partners (Mollering, 2002; Nooteboom et al., 1997). Because of the environmental complexity and a firm's urgency to enhance competitiveness, institution-based trust strengthens the collaboration among organizations in a faster way.

From a sociological perspective, a social system is a collection of many interdependencies that allow participating firms to act as a whole (Ashby, 1956; Bates & Harvey, 1975). The perceived bounded structure of a social system, such as inter-firm

networks or even industrial clusters, establishes an artificial reality indicating the possibility of interaction with other organizations within the system boundary (Bates, 1997; Creed & Miles, 1996). Due to the bounded structure as well as the interdependencies among other organizations in a system, institution-based trust strongly affects a key individual's cognition in making the decision to trust. Thus, social-cultural similarities are considered major sources of institution-based trust.

Other than simple social-cultural similarities, institution-based trust also enhances a networking firm's mutual understanding and knowledge due to institutional forces and local agglomeration. As mentioned in the previous section, understanding and knowledge are crucial for making the decision to trust. Institutional forces, such as social similarities and close group member proximity may provide an easier access to a participating organization's information and knowledge, which can be used to evaluate trustworthiness (Butler, 1991; Hardin, 1998; Nooteboom, 1996). Therefore, institution-based trust is viewed as an effective governance mechanism at the macro level. The following table summarizes the theoretical approaches and key notions of studies in trust.

Table 2

Summary of Trust Related Research

Types of Trust	Decision Criteria	Key Notions	Selected Researches
Calculation-based Trust	• Credibility • Reliability • Competence	Trust is the willingness to rely on an exchange partner to whom one has confidence.	Coote, Forrest & Tam, 2003; Kaser & Miles, 2002; Ganesan, 1994; Gassenheimer & Manolis, 2001; Norman, 2002; Sako, 1992
Process-based Trust	• Goodwill • Reputation • Predictability • History	Trust is an expectation held by an agent that its trading partner will behave in a mutually acceptable manner.	Dyer & Chu, 2000; Gulati, 1995; Kramer, 1999; Sako & Helper, 1998; Uzzi, 1996; Zaheer et al., 1998
Institution-based trust	• Social similarities • Geographical locations • Memberships • Group proximity	Trust is based on socio-cultural similarities which shorten systemic proximity as well as deepening group cohesiveness	Bates, 1997; Miles & Snow, 1984; Mollering, 2002; Nooteboom, 1996; Nooteboom et al., 1997; Zucker, 1986

The above three types of trust are oversimplified to indicate the multidimensional nature of trust at the inter-organizational level. For this study, it is necessary to investigate the dimensions of trust for developing appropriate survey instruments. In the following section, the dimensions of trust are discussed.

Dimensions of Trust

When studying trust, many authors make a distinction between one or more of the following categories: calculation-based, knowledge-based, cognition-based, affect-based, and identification-based trust (Gulati, 1995a; Larson, 1992; Macaulay, 1963; McAllister, 1995; Parkhe, 1993; Shapiro, 1987; Zucker, 1986). However, none of the

research excludes the overlapping nature of previously identified trust types because the distinctions of the intrinsic and extrinsic nature among all the categorized trust types shown may not be clearly present. For instance, to establish trust based on calculation, one usually needs to have sufficient knowledge of how he/she might benefit from the potential trustee in terms of the trustee's competence, reputation, goodwill, etc. In such a case, calculation and knowledge-based trust are complementary, or even identical in nature. The intrinsic value of trust can be non-rational, self-referenced, and environmentally directed, while the extrinsic value of trust is more rational and instrumental, which suggests economical calculation and self-interest (Fukuyama, 1995; Nooteboom, 1999).

Since the overlapping nature of the types of trust is widely recognized (Blau, 1964; Fukuyama, 1995; Jarillo, 1988; Nooteboom, 1996; Sako, 1992), the question arises about whether or how the intrinsic and extrinsic dimensions of trust can be combined. In addition, questions arise about of what intrinsic and extrinsic dimensions constitute trust. As discussed above, the intrinsic value of trust, such as likeness, non-rationality, emotion, confidence, culture, and benevolence, are self-referenced. It is frequently observed in personal relationships between individuals, such as in marriages and friendships. The extrinsic value of trust, however, is involved in a more rational assessment of certain criteria, such as competence, evidence, certifications, history, reputation, and knowledge. It can be more frequently seen in organizational and inter-organizational relationships. Trust has been viewed as an important way to deal with relationships between individuals or organizations; however, it is always a decision made by people. It is argued, therefore, that the intrinsic and extrinsic values of trust

are always present when trusting or distrusting others, especially at the inter-

organizational level. In the following section, both intrinsic and extrinsic dimensions of

trust are examined and summarized based on related literature from multiple

disciplines, such as organization theory, strategic management, sociology, and social

psychology.

From a management perspective, trust is usually involved in an extrinsic and

rational assessment of the trustee's trustworthiness and is based on knowledge and

understanding of others as derived from objective evidence, reputation, records,

professional certifications, established norms, standards, and experience (Holmes,

1978; Kumar, 1996; Morgan & Hunt, 1994, 1999; Nooteboom, 1996; Zucker, 1986). On

the other hand, from sociology and social psychological perspectives, one might not

need to rationally evaluate the trustworthiness of potential trustees. Instead, one could

use some intrinsic and psychological or even emotional criteria to trust (or not to trust)

others. The criteria, such as empathy and personal preferences, often dictate one's

decision to trust (Helper, 1990; McAllister, 1995). The research about trust from different

schools of thought indicates that trust is, in fact, a multidimensional construct. The

following table summarizes selected research and trust dimensions.

Table 3

Multiple Dimensions of Trust

Authors	Dimensions of Trust
Nooteboom, 1996	Competency, Institutionalization, Habitualization
Cummings & Bromiley, 1996	Commitment, Honesty, Absence of Opportunism
Mayer, et al., 1995	Capability, Integrity, Benevolence
Morgan & Hunt, 1999	Willingness to risk, Reliability, Faithfulness
Gulati, 1995a	Transaction History, Experiential Reference
Shapiro, 1987	Culture, Emotion, Environmental Setting
Kaser & Miles, 2002	Knowledge, Economical Motivation
Zucker, 1986	Reputation, Certification, Group Proximity
McAllister, 1995	Knowledge and Understanding, Predictability

The summarized dimensions shown above seem to capture most of the notion of trust involved in inter-organizational relationships. The decision to trust is always made by individuals. It means that the decision of whether to work or not to work with others is up to the key decision makers in the organization. At the individual level, willingness to risk, honesty, commitment, predictability, benevolence, emotion and knowledge and understanding are more prominent. At the inter-organizational level, however, competency, capability, institutionalization, environmental setting, and habit may be more influential. Due to the lack of existing instruments that could serve the purpose of this study, constructing a questionnaire with items for trust was deemed necessary. The questionnaire items were based on the above dimensions and the detailed process is discussed in Chapter III.

Summary

In recent years, trust has become a popular topic in strategic and international management. The research about trust has attracted interest in industrial-cluster related studies that depict social-cultural perspectives, including such approaches and customs as locally shared beliefs, and even social identity (Porter, 1990; Saxenian, 1994). Common cultural, psychological, and sometimes political backgrounds are attributed to organizational decisions about trust, further generating "synergy effects" (Porter, 1990; Saxenian, 1996). One example would be the local social atmosphere of innovations, which encourages, even demands, a mixture of competitive strength of firms and social responsibility from the population in an industrial cluster. Both rational and psychological forces naturally emerge as the population of the clustering organizations increases, and consequently, the cluster environment may further encourage clustering firms to adopt trust as an alternative governance mechanism due to collective knowledge sharing and social-cultural demand (Miles & Snow, 1984; Porter, 1990). In the following section, the concept of industrial cluster will be introduced.

Industrial Cluster

While globalization and the continuing technological revolution provide a number of challenges for firms today, they have also combined to provide many opportunities. This is particularly true for companies in smaller countries that may lack the domestic market necessary for growth, and for companies in developing countries with weak infrastructures and limited supporting industries. Recognizing this, many countries have promoted the development of regional clusters where firms can develop their competences and competitive advantages against the world's best competitors by

sharing resources, innovative capabilities, and knowledge. Many have acknowledged the value of clusters in high technology industries (e.g. Bresnahan et al., 2001; Porter, 1998; Saxenian, 1994; Zucker et al. 1998), which illustrates the advantages they provide for the development, transfer, and application of knowledge necessary for continual innovation.

Successful development of such clusters, however, may prove problematic in many countries. Porter (1990) highlighted four attributes necessary for the development of an industry within a country: factor conditions, demand, supporting industries, and competition. Porter (1990) has posited that the foundation for creating and sustaining regional competitive advantage depends on a highly localized process. That is, local development of supporting facilities, educational institutions, a high quality labor pool, trade opportunities, and a commonly shared culture and industrial atmosphere are examples of locational advantages. By networking across cultures, firms may be able to leverage resources and capabilities that might not otherwise be available, and stimulate continued rounds of innovation. In the following section, four commonly used theoretical frameworks for studying industrial clusters will be presented.

Porter's Diamond Model

One of the most striking features of high technology activity over the last 20 years has been the tendency toward intense geographic concentration of firms. The initial success of areas such as Silicon Valley in California and Route 128 in Boston has lead to efforts on the part of both firms and governments to promote similar clusters in many different locations. By clustering together, firms are able to pull from a common

and accessible pool of resources and information to meet the demand for innovation with which to enhance competencies and create global competitive advantages.

A cluster, sometimes termed an industrial district, can be defined as a geographical, shared-focus, and sectoral concentration and/or combination of firms. A cluster of firms is likely to facilitate efficient and effective collaboration and the leveraging of different resources and competencies possessed by each firm (Lawson, 1999). Porter (1998) defines clusters as the result of an improvement in a business environment. He further explains that an industrial cluster is a socially and geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities (Porter, 1998).

As the sum of the components is of greater value than each individual institution, clusters create synergies. Porter's (1990) studies in industrial clusters have focused on specific industries to create a better theoretical framework. While studying industrial development and international competitiveness in a number of different countries, Porter (1998) argued that there are four broad attributes that constitute the diamond of competitive advantage. These include factor conditions, demand conditions, related and supporting industries, and firm strategy, structure and rivalry.

Factor conditions are the inputs necessary for an industry, including high quality human resources, advanced technology, and natural resources. Demand conditions are the nature of the market and whether it stimulates firms to search for new sources of value through differentiation and specialization. The category of supporting industries refers to the availability and capability of local suppliers that provide firms with the

materials necessary to compete in the market. Finally, firm strategy, structure and rivalry emphasize the promotion of local rivalry that drives firms to differentiation, investment and innovation. The four points of the diamond represent the four basic attributes that affect regional competitiveness and innovation. Each of the four attributes is self-reinforcing, has a unique and important role to play in a regional cluster, and they all operate together as a system. Moreover, this system differs from location to location, and thus, it explains why some firms or industries succeed in a particular location. Figure 3 illustrates Porter's diamond model.
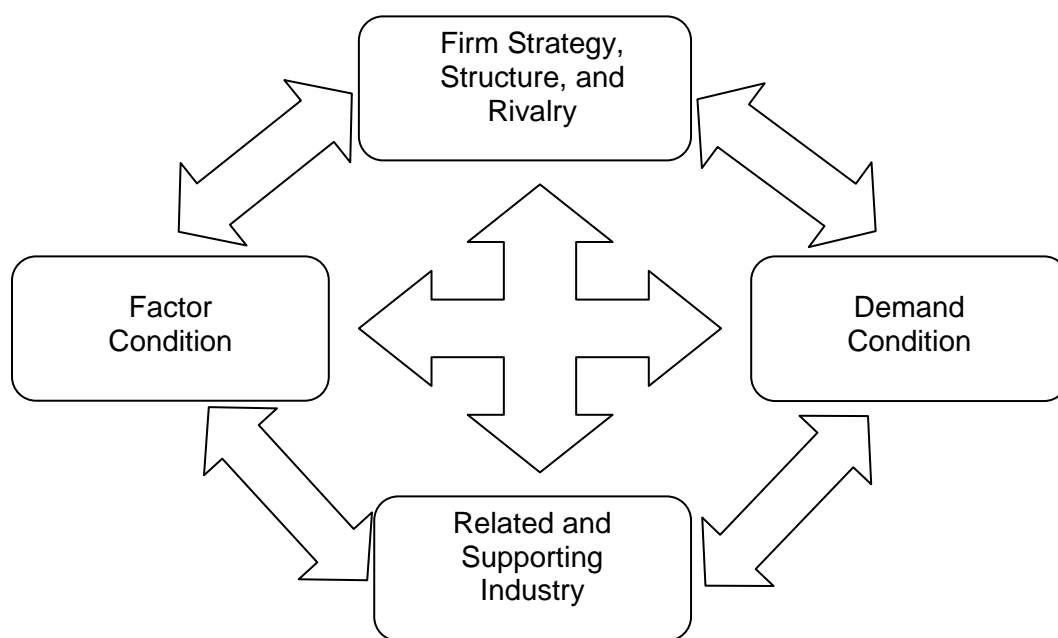
Source: Porter (1998)

Figure 3. Porter's diamond model.

Clusters affect competitiveness in three broad ways (Porter, 1990, 1998). First, clustering can enhance competitiveness by increasing the productivity of constituent

firms. Cluster members are encouraged to specialize in technology, information, and

resources, and thereby develop unique capabilities that can lead to profitability (Barney,

1991; Wernerfelt, 1984). Second, clusters increase the capacity for innovation and

enhance competitiveness. Rivalry existing within the cluster forces firms to develop

dynamic capabilities (Teece et al., 1997) which support innovation. As well, the

differentiation that evolves within firms in the cluster is likely to increase variety, and

thereby enhance learning and innovation (Miles et al., 1993). Third, clusters encourage

and enable new business venturing activities which support innovation and further

expand the industrial cluster.

Within clusters, the local concentration of quality human resources, needed

inputs, and related services makes formation of new firms easier. In addition,

collaboration with existing firms may allow for opportunities not otherwise available.

Overall, the developments of individual firm capabilities, as well as the potential for

collaboration, give companies more strategic options in terms of resource synergism,

technologic know-how, capability enhancement, and innovation. As a result, cluster

members are likely to achieve levels of competitive advantage unattainable for

individual firms (Foss, 1996; Krugman, 1991, 1995; Schmitz, 1999).

Industrial clusters are also likely to enhance the potential for participating firms'

globalization. A firm is considered global if its value adding activities are integrated and

contribute to competitive advantages on a worldwide basis (Ohmae, 1989; Porter,

1990). A cluster tends to produce core products in the home country while performing

lower value adding activities globally. Since clustered firms differentiate themselves by

specialization and perform related activities in other countries at lower cost, the

international coordination and configuration may bring cross-border advantages to the cluster and its constituent firms that can help sustain and enhance competitiveness.

Collective Efficiency

Another major approach in studying industrial clusters is summarized in Schmitz's (1995, 1997) concept of "collective efficiency." The term "collective efficiency" has been used to describe the combined benefits that firms experience as a result of external economic gains from joint action (Schmitz, 1995, 1997). External economic activities take place where market-priced transactions cannot completely integrate the advantages or expenses that are associated with transactional activities. The notable examples are benefits that may take place from relatively easier access to the embedded benefits that an industrial cluster may offer. In sum, the firms in an industrial cluster may enjoy:

- Specialized local suppliers of needed raw material and necessary services.

- A local high-quality pool of labor with needed and important skills and knowledge.

- An atmosphere within an industrial cluster in which related technological know-how and thoughts are "contagiously floating in the air," and eventually may affect all the participating firms in the particular industrial cluster (Marshall, 1919).

Traditionally, external market-priced economic activities are viewed as a starting place representing the market "inefficiency" rather than advantage. For instance, the speedy dissemination of specialized skills and knowledge that is supposed to be a significant characteristic of many industrial clusters could be expected to cause an under-investment in development of new technological breakthroughs (Brusco, 1990; Stewart & Ghani, 1991). Although some industrial clusters do seem to be weak at

radical innovation, persistent incremental technological and organizational changes are deemed to be the notable strength of industrial clusters. Even well-known companies and innovative organizations appear to benefit more from being stationed in a cluster than remaining isolated because of their intensively guarded technological boundaries (Stewart & Ghani, 1991; Schmitz, 1997).

External economies are important in explaining the growth of contemporary industrial clusters, but there is also a deliberate force at work, namely consciously pursued joint action (Brusco, 1990; Pedersen et al., 1994; Schmitz, 1995, 1997). Such joint action can be of two types: individual enterprises joining forces in business associations and producer consortia. Cutting across this distinction, one can distinguish between horizontal cooperation (i.e., between competitors), and vertical cooperation (i.e., supply chain relationships). These gains of joint action are generated through cooperative and collaborative relations among firms in a wide variety of different institutional forms (McCormick, 1999). The most notable form of cooperative relationships occur in a bilateral way between individual firms, for instance, the horizontal relationships established to share the specialized capital equipment by originally competing firms, or vertical collaboration on the next round innovation or new product development between buyers and suppliers (Humphrey & Schmitz, 1996; Nadvi, 1996).

Moreover, in well structured and highly developed industrial clusters, the type of multilateral relationships among clustering firms, ranging from transactional associations and market/organizational consortia to political lobbies, might exist (Nadvi, 1996). For example, the multilateral relational activities might include: penetrating and exploring

new market opportunities through trade shows and exhibitions, upgrading industrial infrastructure, and organizing collective training opportunities. Even if many firms, particularly the smaller ones, are unable to actively participate in these types of collaborative relational activities, the fact that there are others among them who lead in pushing forward the cluster's technological or marketing frontiers can be very significant (Nadvi, 1996).

In sum, the concept of collective efficiency is that (a) the economic viability cannot be understood by focusing on an individual, and (b) the external economies are not a sufficient explanation as the effects of purposeful joint action are an essential component. That is, collective efficiency is the competitive advantage derived from local external economies and joint action.

Flexible Specialization Framework

In today's more advance economies, new forms of organizational processes have emerged to assist firms to better cope with increasingly demanding environmental requirements. One of the emerging new forms is the network structure, which links firms together by transactions or exchanges of both visible and invisible resources. These vertically disaggregated firms are considered flexibly specialized in some of their supply chain functions due to the constant and persistent competence enhancement over time. When all the specialized firms are regarded as a networked whole, this particular network is flexible (Piore & Sabel, 1984). The flexibility here refers to the overall capability in adapting to a fast-changing environment because each of the participating firms can produce unique outputs that may satisfy the environmental demand (Storper & Christopherson, 1987).

As an environment changes over time, traditional mass production reveals a critical problem that is overly dependent on stabilizing and extending the market with homogeneous goods. The more product-specific the machinery, the less variable the product that can satisfy today's changing customer demand. Once a firm has invested heavily in product specific technology, each change in the production process requires high retooling costs. Thus, this logic only applies to mass production and stable markets. Increasingly, the way to obtain high volume sales is to avoid mass production and develop a more flexible strategy to reduce production costs while maintaining the organizational flexibility necessary to adapt to external uncertainty. Companies have to organize so that organizational competency and competitiveness can be constantly realigned to produce a rapidly shifting assortment of goods and services (Starkey & Barnatt, 1997).

Piore and Sabel (1984) describe the shift in thinking about strategy, organization, and technology that they see as a necessary response to new conditions of competition, referring to a conversion from inflexible mass production to flexible specialization. Because of the inappropriateness of inflexible mass production in today's fast changing environment, White and Ruch (1990), and White and Pearson (2001) suggest ten underlying factors that are influential to just-in-time (JIT) manufacturing. One of the ten factors identified in White and Ruch's (1990) study is "focused factory," which originated from Skinner's (1974) seminal paper. The focused factory (Skinner, 1974) suggests that firms need to develop their core competence to ensure their performance and sustain competitive advantage in a timely manner. An industrial cluster can be considered a

collection of many "focused factories" with strong social, geographical, and economical ties that can further induce synergies as well as collective economic gains.

Among the characteristics of flexibly specialized industries are the production of a wide range of products for highly differentiated markets and the constant adaptation of end products and services for changing environmental conditions and expanding markets. This can be managed by developing flexible and widely applicable technologies so that innovation is not held back by massive capital investment in rigid technologies, and workers possess the skills to produce and develop a wide range of products and/or services (Piore & Sabel, 1984; Starkey & Barnatt, 1997). The strategic imperative is a strategy that combines both differentiation and efficiency.

Industrial clusters consist of several vertically disaggregated firms that are able to generate flexible specialization. The production of many specialized firms in regional networks can adapt more quickly to changing market demands than single firms, as is the case in the traditional mass production mode. Vertical disaggregation serves as both a means to reduce fixed costs and a way of increasing product variety relative to the competition (Storper, 1993). The outcome is a flexible network of small, independent, and service-oriented companies specialized to produce a differentiated range of output; this is also known as a "transaction-rich network system" within a cluster (Starkey & Barnatt, 1997). Through its integration of multiple flexible specialized firms (Miles & Snow, 1986), this cluster network serves as an alternative to Williamson's hierarchy (1975). Crucially, the cluster network can counter the diseconomies of scale, the inflexibility of hierarchies, and large and inflexible commitments to highly specialized capital intensive activities (Barnatt & Starkey, 1994; Harrigan, 1985; Thorelli, 1986).

Inter-Firm Network

Williamson argued that uncertain, frequent, and investment-necessary transactions are more likely to take place in organizations while straightforward exchanges take place in the marketplace(Williamson, 1975, 1985, 1993). The inefficiencies of the hierarchy are preferred to the uncertainties of the marketplace, caused by bounded rationality and opportunism (Williamson, 1985). Yet recently, firms are blurring the boundary between hierarchy and market. Williamson now sees the market-hierarchy as a continuum rather than a dichotomy (Williamson, 1985). This implies that markets create organizations, which is historically untrue (Powell, 1990). Others point out that markets exist within a social structure (Miles & Snow, 1984). That is, many economic exchanges are now replaced with collaborative networks. In networks, individual units exist only in relation to other units (Powell, 1990). Strings of reputation, friendship, interdependence, and altruism become integral parts of the relationship. Network information is "thicker" than that acquired in hierarchies and "freer" than that obtained in the marketplace (Powell, 1990). Especially, they are useful in the production of commodities where value is hard to measure (Gulati, 1995b; Miles & Snow, 1984; Powell, 1990).

Research on inter-firm networks advances our understanding of neo-organizational actions and reactions within many industrial clusters. Several scholars (e.g., Miles & Snow, 1984; Gulati et al., 2000) contend that the movement toward the network form has become increasingly more apparent in recent years in response to intensified international competition and environmental change. With the current trend toward vertical disaggregation in many industries, firms are focusing more on core

competencies and seeking alliance partners to access needed complementary resources with the ultimate goal of innovation or survival

Increasingly, network participants are recognizing their interdependence and are willing to share information, cooperate with each other, and customize their products and services to maintain their position within the network (Miles et al., 2000). In addition, companies are more able to work cooperatively and competitively, or "co-evolve" together with the business ecosystems to support new products, satisfy customers, and create the next round of innovations. Hence, the multiple cooperative relationships of a firm can be the source of its competitive strength.

Network relationships can differ in terms of both their duration and in terms of where the partners reside along the value chain. In terms of duration, relationships can vary from stable to dynamic (Miles & Snow, 1984). Along the value chain, partners may engage in both horizontal networks at a common stage, as well as networks that reach across levels of the supply chain. Figure 4 illustrates the inter-firm network structure. Regardless of relative position or duration, however, a more proactive role among participants is likely to improve the final product or service and stimulate collaboration-driven innovation (Miles et al., 2000).
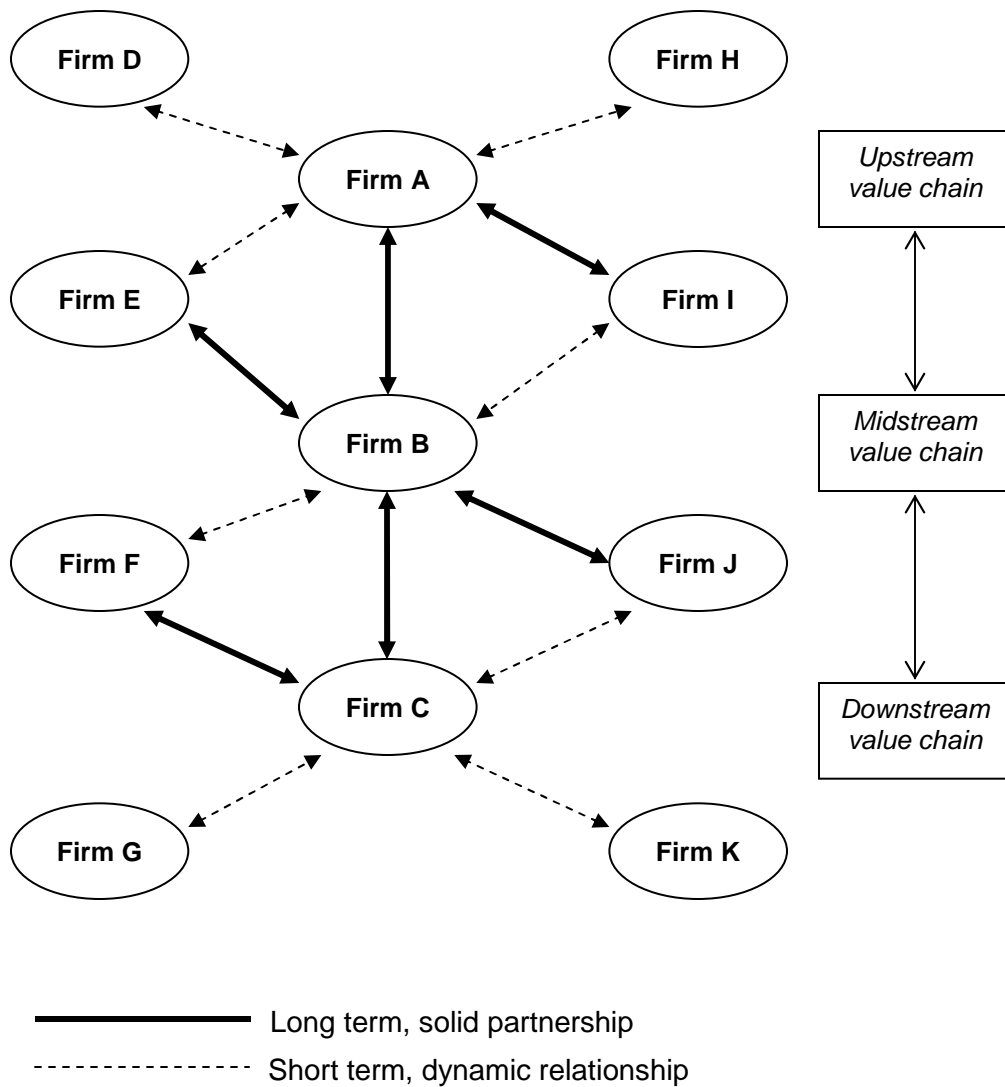
Figure 4. Inter-firm network structure.

In a network, rather than having productive resources structured through internal relationships, firms trade externally, frequently with other firms that might previously have been part of their own organization, but were divested either wholly or in part (Harrigan, 1985). Thus, a key advantage of the network is the ability to achieve flexibility at less cost than in a vertically integrated organization. Networks are also able to accommodate far more complexity at the network level than the individual firm, while

maximizing specialized competence at the firm level as a whole (Miles & Snow, 1984; Miles et al., 2000).

A firm within an industrial cluster has a much greater chance to collaborate with others both vertically and horizontally (Marshall, 1919; Scott, 1992). With multiple firms networking together vertically and horizontally, it then becomes a supply network (Choi et al., 2001). "Supply network" refers to a network of firms engaged in the manufacturing and assembly of parts to create a finished product (Choi et al., 2001). Due to a firms' strategic intent, the membership in a network and its organization vary for a given product and over time (Choi et al., 2002; Hamel & Prahalad, 1991). Since an industrial cluster offers participating firms the advantage of agglomeration, collective learning, and better procurement, it enables the entire cluster to become an adaptive system (Choi et al., 2001). This adaptive system contains a network of firms that collectively supply a given part or subassembly to a buying firm. Such an adaptive system is similar to the "supporting industry" factor in Porter's (1998) diamond model. Based on a study of Taiwan's high technology industrial cluster, there exists a network structure containing not only vertical buyer-supplier relationships, but also horizontal collaborative relationships. Figure 5 illustrates the supply network structure of an industrial cluster in a scientific industrial cluster in Taiwan.
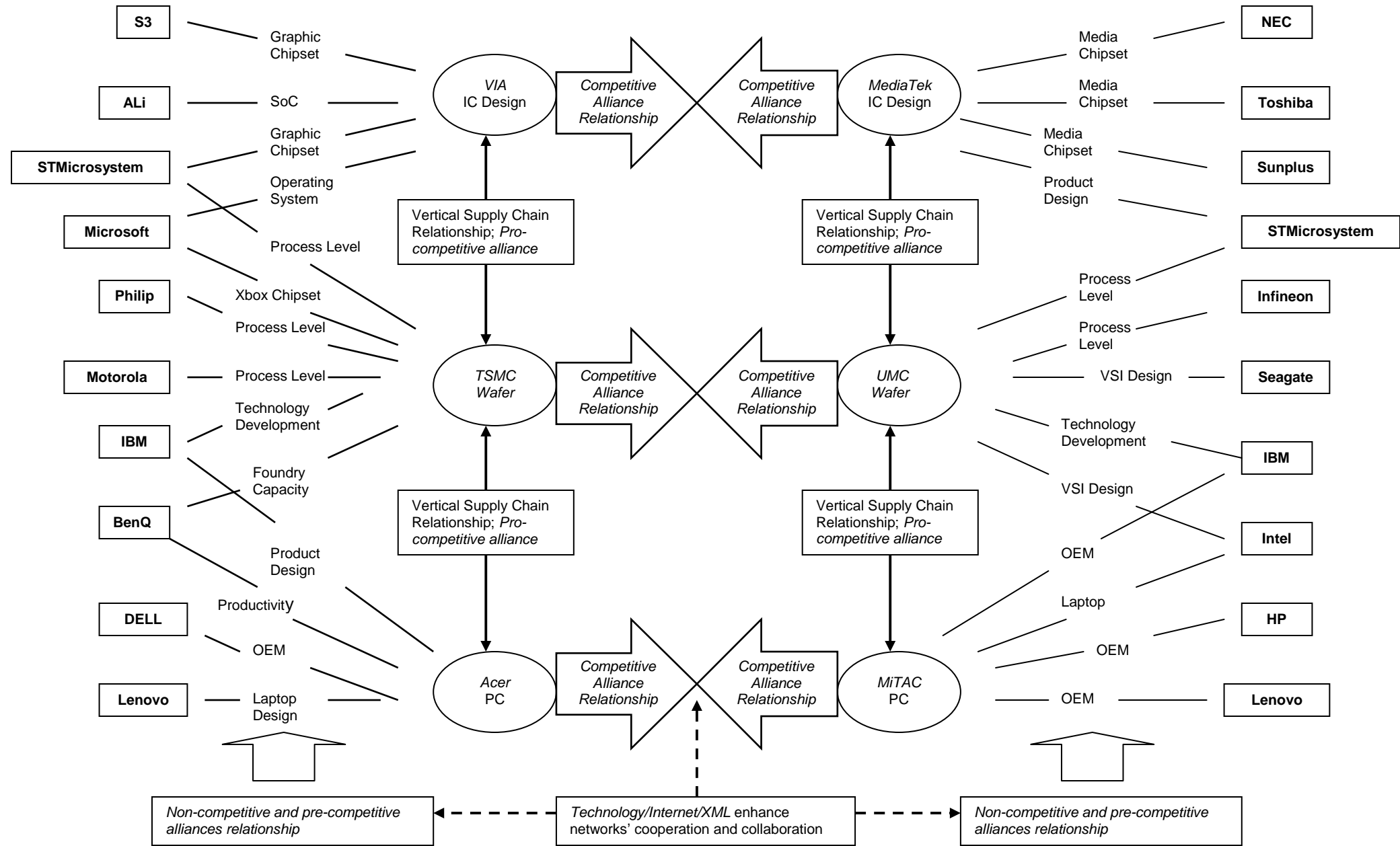
Figure 5. Supply network structure in a cluster.

The above figure uses some of the most representative companies within this particular industrial cluster to illustrate that there are two vertical supply chain networking relationships, and each parallel firm competes and collaborates with others horizontally. In other words, collaboration, competition, and even co-competition can exist simultaneously in a single cluster. For instance, Acer and MiTAC are both positioned in the downstream supply chain because they both have strong powers in branding and distribution channels. In the market, Acer and MiTAC are competing with each other. Meanwhile, they also work together to create the new configurations of next generation electronic devices such as laptops and personal computers.

In sum, active inter-organizational collaboration and networking, rooted in a common geographic location and culture, and supported by common institutions, are seen to be one of the main driving forces in boosting competitiveness in industrial-cluster-related research. Table 4 summarizes the cluster related theoretical approaches. Although much cluster related research has advocated the benefits of developing an industrial cluster, none of it addresses the issues of what characteristics contribute to a successful industrial cluster. This leaves a gap between the theoretical perspectives and empirical aspects in advancing industrial cluster related research. In the following section, the characteristics of an industrial cluster will be categorized.

Table 4

Summary of Industrial Cluster-Related Research

	Diamond Model	*Collective Efficiency*	*Flexible Specialization*	*Inter-firm Network*
Cluster Definition	A group of interconnected firms and institutions in a particular field present in a particular location	A group of producers making similar products and/or services by complementing each other	Cluster is an industrial district which contains many firms bound in a complex web of competition and cooperation	Cluster represents a intense and frequent inter-firm networking activity which can lead to increasing competitiveness
Key Components	Firm strategy, structure and rivalry; factor conditions; demand conditions; supporting industries	Synergy; Joint action; Complementarity	Flexibility; Economies of scope; Innovation; Learning; Product differentiation	Learning; Innovation; Collaboration; Trust
Goal/Focus	Value creation Holistic Dynamic	Cost efficiency Narrow Static	Value creation Narrow Dynamic	Value creation Adaptation Holistic Dynamic
Related Studies	Porter (1990, 1998); Bresnahan, Gambardella, & Saxenian (2001); Saxenian (1994); Zucker, Darby, & Armstrong (1998)	Brusco (1990); Pedersen et al. (1994); Schmitz (1995, 1997)	Piroe & Sabel (1984); Starkey & Barnatt (1997); Storper (1983)	Miles & Snow, (1984); Miles, Snow, & Miles (2000); Gulati, Nohria, & Zaheer (2000)

Characteristics of a Firm's Industrial Cluster Involvement

The term cluster is widely used by both practitioners and academics. This has the unwelcome effect of making its definition flexible. To further define cluster in later analysis, it is important to identify clearly the value judgment associated with defining a cluster. From much cluster related research, Alfred Marshall is considered one of the pioneers of industrial cluster related theory who first coined the term "industrial district."

He published two influential articles, *Principles of Economics* (1890), and *Industry and Trade* (1919), which are believed to have had a deep impact on the advancement of industrial cluster related research. He views industrial cluster as "The many in one, and the one in many" (Marshall, 1919). That is, companies are situated in an industrial cluster. One of them is specialized in a unique economic activity, which leads to the creation of a series of inter-connected economic operations and social dependencies between this particular firm and others to establish a network supply chain in a reduced geographic proximity.

The collectivity of specialized firms and the social interdependencies represent the general concept of industrial clusters in Marshall's research (1890). He further contends that the determinants of economic progression of a region depends on cross border international trade, which advances the research of the localized industry, and attracts a pool of skilled workers who gather within the reduced geographical boundaries of a collectivity of manufacturers or a "thickly peopled industrial district" (Marshall, 1890, 1919).

Extending Marshall's general concept of industrial districts, Markusen (1996) defines industrial cluster as an economic network that is populated by small and medium sized enterprises (SMEs) and these firms are specialized in specific value adding activity and linked by economic transactions, long-term beneficial relationships, and have a strong social tie to the geographic location.

Markusen's definition of industrial cluster seems to fit with many researchers' assertions that industrial clusters can develop and sustain a so-called "regional competitive advantage" (Porter, 1998; Saxenian, 1994, 2001). Several industrial

clusters are selected from developing countries with the aim of exploring how industrial

clusters can help organizational knowledge management, and thus match Markusen's

definition of industrial cluster.

Marshall argues that there are four determinants that make a region specialized

in a particular supply chain activity. They are transportation infrastructures, international

trade opportunities, physical conditions, and government support. A good transportation

infrastructure refers to the products from a particular industrial cluster that can be easily

transported to the markets where there is a demand for the products. International

transactions refer to achieving economies of scale and scope that can lead to the

exploration of new markets by means of growing regional industrial clusters. Physical

conditions refer to the actual resources and support, such as buildings and physical

infrastructures that are available in an industrial cluster. Based on Marshall's research,

Porter offers similar characteristics that he called diamond factors, and argues that

achieving those factors are crucial for a region to build competitive advantage (Porter,

1986)

Tallman et al. (2004) distinguishes between two types of competitive

characteristics that can be further developed into competitive advantage for a cluster:

(a) those based on traded interdependencies, and (b) those based on non-traded

interdependencies. Traded interdependencies exist in the economic sphere and involve

formal exchanges of value for value. They include licensing, alliances, acquisitions, or

technological know-how in which formal exchanges take place (Tallman et al., 2004).

Existence within the economic sphere infers that traded interdependencies reflect the

rational actor principle at work regarding efforts to maximize the efficient allocation and

effective utilization of resources. Storper (1995, 1997) observed that traded

interdependencies are readily dispersed as industries mature. This can be attributed to

a greater understanding of the processes surrounding economic transactions in an

industrial cluster.

Non-traded interdependencies are "based on shared knowledge for which no or

limited market mechanisms exist" (Storper 1993, 1995). They exist outside the

economic sphere. Non-traded interdependencies include customs, cultures, beliefs, and

institutions that lead to the creation of "worlds of production," which present action

trajectories for firms within an uncertain world (Storper & Salais, 1997). Non-traded

interdependencies reflect the "knowledge in the air" associated with what Marshall

(1890) called "industrial atmosphere." These particular competitive characteristics exist

in an industrial cluster that runs parallel to the economic system. Tallman et al. (2004)

states that this parallel system works to reduce the transaction costs of exchanges

related to traded interdependencies.

The importance of traded and non-traded interdependencies has changed over

time. Originally, the advantages associated with the economic sphere received the

greatest attention in, for instance, transaction cost economics, agency theory, and the

resource-based view of firms. Traditional agglomeration economics identified

advantages related to lower production cost, development of pooled suppliers,

specialized labor pools, and spillovers of technological know-how (Krugman, 1991;

Piore & Sabel, 1984; Starkey & Barnatt, 1997; Tallman, 2004). The emergence of

globalization is expected to reduce the importance of proximity in attaining these

advantages. As clusters continue to be able to sustain competitive advantage, the

research focus gradually shifts to non-traded interdependencies. These competitive advantages have been attributed to interaction and the resulting trust that enables industrial clusters to develop what Mathews (2003) refers to as "learned patterns of adaptation." Essentially the importance of "industrial atmosphere" or "knowledge in the air" is growing in the form of collective competitive advantages.

Summary

In previous section, several theoretical aspects that are closely related to industrial cluster study were discussed. The conclusions of cluster related studies, however, cannot always be compared in a straightforward manner, both because they use different definitions and because the cluster studies differ in terms of cultural and geographical settings. To compensate the discrepancies, the defining characteristics of clusters using trade and non-trade interdependence that can represent the general features of industrial clusters are adopted. Table 5 is a summary of trade and non-trade interdependences.

Table 5

Characteristics of Industrial Clusters

	Defining Characteristics	*Selected Research*
Trade Interdependence	1. Inter-firm linkages between enterprises as a result of vertical subcontracting. 2. Inter-firm linkages between enterprises in specific forms of horizontal cooperation. 3. Degree of specialization within a value chain. 4. High density of economic activities. 5. Mutual and collective learning. 6. External economies resulting from linkages and networks. 7. Widespread local product imitation. 8. Shared technical competence pool.	Marshall (1890); Cho (1994); Rabellotti (1997); Sandee (1995); Meyer-Stamer (2000); Schmitz (1996); Visser (1996); Rasmussen (1992); McCormick (1998); Storper (1993, 1995, 1997); Tallman et al. (2004); Piore & Sabel (1984); Porter (1990, 1998)
Non-trade Interdependence	1. A joint social history. 2. Relative spatial proximity of the enterprises. 3. Social networks that are not embedded in transactions among producers or traders. 4. A role for local and traditional institutions. 5. A role for governments. 6. Shared cultural background. 7. Circumstances favorable to the generation of trust between business partners. 8. Favorable and supportive institutional environment.	Marshall (1890); Granovetter (1993, 1995), Uzzi (1992); Trulsson (2000); Mathews (2003); Tallman et al. (2004); Storper (1993, 1995); Starkey & Barnatt (1997); Storper & Salais (1997); Miles & Snow (1984); Gulati, Nohria, & Zaheer (2000)

Overview of Theoretical Foundations and Hypotheses Development

There are two research questions in this research study. First, is there a relationship among trust, industrial cluster, and knowledge management? Second, what is the relationship between knowledge management and organization adaptation?

Knowledge management, trust, industrial cluster, and organizational adaptation are considered related in many studies (Cohen & Levinthal, 1990; March & Simon 1958; Miles & Snow, 1984; Miles et al., 2000; Nelson & Winter, 1982; Ohmae, 1989; Pennings & Harianto, 1992). While the relationship between knowledge management and organizational adaptation is the central component in this study, the previous discussion suggests that trust and a firm's industrial clusters involvement are also influential factors in the research.

Knowledge management theory is associated with gathering and applying information in an organization, which allows organizational units to apply appropriate knowledge to what they already know and to create new knowledge (Marshall, 1997; Pfeffer & Sutton, 2000). The literature suggests that knowledge management is a process that contains three stages: knowledge obtaining, knowledge organizing, and knowledge applying. Knowledge must first be either acquired externally or created internally, and then the newly obtained knowledge needs to be organized through refining, storing, and sharing. Finally, knowledge must be applied to create value for an organization to sustain competitiveness.

Trust is a social phenomenon that makes work within organizations easier and collaboration among organizations possible (Gulati, 1995a; Nooteboom, 1996). Specifically, in a world with growing uncertainty and complexity, trust is considered a more appropriate means for managing collective organizational activities than hierarchical power or direct monitoring (Hosmer, 1995; Zaheer & Venkatraman, 1995). To establish trust, one usually adopts two sources of references to facilitate a decision to trust: rational and psychological sources. Rational source refers to an assessment of

the trustee's trustworthiness, based on knowledge and understanding of others derived from objective evidence, reputation, records, professional certifications, established norms, standards, and experience (Kumar, 1996; Morgan & Hunt, 1994, 1999; Nooteboom, 1996; Zucker, 1986).

By contrast, psychological source refers to empathy, which means that one can identify with someone and thereby understand motives in relation to conditions of action, and can further sympathize with them (Helper, 1990; McAllister, 1995). More importantly, one often mixes rational and psychological sources together when making a decision to trust, or one uses both rational and psychological sources simultaneously to evaluate trustworthiness when making a decision to trust (Nooteboom, 1996; Zaheer & Venkatraman, 1995).

An industrial cluster is defined as a geographical, shared-focused, and sectoral concentrated combination of firms (Porter, 1998). A cluster of firms is likely to facilitate efficient and effective collaboration and the leveraging of different resources and competences possessed by each firm (Lawson, 1999). The underlying logic of an industrial cluster is that the sum of the components is of greater value than each individual company or institution; thus clusters create synergies. Based on the literature review in the previous section, an industrial cluster presents the following two characteristics: trade and non-trade interdependences. Traded interdependencies exist in the economic sphere and involve formal exchanges of value for value, while non-trade interdependencies exist outside the economic sphere. Non-traded interdependencies are comprised of customs, cultures, and industry atmosphere that

combine to produce "worlds of production" that present action trajectories for firms within an uncertain world (Storper & Salais, 1997).

Organizational adaptation refers to the balance between the exploration of new possibilities (i.e., innovating) and exploitation of existing certainties (i.e., competence enhancing) within an organization (Holland, 1975; Kuran, 1988; March, 1991; Schumpeter, 1934). As March (1991) contended, organizations must constantly attempt to find an appropriate adaptive process in relation to the exploitation of existing processes and/or knowledge and the exploration of new alternatives. Maintaining a balance between exploration and exploitation is the primary factor in organizational survival and prosperity (Levinthal, 1990, 1991; March, 1990).

From the previous discussion, it is thought that all the above theories have either direct or indirect impact on a firm's attempt to adapt successfully to the changing environment. It is argued, however, in this study, that both trust and a firm's industrial cluster involvement might not have as direct an impact as knowledge management on organizational adaptation because trust is merely perception while a firm's industrial cluster involvement provides a unique, beneficial environmental setting that both facilitates knowledge management and organizational adaptation. Knowledge management should be seen as a key phase that has direct influence on organizational adaptation. By learning, organizing, and applying useful knowledge, firms may have a better chance to adapt successfully to a turbulent environment. On the other hand, knowledge sharing requires a significant degree of trust within and between organizations; an industrial cluster provides a unique environmental setting with a

reduced proximity that might promote knowledge spillover and trust, and consequently facilitates knowledge management to produce successful organizational adaptation.

As discussed previously, it is clear that knowledge management has three stages, namely knowledge obtaining, knowledge organizing, and knowledge applying. The more intriguing question, as yet unanswered, is how the three knowledge management stages should be put together. One avenue for studying knowledge management suggests that knowledge obtaining must be followed by knowledge organizing and applying to maximize the potential value of knowledge itself to promote more successful adaptation. This argument suggests a linear structure to knowledge management and implies that knowledge management should be viewed as a systematic process that needs to be implemented in an orderly manner (Crossan et al.*,* 1999; Duffy, 2000; Vera & Crossan, 2003; Zack, 1999). This route of research thus offers a possible mediation effect from knowledge obtaining, organizing, and applying to organizational adaptation.

Conversely, another research stream suggests that knowledge obtaining or organizational learning could directly influence organizational adaptation, but the effect can be further strengthened if knowledge organizing and application are logically in place (McGill et al., 1992; Senge, 1990; Starbuck, 1983; Tsai, 2001). Knowledge management does not have to be orderly, but the firm's capability to better organize and apply knowledge could further enhance the relationship between knowledge obtaining and organizational adaptation. Therefore, it suggests an alternative moderation model for knowledge management.

In the following section the research models for this study are discussed.

Relationship between Knowledge Management

 and Organizational Adaptation

Knowledge management theory is associated with gathering, organizing, and applying needed information to achieve a firm's strategic objectives (Barney, 1986, 1988; Marshall, 1997; Penrose, 1959; Pfeffer & Sutton, 2000). From the previous discussion, knowledge management is understood as "managing learning" to provide a positive impact on performance. By contrast, learning refers mainly to absorbing information or simply "knowing," and learning activity usually resides in the knowledge management process (Huber, 1991). According to Vera and Crossan (2003), obtained information and data are simply raw particulars learned from competitive interactions, and interorganizational practices must be rearranged into an evocative, amalgamated framework to transform raw and unorganized data into valuable knowledge. In consequence, knowledge is produced only when information or data is understood and appraised from an appropriate, systematic mode. However, organizations have different models to filter and cleanse information (Senge, 1990).

The knowledge obtained from the same starting place can vary to a great extent not only in value, but also in creativeness to the firm's strategic objective. Knowledge management, therefore, is different from learning because the former implies a determined, deliberate attempt to pull out accessible information and data that is decisive for a firm's long term survival in a timely and consistent manner. Senge (1990) also contends that the most significant resource of a firm, which creates enduring, long lasting competitive advantage, is the exploitable knowledge developed from determined, structured learning activities by all organizational units inside that company.

Most investigations of knowledge management have put their focus on confining

the knowledge located inside the brains of employees at the individual level, while

others have mistaken knowledge management for learning. The initial research in

learning from an individual perspective is certainly important to knowledge

management, but it also seems to be incomplete. Knowledge outside the traditional

limits of the company might demonstrate an important value as well (Gold et al., 2001).

If a company is exposed to an environment with overwhelming information, it will need

to develop structures and processes that will lead to usable and valuable knowledge in

the end. Thus, it naturally leads to the question, "What are the activities involved in

knowledge management and how are they related?"

Knowledge Management as a Linear Systematic Process

The science of knowledge management can be viewed as a linear and

systematic process of strategic actions planned to create management decisions and

inducing collective actions toward the creation of improved organizational performance.

Knowledge management is a strategic procedure that has the objective of discriminating

the firm itself from its adversaries to create a better competitive position. Three major

stages of knowledge management can be summarized: knowledge obtaining,

knowledge organizing, and knowledge applying. For the final end of a successful

organizational adaptation to be achieved, all of the stages must be treated as a system

with linear structure to create a faultless process for administering strategically

important knowledge.

Knowledge obtaining refers to capturing knowledge from external sources or

creating knowledge inside an organization. Knowledge obtaining is similar to learning in

many senses, which is considered an initial activity for organizations to strengthen a competitive advantage. However, knowledge obtaining may not be sufficient to create a positive impact on organizational performance and objectives because one needs to understand the nature of the knowledge. That is, knowledge is "perception," which is a process of getting to know an external object by the impression it makes on the senses. Since perception varies from individual to individual or even company to company, it is essential to further explore a firm's capability to digest and transform learned information.

Knowledge organizing refers to the activities that companies internalize and how they add value to newly obtained knowledge. This mechanism must logically exist in organizations to prevent the unnecessary absorption of valueless knowledge and to make valuable knowledge accessible for future use. Knowledge applying refers to the actual use of the knowledge to create value. Pfeffer and Sutton (2000) argue that competitive advantage does not go to the company who has the best knowledge, but to those who can best realize the value of knowledge. They also posit that unless this final step of applying and realizing the value of knowledge in a competitive activity is achieved, all the preceding stages of knowledge management are simply a waste of resources. More explicitly, Pfeffer and Sutton (2000) posit that not only is it necessary to close the "knowing-doing gap" when managing knowledge, but it is also necessary to initiate a "learning by doing" process that applies critical knowledge to a novel state, and in return, harvests related learning from applying that knowledge.

The three stages of the knowledge management framework described in previous section could be viewed as a systematic process. It implies that knowledge

organizing serves as a mediator between knowledge obtaining and knowledge applying while knowledge applying serves as a mediator between knowledge organizing and organizational adaptation. The three stages of knowledge management offer a rational sequence from knowledge obtaining to the actual knowledge applying. Figure 6 illustrates the relationship between knowledge management and organizational adaptation under the view of knowledge management as a systematic process.
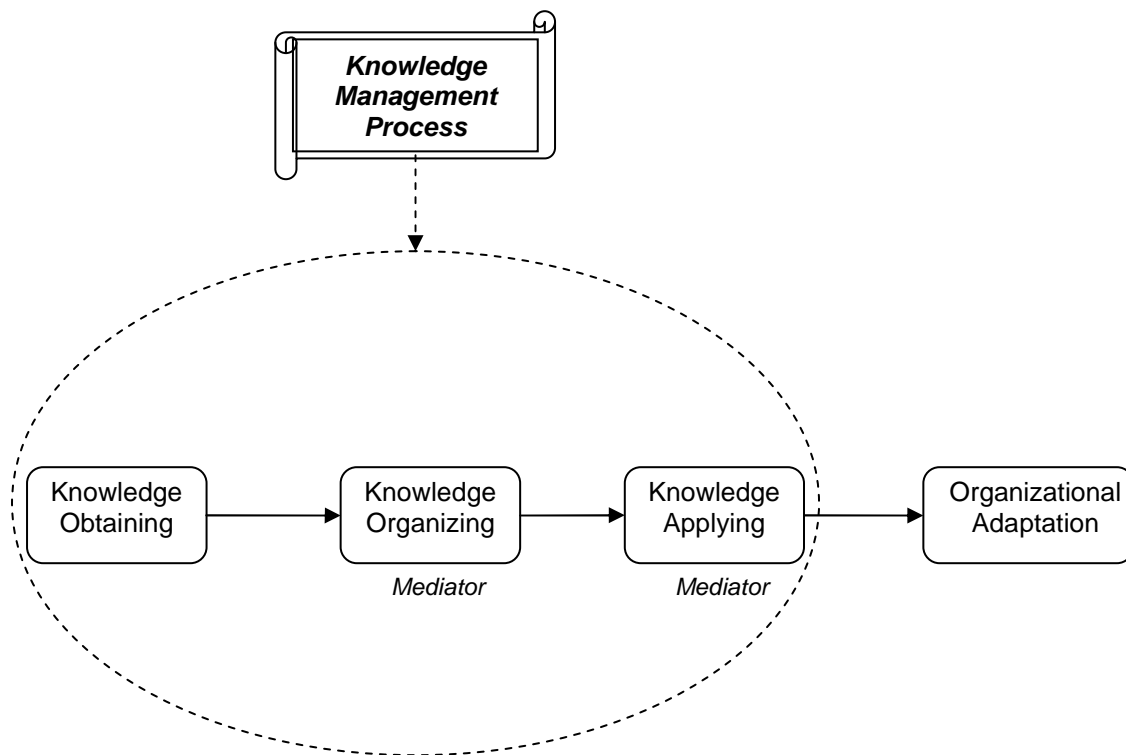
Figure 6. Conceptual model of knowledge management and organizational adaptation.

To better examine and understand the proposed relationships shown above, hypothesis development and testing is required. In fact, only using the rigorous method to test hypotheses will generate empirical results for illustrating reasonable conclusions and guiding future study. Therefore, in the following section the researcher will develop

the hypotheses based on the view of knowledge management as a linear systematic process.

Intelligent adaptation, also known as learning (March, 1991; Levinthal, 1991), is considered an important means of balancing organizational exploration and exploitation and of reconciling adaptation and selection perspectives (March, 1991; Levinthal, 1991). March (1991) models the development and articulation of organizational knowledge and suggests that learning triggers organizational adaptation, which would lead to either organizational exploration or exploitation. However, March (1991) and Zack (1999) also argued that without the effective internal organization of new knowledge, it will not be beneficial to both organizational exploration and exploitation because the knowledge has not yet been filtered through a value added process that is more suitable for the organization and its adaptive systems. Moreover, after the value adding process, knowledge must be stored as a value asset and strategic option and be ready for circulation within an organization. This knowledge readiness will allow organizations to overcome environmental contingencies in the long term (Zack, 1999).

According to Hibbard and Carrillo (1998), knowledge obtaining is essential for organizational survival; however, they also advise against obtaining all accessible information without understanding whether it will be useful and valuable in the future. It is suggested that firms should resist the tendency to classify and index knowledge simply because it is only available or it has been obtained by everyone else. Neither is all the knowledge relevant to a firm's strategic objectives, nor has all knowledge been obtained universally (Zack, 1999), specific mechanisms need to rationally exist to sort through redundant and disturbing knowledge so the information being obtained that is of

greater value to the firm can be stored and shared. The organization stage should be guided by the firms' mission, vision, and strategic objective to offer a valuable means for management to better evaluate the usefulness of newly obtained information (Duffy, 2000; Huber, 1991). Therefore, the first hypothesis is developed as follows:

H1a: There is a positive relationship between knowledge obtaining and knowledge organizing.

One of the essential stages in the knowledge management process is the actual use of internalized and organized knowledge to create value. After effective knowledge organizing activities, information and knowledge, which have value and usefulness, are refined, stored, and shared throughout the company. However, as Pfeffer and Sutton (2000) suggested, organizational competitive advantage goes not to those firms who have the best or most valuable knowledge, but to those who apply knowledge best. It is argued that the application of relevant knowledge to organizational competences and administrative developments facilitates the creation of sustainable competitive advantage (March, 1991; Levinthal, 1991).

Structure or organization is an important characteristic of knowledge. For individuals, structure refers to how concepts, terms, and other ideation are interrelated. Studies demonstrate that well-organized knowledge, rather than a simple collection of facts, differentiates expert and novices. It is a prerequisite to useful, actionable, applicable knowledge within some meaningful organization or structure. The less organized the knowledge, the less likely the organization will possess actionable knowledge. Hence, poor organization restricts application (knowledge applying) because the quantity of useful (high quality) knowledge is diminished

Without the application of knowledge in a real world business activity, all of the preceding stages of knowledge management are of no value. That is, not until the "knowing-doing gap" is closed can the firms achieve successful adaptation (Pfeffer & Sutton, 2000). In sum, knowledge management practices should ideally provide needed functions to help organizational units collectively achieve a firm's strategic objectives (Parikh, 2001). Thus, the following hypothesis is given:

H1b: There is a positive relationship between knowledge organizing and knowledge applying.

Knowledge applying serves as a key stage for organizations to actualize the value of obtained and organized knowledge. It helps sustain competitive advantage and even organizational adaptation (March, 1991; Levinthal, 1991; Parikh, 2001; Pfeffer & Sutton, 2000). As discussed previously, the central measures of organizational adaptation are exploitation and exploration, which include competence advancement, actualization of new ideas, and customer-centered differentiation among others. Knowledge management, especially the actual application of obtained knowledge, is designed to find effective methods for organizations to adapt to their environments in profound ways. Further, knowledge management represents the synergistic attempts from organizations to constantly seek effective ways to run a company of small differences of day-to-day repetitive routines to the broader and much more important decision making processes of strategy in hope of catching up with the speed of environmental change.

As organizations increase learning and accumulate sufficient knowledge, they can perform better and initiate strategic reorientation to best adapt to the external

environment. Moreover, through the constant and ongoing process of knowledge

management (from knowledge obtaining, organizing, to applying) firms can not only

close the "knowing-doing gap," they can also trigger a "learning by doing" effect to

further enhance organizational exploration and exploitation. Therefore, the following

hypothesis is developed:

H1c: There is a positive relationship between knowledge applying and

organizational adaptation.

Knowledge management is a dynamic process and contains three stages:

knowledge obtaining, knowledge organizing, and knowledge applying. As discussed

previously and shown in Figure 6, this dynamic process implies two mediating effects:

knowledge organizing mediates the relationship between knowledge obtaining and

applying; and knowledge applying mediates knowledge organizing and organizational

adaptation. Although some researchers suggest that each of the knowledge

management stages might directly lead to organizational adaptation, it is argued that

without holistic knowledge of management activities, firms will not achieve successful

organizational adaptation. Thus, the following two hypotheses are given:

H1d: Knowledge organizing mediates the relationship between knowledge

obtaining and knowledge applying; and,

H1e: Knowledge applying mediates the relationship between knowledge

organizing and organizational adaptation.

Knowledge Management as a Collection of Non-Linear Activities

Another research stream suggests that organizational learning or knowledge

obtaining directly influences organizational adaptation (Argyris, 1977; McGill et al.,

79

1992; Senge, 1990; Starbuck, 1983; Tsai, 2001). Argyris (1977) posits that organizations ought to establish a double-loop learning model between learning activities and ideal consequences from newly obtained knowledge. Senge (1990) offers the fifth discipline and argues that without obtaining new information consistently, organizations would eventually be overwhelmed in the fast-changing environment. McGill et al. (1992) argue that organizational learning involves people at all levels, individually and collectively, who continually increase their capacity to produce optimal results when facing environmental challenge. More recently, Tsai's (2001) study shows that the degree of a firm's absorptive capacity has significant effects on business unit innovation and performance.

It is also argued that the plausible relationship between knowledge obtaining and organizational adaptation could be influenced by other factors. Huber (1991) and Zack (1999) specifically offer knowledge organizing and application as the two influential factors that might increase or decrease a firm's adaptive outcomes. They argue that a firm can achieve better adaptation from learning if the firm organizes and applies the information and knowledge better. Conversely, a firm might not be able to achieve optimal adaptation if it does not organize and apply the newly obtained knowledge. Arthur and Aiman's (2001) study concludes that knowledge sharing within an organization is as important as initial organizational learning activities. Schulz (2001) finds that not only does a firm need to collect new information and knowledge, but also needs to codify and share it to enable both vertical and horizontal knowledge flow within the organization to enhance organizational effectiveness.

From the above discussion, it is logical to include knowledge organizing and

application in the research model for this study. Moreover, the argument above implies

that the direct relationship between knowledge obtaining and organizational adaptation

can be strengthened when knowledge organizing and knowledge applying are present.

Therefore, it suggests an alternative moderation model that can explain the relationship

between knowledge management and organizational adaptation. The following figure

shows the moderation effect.
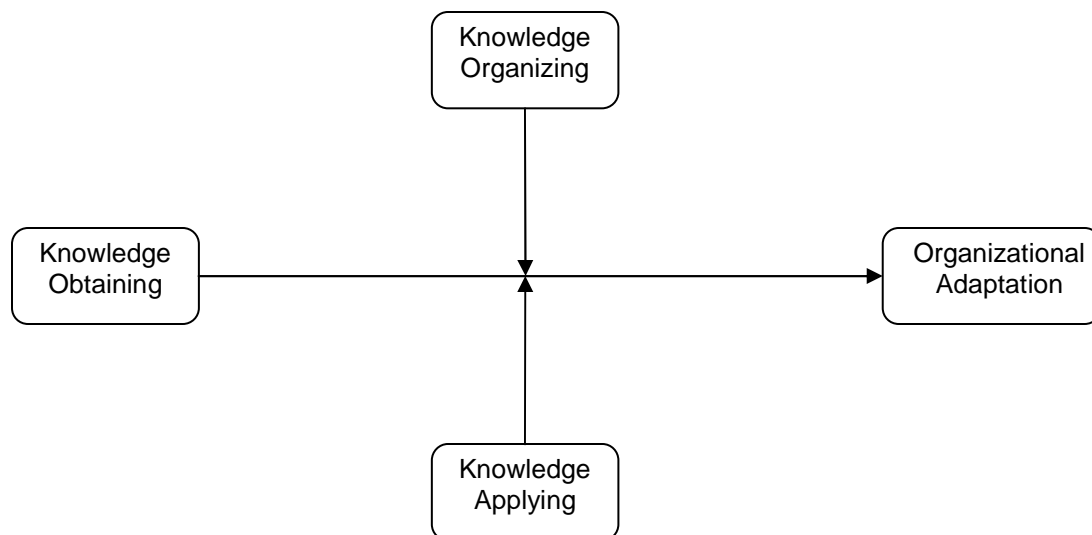
Figure 7. Moderation model of knowledge management.

Other than viewing knowledge management as a systematic process, it is also

argued that knowledge obtaining could directly influence organizational adaptation with

knowledge organizing and application moderating this direct relationship (Argyris, 1977;

Senge, 1990).

Knowledge obtaining refers to either acquiring or creating knowledge from

external or internal sources, while organizational adaptation refers to coping with

environmental change. Knowledge organizing means the integration process to digest and synthesize the newly obtained knowledge, while applying refers to the actual use of knowledge. In reality, it is possible to obtain already usable knowledge to achieve organizational adaptation. It is argued, however, that this relationship could be further strengthened by knowledge organizing because it can further refine and add value to the knowledge that fits the firm better. In a similar fashion, the relationship between knowledge obtaining and organizational adaptation can be strengthened if knowledge can be applied effectively and efficiently rather than aimlessly.

The central notion of the above view is that knowledge obtaining could affect organizational adaptation, but it is a matter of how successful adaptation can be achieved with or without knowledge organizing and application (McGill et al., 1992). That is, if a firm can organize and apply knowledge better, the firm can achieve better adaptation from knowledge obtaining. Otherwise, without effective knowledge organizing and applying activities, the firm's adaptive attempts will not result in optimal outcome. Thus, the hypotheses are:

H1f: There is a positive relationship between knowledge obtaining and organizational adaptation;

H1g: Knowledge organizing moderates the relationship between knowledge obtaining and organizational adaptation; that is, the relationship between knowledge obtaining and organizational adaptation will be stronger at higher levels of knowledge organizing. And,

H1h: Knowledge applying moderates the relationship between knowledge obtaining and organizational adaptation; that is, the relationship between

82

knowledge obtaining and organizational adaptation will be stronger at higher

levels of knowledge applying.

Relationships among Trust, Industrial Cluster

Involvement, and Knowledge Management

Knowledge Management is a managerial discipline that regards knowledge as

one of the most important organizational resources and also as a strategy with the

objective to obtain, refine and put knowledge in action so that it circulates and develops

continuously. Transferring knowledge is a specific strategic action, due either to (a)

personal purposes (e.g., for personal advantages), or (b) to shared objectives and

values (e.g., organizational goals), or (c) to role duties, or (d) finally to habits and

routines (Nonaka, 1995). In all these different motivational sets, some forms of either

implicit confidence or of explicit trust evaluation are always needed (Ganesan, 1994;

Gassenheimer & Manolis, 2001; Nooteboom, 1996).

From previous sections, knowledge obtaining is both a state resulting from a

process or activity (knowledge acquisition) and the process or activity in itself

(knowledge creation). Two fundamental decisions and actions are required to initiate the

knowledge obtaining process: to transfer and pass a piece of knowledge, and to accept

a given piece of knowledge. In many cases, either to pass or to accept knowledge

requires a certain degree of trust to make appropriate decisions (Edmondson, 1999;

Nooteboom, 1996). Schein (1985) argued that trust helps people overcome the

defensiveness and uncertainty that occur when people are presented with unfamiliar

data. When obtaining knowledge, trust induces a sense of confidence that the risk

associated with obtained knowledge will be reduced. Thus, trust can be considered a

precondition for knowledge obtaining as well as an influential factor for the knowledge management process. Typically, the relationship between trust and knowledge obtaining is circular (Gassenheimer & Manolis, 2001). To obtain knowledge, one needs to have confidence in some attributes of others, such as capability and value congruence. To trust, one also needs a significant amount of understanding and knowledge from others. In this study, it is suspected that there might be a strong relationship between trust and knowledge management.

Industrial cluster is widely considered a network-based industrial system (e.g., Silicon Valley) with the aims of adapting to fast-changing markets and technologies as an organized whole (Sexenian, 1994). Industrial clusters can also be viewed as functional performers that can reduce uncertainties that are involved in the transactions that would otherwise increase the transaction costs of small, individual firms (Sexenian, 1994; Camagni, 1991). One example of this reductive function is collective information gathering and screening within the cluster setting. The informal exchange of information and the collaboration effects of successful choices can create a collective information sharing and filtering function in a cluster. Information gathering and screening is the same as knowledge obtaining and knowledge organizing, which are the stages identified in the previous literature review section. The screen function can also assist firms to overcome the challenges that the smaller firms often inherit in investigating and monitoring the quality and hidden characteristics of the raw material, or key devices and necessary equipments for technological advancement (Camagni, 1991). This assertion is in line with Porter's factor condition in his diamond model (Porter, 1990, 1998).

From a network perspective, the interactions among firms within an industrial cluster have cooperative relationships and even strategic alliances that cannot be regarded solely as arms-length market transactions, nor are they administered by the agencies of any organization. Instead, the firms demonstrate the characteristics of a social network, which has its own special economic properties that are socially driven. These characteristics of social networks facilitate the flow of knowledge between clustering firms and transform the decreasing returns faced by isolated organizations into increasing returns (Bearman, 1997). Both cluster and network theory often link the external economies enjoyed by participating firms in an industrial cluster not only with the advantages of flexibility and specialization, but also with the creation of an alternative business environment that promotes cohesion, coordination, cooperation, and trust. More specifically, the industrial clusters often exhibit a greater degree of mutual trust than other environmental settings. Therefore, it is suspected that there might be a relationship between a firm's industrial cluster involvement and trust.

The globalization of today's business and the fast pace of the technological breakthrough enable today's competition to be increasingly knowledge-based in terms of the premium attachment to innovation, and to the early awareness of changing environmental conditions. Networking of firms in an established industrial cluster is recognized as one of the effective ways for collective knowledge obtaining. Thus, industrial cluster and knowledge management should have a strong relationship. Figure 8 illustrates the concept of trust, industrial cluster, and knowledge management.

```
          ┌──────────┐
          │  Trust   │
          └────┬─────┘╲
               │       ╲
               │        ╲
               │         ╲      ┌──────────────┐
               │          ╲     │  Knowledge   │
               │           ╲    │  Obtaining   │
          ┌────┴─────┐     ╱    └──────────────┘
          │Industrial│    ╱
          │ Cluster  │   ╱
          │Involvement│ ╱
          └──────────┘╱
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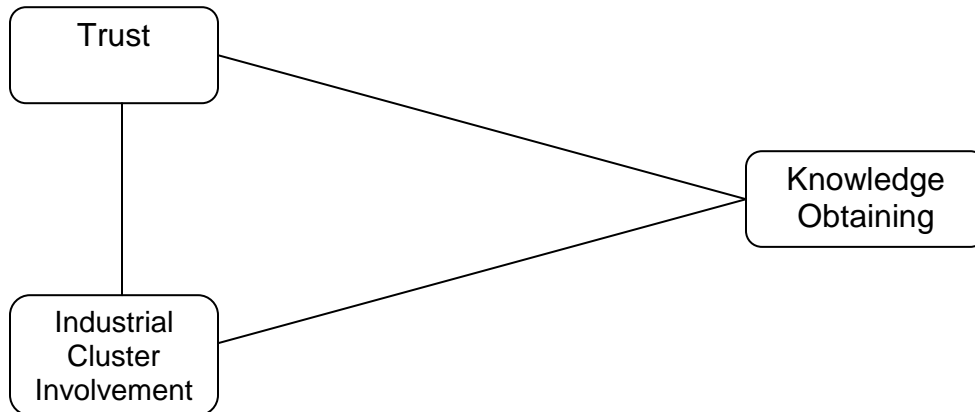
Figure 8. Conceptual model of trust, industrial cluster, and knowledge management.

Obtaining knowledge or learning is a specific action, either due to personal

purposes, or to commonly shared objectives and values within a network. In all the

different motivations, some form of either implicit confidence or explicit trust evaluations

is usually needed. Ganesan (1994) posits that trust is necessary for communication,

knowledge exchange and information sharing, and it is common for cooperative

teamwork. He also underlines the circular relationship between trust and knowledge

obtaining: if trust helps knowledge inflow and outflow, people tend to trust persons or

parties who share the knowledge more than others. Therefore, the following hypothesis

is given:

H2a: There is a positive relationship between trust and knowledge obtaining.

Industrial cluster is recognized as a network-based system that contains many

small and medium-sized firms closely bound together (Sexenian, 1994, 2001). This type

of network formation is also characterized by linkages between actors that are created

in a temporal or semi-temporal fashion, commonly centering on a problem or issue

(Schmitz, 1995). Actors in a network-based system have more access to learn from each other and integrate each other's knowledge until the problem is solved or the goal is achieved. In a cluster such as Silicon Valley, the entire region is organized to adapt continuously to fast-changing markets and technologies by frequent and synergistic knowledge flow within the cluster. The decentralized structure of the cluster encourages the pursuit of multiple technical opportunities through the spontaneous exchange and regrouping of skill, technology, and even capital investment. This flexibility promotes a process of collective learning and knowledge sharing that reduces the distinction between large and small firms and between industrial or service sectors in a supply chain (Porter, 1998; Sexenian, 1994).

Network-based clusters support a decentralized process of experimentation and learning that foster positive interaction between organizations because of the easy access to other proprietary knowledge and other types of resources. Industrial clusters virtually represent a pooled resource and knowledge within a reduced proximity; they literally provide easier access and plentiful complementary assets that may directly benefit clustering firms. Because the characteristics of cluster, namely trade and non-trade interdependences, clustered firms form a complex network structure within a cluster that further develops and even strengthens multiple inter-organizational relationships that offer firms multiple portals to access others' resources and knowledge. Therefore, I present the following hypotheses:

H2b: There is a positive relationship between a firm's industrial cluster involvement and knowledge obtaining.

Industrial clusters present regional agglomerations that consist of a number of networking firms; it significantly reduces the social proximity and increases the sharing of social similarities among the clustering firms. Based on the literature of trust, lower social proximity and higher social similarity are considered important signals for build trust. Once clustering firms are engaged in inter-organizational relationships, they have a better chance to get familiar with each other due to the unique environmental setting within an industrial cluster. This suggests that firms within an industrial cluster learn and get to know each other from a constant transaction process over time in a reduced proximity and shared culture. As discussed previously, a successful industrial cluster can usually develop a reputation and it may act as both cooperative advertising and a form of quality certification that can be considered an important reference to establish trust. Clustering firms can also develop a social identity due to the reduced proximity to other clustering firms that may also serve as another reference to build trust. Thus, the following hypothesis is posited:

H2c: There is a positive relationship between a firm's industrial cluster involvement and trust.

Summary

Although many researchers have recognized the importance of knowledge management, trust and a firm's industrial cluster involvement to organizational adaptation, they have not been studied and analyzed as a whole. By linking and testing organizational adaptation, knowledge management, trust and industrial cluster involvement, this study provides a more holistic explanation of the relationships among the above theoretical foundations.

More interestingly, the three-staged knowledge management framework has been broken into two alternative models for further analysis. The first model refers to knowledge management with an orderly structure, which implies a mediation model. The second model argues that knowledge obtaining could lead to organizational adaptation, but the efforts can be strengthened if knowledge organizing and application are in place. It leads to the development of a moderation model.

The eleven hypotheses are developed based on trust, industrial cluster, and the two alternative models of knowledge management. Figure 9 presents the hypothesized model for this study. In the next chapter, the research methodology for testing the hypothesized model will be discussed.
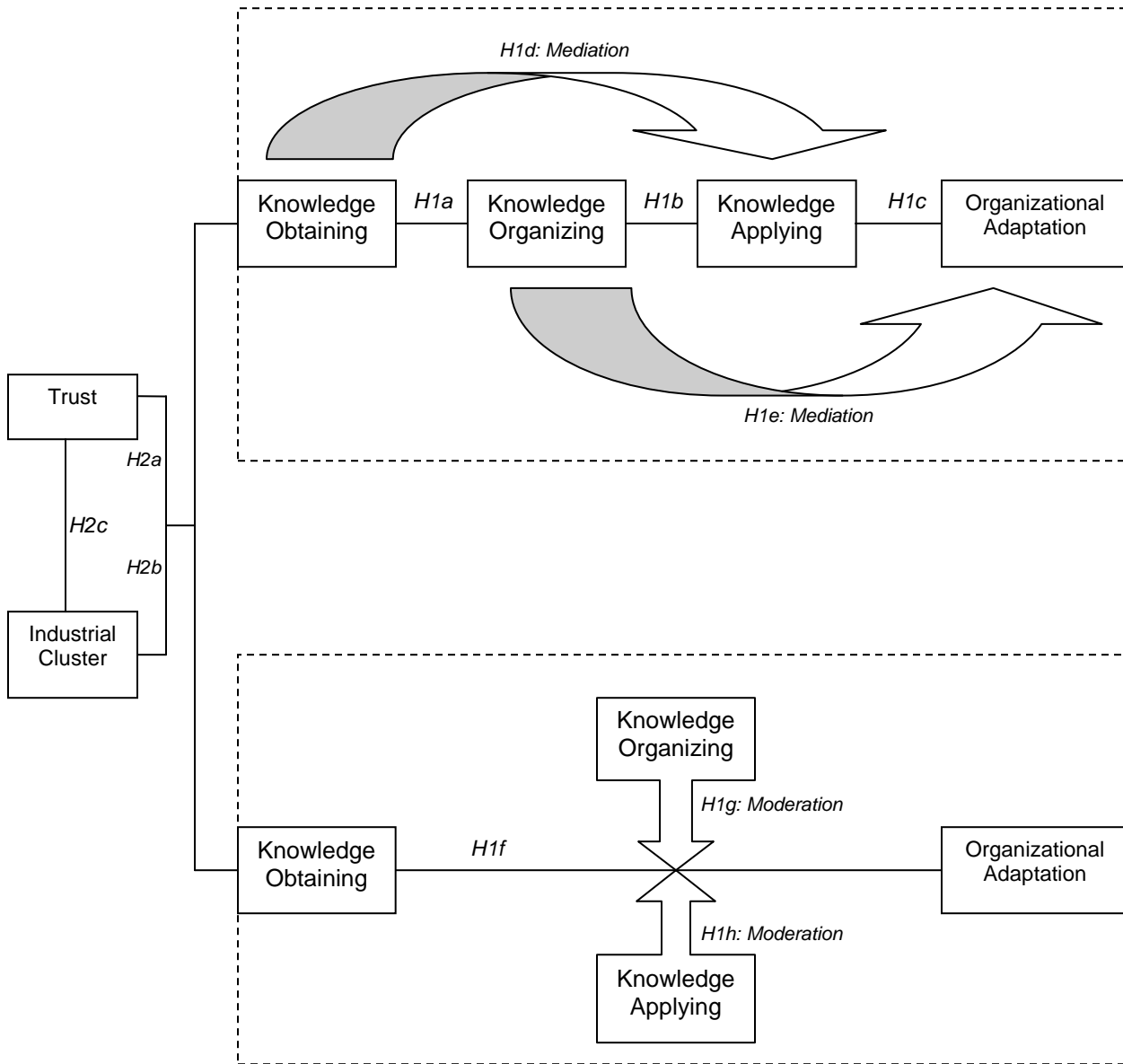
Figure 9. Hypothesized model.

CHAPTER III

RESEARCH METHODOLOGY

Introduction

The primary purpose of this research study was to answer the questions of whether there is a relationship between knowledge management and organizational adaptation, as well as whether there are relationships among trust, a firm's industrial cluster involvement and knowledge management. In Chapter II, a hypothesized model and related hypotheses were developed. Chapter III presents the methodology with which to measure and test the hypotheses. Topics covered in this chapter include the research design and data collection, sampling procedure, the operationalization of constructs and questionnaire design, a pilot study, and a data analysis plan.

As discussed previously in Chapter II, the central research focus is the relationship between knowledge management and organizational adaptation. Knowledge management refers to an organization's internal procedure to process newly obtained knowledge into applicable knowledge. Therefore, the analysis of the relationship between knowledge management and organizational adaptation is the examination of whether the process of knowledge obtaining, organizing, and applying will influence organizational adaptation. On the other hand, the analysis for the relationships among trust, industrial cluster involvement, and knowledge management is the investigation of whether there are relationships among trust, knowledge management, and industrial cluster.

Research Design and Data Collection

Research design provides the glue that holds the research project together and is highly relevant to internal validity (Kerlinger & Lee, 2000). A research design is used to structure the research and show how all of the major parts of the research project, including the samples, measures, and methods, work together to address the central research questions in the study (Trochim, 2001).

Whereas Chapter II focused on the theory-building process, Chapter III focuses on the theory-testing process by adopting a statistical model to test specific hypotheses. The research method that was adopted for the study is field survey research strategy, which tests the hypotheses with information gathered from real world situations. The field survey research selected for this study does not manipulate or create a change in the research settings or research subjects.

Survey research is a method of gathering data from respondents thought to be representative of some populations, using an instrument comprised of closed structure or open-ended items or questions (Kerlinger & Lee, 2000). It is considered the dominant form of research design in many social studies, providing for efficient collection of data over broad populations, amenable to administration in person, by telephone, or over the Internet (Kerlinger & Lee, 2000; Trochim, 2001). The benefits of field survey research, particularly online survey, are as follows:

- It is a relatively efficient and highly feasible way of collecting information from a large number of respondents.
- Survey research is flexible in the sense that a wide range of information can be collected.

- An online survey is relatively inexpensive to administer (Gaddis, 1998).

- An online survey is easier to revise and refine after expert review (Gaddis, 1998).

- An online survey allows faster returns (Gaddis, 1998).

Although field survey research is considered dominant in management related research, it is crucial to realize that internal validity comes before external validity (Cook & Campbell, 1979). Thus, rigorous development and refinement in the instrument is needed to ensure confidence in the generalization of the findings (Taylor, Goodwin & Cosier, 2003). According to Snow and Thomas (1994), theory testing at the description stage, including developing and validating measures of key constructs, is important to the later prediction stage. Therefore, detailed research design procedures are discussed in the following.

Several international industrial clusters were selected as the samples. Within the samples, questionnaires were distributed to a number of firms who reside in each cluster. Due to the large size of the industrial clusters (in terms of the number of firms residing within the clusters), it is adequate to employ field survey research methods.

Data collection methods available for field research include field observation, case study, interviews, and questionnaires (Snow & Thomas, 1994). Rather than giving a direct interview, questionnaires were developed for data collection and distributed to the respondents with the hope of achieving a high rate of return. More specifically, this study used an online survey method for data collection. This method delivers lower per-unit cost and incurs less risk of a social desirability bias than face-to-face or telephone interviews (Snow & Thomas, 1994). Furthermore, online survey methods permit consultation and provide time for respondents to check facts or records before making

responses (Dillman, 2007). In additional to the online survey method, assistance from

key personal contacts provided an opportunity for respondents to have meaningful

involvement, which further helped the rate of return as well as minimizing the non-

responses (Snow & Thomas, 1994).

The Sampling Procedure

Sampling is the process of selecting units (e.g., people, organizations) from a

population of interest so that by studying the sample, one may fairly generalize the

results back to the population from which they were chosen (Kerlinger & Lee, 2000;

Trochim, 2001). External validity can be strengthened by carefully implementing a

sampling practice. In this study, all the existing industrial clusters are the theoretical

population. However, due to many practical difficulties, not every industrial cluster is

accessible. Consequently, four industrial clusters that are accessible were selected as

the study population and information was gathered from the sampling subjects within

the four industrial clusters.

Description of the Study Population

The four industrial clusters were selected from among many internationally well-

known industrial clusters. One was selected from the west coast of the U.S., a second

from Taiwan, a third from China, and the last one was from Sweden. In the following

section, *CU* is used to represent the cluster from United States, *CT* for the one from

Taiwan, *CC* for the one from China, and *CS* for the one from Sweden.

CU is the world's leading industrial cluster in the high technology industry with

thousands of companies headquartered within the U.S. and also worldwide, such as

Apple Computer, Google, Intel, Cisco, and Sun Microsystems. The targeted subjects were chosen from Fortune 1000 (2006) and Forbes Global 2000 (2006) firms. Since there are so many companies residing in *CU*, selecting the targeted firms from Fortune 1000 and Forbes Global 2000 firms was most representative and reliable. *CT* is one of the famous high technology industrial clusters in Asia Pacific region. It is known for its well-developed semiconductor industry and original equipment manufacturers. The subject was selected from the Annual Semiconductor Industry Yearbook published by a government sponsored agency: The Industrial Technology Research Institute (ITRI, 2004, 2005, 2006). *CC* is another well known high technology industrial cluster in Asia. Although it is not as well developed as others, it still catches significant foreign attention due to its market opportunity and above-average rate of growth. The targeted firms were selected from the Annual High Technology Industry Yearbook in China published by the Industrial Technology Research Institute (ITRI, 2004, 2005, 2006). *CS* is well established in information technology and is also recognized worldwide for its leading position in biotechnology. The targeted companies were identified by using the information from the Centre of Market Analysis, which is a spin-off from the University of Linkoping (Sweden).

The reasons for selecting four industrial clusters as the study population were twofold. First, selecting four industrial clusters from different geographical locations provided richer information and more holistic analytical results. Second, the results obtained from analyzing each cluster individually could be used to compare and contrast each cluster's unique features.

Sampling Method

Sampling method refers to the procedures for selecting participants for the study (Trochim, 2001). This study used a convenience sampling method to approach the targeted firms in the pool of potential subjects, and the first task was to identify potential samples from the study population. From Fortune 1000 (2006) and Forbes Global 2000 (2006), 194 companies are categorized as high technology companies that are headquartered in the industrial cluster on the west coast of the U.S. (*CU*). There are 173 companies from the industrial cluster in *CT*, and 361 from *CC*. According to the information acquired from Centre of Market Analysis, 215 reside in *CS*. Therefore, the sampling frame consisted of 943 companies.

The methods for identifying industrial clusters are different across studies. Porter (1990, 1998) and Saxenian (1994) view industrial clusters in the U.S. as firmly established industrial clusters because they represent shared-focus and sectoral concentration and combination of firms, while Brusco (1990), Pedersen et al. (1994) and Schmitz (1995, 1997) emphasize industrial clusters in Europe and Asia that are government sponsored. Since there is no unifying way to evaluate and identify industrial clusters, the selection of industrial clusters and firms within the clusters may have potential limitations. In this study, although selected from the reliable sources, the 194 targeted samples in *CU* may be biased toward large, internationally well-known companies. On the other hand, the 173 companies selected from *CT*, 361 companies from *CC*, and the 215 companies from CS represent the population of each industrial cluster regardless of company size and brand image. This potential limitation is recognized; however, it is believed that by selecting targeted companies from a variety

of different industrial clusters it may add more variances representing the different nature of environmental settings across clusters, which allows the comparison in a later chapter.

The instruments were sent out to all the 943 companies with assistance from several individuals who had better access to each industrial cluster in hopes of increasing the response rate. According to the literature (Kerlinger & Lee, 2000; Trochim, 2001), the generally accepted response rate in a social science related study is typically 10%. In this study, with help from individuals who had access to each sampling cluster, the intended response rate was set at 20%, resulting in the sample size of 189 companies.

The process for collecting data was to gather the data from individuals who served as key organizational informants who are considered representative of each company. The informants were at the management level or higher. In a previous study from Niu and Miles (2005), their results, which showed no significant difference between the personnel working at middle management level or the top management level regarding the understanding of organizational knowledge management practices, suggest that key informants do not have to be exclusively at top management level. Therefore, collecting data from key informants at management level or higher was appropriate in this study.

Statistical Power, Effect Size, and Sample Size

Statistical power is defined as the probability that the test will reject a null hypothesis in a study (Kaplan & George, 1995). As power increases, the chances of a Type II error decrease, and vice versa. The statistical power ranges from 0 to 1 since it

is a probability value, but a common value used in social science would be .80 (Cohen, 1988). It is suggested that the chance of committing a type II error (β) should be held to approximately four times the chance of a type I error (α) (Cohen, 1988). Since α is usually held to .05, β should be .20, resulting in a statistical power of .80 (i.e., 1 – β).

Effect size is a measure of the strength of the relationship between two variables which are generally defined as small (.20), medium (.50), and large (.80). The resulting numbers of sampling case after using GPOWER statistical software, based on power = .80 and α = .05, are 191 for small effect sizes, 26 for medium effect sizes, and 7 for large effect sizes (Cohen, 1988). Using n=191, the resulting ideal response rate is 20.25 %, which is conformed to the intended response rate discussed previously. Using the small effect size and preferred sample size of 191 firms as bases, surveys will be mailed to the managers of 943 companies.

<center>Operationalization and Questionnaire Design</center>

The survey instrument developed for this study includes the following constructs that were identified in Chapter II. They are: organizational adaptation, knowledge management, trust, and industrial cluster involvement. In this study, independent variables are knowledge management, trust, and industrial cluster, while the dependent variable is organizational adaptation. Some of the instruments were adopted from existing scales, while others were developed by Niu and Miles (2005) and based on the literature. The following figures show the analytical model of this study.
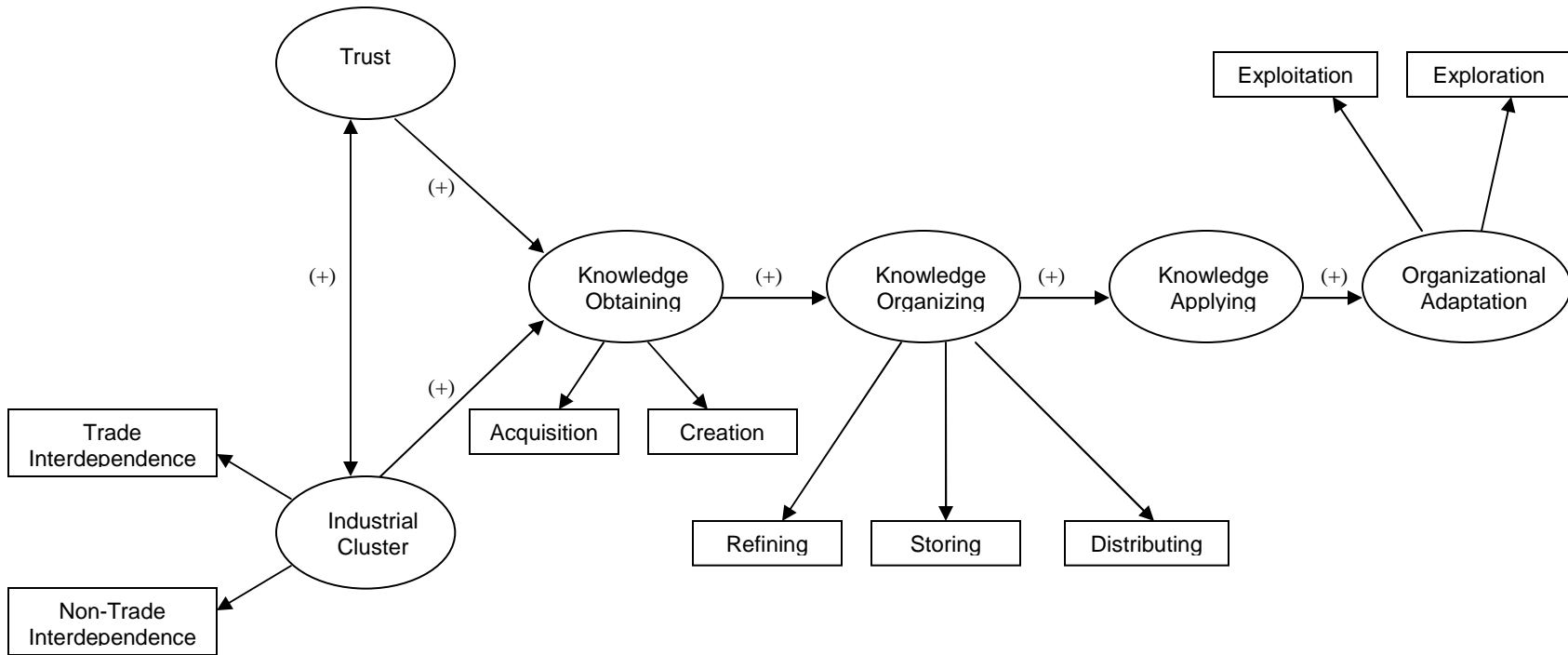
Figure 10. Mediation model of organizational adaptation,
knowledge management, trust and industrial cluster.
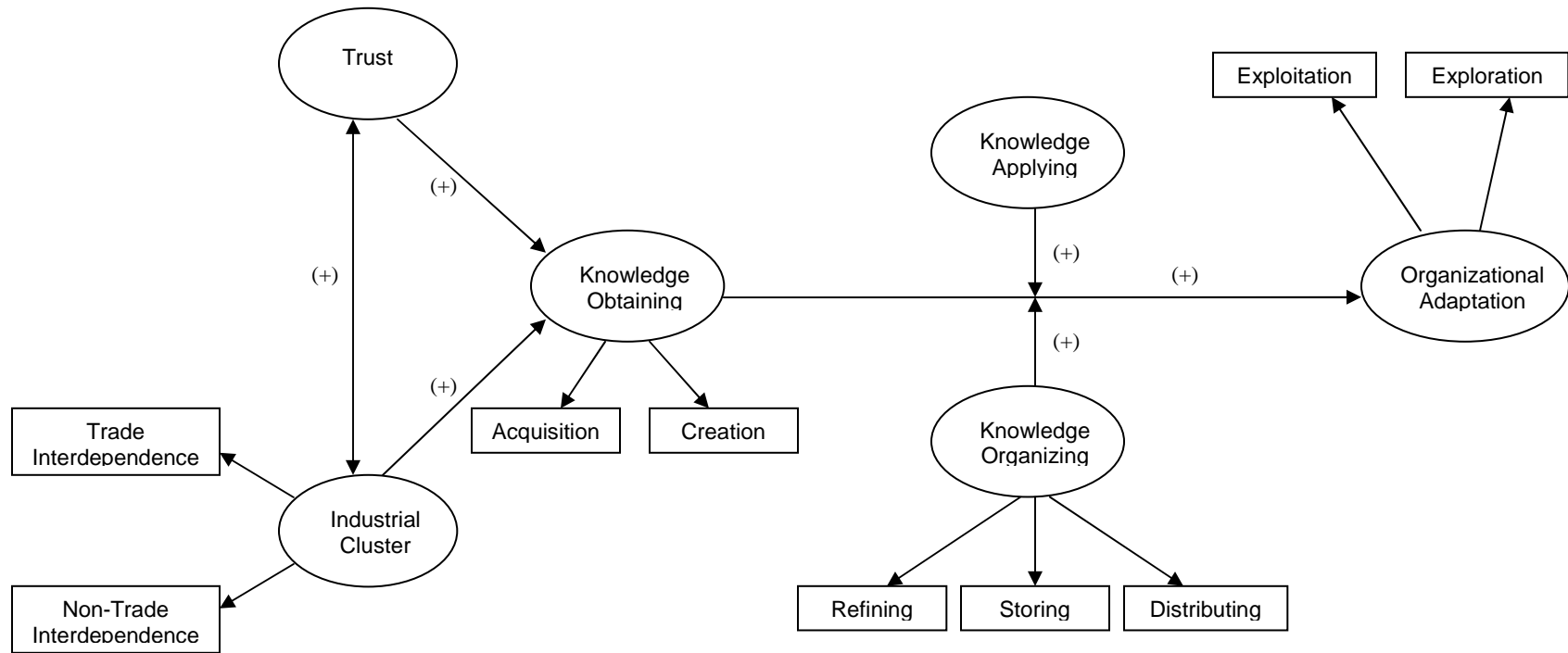
Figure 11. Moderation model of organizational adaptation,
knowledge management, trust and industrial cluster.

Independent Variable: Knowledge Management

Knowledge management theory is associated with obtaining, organizing, and applying knowledge to achieve a firm's strategic objectives (Marshall, 1997; Pfeffer & Sutton, 2000). It also represents a systematic process for gathering information, organizing information, and applying and creating value in real world settings. Based on the previous discussion in Chapter II, knowledge management encompasses three major stages: knowledge obtaining, knowledge organizing, and knowledge applying.

Knowledge obtaining represents the source of knowledge that organizations collect. Before knowledge can be successfully maneuvered for strategic use, it needs to be obtained from reliable sources. In line with the notion of organizational learning and absorptive capacity, organizations can either create knowledge from the organization internally, or acquire it deliberately from outside the firm (Duffy, 2000). It is theorized by several organizational learning researchers that knowledge obtaining or learning leads to competitive advantage (Tallman et al., 2004). It is thought that knowledge, after being obtained, continues to be more value-added because of its benefits and importance to organizational strategic initiatives. Gold et al. (2001) posits that collaboration among organizational units, or even between organizational partners, can also benefit from knowledge obtaining.

Due to the lack of existing measures, items for knowledge obtaining were constructed based on two dimensions: acquisition and creation. The questionnaire items are shown in the following table. Items 1 to 5 are associated with knowledge acquisition, while Items 6 to 10 pertain to knowledge creation. Respondents were asked to mark the source of knowledge using a Likert scale ranging from 1, indicating highly

disagree, to 5, indicating highly agree. The questionnaire items for knowledge obtaining

have been validated in Niu and Miles (2005). The results of factor analysis in Niu and

Miles (2005) suggested two factors for knowledge obtaining at .05 level. The final

measures, labeled as knowledge *acquisition* and *creation*, explained 50% of variance

and consisted of ten items. The Cronbach's alpha was .73 for knowledge acquisition

and .74 for knowledge creation.

Table 6

Measures and Questionnaire Items of Knowledge Obtaining

	*Items**
Knowledge Obtaining	1. My company frequently acquires information or knowledge *from outside* out company. 2. My company receives valuable information or knowledge *by benchmarking*. 3. My company frequently communicates with *partners/alliances*. 4. My company is able to get needed knowledge from *contractual relationships from strategic partners*. 5. My company frequently receives feedback from *customers*. 6. My company is capable of *analyzing, categorizing, or systematizing* general knowledge and transforming it into specific knowledge. 7. My company is able to *initiate various experimentations* to explore new knowledge. 8. My company is able to generate needed knowledge *internally*. 9. My company has *formal procedures or departments* to develop valuable and useful knowledge. 10. My company has *informal procedures* to develop knowledge.

* Item 1 to 5 are related to knowledge acquisition; Item 6-10 are related to knowledge creation.

Knowledge organizing follows knowledge obtaining. This stage acts as the initial

filtering mechanism to examine and identify the potential pay-off of an organization's

purposeful use of the knowledge. This mechanism needs to logically exist in

organizations to prevent the unnecessary absorption of valueless knowledge.

Knowledge organizing assists the understanding of what mechanisms are applied in an organization and how well an organization implements knowledge management. According to the literature as discussed in Chapter II, a firm's knowledge organizing mechanisms include refining, storing, and sharing. Each stage is briefly discussed in the following section.

Knowledge refining theory defines knowledge refinement as a value adding process before storing and distributing the newly captured knowledge to the repository or knowledge base (Zack, 1999). After obtaining the knowledge, organizations need to systematically add values by labeling, cleansing, standardizing, and abstracting the knowledge to the knowledge platform for reviewers to examine and search easily. Knowledge refinement is perceived as the initial stage of internalizing the newly obtained knowledge, and this mechanism can be used to enhance the effectiveness and efficiency of an organization's knowledge management.

Once the obtained knowledge has passed through the value adding process (i.e., refinement) and been examined for its potential usefulness, organizations benefit from developing mechanisms for storing this knowledge. Knowledge storing, such as database and data warehousing, acts as a bridge between knowledge obtaining and distributing (Crossan et al., 1999; Duffy, 2000; Huber, 1991; Zack, 1999). The structure of knowledge storage must allow different content views so that users can examine stored knowledge based on needs.

Knowledge distribution refers to the methods of delivering knowledge to users, groups, and organizations (Crossan et al., 1999; Huber, 1991; Pfeffer & Sutton, 2000; Zack, 1999). Zack (1999) defined knowledge distribution as a mechanism that

organizations adopt to make stored knowledge accessible. Knowledge distribution is

usually mediated by organizational culture and frequency of communication (Buckman,

1998; Pfeffer & Sutton, 2000). Various organizational members and units that serve as

knowledge acquirers also communicate and share knowledge with other organizational

components (Huber, 1991). Knowledge needs to be readily available for users within

organizations who search for information to generate solutions. The structure of

knowledge storage, organizational communications, well-developed indexing and

abstracting, and user friendly interface to disparate data sources greatly impacts the

effectiveness and efficiency of knowledge distribution (Duffy, 2000; Huber, 1991; Zack,

1999).

     The items used to assess knowledge organizing appear in the following table.

Note that Items 1 to 5 pertain to knowledge refining, Items 6 to 9 to knowledge storing,

and Items 10 to 14 are about knowledge distribution. Respondents were asked to mark

the source of knowledge using a Likert scale ranging from 1, indicating highly disagree,

to 5, indicating highly agree. The result of factor analysis in Niu and Miles (2005)

suggested three measures labeled as *refining*, *storing*, and *distributing* at .05 level.

Refining contained five items; storing consisted of four items; distributing consisted of

five items. Refining, storing, and distributing explained 34%, 20%, and 15% of

variances, respectively. The Cronbach's alpha of refining, storing, and distributing is .92,

.69, and .76, respectively.

Table 7

Measures and Questionnaire Items of Knowledge Organizing

	Items*
Knowledge Organizing	1. My company has a formal way of *filtering* knowledge. 2. My company has a formal way of *categorizing* knowledge. 3. My company has a formal way of *integrating* knowledge. 4. My company has a formal way of *codifying* knowledge 5. My company has a formal way of *indexing* knowledge 6. My company has a *database* to store knowledge and information. 7. My company has a *dedicated area or storage* to keep knowledge and information in physical form (e.g., papers, reports, etc.). 8. My company adopts *data warehousing* activities. 9. My company uses *electronic means (e.g., internet, website…etc.)* to store and manage information and knowledge. 10. My company's database is easily *accessible.* 11. My company expects employees to *share knowledge* with others. 12. Employees have a willingness to share knowledge in *my company.* 13. My company has a willingness to share knowledge with *partnering firms.* 14. Employees can easily get knowledge from *different departments.*

* Item 1 to 5 are related to knowledge refining; Item 6-9 are related to knowledge storing; Item 10-14 are related to knowledge distributing.

Knowledge applying is associated with the actual use of the knowledge. Pfeffer

and Sutton (2000) argued that competitive advantage goes to organizations that use

knowledge the best, not to those who have the best knowledge. They contended that

unless the final stage of knowledge management, knowledge applying, is achieved in

the business world, the preceding stages of knowledge management are ineffective and

will form a "knowing-doing gap" (Pfeffer & Sutton, 2000). Wong and Radcliffe (2000)

proposed a theoretical model of knowledge applying. It emphasizes the relationship

among different types of functional knowledge (i.e., from different departments,

personnel), focal knowledge (i.e., knowledge needed to perform certain task), and the

performance of the tasks. If functional knowledge is able to support the focal knowledge

involved in performing a task, organizations are likely to perform better.

The following table summarizes the items of knowledge applying. Respondents

were asked to mark the source of knowledge using a Likert scale ranging from 1,

indicating highly disagree, to 5, indicating highly agree. A total of ten items originally in

Niu and Miles (2005) were related to this construct. The result of factor analysis

suggested two factors for knowledge applying at .05 level. They were labeled as

effectiveness and *value creation*. Effectiveness consisted of six items and value

creation contained another six. Effectiveness explained 31% of variance and value

creation explained 29% of variance. The Cronbach's alpha of effectiveness and value

creation is .90 and .87, respectively. In this study, however, it is focused on the actual

use (i.e., action) of knowledge to create value. The items have been reduced to six with

a primary focus on the application of knowledge.

Table 8

Measures and Questionnaire Items of Knowledge Applying

	Items
Knowledge Applying	1. My company can apply knowledge *flexibly* to create more value. 2. My company can apply knowledge *effectively* to create more value. 3. My company can apply knowledge *efficiently* to create more value. 4. My company can apply knowledge *consistently* to create more value. 5. My company can apply knowledge *innovatively* to create more value. 6. My company's units can apply knowledge *collaboratively* with each other to create more value.

Independent Variable: Trust

In Chapter II, trust is defined as willingness to take risks based on confidence in trustees' honest and truthful behavior (Cummings & Bromiley, 1996; Morgan & Hunt, 1994). It is measured in this study using an organizational trust inventory scale developed by Cummings and Bromiley (1996), which tests a potential partner's honesty and benevolence. The original items of trust were adopted from Cummings and Bromiley's (1996) eight items of trust with previous α= .91 for honesty and α= .85 for benevolence. Hence, construct reliability is supported. However, according to the dimensions summarized in the previous chapter, several items were added to better serve the purpose of this study. According to Johnston et al. (2004), trust is measured by using two dimensions: benevolence and dependability. The dependability refers to the belief in the other party being dependable or reliable (Johnston et al., 2004). The items are developed and added based on the dimensions of dependability including environmental setting, reputation, culture, competence, and knowledge and

understanding. The original items have a Cronbach alpha at .92, which indicates

acceptable construct reliability. The items are shown in the following table. Items 1 to 4

are related to honesty and Items 5 to 8 are related to benevolence. Items 9 to 14 are

related to dependability. Respondents were asked to mark the source of knowledge

using a Likert scale ranging from 1, indicating highly disagree, to 5, indicating highly

agree.

Table 9

Measures and Questionnaire Items of Trust

	Items
Trust	1. I work with a number of companies who *tell the truth* in communication. 2. I work with a number of companies who are *honest* in business dealings. 3. I work with a number of companies who handle *joint expectations* fairly. 4. I work with a number of companies who *have not misled* my company. 5. I work with a number of companies who *succeed by stepping on others*. 6. I work with a number of companies who try to *get the upper hand*. 7. I work with a number of companies who *take advantage of my problems*. 8. I work with a number of companies who *take advantage of people who are vulnerable*. 9. I have *strong business confidence* in what my partners can do and achieve. 10. I work with a number of companies who are *competent* in fulfilling my need. 11. I work with a number of companies who have a good *reputation*. 12. My company has a *culture* that promotes trustworthy relationship. 13. My company is in an *environment* which promotes trust between partners. 14. I work with a number of companies whom I have *worked with before.*

* Item 1 to 4 are related to honesty; Item 5 to 8 are related to benevolence; Item 9 to 14 are related to dependability.

Independent Variable: Industrial Cluster Involvement

Tallman et al. (2004) distinguishes between two types of competitive

characteristics of a cluster that lead to a firm's competitive advantage: those based on

traded interdependencies, and those based on non-traded interdependencies. Traded

interdependencies exist in the economic sphere and involve *formal exchanges of value*

for value. They include licensing, alliances, acquisitions, or technological know-how in which formal exchanges take place (Tallman et al., 2004). Conversely, non-traded interdependencies are "based on shared knowledge and understanding for which either no or limited market mechanisms exists" (Storper, 1993, 1995, 1997). They exist outside the economic sphere. Non-traded interdependencies are comprised of cultures, customs, and industry atmosphere that combine to produce "worlds of production," which present action trajectories for firms within an uncertain world (Storper & Salais, 1997). Moreover, non-traded interdependencies reflect the "knowledge in the air" associated with what Marshall (1890) called the "industrial atmosphere." These particular competitive characteristics exist in an industrial cluster that runs parallel to transactional characteristics in a economic system. Based on the notion of trade and non-trade interdependencies, the items representing cluster characteristics were constructed based on literature. Table 10 shows the related items of trade (i.e., Item 1 to 7) and non-trade interdependencies (i.e., Item 8 to 14). Respondents were asked to mark their answers using a Likert scale ranging from 1, indicating highly disagree, to 5, indicating highly agree.

Table 10

Measures and Questionnaire Items of Industrial Cluster Involvement

	*Items**
Industrial Cluster Involvement	1. Firms within this industrial cluster often engage in *subcontracting* with other buyers and suppliers. 2. Firms within this industrial cluster often engage in *collaboration* with other companies in a similar position on the supply chain. 3. Firms within this industrial cluster can often focus more on developing their *core value and activities*. 4. This industrial cluster encourages and stimulates more *economic activities* inside and outside the cluster. 5. This industrial cluster allows the participating companies to establish a *multiple interlinked relationship* with their partners. 6. Widespread local *product imitation* can be observed in this industrial cluster. 7. This industrial cluster represents a particular *technical competence* as a whole (e.g., semiconductor, biotechnology, software…etc.). 8. Many companies that reside in this cluster share a *joint social history.* 9. Companies in this cluster are located in *close geographic proximity* to each other. 10. The *social network* relationship among the companies and labors in this cluster are not based on purely economic or transactional relationships. 11. There are some or many *supportive institutions (e.g., research labs and universities…etc.)* around the cluster. 12. National and/or local *governments support* the development of this cluster. 13. Many companies and labors have a shared *cultural background.* 14. The *infrastructure (e.g., transportation and logistics)* are favorable and supportive of participating companies in this cluster.

* Item 1 to 7 are related to trade interdependence; Item 8-14 are related to non-trade interdependence.

Dependent Variable: Organizational Adaptation

An organizational adaptation system is defined as the balance between the

exploration of new possibilities and exploitation of existing certainties (Holland, 1975;

Kuran, 1988; March, 1991; Schumpeter, 1934). Exploitation means enhancing

organizational capabilities and competences, while exploration of new possibilities

refers to organizational innovation. As should be clear from the literature review in

Chapter II, the measurement of exploration and exploitation is likely to be difficult due to

the broad nature of the scope of innovative activities. Therefore, to best serve the

purpose of this study, the operationalization of exploitation uses Reimann's (1982) eight

criteria:

1. Profit growth (in the previous five years).

2. Sales growth (in the previous five years).

3. Attraction and retention of high quality human resources.

4. Product quality.

5. Customer service.

6. Employee job satisfaction and morale.

7. Potential for future growth.

8. Competitive strength and core capability.

The above eight criteria are intended to be representative of a set of activities

that are important in companies' attempts to enhance competences over time, not as an

all inclusive list. The first two were obtained from companies' financial reports by the

informants and the rest were asked of key informants. For measurement purposes, the

question development for exploitation used part of the above eight criteria with some

modifications to better serve this study.

On the other hand, exploration primarily refers to innovative accomplishments.

This study adopts Nohria and Gulati's (1996) notion of innovative accomplishments as

policies, structures, methods, products, or market opportunities that the manager of an

organization perceived to be new. This study uses a broad definition of innovative

accomplishments because the aim of the study is to capture the extent to which each

department is responsible for generating any form of newness that can benefit the

organization as a whole (Nohria & Gulati, 1996; Van de Ven, 1986).

A set of items for organizational adaptation based on the notion of exploration

and exploitation was constructed. The respondents were asked to answer by using a

five-point Likert scale with the responses ranging from "strongly agree" to "strongly

disagree." The following table summarizes the questionnaire items for organizational

adaptation. Items 1 to 8 are the questions regarding exploitation, while Items 10 to 16

are mainly about exploration.

In Niu and Miles (2005), organizational adaptation consists of two dimensions:

competence enhancement and *innovation initiative* were suggested from the results of

factor analysis. A total of nine items were related to competence and seven items were

related to innovation initiative. The variances explained by competence and innovation

initiative were 29% and 26%, respectively. Cronbach's alpha of the two measures is .91

and .89, respectively. Table 11 as follows details the measures and questionnaire items

for organizational adaptation.

Table 11

Measures and Questionnaire Items for Organizational Adaptation

	Items*
Organizational Adaptation	1. My company frequently *enhances* the *supply chain function*. 2. My company frequently *improves and refines* its *financial strategies*. 3. My company frequently *improves and refines* its *corporate/business strategies*. 4. My company frequently *improves and refines* its *engineering function*. 5. My company consistently *improves* the *features* of existing products/services/technologies. 6. My company frequently *improves* the *product quality*. 7. My company frequently *enhances* the *customer service*. 8. My company's *existing product/service* can generate significant profit for a longer term. 9. My company consistently *patents new* products/services/technologies. 10. My company frequently adopts *new ways* to *improve supply chain function*. 11. My company frequently adopts *new ways* to *manage* its *financial strategies*. 12. My company frequently adopts *new ways* to *manage* its *corporate/business strategies*. 13. My company frequently adopts *new ways* to *manage* its *engineering function*. 14. My company frequently *introduces new* products/services. 15. A significant portion of my company's *sales* are from *new products/services*. 16. My company's innovation opens up *new market opportunities*.

* Item 1 to 8 are related to exploitation; Item 9 to 16 are related to exploration.

Control Variables

Demographic information, which is the control variable in this study, was

collected from the respondents after they finished answering the questionnaire. The

information included gender, age, education level, tenure, job title/position,

departmental information, the nature of the company, and the geographical location of

the company. The respondents were asked to mark their answers in the appropriate ranges or categories.

Although these variables are not suggested to have any significant effect on organizational adaptation since none of the demographic information is within the major scope of this study, they are still of some importance and provided additional analytical results. Demographic information is collected for comparison purposes regarding questions about whether the individual perception toward organizational knowledge management practices differed from educational level, managerial position, the nature of the company, and the geographical location.

<div align="center">Pilot Study</div>

A pilot study involves the use of a questionnaire with a small sample size to ascertain how well the questionnaire works. Pilot testing a newly developed instrument is necessary because, as Backstrom and Hursch (1963, p.131) have pointed out, "No amount of intellectual exercise can substitute for testing an instrument designed to communicate with ordinary people". Before the actual administration of the surveys, a pilot study for contextual refinement is conducted to ensure the clarity, user-friendliness, wording and meaning of the questionnaire. Further, by seeking the expert review, the face and content validity of the questionnaire can be improved.

The pilot study has two major objectives. First, to initiate preliminary data analysis, including a test for reliability (Cronbach, 1951) and discriminant validity. Nunnally and Bernstein (1994) concluded that a Cronbach's alpha in a .6 to .7 range is acceptable for well-researched constructs, and this was the primary target that the newly constructed questionnaire for this study was intended to achieve. Although

<div align="center">115</div>

knowledge management related constructs and organizational adaptation have been studied and validated before (Niu & Miles, 2005), it is still necessary to check how well the questionnaire has been constructed after adding other constructs: trust and industrial cluster. Second, administering the questionnaire to a smaller sample helps refine the questionnaire and testing procedures, based on respondent's comments, to achieve content and face validity. In this study, due to the limited sample size, the first objective of the pilot study was not likely to be achieved. Instead, the reliability and discriminant validity was tested by using exploratory factor analysis after completing data collection.

A small amount of data were collected from five high technology companies in Dallas, Texas. As mentioned above, due to the practical difficulty, data collected from the five companies was not sufficient for factor analysis. It did help refine the survey distribution procedures and content validity. After refining the initial questionnaire, the instrument was sent out to ten companies in each cluster to gather data for a second pilot study. The data gathered from 40 companies was sufficient for preliminary data analysis such as factor analysis and item reduction.

Because a large portion of the questionnaire was validated in Niu and Miles' (2005) study, this pilot study helped the refinement of the testing procedures and questionnaire items for content and face validity.

Data Analysis Plan

Sampling of a study population yields raw data that must be examined to draw conclusions about the variables and relationships of the study. There are two primary objectives of using data analysis. First, characteristics of the data base are examined to

116

determine if the sample adheres to the assumptions of the statistical tools that are being

used. Second, the hypotheses are supported or not supported based on the analysis of

the data collected from the samples. This section will address the following topic:

primary data analysis technique, and alternative data analysis technique.

Primary Data Analysis Technique: Regression Analysis

Following the data collection, the resulting data were analyzed to determine

whether the hypotheses should be rejected or not. The primary data analysis technique

was multiple regression analysis. The general purpose of multiple regression analysis is

to explore the patterns between multiple independent variables and single dependent

variables. Multiple regression analysis was chosen in this study because the dependent

variable is a continuous variable, one of the requirements for using multiple regression

analysis. The dependent variable in this study was organizational adaptation, which is a

continuous variable, and this fits the requirement of using multiple regression analysis.

The multiple regression analysis will test the following equation:

$Y = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + e$

Where,

Y = Dependent variable. Organizational adaptation.

X1 = Independent variable. Knowledge obtaining.

X2 = Independent variable. Knowledge organizing.

X3 = Independent variable. Knowledge applying.

β1, 2, 3 = coefficient weight.

e= error terms.

In terms of trust and industrial cluster, correlational analysis (R) to test the

hypotheses was used. The regression was also used for testing mediation effect as

hypothesized in H1d and H1e by following Baron and Kenny's (1986) approach. There

are four steps involved in testing mediation. Step 1 is to show the initial variable is

correlated with the outcome. Step 2 is to show the initial variable is correlated with the

mediator. Step 3 is to show the mediator affects the outcome variable. Step 4 is to

investigate whether the mediator affects the initial-outcome relationship. If the initial-

outcome relationship is zero, then it indicates complete mediation; if it is not zero, but

the number is reduced, it indicates partial mediation. On the other hand, the regression

was used to test moderation effect as hypothesized in H1g and H1h by investigating

whether the initial-outcome relationship varied if the moderator varied.

Even though a multiple regression analysis was chosen here, it had potential

limitations. First, there was only one dependent variable when using regression, and it

often cannot represent and test a relatively complex model with multiple dependent

variables. Second, in multiple regression analysis, a variable can either be an

independent (predictor) variable or a dependent (outcome) variable. A more realistic

view of the world is that a given variable may be an outcome with respect to some

variables, but may in turn become a predictor of other variables. It is, in fact, what it

appeared to be in this study. To overcome the above drawbacks, a Path Analysis was conducted after testing the hypotheses by using multiple regression analysis. Path analysis is a type of multiple regression analysis and it enables the researcher to see the big picture by incorporating all the variables studied. Path analysis does not require a significantly large sample size, as SEM does, and it can also illustrate the model with more dependent variables. The overall model fit was examined using set fit indices (e.g., chi-square) and the researcher chose the model with best fit.

Alternative Data Analysis Technique: Structural Equation Modeling

The alternative data analysis technique in this study was Structural Equation Modeling (SEM). The implementation of this alternative technique heavily depended on the sample size. As discussed previously, the intended sample size was 191 out of 943 companies with power = .8 as the base. There was roughly a 20% response rate and that is appropriate for multiple regression analysis. However, due to the complexity and higher requirements of SEM, a significantly larger sample size was needed. This limitation causes difficulty in practice. An ideal sample size was achieved; consequently, a more through analysis by using SEM can be adopted. In the following paragraph, the possible implementation of structural equation modeling is discussed.

Structural equation modeling is considered a powerful research technique for statistical analysis because it factors in interactions, measurement errors, and latent variables (Bollen, 1989, 1990). If available, SEM can be as a to substitute for multiple regression analysis, factor analysis, and path analysis to achieve a better analysis. Advantages of SEM compared to multiple regression analysis include:

- Flexible assumptions (particularly allowing interpretation even when multicollinearity occurs).

- Use of confirmatory factor analysis to reduce measurement error by having multiple indicators per latent variable to induce convergent validity that is complementary to discriminant validity in the pilot study.

- Attraction of SEM's graphical modeling interface.

- Desirability of testing models overall rather than coefficients individually.

- Ability to test models with multiple dependents.

- Ability to model mediating variables.

- Ability to model error terms.

- Ability to test coefficients across multiple between-subjects groups.

- Ability to handle difficult data (non-normal data or incomplete data).

The basic components of the hypothesized model consist of multiple independent variables and mediators to predict a dependent variable. Moreover, the dependent variable was a continuous variable, which is considered one of the requirements for the implementation of SEM. Either multiple regression analysis or SEM can be used if a study has the criteria discussed above. However, since SEM is generally considered more powerful than multiple regression analysis (see above advantages of SEM), it can still capture the benefits of multiple regression analysis and was appropriate for this study. The analytical software of SEM that was used in this study is LISREL (Jöreskog & Sörbom, 1988), which is considered the most popular SEM software in social science research.

Structural Equation Modeling Procedure

      SEM in this study was broken down into seven relatively distinct but interrelated steps (Bentler & Chou, 1987). The seven steps include: model conceptualization, path diagram construction, model specification, model identification, parameter estimation, assessment of model fit, and model modification.

      Model conceptualization was identification of the research model from theories. It involved the development of theory based hypotheses to serve as a guide for linking the latent variables to each other and to their corresponding indicators. This step was performed in Chapter II and early Chapter III. Figure 9 illustrates the analytical model after model conceptualization.

      The second step was path diagram construction. A path diagram allows researchers to visually illustrate the hypotheses and measurement scheme. While construction of a path diagram is not a requirement for SEM modeling, it should not be omitted. The graphic representation assists the user to more easily comprehend the system of hypotheses contained in the model than does a verbal or mathematical representation. The following figure shows the path diagram for this study.
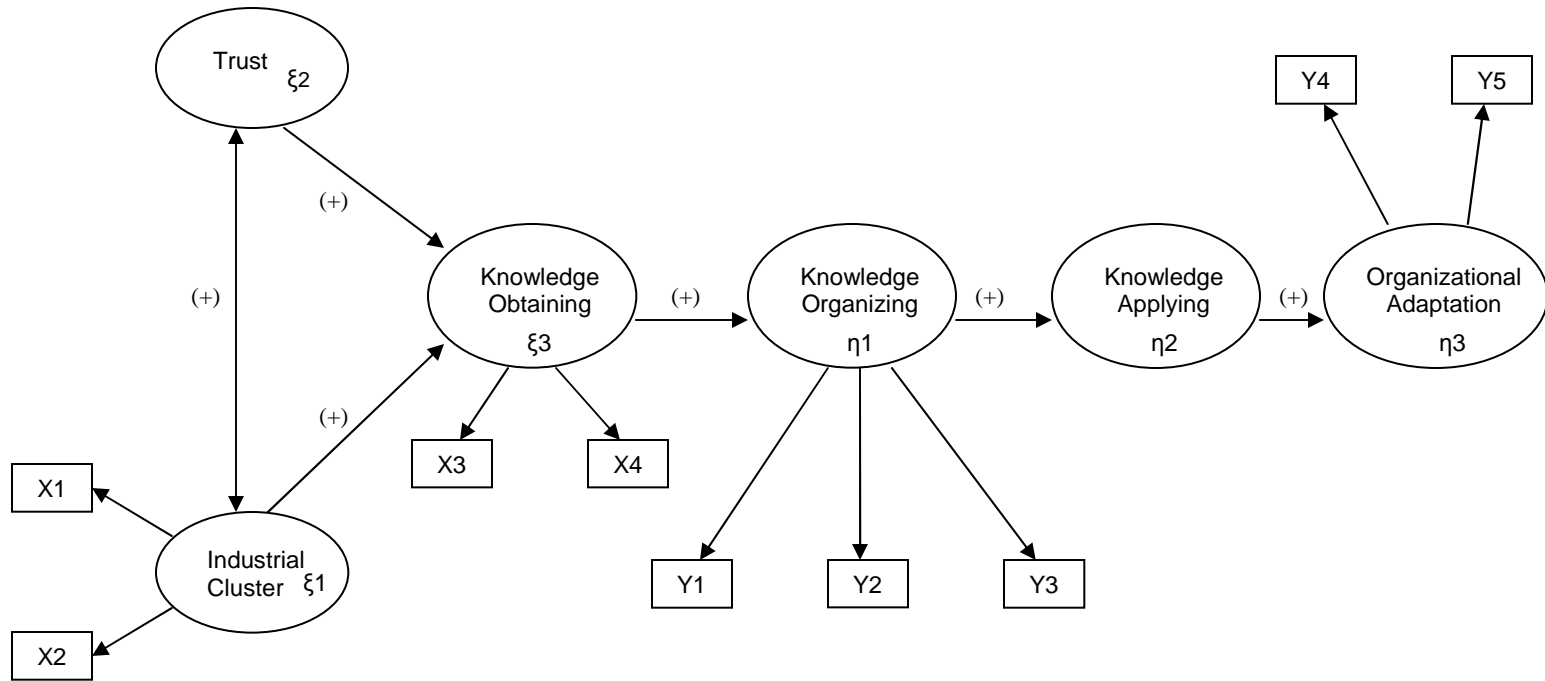
Figure 12. Path diagram of mediating model in this study.
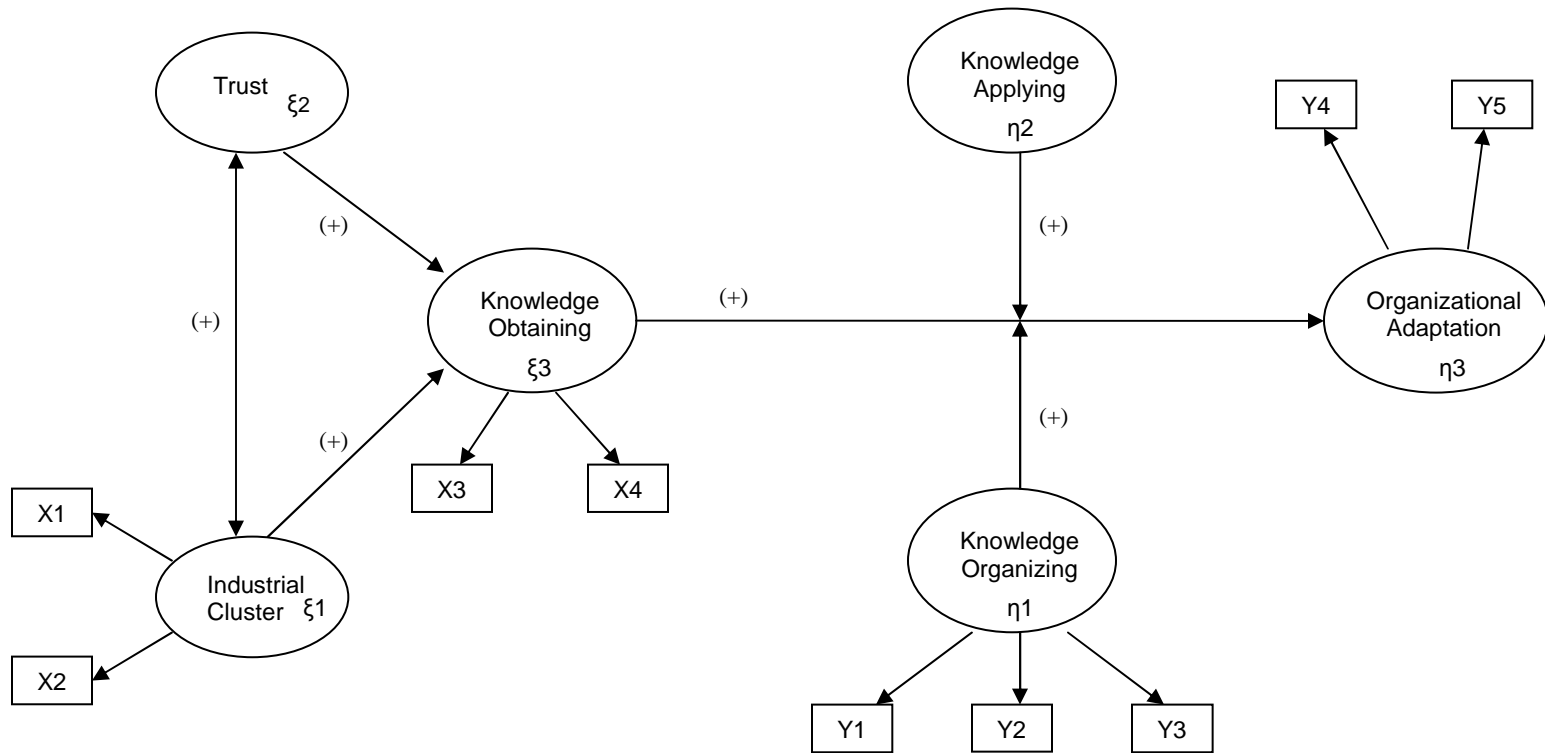
Figure 13. Path diagram of moderating model in this study.

Following the hypotheses development in Chapter II, this study postulated a positive correlation for each path. The structural equation of the model is as follows:

$\eta1 = \gamma11 \xi1 + \gamma21 \xi2 + \gamma31 \xi3 + \Psi$ (Equation 1: Total effect)

$\eta2 = \gamma11 \xi1 + \gamma21 \xi2 + \gamma31 \xi3 + \beta21 \eta1 + \Psi$ (Equation 2: Total effect)

$\eta3 = \gamma11 \xi1 + \gamma21 \xi2 + \gamma31 \xi3 + \beta21 \eta1 + \beta32 \eta2 + \Psi$ (Equation 3: Total effect)

$\eta1 = \gamma31 \xi3 + \Psi$ (Equation 4: Partial effect)

$\eta2 = \beta21 \eta1 + \Psi$ (Equation 5: Partial effect)

$\eta2 = \gamma23 \xi3 + \Psi$ (Equation 6: Partial effect)

$\eta2 = \gamma23 \xi3 + \beta21 \eta1 + \Psi$ (Equation 7: Partial effect)

H1d: Mediating Effect

$\eta2 = \beta12 \eta1 + \Psi$ (Equation 8: Partial effect)

$\eta3 = \beta23 \eta2 + \Psi$ (Equation 9: Partial effect)

$\eta3 = \beta13 \eta1 + \Psi$ (Equation 10: Partial effect)

$\eta3 = \beta21 \eta1 + \beta32 \eta2 + \Psi$ (Equation 11: Partial effect)

H1e: Mediating Effect

$\eta3 = \gamma33 \xi3 + \Psi$ (Equation 12: Direct effect)

$\eta3 = \gamma33 \xi3 + \gamma13 \xi3 + \Psi$ (Equation 13)

$\eta3 = \gamma33 \xi3 + \gamma13 \xi3 + \Psi$ (Equation 14)

H1f & g: Moderating Effect

Where,

η1 = Knowledge organizing. This is the endogenous variable that was considered the resulting stage after knowledge obtaining (ξ3). It is argued that three factors, knowledge refining (Y1), knowledge storing (Y2), and knowledge distributing (Y3), are under knowledge organizing.

η2 = Knowledge applying. This is another endogenous variable used in the analytical model. It is suggested that knowledge applying must follow knowledge organizing to complete the knowledge management process.

η3 = Organizational adaptation. This is the last endogenous variable in this study, which is considered the key. According to equation 3, it is suggested that organizational adaptation is achieved after all the knowledge management steps are satisfied. It also indicates the mediating effect hypothesized in H1d and H1e.

ξ1 = Industrial cluster. This is the exogenous variable that can be measured by using trade (X1) and Non-Trade (X2) interdependences.

ξ2 = Trust. This is the second exogenous variable.

ξ3 = Knowledge obtaining. This is the third exogenous variable. Knowledge obtaining is considered the first step of entire knowledge management

125

system and it triggers the success of organizational adaptation. It is suggested that two factors, knowledge acquisition (X3) and knowledge creation(X4), are under knowledge obtaining.

Ψ= error terms in equations.

γi, βi = model parameter estimates where i= 1, 2, 3.

The third step is model specification. It involves describing the nature and number of parameters to be estimated. No data analysis and discussion of results can be done until this step is completed. The fourth step is model identification. The information provided from the data is examined to determine whether it is sufficient for parameter estimation. If the model is properly identified, then the fifth step, parameter estimation, can take place. Parameter estimates for the model are obtained from the data as the LISREL program generates a model based covariance matrix that is close to the actual covariance matrix. Moreover, significance tests were performed to check whether the obtained parameters were significantly different from zero.

The sixth step is the assessment of model fit. A model provides good fit when the covariance matrix it implies is very close to the actual covariance matrix of the collected data. Goodness of fit is evaluated primarily with the chi-square statistic and other fit indices such as GFI, AGFI, NFI, CFI, and RMSEA (Bentler, 1986; Kline, 1998). The chi-square is considered the most common fit test used by all computerized statistical programs (e.g., AMOS and LISREL). The chi-square should not be significant if there is

a good model fit, while a significant chi-square value indicates lack of satisfactory model fit. The major drawback of the chi-square test, however, is that the chi-square test is very sensitive to sample size. That is, if the sample size is big enough, it is likely to have non-significant chi-square value. Therefore, it is believed that using chi-square in conjunction with reasonable sample size, as well as other fit indices such as GFI, AGFI, NFI, CFI, and RMSEA, can fairly estimate the model fit.

As discussed above, the fit indices provided an evaluation of the soundness of the measurement. In addition, it provided the opportunity to conduct the hypotheses testing by examining the path coefficients. Jaccard and Wan (1996) recommend use of at least three fit tests, while Kline (1998) recommends at least four. To achieve the goodness of fit, this study used at least four fit tests to examine the model fit.

The last step is the evaluation of the necessity of model modification. Modifying model, if necessary, was based on theory and guarded against the temptation of another data-driven study.

Testing Mediation and Moderation Effect by Using SEM

The method to test the mediation using SEM followed the procedures suggested by Baron and Kenny (1986) as well as Bollen (1989). Baron and Kenny (1986) indicate that three conditions must be met for a mediation effect to be present. The first condition states that the exogenous variable must affect the mediating variable. The second condition asserts that the mediating variable must affect the endogenous variable. The third condition is that, when controlling mediating variable, the direct effect between exogenous and endogenous variable must be significantly reduced to illustrate the presence of the mediation effect. Bollen (1989) posits that by following the logic

provided by Baron and Kenny (1986), SEM can also be a robust technique for detecting mediation effects.

As shown above, equation 4, 5, 6, 7 represent the effect from knowledge obtaining to knowledge organizing, knowledge organizing to knowledge applying, knowledge obtaining to knowledge applying, as well as knowledge obtaining to knowledge applying through knowledge organizing respectively. Using SEM to generate the estimates of the path coefficient, standard error, and t value for each equation, the comparison of the amount of decrease for the path coefficient between knowledge obtaining and knowledge applying when knowledge organizing is in place can be achieved. It yielded some information about Hypothesis 1d. The same steps were also applied to Hypothesis 1e by using equation 8, 9, 10, and 11 to examine the second mediation effect in the model.

In terms of moderation effect, Sharma et al. (1981) suggest that the procedure for testing moderation using SEM is similar to regression analysis. First of all, the researcher has to model for the direct effect. In this study, the direct effect refers to the relationship between knowledge obtaining and organizational adaptation (i.e., equation 12). Second, by adding the interaction term of knowledge obtaining and knowledge organizing (i.e., equation 13) to see if knowledge organizing moderates the effect by testing whether the path coefficient is significantly different from zero or is significantly adding the variance explained. If so, then the test supports the hypothesis of moderation effect. The same steps will also be applied to Hypothesis 1g by using equation 14.

Summary

This chapter details the methods used to test the hypotheses that were presented in Chapter II. The data collection plan, sampling procedure, power, effect size, adequate sample size, and data analysis technique were discussed. Questionnaire design and development were addressed. After data collection, a small scale pilot study was conducted to ensure the quality and appropriateness of the newly developed instrument. In the next chapter, the results of the method are discussed and the results are presented.

CHAPTER IV

DATA ANALYSIS AND RESULTS

This following describes the results of analysis of the data from the survey instrument. The survey response rate, characteristics of the sample, results of factor analysis of the newly constructed variables, validity checks, preliminary data analysis, results of the hypothesis tests, and post-hoc statistical tests are revealed.

Survey Response Rate and Sample Characteristics

An online survey method was used to collect data from four industrial clusters in the U.S., Taiwan, China, and Sweden. The survey consisted of 80 questions. The first page of the survey included an introduction to the survey, the time to complete, contact information, and instructions. The second page of the study included all 80 questions with instructions provided throughout the instrument. A copy of the survey item is shown in Appendix B. An email was sent to the key contact in each firm with an introduction letter informing the recipient of the request for participation. The email contained the link to the online survey, and information concerning receipt of a report of the findings from the study.

The original sample size consisted of 943 companies from the sampling population. There are 173 companies from the industrial cluster in Taiwan, and 361 from China, 215 firms reside in Sweden and 194 from the U.S. Therefore, the number of the sampling frame was 943 companies. Respondents totaling 242 accessed the web survey and participated in the survey. Of the 242 respondents who did access the web survey, 213 respondents completed the survey. This provided a 22.6% response rate,

and an 88.3% response rate of those who accessed the survey. Of the 213 individuals who completed the survey, 188 useable surveys were obtained, resulting a 20.8% overall response rate. Hence, the survey yielded sufficient responses from the four industrial clusters to satisfy the minimum statistical power requirement of a 20% response rate from the entire sample population.

Ethical Assurances

The design of this study presented minimal risk to the participants, as it involved no experiential treatments of the subjects or exposure to physical or psychological harm. The study collected demographic information and survey data about the participants. There was no formal debriefing of the participants after the study, but participant companies will be supplied with an executive summary of the findings if requested. Individual participants may also request a summary.

Great care was taken to ensure that the participants fully understood the nature of the study and the fact that participation was voluntary. No sanctions or incentives were used to encourage participation, nor was any applied if the participants declined or withdrew from the study. No information regarding participation of any individual was communicated to their respective organization. Confidentiality of data was maintained at all times and identification of individual named responses will not be available. These conditions were communicated to all participants at the start of the survey. As with all research with human participants, University of North Texas institutional approval was obtained before conducting the research and it is shown in Appedix I.

Non-Response Bias

Efforts to measure the appropriateness of the sample involved the comparison of respondents to non-respondents. Armstrong and Overton (1977) suggested that late respondents are similar to non-respondents. Therefore, in checking for non-response bias, a t test was run to compare the first 30 respondents with the last 30 respondents. To ensure the early respondents and late respondents did not systematically differ, these two groups of respondents were compared based on key variables and demographic data in this study using an independent t test to check for the equality of means.

Before conducting t tests, Levene's statistic was calculated for each analysis to ensure comparable variances between groups. Levene's statistic revealed significant variance difference in each of the analysis, and thus, t tests assuming unequal variances for dependent, independent and demographic variables were used. The results of t tests showed no significant differences between the first and last 30 responses at .05 significant level. Based on the findings, non-response bias was not a major issue in this study. Table 12 shows the results of the non-response bias test.

Further investigation of the results indicate that multicollinearity within each variable are not excessive and within tolerance. Therefore, it does not appear to be a problem in this study.

Table 12

Test of Non-Response Bias

	Respondents	N	Mean	S.D.	t value	Sig level
Knowledge Acquisition	Early	30	3.27	.83	.864	.251
	Late	30	3.39	1.01		
Knowledge Creation	Early	30	3.41	1.31	1.421	.364
	Late	30	3.27	1.17		
Knowledge Refining	Early	30	3.16	1.61	1.247	.184
	Late	30	3.31	1.31		
Knowledge Storing	Early	30	3.19	.98	1.341	.548
	Late	30	3.23	1.15		
Knowledge Distributing	Early	30	3.21	1.28	1.628	.621
	Late	30	3.11	1.12		
Knowledge Applying	Early	30	3.45	1.39	1.346	.268
	Late	30	3.61	1.27		
Honesty	Early	30	3.09	1.62	1.875	.861
	Late	30	3.26	2.14		
Benevolence	Early	30	3.14	1.37	1.625	.456
	Late	30	3.13	1.68		
Dependability	Early	30	3.31	1.42	1.964	.367
	Late	30	3.42	1.54		
Trade Interdependence	Early	30	3.61	1.26	1.843	.412
	Late	30	3.35	.98		
Non-Trade Interdependence	Early	30	3.51	1.05	1.721	.283
	Late	30	3.37	1.36		
Exploitation	Early	30	3.51	1.28	1.264	.179
	Late	30	3.38	1.08		
Exploration	Early	30	3.49	1.31	1.832	.365
	Late	30	3.41	1.24		
Gender	Early	30	1.33	.97	1.447	.136
	Late	30	1.17	1.08		
Age	Early	30	3.23	.56	1.205	.276

	Late	30	3.18	.47		
Education	Early	30	2.33	.98	1.331	.346
	Late	30	3.13	1.23		
Position	Early	30	2.13	7.59	1.456	.117
	Late	30	3.17	11.03		
Tenure at	Early	30	2.75	.44	1.231	.301
company	Late	30	3.15	.38		
Tenure at	Early	30	3.18	.34	1.421	.239
position	Late	30	3.43	.47		
Department	Early	30	11.08	1.31	1.865	.162
	Late	30	9.13	1.08		
Industry	Early	30	13.46	1.34	1.832	.119
	Late	30	12.97	0.97		

Sample Characteristics

The 196 useable responses represent a wide variety of the four international industrial clusters. The sample was predominantly male and most fell between the 34 to 54 years old. In terms of education, more than 80% held at least a Masters degree. Table 13 and 14 show the characteristics of the samples regarding gender and age. With regard to education level, 5.5% of the respondents hold a Bachelors degree, 80.2 hold Masters degree, and 14.3% hold Doctoral degree. Table 15 shows the education level of the respondents.

Table 13

Gender of Respondents

	Frequency	Percent	Cumulative Percent
Males	140	73.5	73.5
Female	48	26.5	100.0
Total	188	100.0	

Table 14

Age of the Respondents

	Frequency	Percent	Cumulative Percent
25-34	30	16.1	16.1
35-44	103	54.5	70.7
45-54	33	17.8	88.4
55-64	22	11.6	100.0
Total	188	100.0	

Table 15

Education of the Respondents

	Frequency	Percent	Cumulative Percent
Bachelor	10	5.5	5.5
Master	150	80.2	85.7
Doctorate	28	14.3	100.0
Total	188	100.0	

To ensure appropriate representation, information about respondents' current position with their company was also collected. The results show that 4.5% are at upper management, 43.4% are at middle management, 51.2% are at junior management, and only .8% of the respondents are not from management level. Table 16 illustrates the respondents' position. Using a single respondent to represent a firm might be an issue. According to Edwards and Cantor (1991), and Bowman and Ambrosini (1997), if the respondent from a company is in a position that appears to have overall knowledge of a firm's practices and strategic dimensions (e.g., management level), it is appropriate to use the response from a single respondent to represent the company. Given the respondents are at least from a junior management level, it appears that they are in a position to report on the knowledge management and other practices of their firms. Table 17 shows the frequency of respondents' tenure. The average length of service in an organization is 4.32 years, with more than 90% having at least 3 years job experience in their current position.

Table 16

Position of the Respondents

	Frequency	Percent	Cumulative Percent
Upper Management	9	4.5	4.5
Middle Management	81	43.4	47.9
Junior management	97	51.2	99.2
Non-Management	1	.8	100.0
Total	188	100.0	

Table 17

Organizational Tenure

	Frequency	Percent	Cumulative Percent
1-3 years	8	4.1	4.1
3-5 years	111	60.7	64.9
5-10 years	55	28.1	93.0
More than 10 years	14	7	100.0
Total	188	100.0	

In terms of company geographical location and industry, 79 responses are from the industrial cluster in Taiwan, 52 are from China, 35 responses are from the U.S., and 30 responses are from Sweden. With regard to industry of respondents, 16.3% are in a research and development-related industry, 14.7% are in computer manufacturing,

14.3% are network service consultants, and 13.9% are in the biotechnology industry.

The following table summarizes the findings.

Table 18

Companies' Market Sector

	Frequency	Percent	Cumulative Percent
R&D	32	16.3	16.3
Computer Manufacturing	29	14.7	31.0
Network	28	14.3	45.3
Biotechnology	27	13.9	59.2
Others	72	40.8	100.0
Total	188	100.0	

Measurements of the Study

In this section, the steps used to generate and evaluate the measurements and variables of the study are discussed.

Factor Analysis

Factor analysis is a multivariate statistical technique that is used to analyze the structure of the correlations among a large number of variables based on a set of common underlying dimensions (Hair et al., 1998).

An exploratory factor analysis was conducted using SPSS before hypothesis testing because of the newness of the survey questionnaire. This study adopted parallel analysis for factor retention (Horn, 1965; Thompson & Daniel, 1996; Zwick & Velicer, 1986). One of the most important decisions that can be made in the use of factor analysis is the number of factors to retain. Numerous studies have consistently shown

that Horn's (1965) parallel analysis is the most nearly accurate methodology for determining the number of factors to retain in an exploratory factor analysis and hence, was used in this study.

Items measuring each construct were considered during the first run using principal components and varimax rotation at an eigenvalue greater than one level. It resulted in items that did not load on the intended factors. Hence, minor modifications of the instrument were made to generate a cleaner result of factor analysis after the first run, and several items were extracted from the analysis. The resulting items were subjected to another factor analysis resulting in a model with a better fit.

Knowledge Obtaining

This construct represents the source from which organizations obtain knowledge. Organizations can either acquire knowledge externally or create it internally. Based on theory, two factors (i.e., acquisition and creation) are expected from the result of factor analysis. Initially there were ten items representing knowledge obtaining and five items for each dimension of knowledge obtaining. Respondents were asked to mark the source of knowledge using a Likert scale ranging from 1, indicating highly disagree, to 5, indicating highly agree. After first run of factor analysis, two items were deleted due to cross loading and concept ambiguity. The two items were about whether the respondents' organizations have database for employees to access, and about the organizational capability to analyze and categorize the newly acquired or created knowledge. It is believed that the two items were similar to the questions being asked in the knowledge organizing section and, therefore, they were deleted. Eight questionnaire items were retained to represent this construct. The results of factor analysis suggested,

as expected, two factors for knowledge obtaining. The final measures, labeled as

knowledge *acquisition* and *creation*, explained 58% of variance and consisted of eight

items (i.e., four items for each variable). The Cronbach's alpha was .75 for acquisition

and .73 for creation. The following table shows the result of factor analysis on

knowledge obtaining.

Table 19

Factor Analysis of Knowledge obtaining

Variable	*Factor 1*	*Factor 2*
Knowledge Obtaining	Acquisition	Creation
Kob1	.779	
Kob2	.813	
Kob3	.568	
Kob4	.737	
Kob5		.870
Kob6		.760
Kob7		.548
Kob8		.607
Total Variance Explained	*.30*	*.28*
Cronbach's Alpha	*.75*	*.73*

Knowledge Organizing

This construct assisted with the understanding of what screening mechanism

was applied in the organization and how well the organization filtered the needed

knowledge. According to theory, three factors are expected and they should represent

knowledge refinement, storage, and distribution. Sixteen items are initially related to this

construct. Four items were extracted with cross-loading in two or more factors. One item

was dropped from knowledge refinement related items, one item from storage related

items, and two from distribution related items. One of the items dropped from

knowledge refinement pertained to the efficiency of the knowledge integration process,

which does not fit in the conceptual scope of knowledge refinement. The item dropped

from knowledge storage was about whether the organization has dedicated

departments or structural units that handle knowledge storage activities. Since the

questionnaire items of knowledge storage are about the actual action, not the structure,

the item was then deleted. Two of the items dropped from knowledge distribution were

about the willingness and expectation of knowledge distribution activities, and they were

not related to knowledge distribution actions.

The result of factor analysis suggested three measures, and they were labeled

as *refining*, *storing*, and *distributing*. Refining, storing, and distributing each contained

four items. The three factors explained 63% of total variance. The Cronbach's alpha of

refinement, distribution, and storing is .86, .70, and .75, respectively. The following table

illustrates the factor analysis of knowledge organizing.

Table 20

Factor Analysis of Knowledge Organizing

Variable	*Factor 1*	*Factor 2*	*Factor 3*
Knowledge Organizing	Refining	Storing	Distributing
Korg1	.855		
Korg2	.896		
Korg3	.828		
Korg4	.838		
Korg6		.635	
Korg7		.682	
Korg8		.556	
Korg9		.640	
Korg10			.817
Korg11			.832
Korg12			.521
Korg14			.702
Total Variance Explained	*.27*	*.17*	*.19*
Cronbach's Alpha	*.86*	*.70*	*.75*

Knowledge Applying

This construct captures whether the organization actually puts knowledge into practice in product, market, technology, and strategy after employing knowledge management. One factor was expected from this theory. A total of six items were initially related to this construct. Two items were deleted due to heavy cross loading and the possibility of misleading the respondents to rate the organizational performance, rather than actual knowledge applying activities. The result of factor analysis suggested one factor for knowledge applying and it is labeled as *applying*, which consists of four items. The Cronbach's alpha of this factor is .84 and it explained 71% of variance. The result of factor analysis on knowledge applying is shown in the following table.

Table 21

Factor Analysis of Knowledge applying

Variable	Factor 1
Knowledge Applying	Applying
Kapp1	.885
Kapp2	.875
Kapp3	.830
Kapp4	.776
Total Variance Explained	.71
Cronbach's Alpha	.84

Organizational Adaptation

The dependent variable in this study was organizational adaptation and it was expected to have two factors based on theory. The instrument initially consisted of sixteen items, but one item was dropped from exploration related items due to cross loading. The item dropped was about whether the organization supports its R&D activities to achieve competitive advantage. This item might have misled the respondents to direct their thinking toward the organizational performance rather than innovation capabilities, and hence it was dropped. The result of factor analysis suggested two factors: *exploitation and exploration.* A total of eight items were related to exploitation and seven items were related to exploration. The variances explained by both exploitation and exploration are 59%. Cronbach's alpha of the two measures is .81 and .79, respectively. The following table shows the result of factor analysis.

Table 22

Factor Analysis of Organizational Adaptation

Variable	*Factor 1*	*Factor 2*
Organizational Adaptation	Exploitation	Exploration
Adapt1	.713	
Adapt2	.752	
Adapt3	.750	
Adapt4	.871	
Adapt5	.791	
Adapt6	.822	
Adapt7	.560	
Adapt8	.601	
Adapt10		.635
Adapt11		.718
Adapt12		.727
Adapt13		.735
Adapt14		.709
Adapt15		.797
Adapt16		.612
Total Variance Explained	*.28*	*.31*
Cronbach's Alpha	*.81*	*.79*

Trust

In this study, trust was also considered an important mechanism that could ensure a just transactional exchange between organizations. It was expected to have three factors from theory as well as the studies from which the items were adopted. The results of factor analysis revealed three factors: *honesty, benevolence, and dependability*. Twelve items were initially related to trust. One item was dropped due to cross loading and the conceptual similarity to organizational performance. The second run of factor analysis suggested that three items were associated with honesty, four items were related to benevolence and have been reversely coded, and four items were related to dependability. The total variance explained by the three factors is 63% and the alpha is .84 for honesty, .83 for benevolence, and .86 for dependability, which

144

agrees with the Cummings and Bromiley (1996) and Johnston et al. (2004) studies. The following table shows the result of factor analysis on trust.

Table 23

Factor Analysis of Trust

| Variable | Factor 1 | Factor 2 | Factor 3 |
Trust	Honesty	Benevolence	Dependability
Trust1	.871		
Trust2	.917		
Trust3	.832		
Trust4		.811	
Trust5		.892	
Trust6		.838	
Trust7		.712	
Trust9			.691
Trust10			.838
Trust11			.801
Trust12			.676
Total Variance Explained	.21	.19	.23
Cronbach's Alpha	.84	.83	.86

Cluster Involvement

This construct represents a unique environmental setting that may enable firms to more efficiently and effectively implement knowledge management practices. According to theory, two distinct factors were expected and there were fourteen items associated with this construct. After the first run of factor analysis, three items were dropped due to cross loading. Two items dropped were related to strategic alliances and joint ventures, since these items did not fit the conceptual scope of a firm's industrial cluster involvement. The other item dropped was about organizational culture, and again, it did not fit the scope of industrial cluster and regional cluster involvement. The second run of factor analysis suggested two factors and they were labeled *trade* and *non-trade interdependence.* Trade interdependence has five items while non-trade

interdependence has six, and the total variance explained by these two factors was

57%. The alpha for trade and non-trade interdependence was .86 and .85, respectively.

The result of factor analysis is shown in the following table.

Table 24

Factor Analysis of Cluster Involvement

Variable	Factor 1	Factor 2
Cluster Involvement	Trade	Non-Trade
Cluster1	.682	
Cluster2	.832	
Cluster3	.812	
Cluster4	.536	
Cluster6	.606	
Cluster8		.757
Cluster9		.688
Cluster10		.804
Cluster11		.760
Cluster12		.762
Cluster14		.560
Total Variance Explained	*.27*	*.30*
Cronbach's Alpha	*.86*	*.85*

The correlation matrix of the variables derived from factor analyses, as well as

the factor correlations, are shown in the following tables. As shown in table 25 and table

26, all knowledge management stages are correlated with each other in a predicted

pattern. The multicollinearity diagnostics was also conducted based on the correlations

of each variable not greater than .75; it suggested multicollinearity was not an issue in

this study.

To determine if the number of factors and the loadings of measured variables on

them conform to what is expected on the basis of pre-established theoretical model in

this study, confirmatory factor analysis was used to determine whether the items loaded

on the expected factors. Confirmatory factor analysis was performed by using AMOS,

146

and the items loaded on the factors in the same way as exploratory factor analysis. The following figures show the results of confirmatory factor analysis. Another factor analysis was performed by entering all the items and factors derived from previous exploratory factor analysis. The results show all knowledge management components are independent and no cross-loading to each other.
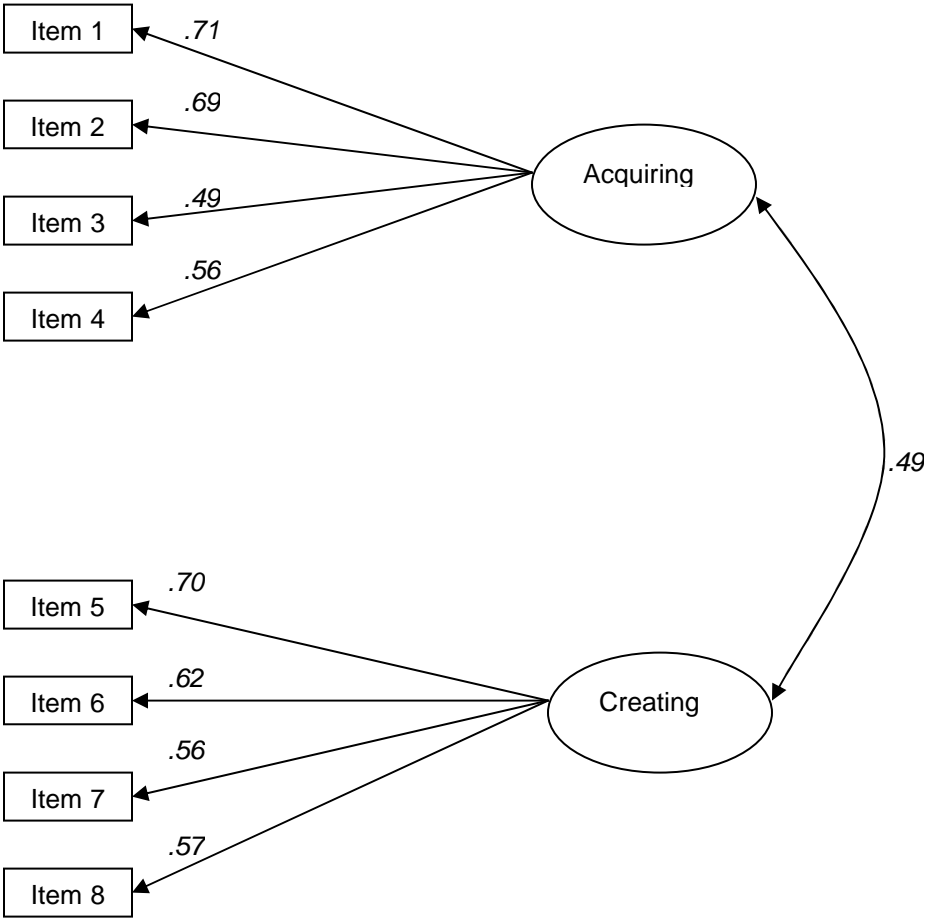
Figure 14. Results of confirmatory factor analysis for knowledge obtaining.
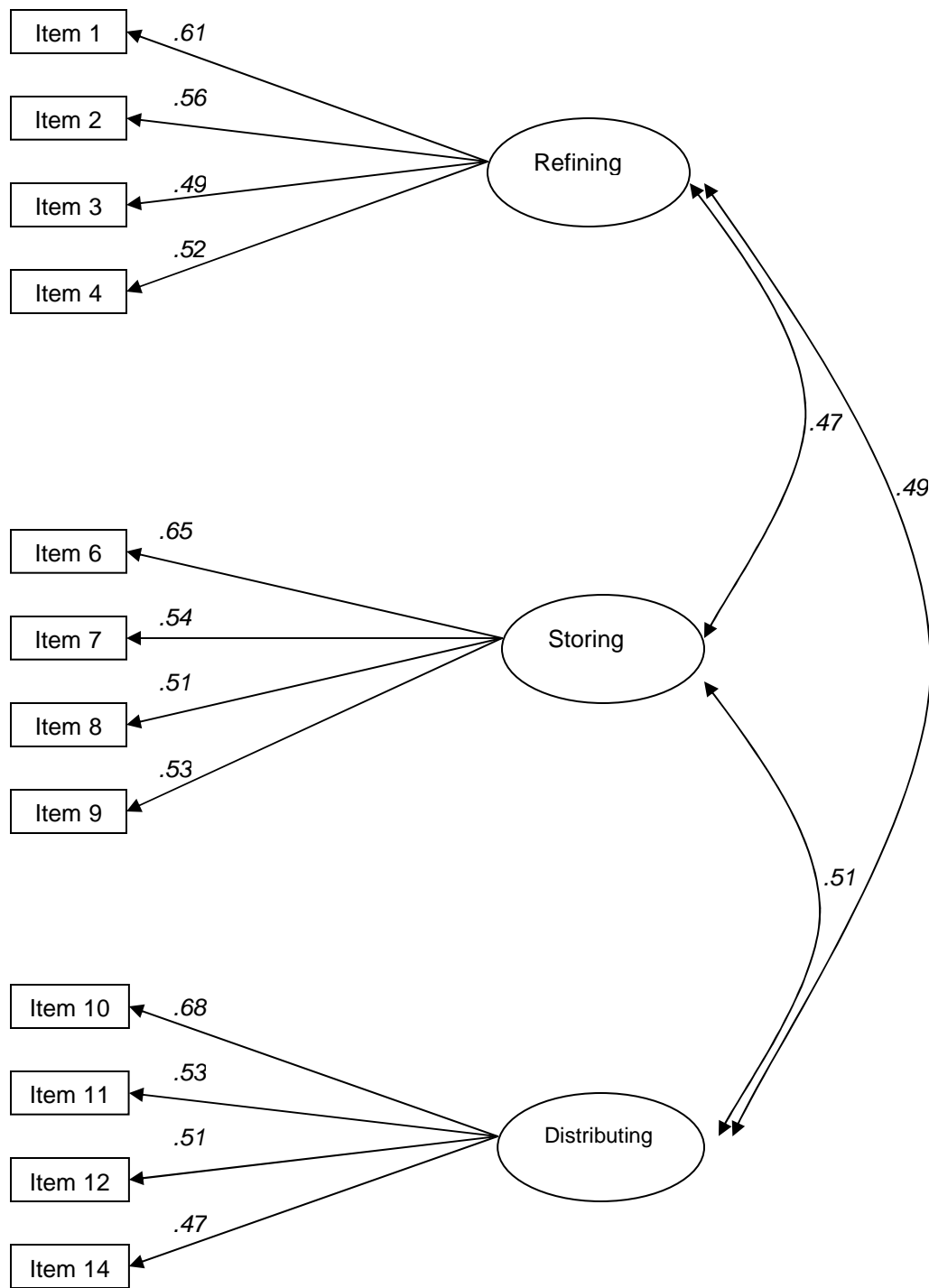
Figure 15. Results of confirmatory factor analysis for knowledge organizing.
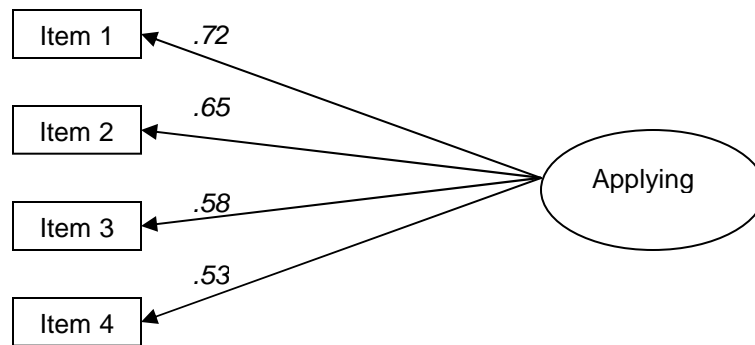
Figure 16. Results of confirmatory factor analysis for knowledge applying.
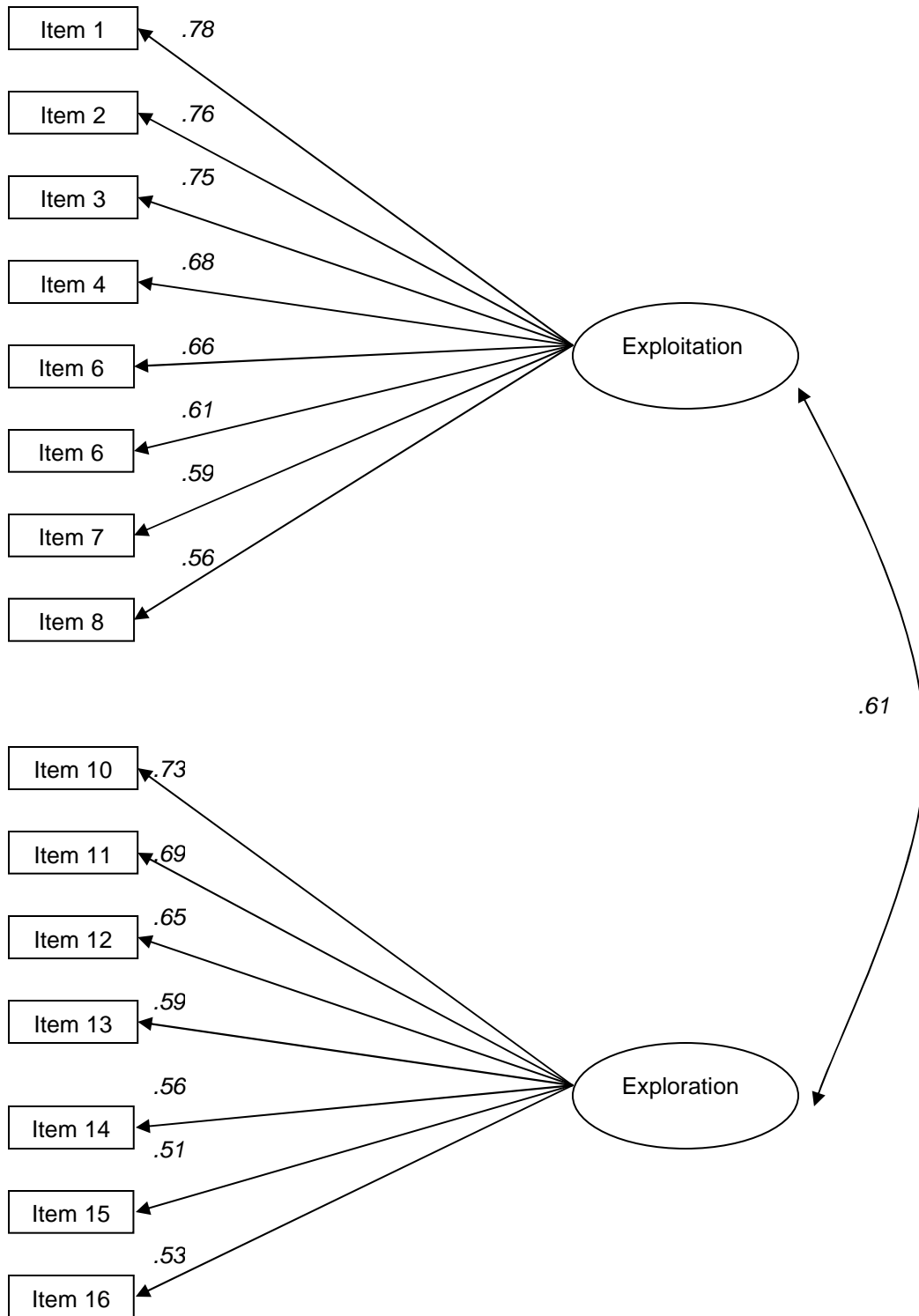
Figure 17. Results of confirmatory factor analysis for adaptation.
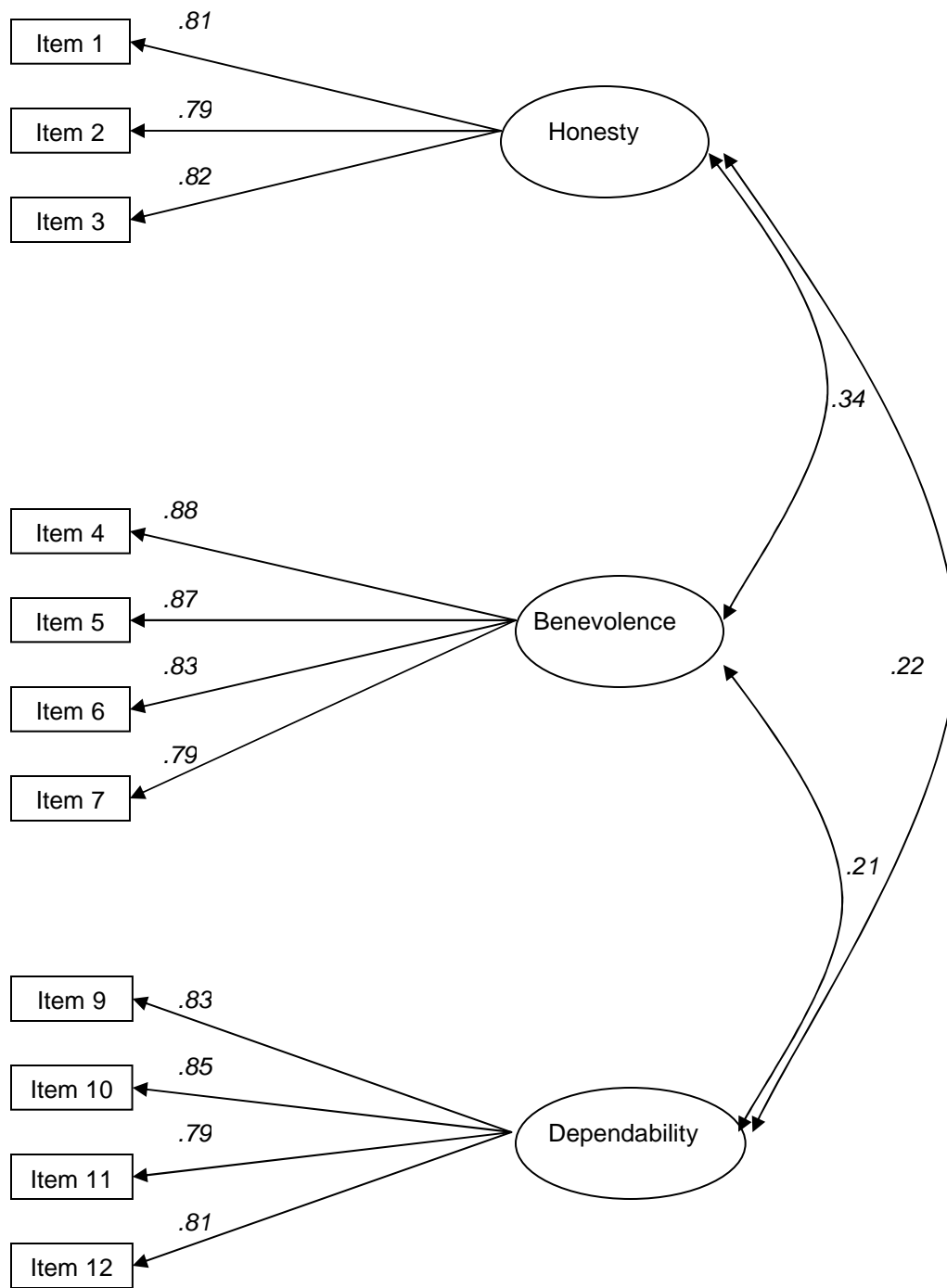
Figure 18. Results of confirmatory factor analysis for trust.
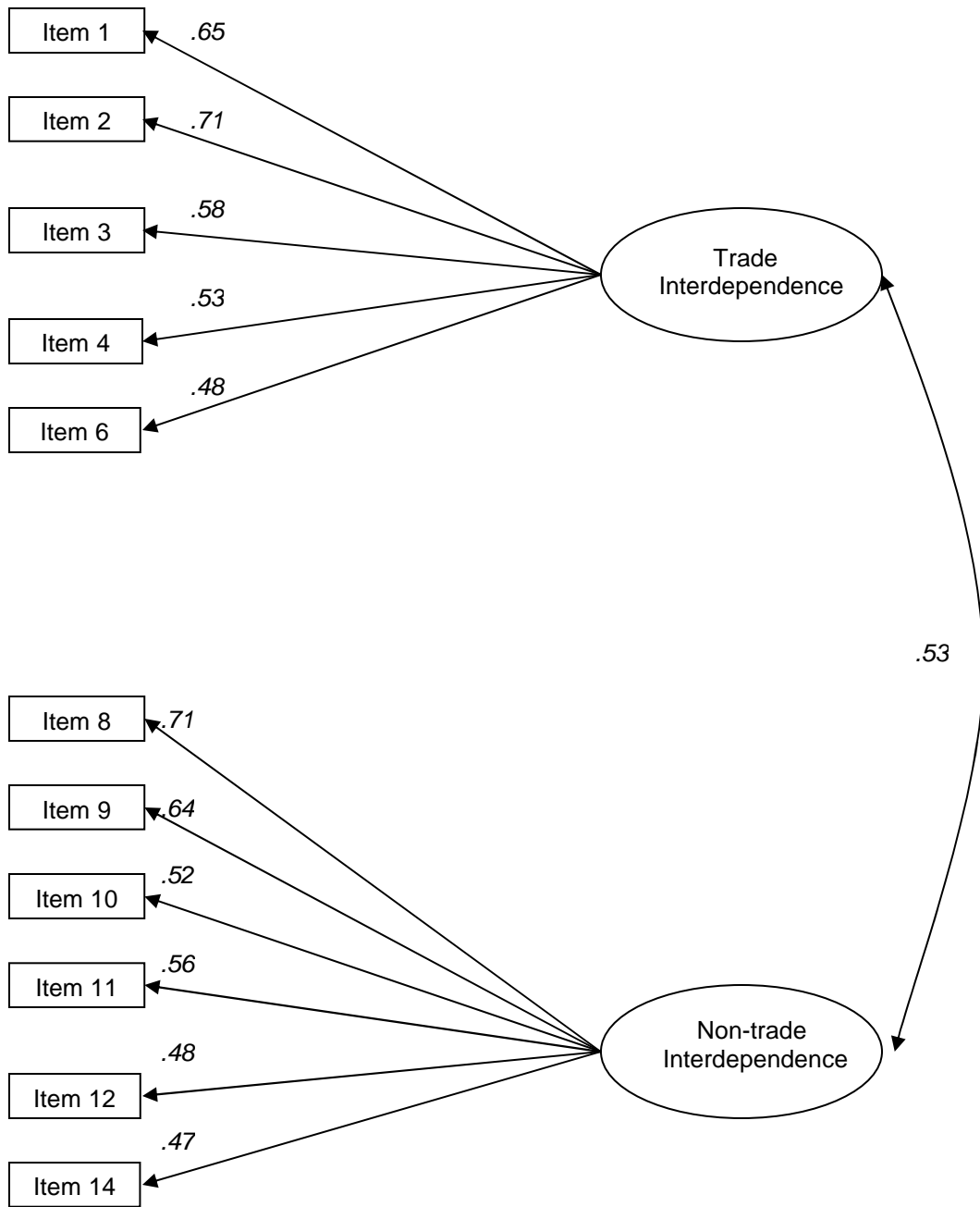
Figure 19. Results of confirmatory factor analysis for cluster involvement.

Table 25

Means, Standard Deviations, and Correlations

	Mean	s.d.	1	2	3	4	5	6	7	8	9	10	11	12
1. Acquisition	3.72	0.65	1.00											
2. Creation	3.91	0.61	.49**	1.00										
3. Refining	3.44	0.76	.45**	.49**	1.00									
4. Storing	3.58	0.77	.38**	.47**	.62**	1.00								
5. Distributing	3.52	0.72	.43**	.39**	.48**	.51**	1.00							
6. Applying	3.66	0.69	.51**	.54**	.65**	.51**	.62**	1.00						
7. Honesty	3.77	0.75	.05	.10	.08	.10	.03	.17**	1.00					
8. Benevolence	3.72	0.63	.11	.18**	.06	.11	.08	.13*	.29**	1.00				
9. Dependability	3.61	0.64	.17**	.15*	.21**	.18**	.13*	.21**	.09	.21**	1.00			
10. Trade	3.67	0.64	.19**	.21**	.23**	.15*	.14*	.25**	.20**	.20**	.56**	1.00		
11. NonTrade	3.73	0.69	.15*	.31**	.23**	.17**	.13*	.28**	.26**	.21**	.57**	.51**	1.00	
12. Exploitation	3.57	0.69	.51**	.32**	.45**	.34**	.29**	.49**	.03	.10	.16*	.28**	.31**	1.00
13. Exploration	3.89	0.64	.37**	.61**	.48**	.41**	.39**	.54**	.12	.17**	.15*	.20**	.30**	.62**

N= 188

**p<.01

*p<.05

Table 26

Factor Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11	12
1. Acquisition	1.00											
2. Creation	*.47*	1.00										
3. Refining	.09	.01	1.00									
4. Storing	.07	.03	*.57*	1.00								
5. Distributing	-.06	.02	*.46*	*.47*	1.00							
6. Applying	.07	.07	-.03	.03	-.11	1.00						
7. Honesty	-.01	.03	-.13	.09	.03	-.18	1.00					
8. Benevolence	.03	.05	-.06	-.01	.09	-.03	*.25*	1.00				
9. Dependability	.11	.02	.02	.09	.07	.01	*.10*	*.20*	1.00			
10. Trade	-.13	-.07	.09	.03	.07	.06	.03	-.01	.03	1.00		
11. NonTrade	.03	-.03	.01	-.14	.06	.08	-.05	.04	.06	*.49*	1.00	
12. Exploitation	-.16	-.12	.04	-.06	-.03	.06	.01	.03	-.03	.02	-.01	1.00
13. Exploration	-.09	.08	-.08	.05	.08	.03	.01	.02	.01	.08	.08	*.56*

N= 188

Reliability Test

An important step in instrument validation is to test the instrument for reliability to ensure measurement accuracy; that is, to minimize the measurement error. Reliability refers to the state when a scale yields consistent measures over time (Henson, 2001). Several types of reliability are defined in the literature. Internal consistency tends to be a frequently used type of reliability in management related research.

Cronbach's alpha was used to establish the reliability of the scales used in this study (Nunnally & Bernstein, 1994; Henson, 2001). The coefficient alpha's for each scale in this exploratory study were all above Nunnally and Bernstein's (1994) suggested reliability coefficient of .70. The Cronbach's alpha for knowledge acquisition, creation, refining, storing, distributing, applying, and organizational adaptation ranged between .70 and .86, indicating appropriate reliability for those measures, especially for exploratory research such as this study. The scale for trust had a Cronbach's alpha .84 for honesty, .83 for benevolence, and .86 for dependability, which were consistent with previous research. The scale for cluster involvement had alpha .86 for trade interdependence and .85 for non-trade interdependence, indicating good internal consistency.

Validity Test

To claim the validity of an instrument, it is necessary to check both convergent and discriminant validity. Convergent validity ensures that all items measure a single underlying construct (Grandon & Pearson, 2003). Discriminant validity reflects the extent to which measures for each construct are distinctly different from each other (Hair et al., 1998).

155

Convergent and discriminant validity were assessed by using factor analysis. The results were discussed in the previous section. Convergent validity is demonstrated if the items load strongly (> .50) on their associated factors (Grandon & Pearson, 2003). Discriminant validity was achieved when each item loads stronger on its associated factor than on any other factor (Grandon & Pearson, 2003; Hair et al., 1998). Tables 20 to 24 illustrate that all items loaded stronger on their associated factors than on other factors. Thus, convergent and discriminant validity were achieved while internal consistency was assessed by using Cronbach's alpha (1951). Based on the results, validity and reliability appear to be non-problematic in this study.

Control Variables

ANOVA was used to examine the mean differences in cluster locations in order to ensure the representative of sample. The ANOVA from Table 27 shows the means of all the four industrial clusters from which the data was collected. The industrial clusters of Taiwan and China, which are being categorized as the Eastern Industrial Cluster, tended to have lower mean values in certain categories, such as knowledge creation, applying, exploitation and exploration. However, the Eastern Industrial Clusters appear to have relatively higher mean values on the trust and industrial cluster involvement measures. On the other hand, Western Industrial Clusters had higher mean values on knowledge creation, applying, and organizational adaptation, indicating that they have a stronger and more focal approach to finding new ways of doing business. Although the results of ANOVA appears to have some differences with some trends, it does not appear to have huge differences overall. That is, in most cases, the results of ANOVA showed significant difference between the highest and lowest mean value, but not the

pair wise mean comparison. Thus, the overall result of ANOVA does not appear to have major issues.

From the results of ANOVA, the responses from each industrial cluster appear to have some variation. To see whether industrial clusters would influence the relationships between knowledge management and organizational adaptation, dummy codes were created for the China, U.S., and Swedish industrial clusters. In all the hierarchical regression analyses, dummy coded variables were introduced as control variables in step 1, knowledge acquisition and creation were extended in step 2, knowledge refinement, storing, and distribution were introduced in step 3, and knowledge applying were inserted in step 4. In the regression analysis that follows, all the dummy coded variables of industrial clusters were non-significant, indicating that industrial clusters did not influence the research model. For the purpose of clarity, the steps that are involved with dummy variables were purposefully omitted. The following table shows the results of ANOVA.

Table 27

ANOVA on Industrial Clusters

	Eastern Nations		Western Nations		
	Taiwan	China	U.S.	Sweden	F value
Acquisition	3.82	3.83	3.59	3.68	1.62
Creation	3.86	3.71	4.15	3.92	5.18**
Refining	3.74	3.35	3.58	3.82	8.76**
Storing	3.71	3.69	3.51	3.72	.824
Distributing	3.62	3.72	3.43	3.57	4.22**
Applying	3.68	3.57	3.97	3.89	4.57**
Honesty	3.71	3.92	3.65	3.68	1.57
Benevolence	3.75	3.68	3.52	3.62	1.21
Dependability	3.56	3.58	3.75	3.64	1.83
Trade	3.55	3.89	3.45	3.56	8.79**
Non-Trade	3.67	3.78	3.61	3.64	7.46**
Exploitation	3.48	3.67	3.49	3.52	2.95**
Exploration	3.73	3.61	3.91	3.88	5.81**

$**p<.01$
$*p<.05$

Hypotheses Testing

In this section, the statistical analysis used to test the research model and hypotheses is discussed, and the results obtained from the tests are presented. This section starts with a brief discussion of the correlation matrix for the variables derived from the factor analyses, followed by a report of the results of the regression for hypotheses testing. The following table summarizes the hypotheses proposed in the previous chapter.

Table 28

Summary of Hypotheses

Alternative Models	Hypotheses
Mediation Model	*H1a*: There is a positive relationship between knowledge obtaining and knowledge organizing. *H1b*: There is a positive relationship between knowledge organizing and knowledge applying. *H1c*: There is a positive relationship between knowledge applying and organizational adaptation. *H1d*: Knowledge organizing mediates the relationship between knowledge obtaining and knowledge applying. *H1e*: Knowledge applying mediates the relationship between knowledge organizing and organizational adaptation.
Moderation Model	*H1f*: There is a positive relationship between knowledge obtaining and organizational adaptation. *H1*g: Knowledge organizing moderates the relationship between knowledge obtaining and organizational adaptation; that is, the relationship between knowledge obtaining and organizational adaptation will be stronger at higher levels of knowledge organizing. And, *H1h*: Knowledge applying moderates the relationship between knowledge obtaining and organizational adaptation; that is, the relationship between knowledge obtaining and organizational adaptation will be stronger at higher levels of knowledge applying.
H2a to H2c	*H2a*: There is a positive relationship between trust and knowledge obtaining. *H2b*: There is a positive relationship between a firm's industrial cluster involvement and knowledge obtaining. *H2c*: There is a positive relationship between a firm's industrial cluster involvement and trust.

Hypotheses Testing: Mediation Model

To test hypotheses 1a through 1c in this study, several linear regression analyses were conducted. For testing Hypothesis 1a, the three measures of knowledge organizing (i.e., refining, storing, and distributing) were used as the dependent variables and the two measures of knowledge obtaining (i.e., acquisition and creation) as independent variables.

As predicted, both knowledge acquisition and creation are important to knowledge refining, storing, and distributing. As shown in Table 29, acquisition and creation are both significant at .01 level on each of the knowledge organizing activities, and knowledge obtaining explained 36% of the variance when the dependent variable is refining, as well as 31% for storing, and 27% for distributing. Therefore, Hypothesis 1a is supported. Table 29 illustrates the regression analyses for testing Hypothesis 1a.

Table 29

Regression of H1a

Independent Variable	Dependent Variables		
	Refining	Storing	Distributing
Intercept	.51	.74	.91
Acquisition	.26**	.21**	.33**
Creation	.43**	.42**	.27**
F	52.58**	42.03**	34.8**
R2	.36	.31	.27
**p< .01			
*p< .05			

Another set of regression analyses was also conducted to test Hypothesis 1b. The dependent variable in this regression analysis is knowledge applying while the independent variables are knowledge refining, storing, and distributing. As the result,

55% of the variance is explained by knowledge organizing, indicating the strong association with knowledge organizing and knowledge applying.

In this regression, both refining and distributing are significant to knowledge applying at .05 level, while knowledge storing is not significant. One possible explanation is that when refining, storing, and distributing are present, refining and distributing appear to have more influence on the dependent variable of applying. Thus, one can still conclude that Hypothesis 1b is supported. Table 30 shows the results of the regression analysis for testing Hypothesis 1b.

Table 30

Regression of H1b

Independent Variable	Dependent Variables
	Applying
Intercept	.85
Refining	.43**
Storing	.10
Distributing	.39**
F	78.31**
R2	.55
**p< .01	
*p< .05	

The third set of regression analyses was run to test Hypothesis 1c. In this regression model, two measures of organizational adaptation, namely exploitation and exploration, were the dependent variables, while knowledge applying was used as the independent variable.

As shown in the following table, knowledge applying is significant to both exploitation and exploration at .01 levels. It explains 37% of the variance in exploitation and 35% in exploration. This indicates the practice of closing the "knowing-doing" gap is

161

very relevant to successful organizational adaptation. Therefore, Hypothesis 1c is

supported. Table 31 illustrates the results of testing Hypothesis 1c.

Table 31

Regression of H1c

Independent Variable	Dependent Variables	
	Exploitation	Exploration
Intercept	1.19	1.83
Applying	.61**	.59**
F	110.71**	97.54**
R2	.37	.35
**p< .01		
*p< .05		

To test hypotheses 1d and 1e, Baron and Kenny's (1986) steps were adopted to

determine whether mediating effect occurred. The steps are:

1. Establish the relationship that the independent variable predicts dependent

    variable.

2. Establish the relationship that independent variable predicts mediation.

3. Establish the relationship that mediator predicts dependent variable.

4. Establish the relationship that independent variable does not predict dependent

    variable while controlling mediator.

For Hypothesis 1d, the dependent variable is knowledge applying. The mediators

are knowledge refining, storing and distributing. The independent dependent variables

are knowledge acquisition and creation. To investigate whether mediating effects has

occurred was performed by using Baron and Kenny's (1986) suggestions.

As shown in table 32, by using Baron and Kenny's (1986) steps, knowledge

obtaining practices are still partially significant at .01 level when knowledge organizing

practices are in place. What can be concluded here is that the relationship between knowledge obtaining and applying is partially mediated by knowledge organizing. Therefore, Hypothesis 1d is supported.

Statistically, knowledge organizing appears to be a partial mediator. However, when examining the changes in R square, it is reduced from 41% to 3%, indicating knowledge organizing almost eliminated most of the variances. Therefore, statistically, knowledge organizing is a partial mediator; however, practically speaking, one can conclude that knowledge organizing fully mediates the relationship between knowledge obtaining and knowledge applying.

Table 32

Mediation Test of H1d

Independent Variable	Step 1 DV: Applying	Step 2 DV: Applying	Step 3 DV: Applying
Intercept	.86	.85	.42
Acquisition	.28**		.07
Creation	.45**		.21**
Refining		.43**	.33**
Storing		.10	.04
Distributing		.39**	.34**
F	63.86**	78.31**	53.16**
R2	.41	.55	.58
ΔR2	-	-	.03**
**p< .01			
*p< .05			

For more insights, several mediation tests were performed for each knowledge obtaining measure. The following tables show the results of separate mediation tests for knowledge acquisition and knowledge creation.

From the results shown in the following tables, one can conclude that knowledge organizing activities partially mediate the relationship between knowledge obtaining and

knowledge applying. Knowledge refining and distributing are both significant at p<.01

level at step 2 and 3 in the following two separate regression analyses, indicating the

mediating effect. Both knowledge acquisition and creation are still significant once

knowledge organizing activities were entered. However, the beta weights are largely

reduced from .01 to .05 level of significance with the presence of knowledge organizing

activities, and acquisition only explained an additional 2% of the variance, and creation

4% versus 26% and 35%, when entered alone in step 1 (see Tables 33 and 34).

Therefore, knowledge organizing mediates the relationship between knowledge

obtaining and knowledge applying.

The changes in R square were largely reduced with the presence of knowledge

organizing activity, which suggests that, practically speaking, knowledge organizing

almost fully mediates the relationship between knowledge obtaining and applying. As

the second check, Sobel Test was used for testing the mediation effect. Table 35 shows

the results of Sobel Test.

Table 33

Mediation Test of Acquisition, Organization, and Application

Independent Variable	Step 1 DV: Applying	Step 2 DV: Applying	Step 3 DV: Applying
Intercept	1.86	.85	.51
Acquisition	.52**		.12*
Refining		.43**	.39**
Storing		.10	.08
Distributing		.39**	.36**
F	65.55**	78.31**	60.82**
R2	.26	.55	.57
ΔR2	-	-	.02*

**p< .01
*p< .05

Table 34

Mediation Test of Creation, Organizing, and Applying

Independent Variable	Step 1 DV: Applying	Step 2 DV: Applying	Step 3 DV: Applying
Intercept	1.27	.85	.49
Creation	.61**		.23**
Refining		.43**	.35**
Storing		.10	.04
Distributing		.39**	.34**
F	100.91**	78.31**	65.89**
R2	.35	.55	.59
ΔR2	-	-	.04**

**p< .01
*p< .05

Table 35

Results of Sobel Test

Relational Model	Sobel Test Statistic
Acquisition → Refining → Applying	4.43**
Acquisition → Storing → Applying	1.80*
Acquisition → Distributing → Applying	5.03**
Creation → Refining → Applying	6.08**
Creation → Storing → Applying	1.93*
Creation → Distributing → Applying	4.41**

**p< .01
*p< .05

Similar approach as discussed above was used to test Hypothesis 1e. For testing

Hypothesis 1e, the dependent variables were exploitation and exploration; the mediator

was knowledge applying; and the independent variables were knowledge refining,

storing, and distributing. The following table illustrates the regression analysis for testing

Hypothesis 1e.

Also, as shown in the Table 36, knowledge applying partially mediated the

relationship between knowledge organizing and organizational adaptation. This

conclusion is drawn because, although knowledge applying is significant at .01 level,

refining remains significant for both exploitation and exploration and storing is significant

for exploration. This indicates partial mediating and thus, Hypothesis 1e is supported.

The Sobel Test for mediation, in conjunction with Baron and Kenny's approach, was

used here as a second check. Table 37 shows the results of the Sobel Test.

From a practical perspective, the change in R square was reduced from 39% to

6% when the dependent variable was exploitation and from 40% to 10% when the

dependent variable was exploration, indicating that knowledge applying eliminated most

of the variance. Therefore, statistically speaking, it shows a partial mediation effect of

knowledge applying, while practically speaking, knowledge applying reduced much of

the variance explained by the relationship between knowledge organizing and

organizational adaptation, suggesting a strong mediating effect brought by knowledge

applying.

Table 36

Mediation Test of H1e

Independent Variable	Step 1a DV: Exploitation	Step 1b DV: Exploitation	Step 1c DV: Exploitation	Step 2a DV: Exploration	Step 2b DV: Exploration	Step 2c DV: Exploration
Intercept	1.11	1.19	.80	1.61	1.83	1.37
Refining	.47**		.32**	.35**		.23**
Storing	.15*		.12	.26**		.22**
Distributing	.13*		.01	.16*		.05
Applying		.61**	.35**		.59**	.29**
F	41.34**	110.71**	38.35**	41.11**	97.54**	35.79**
R2	.39	.37	.43	.40	.35	.45
ΔR2	-	-	.06**	-	-	.10**

**p< .01
*p< .05

Table 37

Results of Sobel Test of H1e

Relational Model	Sobel Test Statistic
Refining → Applying → Exploitation	7.02**
Storing → Applying → Exploitation	1.97*
Distributing → Applying → Exploitation	6.57**
Refining → Applying → Exploration	6.95**
Storing → Applying → Exploration	1.96*
Distributing → Applying → Exploration	6.50**

**p< .01
*p< .05

Another set of regression analyses was also conducted by separating knowledge

organizing activity. The following tables show the results. As one can observe, the

change in R square has been significantly reduced with the presence of knowledge

applying, indicating that knowledge applying almost fully mediates the relationship

between knowledge organizing and organizational adaptation. Especially when the

independent variable is distributing, knowledge applying demonstrates the full mediation

effects on the relationships between independent and dependent variables.

Table 38

Mediation Test of Refining, Applying, and Exploitation

Independent Variable	Step 1 DV: Exploitation	Step 2 DV: Exploitation	Step 3 DV: Exploitation
Intercept	1.58	1.19	.91
Refining	.60**		.36**
Applying		.61**	.38**
F	105.44**	110.71**	74.88**
R2	.36	.37	.44
ΔR2	-	-	.07**

**p< .01
*p< .05

Table 39

Mediation Test of Storing, Applying, and Exploitation

Independent Variable	Step 1 DV: Exploitation	Step 2 DV: Exploitation	Step 3 DV: Exploitation
Intercept	2.03	1.19	.94
Storing	.21**		.15*
Applying		.61**	.64**
F	51.22**	110.71**	62.13**
R2	.21	.37	.39
ΔR2	-	-	.02*

**p< .01
*p< .05

Table 40

Mediation Test of Distributing, Applying, and Exploitation

Independent Variable	Step 1 DV: Exploitation	Step 2 DV: Exploitation	Step 3 DV: Exploitation
Intercept	2.25	1.19	1.16
Distributing	.40**		.04
Applying		.61**	.59**
F	35.29**	110.71**	54.94**
R2	.25	.37	.37
ΔR2	-	-	0
**p< .01			
*p< .05			

Table 41

Mediation Test of Refining, Applying, and Exploration

Independent Variable	Step 1 DV: Exploration	Step 2 DV: Exploration	Step 3 DV: Exploration
Intercept	2.23	1.83	1.61
Refining	.56**		.30**
Applying		.59**	.39**
F	83.64**	97.54**	61.61**
R2	.31	.35	.39
ΔR2	-	-	.04**
**p< .01			
*p< .05			

Table 42

Mediation Test of Storing, Applying, and Exploration

Independent Variable	Step 1 DV: Exploration	Step 2 DV: Exploration	Step 3 DV: Exploration
Intercept	2.34	1.83	1.48
Storing	.52**		.30**
Applying		.59**	.43**
F	70.68**	97.54**	64.41**
R2	.27	.35	.40
ΔR2	-	-	.05**

***p< .01*
*p< .05

Table 43

Mediation Test of Distributing, Applying, and Exploration

Independent Variable	Step 1 DV: Exploration	Step 2 DV: Exploration	Step 3 DV: Exploration
Intercept	2.62	1.83	1.74
Distributing	.44**		.12
Applying		.59**	.52**
F	43.53**	97.54**	50.44**
R2	.19	.35	.35
ΔR2	-	-	0

***p< .01*
*p< .05

Hypotheses Testing: Moderation Model

As discussed in the previous chapter, there is also a possibility that firms may

obtain already usable knowledge that can lead to successful organizational adaptation.

Therefore, an alternative moderation model was proposed. Hypotheses 1f to 1h capture

the rationale of this alternative moderation model.

For testing the moderation, Cohen and Wills' (1986) procedures were adopted:

1. Establish the relationship between independent variable and dependent variable.

2. Establish the relationship between moderator and dependent variable, and.

3. Establish the relationship between independent variable x moderator and dependent variable.

The new variable, independent variable x moderator, was created using the COMPUTE function in SPSS. The following table shows the regression analyses for Hypothesis 1f, 1g, and 1h. As shown in Tables 39 to 44, the step 1 is actually the hypotheses testing of H1f, where the dependent variables are exploitation and exploration, and the independent variables are knowledge acquisition and creation.

According to the result of regression analysis shown on Table 44, knowledge obtaining practices have a positive impact on the dimensions of organizational adaptation. Notably, knowledge acquisition has more weight on exploitation, while knowledge creation has more influence on exploration. Based on this result, Hypothesis 1f is supported.

In terms of hypotheses 1g and 1h, a step-wise regression analysis was performed by entering knowledge obtaining, knowledge organizing practices, and knowledge applying to see whether knowledge organizing and/or knowledge applying strengthened the relationship between obtaining and organizational adaptation. The regression analyses showed no significant effect of the interaction terms on the relationship between knowledge obtaining and organizational adaptation (see Tables 44 to 47). Therefore, hypotheses 1g and 1h are not supported.

Table 44

Moderation Test of H1f and H1g: DV = Exploitation

Independent Variable	Dependent Variable: _Exploitation_			
	Model 1	Model 2	Model 3	Model 4
Intercept	.89	1.11	.58	.57
Acquisition	.53**		.31**	.79**
Creation	.16*		.01	-.49
Refining		.47**	.36*	.46
Storing		.15*	.07	-.29
Distributing		.13*	.08	.43
Acq*refine				.06
Acq*store				.18
Acq*distribute				.35
Cret*refine				-.18
Cret*store				.33
Cret*distribute				-.11
F	49.59**	41.34**	30.82**	14.27**
R2	.35	.39	.45	.44
ΔR2	-	-	-	-.01

_**p< .01_
_*p< .05_

Table 45

Moderation Test of H1g: DV = Exploration

Independent Variable	Dependent Variable: *Exploration*			
	Model 1	Model 2	Model 3	Model 4
Intercept	.73	1.61	.67	-.32
Acquisition	.21**		.11	.28
Creation	.43**		.34**	.48*
Refining		.44**	.29**	.39
Storing		.27**	.14	.43
Distributing		.03	.04*	-.06
Acq*refine				-.39
Acq*store				.22
Acq*distribute				-.14
Cret*refine				.13
Cret*store				-.13
Cret*distribute				.23
F	.61.42**	41.11**	53.57**	25.71**
R2	.41	.41	.49	.50
ΔR2	-	-	-	.01

***p< .01*
*p< .05

Table 46

Moderation Test of H1h: DV = Exploitation

Independent Variable	Dependent Variable: *Exploitation*			
	Model 1	Model 2	Model 3	Model 4
Intercept	.89	1.19	.52	.29
Acquisition	.53**		.33**	.31
Creation	.16*		.06	.01
Applying		.62**	.41**	.47*
Acq*Apply				-.36
Cret*Apply				.46
F	49.59**	110.07**	49.31*	29.45**
R2	.35	.37	.44	.43
ΔR2	-	-	-	-.01

***p< .01*
*p< .05

Table 47

Moderation Test of H1h: DV = Exploration

Independent Variable	Dependent Variable: *Exploration*			
	Model 1	Model 2	Model 3	Model 4
Intercept	.73	1.83	.88	-.45
Acquisition	.21**		.19*	.42
Creation	.43**		.32**	.53
Applying		.59**	.35**	.77**
Acq*Apply				-.34
Cret*Apply				-.41
F	.61.42**	97.54**	84.37**	53.28**
R2	.41	.35	.47	.43
ΔR2	-	-	-	-.04
**p< .01*				
p< .05				

Based on the analysis shown above, hypotheses 1g and 1h are not supported; however, it is interesting to see the possible moderation effects of knowledge organizing and knowledge applying activities on the relationship between each knowledge obtaining activity and organizational adaptation. Therefore, separate regression analyses were performed to test the moderation effect using individual knowledge obtaining activity as the independent variable. The following tables show the results.

From the results shown in Table 48, the interaction terms are not significant, indicating that they did not moderate the relationship between knowledge acquisition and exploitation. In terms of knowledge creation (see Table 49), the interaction term "cret*refine" is significant in the model and it shows the moderating effect on the relationship between knowledge creation and exploitation.

Table 48

Moderation Test of Acquisition, Organization, and Exploitation

Independent Variable	Dependent Variable: *Exploitation*		
	Model 1	Model 2	Model 3
Intercept	1.07	.59	.13
Acquisition	.57**	.32**	.41*
Refining		.36**	.25
Storing		.07	-.15
Distributing		.08	.57
Acq*refine			.18
Acq*store			.31
Acq*distribute			-.71
F	94.65**	38.72**	22.21**
R2	.33	.45	.44
ΔR2	-	.12**	-.01

***p< .01*
*p< .05

Table 49

Moderation Test of Creation, Organization, and Exploitation

Independent Variable	Dependent Variable: *Exploitation*		
	Model 1	Model 2	Model 3
Intercept	1.47	.61	1.16
Creation	.56**	.21**	.20**
Refining		.39**	.15
Storing		.11	.10
Distributing		.16*	.13
Cret*refine			.28**
Cret*store			.05
Cret*distribute			-.17
F	118.79**	59.92**	24.98**
R2	.31	.47	.50
ΔR2	-	.16**	.03*

***p< .01*
*p< .05

In terms of the relationship between knowledge obtaining and exploration, the results from the regression analysis in the above section shows the interaction terms did not introduce the moderating effects on knowledge acquisition and exploration. However, the interaction terms did cause significant moderating effects on knowledge creation and exploration, indicating if a firm's focus was to create international knowledge for next round innovation, the moderating effects of cret*refine as well as cret*distribute are significant at .05 level.

Table 50

Moderation Test of Acquisition, Organization, and Exploration

Independent Variable	Dependent Variable: *Exploration*		
	Model 1	Model 2	Model 3
Intercept	1.71	1.47	.83
Acquisition	.59**	.24**	.38*
Refining		.42**	.79**
Storing		.15	.05
Distributing		.05	-.04
Acq*refine			-.64
Acq*store			.12
Acq*distribute			.07
F	65.66**	34.68**	21.04**
R2	.26	.43	.42
ΔR2	-	.17**	-.01

**p< .01
*p< .05

Table 51

Moderation Test of Creation, Organization, and Exploration

Independent Variable	Dependent Variable: *Exploration*		
	Model 1	Model 2	Model 3
Intercept	2.18	1.61	.79
Creation	.54**	.24**	.21**
Refining		.40**	.16*
Storing		.06	.04
Distributing		.15*	.12*
Cret*refine			.35*
Cret*store			-.48
Cret*distribute			.27*
F	73.17**	33.91**	31.68**
R2	.28	.41	.49
ΔR2	-	.13**	.08**

**p< .01
*p< .05

The relationship between knowledge obtaining and exploitation (see Tables 52 and 53) is not moderated by knowledge applying. The interaction term "cret*apply", however, did moderate the relationship between knowledge creation and exploration.

Table 52

Moderation Test of Acquisition, Application, and Exploitation

Independent Variable	Dependent Variable: *Exploitation*		
	Model 1	Model 2	Model 3
Intercept	1.71	.86	.41
Acquisition	.59**	.36**	.48**
Applying		.35**	.51**
Acq*apply			-.24
F	65.66**	73.43**	49.31**
R2	.26	.36	.36
ΔR2	-	.10**	-

**p< .01
*p< .05

Table 53

Moderation Test of Creation, Applying, and Exploitation

Independent Variable	Dependent Variable: *Exploitation*		
	Model 1	Model 2	Model 3
Intercept	1.47	.96	.41
Creation	.56**	.41**	.53**
Applying		.30**	.47**
Cret*apply			-.29
F	118.79**	79.13**	53.19**
R2	.31	.37	.37
ΔR2	-	.06**	-

***p< .01*
*p< .05

Table 54

Moderation Test of Acquisition, Application, and Exploration

Independent Variable	Dependent Variable: *Exploration*		
	Model 1	Model 2	Model 3
Intercept	1.71	1.04	.12
Acquisition	.59**	.44**	.71**
Applying		.39**	.70**
Acq*apply			.08
F	65.66**	118.31**	82.21**
R2	.26	.41**	.42
ΔR2	-	.15**	.01

***p< .01*
*p< .05

Table 55

Moderation Test of Creation, Application, and Exploration

Independent Variable	Dependent Variable: *Exploration*		
	Model 1	Model 2	Model 3
Intercept	2.18	1.39	1.95
Creation	.54**	.35**	.06
Applying		.38**	.27**
Cret*apply			.40**
F	73.17**	90.28**	67.80**
R2	.28	.40	.43
ΔR2	-	.12**	.03**

***p< .01*
*p< .05

Based on the moderation test in the previous section, there is no evidence to support the argument of moderation effects from knowledge organizing and applying. Although some of the interaction terms did show moderating effects, in the overall scheme, the moderating effects brought by those interaction terms were not significant.

Hypothesis Testing: H2a, H2b, and H2c

Hypotheses 2a, 2b, and 2c are mainly focused on the relationship between trust, industrial cluster involvement, and knowledge obtaining. The results provided in the correlation matrix indicate positive correlations among trust, industrial cluster involvement, and knowledge obtaining measures. Although a preliminary conclusion can be drawn from the correlations provided in previous section (Table 25), a more in-depth examination was conducted by using regression analysis.

Theories suggest that both trust and industrial cluster involvement may enhance a firm's knowledge obtaining practices due to the reduced opportunistic behaviors and closer proximity (Edmondson, 1999; Nooteboom, 1996). Therefore, knowledge

obtaining practices, namely acquisition and creation, were used as the dependent

variable, and trust and industrial cluster involvement measures as the independent

variables in the regression analysis. The following tables illustrate the results of

regression analysis of H2a and H2b

Table 56

Regression Analysis of H2a

Independent Variable	Dependent Variables	
	Acquisition	Creation
Intercept	2.82	2.35
Honesty	.03	.05
Benevolence	.12	.22**
Dependability	.14*	.18*
F	2.46*	7.69**
R2	.04	.11
**p< .01		
*p< .05		

Table 57

Regression Analysis of H2b

Independent Variable	Dependent Variables	
	Acquisition	Creation
Intercept	2.75	2.64
Trade	.28**	.13
Non-Trade	.07	.26**
F	13.61**	11.84**
R2	.10	.11
**p< .01		
*p< .05		

For Hypothesis 2a, as shown in Table 56, dependability has more beta weight on

knowledge acquisition, while benevolence and dependability has more weight on

knowledge creation. The betas for all the trust measures are positive and hence, Hypothesis 2a is supported.

In terms of industrial cluster involvement, trade interdependence has more weight on knowledge acquisition, and non-trade interdependence has more weight on knowledge creation. Again, all the betas are positive and thus, Hypothesis 2b is supported. Further, based on the correlation matrix (i.e., Table 25), honesty, benevolence, dependability, trade interdependence and non-trade interdependence are all positively related. Therefore, Hypothesis 2c is supported as well.

Post Hoc Analysis

In the previous chapter, it is argued that knowledge obtaining, knowledge organizing, and knowledge applying works as a system, which leads to organizational adaptation. To fully understand the model, a hierarchical regression analysis was performed to see whether both knowledge organizing and applying mediate the relationship between knowledge obtaining and organizational adaptation. Table 58 shows this regression analysis.

As the results below, indicate both acquisition and creation are significant to organizational adaptation. Once knowledge organizing and applying are in place, it took away the fairly large explanatory power of knowledge obtaining.Thus, they are significant at p<.01 level. Therefore, it is concluded that knowledge organizing and applying partially mediate the relationship between knowledge obtaining and organizational adaptation.

Table 58

Mediation Test on Complete Knowledge Management Process

Independent Variable	Step 1a DV: Exploitation	Step 1b DV: Exploitation	Step 1c DV: Exploitation	Step 2a DV: Exploration	Step 2b DV: Exploration	Step 2c DV: Exploration
Intercept	.89	.80		.73	1.37	
Acquisition	.53**		.25**	.21**		.07
Creation	.16*		.03	.43**		.23**
Refining		.32**	.27**		.23**	.21**
Storing		.12	.06		.22**	.05
Distributing		.01	.01		.05	.03
Applying		.35**	.28**		.29**	.24**
F	49.59**	38.35**	28.97**	.61.42**	35.79**	48.16**
R2	.35	.43	.48	.41	.45	.51
ΔR2	-	.08**	.05**	-	.04**	.06**

$**p< .01$
$*p< .05$

As discussed in the previous chapter, the secondary data analysis technique was structural equation modeling. However, due to the limited sample size of this study, a complete structural equation model was not possible. Instead, path analysis technique was adopted to investigate the model fit of the proposed hypothesized model of this study.

Average scores of the factors derived from previous steps were used to represent each construct (i.e., knowledge obtaining, organizing, applying, organizational adaptation, trust, and industrial cluster involvement). This method was adopted because the corresponding factors of each construct were highly correlated (see Table 25 and 26), while not highly correlated with other constructs. Thus, it provides justification for the use of average scores to represent each construct.

By using SPSS and AMOS Graphics, a path diagram and output of model fit

indices for the hypothesized model were generated. The following figure shows the path
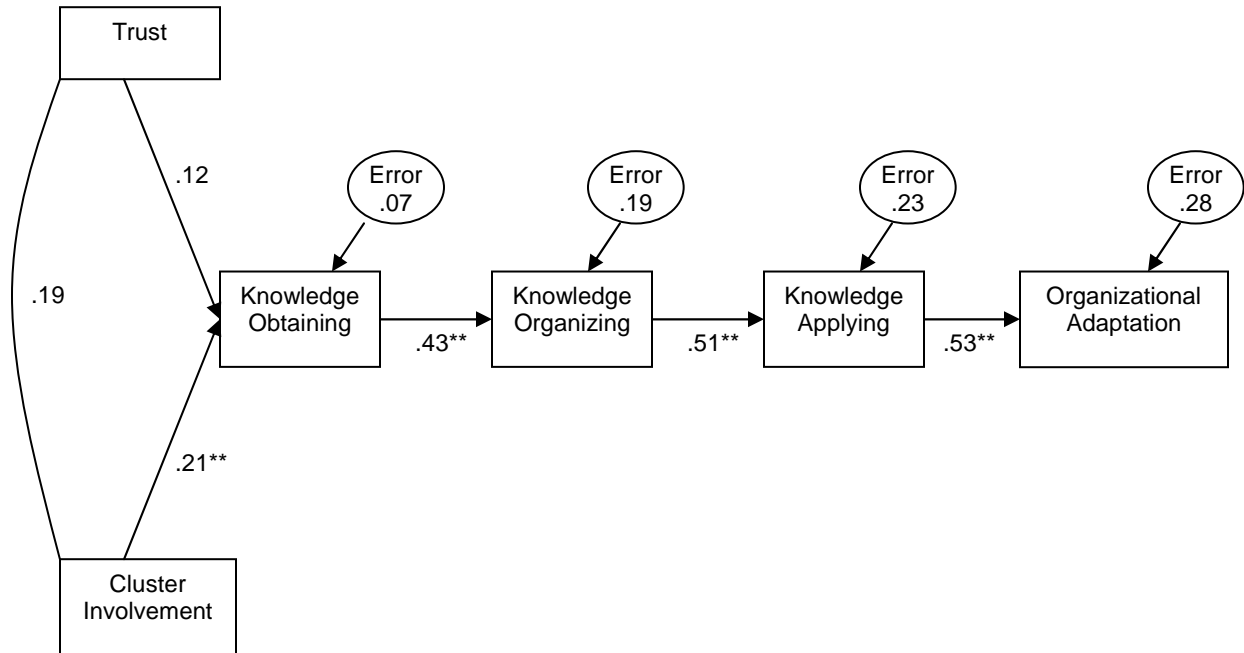
diagram of the model.

Figure 20. Path analysis of hypothesized model.

As shown in the above figure, the path coefficients are similar to the beta weights

in regression analysis. The coefficients are all significant at .01 level except for the

coefficient on the path between trust and knowledge obtaining. Based on the results, it

supports the argument of mediation discussed in the previous chapter.

To better understand the model, model fit indices must be reviewed. The chi-

square value is 20.03 and it is significant at .05 level. This chi-square tests the null

hypothesis that the over identified (i.e., reduced) model fits the data, as well as does a

just-identified (i.e., full, saturated) model. In a just-identified model there is a direct path from each variable to each other variable. When one deletes one or more of the paths, an over identified model is obtained.

As a consequence, a non-significant chi-square value indicates that the fit between the over identified model and the data is not significantly worse than the fit between the just-identified model and the data. Therefore, a non-significant chi-square is preferred. However, the major limitation of using chi-square value is the high sensitivity of sample size. To compensate for this drawback, other fit indices are needed to access the model fit.

In structural equation modeling, the commonly used goodness of fit indices are NFI, CFI, and RMSEA. The NFI for the above model is .925, CFI is .955, RMSEA is .085 and they can be viewed as evidence of an overall acceptance of the fit for the hypothesized model.

On the other hand, according to the results of regression analysis in previous steps, knowledge obtaining is significant to organizational adaptation (see Table 43 and 44). An additional modified model was generated by adding a path between knowledge obtaining and organizational adaptation to see if there is any improvement of model fit. The following figure shows the results of the path analysis.
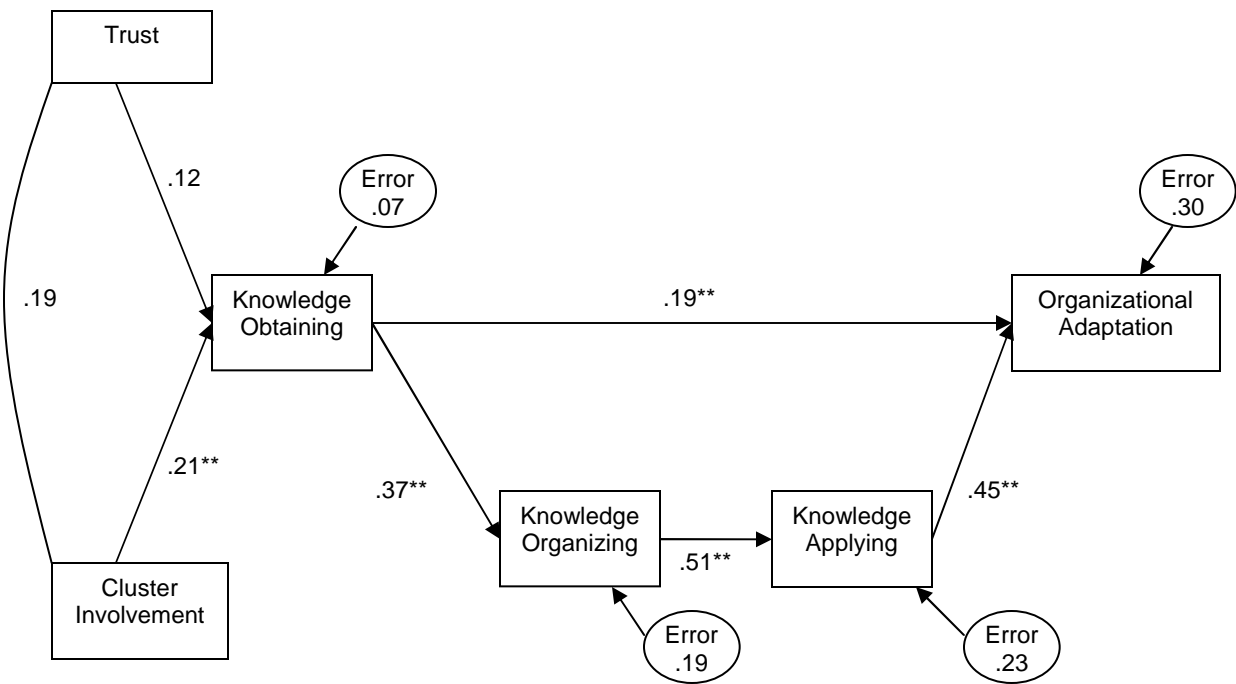
Figure 21. Path analysis of revised model.

From the second path analysis, the path coefficient between knowledge obtaining and organizational adaptation appeared to be significant at .01 level. The chi-square value is dropped from 20.03 to 12.8 and it is not significant, indicating that this revised model fits data well. The NFI of the revised model is .954, CFI is .982, and RMSEA is .037, and all the values have been improved. That is, by adding an additional path between knowledge obtaining and organizational adaptation, the entire model appears to have a better fit.

Summary

Data analysis and results were discussed in this chapter. Sample characteristics
and sample size are discussed in the beginning of the chapter, followed by the factor
analysis, reliability and validity test and finally, the results of hypothesis testing are
presented and discussed. Hypotheses 1a to 1e are either supported or partially
supported, while only Hypothesis 1f is supported. In terms of Hypothesis 2a to 2c, they
are all supported. Table 59 on the following page shows the summary of hypotheses
testing.

Table 59

Summary of Hypotheses Testing

Alternative Model	Hypothesis	Results
Mediation Model	*H1a*: There is a positive relationship between knowledge obtaining and knowledge organizing.	*H1a*: Supported
	H1b: There is a positive relationship between knowledge organizing and knowledge applying.	*H1b*: Supported
	H1c: There is a positive relationship between knowledge applying and organizational adaptation.	*H1c*: Supported
	H1d: Knowledge organizing mediates the relationship between knowledge obtaining and knowledge applying.	*H1d*: Supported
	H1e: Knowledge applying mediates the relationship between knowledge organizing and organizational adaptation.	*H1e*: Supported
Moderation Model	*H1f*: There is a positive relationship between knowledge obtaining and organizational adaptation.	*H1f*: Supported
	H1g: Knowledge organizing moderates the relationship between knowledge obtaining and organizational adaptation; that is, the relationship between knowledge obtaining and organizational adaptation will be stronger at higher levels of knowledge organizing. And,	*H1g*: Not Supported
	H1h: Knowledge applying moderates the relationship between knowledge obtaining and organizational adaptation; that is, the relationship between knowledge obtaining and organizational adaptation will be stronger at higher levels of knowledge applying.	*H1h*: Not Supported
H2a to H2c	*H2a*: There is a positive relationship between trust and knowledge obtaining.	*H2a*: Supported
	H2b: There is a positive relationship between a firm's industrial cluster involvement and knowledge obtaining.	*H2b*: Supported
	H2c: There is a positive relationship between a firm's industrial cluster involvement and trust.	*H2c*: Supported

CHAPTER V

DISCUSSION

The preceding chapter reported the results of the data analysis and hypothesis

testing for this study. This chapter contains a discussion of the meaning of the findings

for the overall knowledge management model and the influence of knowledge

management on organizational adaptation discussed in previous chapters. The impact

of trust and industrial cluster involvement on knowledge management is also discussed.

The chapter is divided into three parts. First, the implications of the findings are

addressed. Second, the limitations of the study are presented. Finally, given the results

of this study, future research is suggested.

Implications of the Findings

Organizational adaptation is highly related to both contingency theory and the

environmental selection process. Knowledge management has been suggested as a

critical factor for increasing the chance of successful organizational adaptation

(Levinthal, 1991; March, 1991; Scott, 1987). Moreover, knowledge management is

considered an effective way for remaining competitive in turbulent environments, and for

improving the overall innovation in an organization (Amabile, 1998; Kanter, 1988;

Shalley, 1991; Shalley et al., 2000).

This study focused on how knowledge management enhances organizational

adaptation by discriminating and analyzing the stages of knowledge management. The

results of this study provide empirical support for theories of knowledge management,

and establish a connection between knowledge management and organizational

adaptation. Moreover, the results of analyses suggest that knowledge management is significantly associated with organizational adaptiveness.

This section discusses the results of the hypothesis testing and offers possible explanations for the findings. The following discussions provide answers to the research questions posed in this study. This section is organized as the following:

1. What are the stages that are involved in knowledge management?

2. How can the knowledge management related stages be best organized to achieve successful organizational adaptation?

3. Will trust and industrial cluster involvement influence knowledge management activities?

4. What are the results of a post hoc analysis of knowledge management, organizational adaptation, trust, and industrial cluster involvement?

The findings and answers to the research questions are discussed in this study based on the variables and the proposed research model (i.e., mediation and moderation) in the following section.

Knowledge Management Stages

Knowledge management theory is associated with obtaining, organizing, and applying knowledge to achieve a firm's strategic objectives (Marshall, 1997; Pfeffer & Sutton, 2000). Knowledge management is also viewed as a managerial action, which is specific controlling and planning within a company aimed at achieving strategic objectives by creating, capturing, internalizing, and using appropriate knowledge. From the above definition, one recognizes that knowledge management has a strong

prescriptive element, which is to "manage learning" to achieve a positive impact on performance.

As argued in previous chapters, organizations need to develop the ability to leverage existing knowledge and create new knowledge that favorably positions the organizations in the target markets to become competitive (Gold et al., 2001). To do so, several knowledge management related stages and activities need to be identified. According to theory and analytical results from this study, there are three distinct stages associated with knowledge management. Each stage is discussed in the following section

Knowledge obtaining. As discussed previously, the first stage of knowledge management is knowledge obtaining and it is similar to the notion of learning. Before knowledge can be effectively manipulated to meet the goals of an organization, knowledge must be obtained. Using exploratory factor analysis, two factors were generated and they were labeled as knowledge acquisition and knowledge creation.

It was posited that knowledge obtaining and knowledge organizing are positively related, and based on the analysis, Hypothesis 1a is supported. Both knowledge acquisition and creation are significant to all the knowledge organizing practices at $p < .01$ and added appreciably to the variance explained.

This finding is important because it shows that both knowledge acquisition and creation are influential in the knowledge management process and they logically lead to knowledge organizing for identifying the best value for the firms. Literature has suggested that obtaining knowledge or learning is crucial for a company's long term success, but there should be a filtering mechanism in place to allow company

executives to spot what the organization really needs and what the most relevant knowledge is (Kramer, 1993; Huber, 1991).

When executives are trying to acquire knowledge from external sources, they increase the chance of obtaining irrelevant or unimportant knowledge. On the other hand, knowledge creation might also be a similar challenge, and knowledge organizing may act as a monitoring mechanism to correct the knowledge creation process and assist executives in achieving the goals of the firm.

In terms of the relationship between knowledge obtaining and organizational adaptation, it appears that knowledge acquisition is more important to exploitation, while knowledge creation is more relevant to exploration. This finding makes intuitive sense because executives are acquiring knowledge from external sources, and they usually acquire explicit knowledge that they intend to put it into practice immediately. However, when executives are trying to create knowledge in-house, there is often a timely process of transforming tacit knowledge to explicit knowledge. If the knowledge creation process is successful, it usually introduces technological breakthroughs and brings the firm substantial market value. Therefore, the practices of knowledge obtaining, namely knowledge acquisition and creation, are important in the entire knowledge management process, as well as to organizational adaptation.

Knowledge organizing. Knowledge organizing is considered the second stage after knowledge obtaining. This stage acts as an initial filtering mechanism for examining and identifying the potential payoff of organizations' purposeful use (Huber, 1991). This mechanism must logically exist in organizations to prevent the unnecessary

absorption of valueless knowledge. After factor analysis, the results suggest three factors, and they were labeled as knowledge refining, storing, and distributing.

As hypothesized, knowledge organizing and knowledge applying has a positive relationship. Based on the factor analysis, three distinct sub-dimensions were identified. They are refining, storing, and distributing. According to the correlation matrix, each sub-dimension of knowledge organizing is strongly correlated. From the regression analysis, however, all three variables, except for storing, are significant to knowledge applying at $p < .01$ level. This indicates that knowledge organizing is quite influential to knowledge applying, but the variances explained by storing might be shared by refining and distributing, indicating that refining and distributing are more influential to knowledge applying.

The possible explanation for this finding is that knowledge refining is perceived as the initial stage for internalizing the newly obtained knowledge, and this mechanism can be used to enhance the effectiveness and efficiency of executive knowledge management. On the other hand, distributing is viewed as a mechanism that organizations adopt to make knowledge storage accessible. Further, knowledge distribution can be affected by other factors such as organizational culture and frequency of communication (Buckman, 1998; Pfeffer & Sutton, 2000). If this is the case, the function of knowledge storage might be diluted by frequent knowledge distribution, which will make knowledge storing less important compared to knowledge refining and distributing.

Since the results show distributing is significant, it suggests that firms are able to distribute and share knowledge from knowledge storage, and distributing is considered

more relevant to a firm's knowledge applying and knowledge management process when compared to knowledge storing. Therefore, knowledge organizing is significant to knowledge applying.

Knowledge applying. Knowledge applying is associated with the actual use of the knowledge. Pfeffer and Sutton (2000) argued that the competitive advantage goes to organizations that use knowledge the best, not to those who have the best knowledge. They contended that unless the final stage of knowledge management, knowledge applying, is achieved in the business world, the preceding stages of knowledge management are ineffective and will form a "knowing-doing gap" (Pfeffer & Sutton, 2000).

As hypothesized in the previous chapter, knowledge applying has a positive relationship to organizational adaptation. The results of regression analysis show that knowledge applying is significant to both exploitation and exploration at $p < .01$ level, suggesting that executives need to actually put knowledge into practices to realize the potential value.

This finding confirms what the theory suggested: that a firm needs to close the "knowing-doing gap" to sustain a competitive advantage. As organizations increase learning and accumulate sufficient knowledge, organizations will perform better and possibly initiate strategic reorientation, and in turn, adapt to environmental changes more effectively and efficiently through innovation and/or enhancing competence. Therefore, knowledge applying is important to organizational adaptation.

Organizational Adaptation

As discussed in the previous chapter, the central concern of organizational adaptation is the balance between the exploration of new possibilities and exploitation of existing certainties (Holland, 1975; Kuran, 1988; March, 1991; Schumpeter, 1934). The factor analysis using parallel analysis factor retention suggests two factors under organizational adaptation, and they are labeled as exploitation and exploration.

Knowledge accumulation and development within an organization contributes significantly to both exploratory and exploitative learning, and in turn, allows organizations to adapt to the environment in both the short run and long term. More specifically, effective knowledge management helps organizations enhance innovation as well as organizational competency. As the results showed in the previous chapter, knowledge management does have a significant relationship with organizational adaptation.

Organizing Knowledge Management Stages: Mediation vs. Moderation Model

Knowledge management process is summarized into three major stages and argued that the three stages need to logically exist and act as a complete system for a firm to achieve successful organizational adaptation. The three stages can be viewed as a linear process. That is, knowledge obtaining leads to organizing, and then applying. While this suggests that knowledge management as a linear system, knowledge organizing may also act as a mediator between knowledge obtaining and knowledge applying. Further, it is argued that once a firm completes the knowledge management process, it will lead to successful organizational adaptation, which also suggests another mediation effect of knowledge applying between knowledge organizing and

194

organizational adaptation. In the following section, the two alternative models (i.e., mediation and moderation model) are discussed and compared.

Mediation model. Stepwise regression was used to test the mediation effect of knowledge organizing to the relationship between knowledge obtaining and knowledge applying, as suggested by Baron and Kenny (1986). The results suggested that knowledge organizing partially mediated the relationship between knowledge obtaining and knowledge applying.

Initially, without any other knowledge management practice, knowledge obtaining (i.e., acquisition and creation) is significant to knowledge applying at $p < .01$ level and the R square is .41. After inserting knowledge organizing, the beta weight of both knowledge acquisition and creation are reduced, and only knowledge creation is significant at $p < .01$ level, while knowledge refining and distributing are both significant at $p < .01$ level, indicating that knowledge organizing has partial mediating effects on the relationship between knowledge obtaining and applying. The R square was reduced from .41 to .03 after entering the knowledge organizing activities. Although knowledge creation remains significant, the change of in R square is very large, and from a practical perspective, one might conclude that knowledge organizing almost fully mediates the relationship between knowledge obtaining and knowledge applying.

A firm usually acquires knowledge from external sources that are relatively more tacit in nature and need more internal work to refine and organize. However, when a firm is trying to create knowledge internally, it is usually goal- oriented and strategically focused. That is, executives try to create the knowledge that fits exactly what the firm really needs and, as a consequence, the knowledge is usually less tacit and more

transparent for every organizational unit to apply. Therefore, knowledge organizing partially mediates the relationship between knowledge obtaining and knowledge applying.

The second mediation test was to find out whether knowledge applying mediates the relationship between knowledge organizing and organizational adaptation. In this set of tests, whether knowledge organizing has positive impact on organizational adaptation is the question that needs to be answered. The results of a stepwise regression showed that all three knowledge organizing practices are significant to both exploitation and exploration at least $p < .01$ level with R square = .39 (i.e., DV = exploitation), and .40 (i.e., DV = exploration). Knowledge applying was then entered to see whether it has a significant influence on the relationship between organizational and knowledge organizing. The results show that knowledge applying is significant to organizational adaptation at $p < .01$ level, but knowledge refining and storing are still significant, indicating the partial mediation. The change of R square was, however, reduced from .39 to .06 (i.e., DV = exploitation), and from .40 to .10 (i.e., DV = exploration), indicating that knowledge applying almost fully mediates the relationship between knowledge organizing and organizational adaptation.

The mediation of knowledge applying on the relationship between organizing and organizational adaptation suggests that knowledge applying is essential to successful organizational adaptation, but knowledge organizing is still necessary depending on what organizations intend to achieve. If executives strategically intend to enhance core competence, applying the refined knowledge to generate value is deemed necessary. If

196

executives, however, intend to innovate, not only applying the refined knowledge, but also storing it to gain strategic flexibility for the future is more appropriate.

The two mediation models are primarily for hypotheses testing. To have a better insight, a regression analysis was used to examine the complete knowledge management process in relation to organizational adaptation. The results from Table 58 show that knowledge acquisition, refining, and applying are more important, especially when an organization's adaptation system emphasizes enhancing organizational competence (i.e., exploitation). However, knowledge creation, refining, and applying are more important if an organization's adaptation system focuses on innovation (i.e., exploration).

The results shown in Table 58 indicate that if a firm intends to enhance competence, knowledge acquisition, refining, and applying are significant. On the other hand, if a firm wants to innovate, then knowledge creation, refining, and applying are significant. From this finding, it appears that refining the knowledge and applying it to realize the potential value are necessary steps. It is also interesting that knowledge acquisition is more important to exploitation, while knowledge creation has more influence on exploration. This might be because firms usually acquire already usable knowledge and put it into practice quickly to improve their operation routine. However, when companies try to introduce new products, services, or to find new market opportunities, more efforts are needed in the area of research and development, which further requires creating and developing knowledge in-house.

Under knowledge organizing, knowledge refining is the only variable that is significant in the complete knowledge management process. The possible explanation

for this finding is that if a firm employs knowledge refining practices, it usually has

storing and distributing activities. Otherwise, there is no need to refine the newly

obtained knowledge.

The differences of the results of exploration (innovation) and exploitation

(competence enhancement) are apparent. The enhancement of organizational

competence depends on the knowledge transparency inside the organization (Hamel,

1991). Organizational knowledge needs to be refined, codified, and integrated into the

knowledge management system to be transformed into organizational capability and

competence easily. Differential capabilities for creating new component knowledge are

the key for an organization to innovate (Cohen & Levinthal, 1990; Tallman et al., 2004).

An organization needs to "decipher" knowledge after creating new knowledge,

which is the process of transforming tacit knowledge to an explicit one, and to apply it to

create the next round of innovations. The results indicate that knowledge applying is

significantly associated with both exploitation and exploration, which supports the

argument in the present study that knowledge needs to be applied to realize the

potential value. Knowledge storing and distribution are not significant as shown in the

analysis (Table 58). However, many other research findings suggest that knowledge

distribution and storing will naturally occur when knowledge is refined, less tacit, and

sufficiently transparent (Hamel, 1991; Zahra & George, 2002).

Moderation model. The alternative hypothesized model in this study is the

moderation model, which suggests that knowledge obtaining directly leads to

organizational adaptation, but the relationship will be strengthened with the existence of

knowledge organizing and applying. This model is in line with many organizational

198

learning related studies that argue that learning leads to increased performance, and hence, leads to successful organizational adaptation.

The first step is to find out whether knowledge obtaining has a positive relationship with organizational adaptation. The result shows that both knowledge acquisition and creation are significant to both exploitation and exploration. Knowledge acquisition especially has more influence when the dependent variable is exploitation, while creation has influence when the dependent variable is exploration. When a firm acquires knowledge from external sources, it usually acquires already usable knowledge with the hope of enhancing current capability and generating value immediately. In the business world, a firm uses a variety of different forms of inter-organizational relationship, such as joint ventures, strategic alliances, and mergers and acquisitions, to absorb knowledge with the intention of enhancing its core competence and enjoying the synergy.

Knowledge creation, however, usually takes time and it usually involves numerous trial and error activities. Once knowledge is successfully created, it is usually tacit in nature and held proprietarily. The benefits of creating proprietary knowledge are twofold. First, a firm can use its proprietary knowledge to introduce innovative products and services to capture the first mover's advantage. For example, Apple introduced iPhone in 2007, and Intel introduced Core2 Dual processor in 2006. Second, the proprietary knowledge can be treated as an important means to maintain organizational flexibility for the future. For instance, both IBM and 3M had more than 10,000 patents filed in 2006. Newly created knowledge can not only bring the firm significant value, but it also can assist the firm to deal with future contingencies flexibly. Overall, the results

suggest knowledge obtaining has positive effects on organizational adaptation and the results are in line with many empirical studies on learning, innovation, and performance (e.g., Szulanski, 1996; Tsai, 2001).

From Tables 44 to 55, the results of moderation tests show very little evidence of moderating effects, indicating that the relationship between knowledge obtaining and organizational adaptation are not moderated by knowledge organizing and applying. The possible explanation for this finding is that a firm's knowledge obtaining capability determines the extent to which it can absorb the knowledge from external or internal sources. Investing in knowledge obtaining capability allows executives to effectively assimilate and apply it for their own use (Tsai, 2001).

According to Tsai's (2001) study, high absorptive capacity is associated with a better chance to successfully apply new knowledge toward commercial ends, producing more innovations and better business performance. It somehow suggests that if a firm's knowledge obtaining capability is strong, knowledge organizing and applying may naturally occur and will lead to better organizational adaptation. This present study offers some evidence to support the above argument. Tables 36 and 58 show only partial mediation, rather than full mediation, on knowledge organizing and applying, indicating knowledge obtaining is still significant to a firm's organizational adaptation.

While there is very little evidence to support the moderation hypotheses, the analytical results showed the moderation effect on some of the interaction terms. From Table 49, the interaction term of knowledge creation and refining is significant, indicating a partial moderation. From Table 51, knowledge creation and distributing, and

creation and refining are both significant, also indicating partial moderation. In Table 55, knowledge creation and applying is significant, again indicating partial moderation.

From the above findings, it appears that knowledge creation relies on the activities related to organizing and applying. The explanation is that when firms try to create valuable knowledge in-house, it usually takes more time to transform tacit knowledge to a more applicable, explicit knowledge. Therefore, after creating knowledge that is initially vague, more work is required to refine, store, and distribute knowledge so that every organizational unit that matters can access and adopt it when it fits. In the end, firms do not want to waste the efforts and resources invested in creating the knowledge and hence, firms want to actually apply knowledge to realize the value of the newly created knowledge.

Although some of the interaction terms appeared to be significant, the present study and previous literature on organizational learning both suggest that knowledge management is a systematic process, and thus, the hypotheses of full moderation effects are not supported in this study.

<div align="center">The Influence of Trust and Industrial Cluster</div>

As discussed in previous chapter, trust and industrial cluster are considered influencing factors to knowledge management. In the following section, the findings from the analysis are discussed and possible explanations to the findings are offered.

Trust

Trust is widely considered an effective control mechanism in inter-organizational relationships, and it can reduce transaction costs and risks that are involved in cooperating with others (Nooteboom, 1998; Parkhe 1993). Theory has suggested that

trust is influential in inter-organizational learning (Larson, 1992; Macaulay, 1963; Shapiro, 1987, 1989; Zaheer & Venkatraman, 1995). According to the results from the analysis in this study, trust, indeed, has a positive effect on knowledge obtaining.

From the factor analysis, trust has three dimensions: honesty, benevolence, and dependability. When a firm is trying to acquire knowledge from external sources, dependability is more relevant. This is because a firm is trying to absorb the knowledge that is already usable and has apparent economic value.. The firm wants to make sure that the knowledge will be acquired from reliable sources or partners and readily applicable to create value. On the other hand, if a firm is trying to create knowledge internally, benevolence and dependability appear to have more weight. One explanation for this finding is that although a firm intends to create knowledge in-house, it is still beneficial to have contacts in the external environment, such as other organizations, conferences, seminars, or educational institutions, to obtain some new thoughts that can facilitate the progression of a technological breakthrough. These external environmental factors discussed above have to be reliable and benevolent so the firm can obtain needed information to successfully create knowledge inside the organization.

In sum, one can notice from the above findings that not only the organizational units want to receive the component knowledge from reliable sources, but also want to make sure that others will not hold back or take advantage of them. Knowledge creation requires synergies from all the organizational units, as well as assistance from external contact. Usually, creating knowledge for next round innovations is considered strategically important. This strategic objective can be achieved only if every

organizational unit can contribute to the project fully and fairly and therefore, both benevolence and dependability are significant to knowledge creation.

Industrial Cluster Involvement

Industrial clusters are widely considered a network-based industrial system (e.g., Silicon Valley) with the aim of adapting to fast-changing markets and technologies as an organized whole (Sexenian, 1994). The informal exchange of information can create a collective information gathering and screening function in a cluster.

From a network perspective, the interactions among firms within an industrial cluster consist of cooperative and strategic alliances that are neither pure market transactions nor governed by the authority of internal organization. Rather, the firms display the characteristics of a social network, which has its own special economic properties. These characteristics of social networks facilitate the flow of knowledge between clustering firms and the network effect, which lead to the transformation of the decreasing returns faced by an isolated organization into increasing returns (Bearman, 1997).

Based on the findings in this study, industrial cluster involvement has positive affects on knowledge obtaining. Moreover, when a firm's focus is to acquire knowledge from external sources, trade interdependence is significant. Conversely, if the firm's objective is to create knowledge in-house, non-trade interdependence matters more. The findings make intuitive sense because an industrial cluster is literally a network based entity and it promotes development of collaborative relationships among participating firms. Once a collaborative relationship has been established in the industrial cluster setting, knowledge exchange and transfer are highly likely to happen.

Due to the reduced geographical proximity, synergy, and high frequencies of formal transactions, firms find it easier to acquire needed knowledge because of the industrial cluster.

Not only do firms intend to acquire knowledge from external sources, they also want to create relevant knowledge that fit the firms' strategic goals better. By residing in an industrial cluster, a firm can often enjoy the benefits of many non-transactional means such as research, university partnerships, government support, and the common culture and atmosphere that promote knowledge creation and innovations. Moreover, one of the key characteristics of non-trade interdependences discussed in the previous chapter is the structure of the social network that is embodied in an industrial cluster, which can lead to knowledge spillover. According to Saxenian (1994), knowledge spillover may contain both involuntary leakage of knowledge, as well as voluntary exchange of useful technical information, which can help firms achieve their goal of creating knowledge for next round innovation. Based on the results, non-trade interdependence is more relevant to knowledge creation and it supports the above argument.

Post Hoc Analysis: Complete Research Model

As discussed in previous chapters, the major research theme was the relationship between knowledge management and organizational adaptation. The secondary research objective was to explore the relationships among trust, industrial cluster involvement, and knowledge management. In the following section, explanations of the results from path analysis are offered.

The theoretical pieces in this study were pulled together using path analysis to see whether the model had good fit. From Figure 20, the path analysis showed the model has acceptable fit indices. In the path diagram, knowledge management activities have significant path coefficients to the following ones, suggesting a linear, systematic process of knowledge management. Moreover, when both trust and industrial cluster involvement are present, only industrial cluster involvement has a significant relationship to knowledge obtaining. The explanation is that one of the benefits of industrial cluster is knowledge spillover and the geographic proximity that may help a firm to obtain knowledge. Therefore, industrial cluster appears to be significant.

A path analysis was also performed based on the modification indices of the previous path analysis by adding a direct path from knowledge obtaining to organizational adaptation (see Figure 21). Again, it shows that all the paths of knowledge management are significant. In addition, the entire model fit has been improved, indicating that the newly added path between knowledge obtaining and organizational adaptation is significant enough to improve the overall model fit. This model supports the finding from regression analysis, which is a partial mediation of the knowledge management process.

The direct link between knowledge obtaining and organizational adaptation confirms the findings of many organizational learning related studies. It suggests that it is possible to obtain knowledge that is ready to be put into practice. Further, it is also likely that a firm needs to go through the knowledge organizing and applying process to realize the maximum value of the obtained knowledge. It is also interesting to see that trade interdependencies are significant to knowledge acquiring, and knowledge

acquiring is significant to exploitation, where non-trade interdependences are significant to knowledge creation and knowledge creation is significant to exploration. This finding is intriguing and will become one of the recommendations for future research in this study.

The possible explanation for the second path analysis is probably the difference between the tacitness and explicitness of obtained knowledge. If a firm is able to obtain knowledge that is explicit in nature, then knowledge can be comprehended by every organizational unit and can be applied immediately. Conversely, if the obtained knowledge is very tacit in nature, it needs to go through the knowledge organizing process to further codify, abstract, to transform it from tacit knowledge to explicit knowledge. Once a firm finishes the organizing process, knowledge needs to be applied to create value to avoid the waste of organizational resources that are involved in the obtaining and organizing stages.

Based on this finding, trust and industrial cluster involvement are both significant to knowledge obtaining. However, when including trust and industrial cluster simultaneously in the path analysis, only industrial cluster involvement is significant to knowledge obtaining. This might be because the industrial cluster involvement shares large portions of variances of trust. Regarding non-trade interdependences, it captured some of the notions of trust, and it caused trust to be non-significant in the path analysis.

The post hoc analysis illustrates the complete research model of this study and it offers evidence to support the arguments in this study. In the following section, the limitations of the study are addressed.

Limitations of the Study

The major contribution of this work is a coherent model that integrates two highly related fields, namely knowledge management and organization learning, into a systematic order to identify a link between knowledge management and organizational adaptation. An underlying assumption about the role of organizational learning toward organizational adaptation has also been examined.

This study emphasizes how organizations create value through actual knowledge applying, and how knowledge management processes effectively promote organizational adaptation. Moreover, the findings of this study suggest that knowledge applying is an influential factor in the knowledge management process. The research findings provide several significant insights and implications for organizations to use when designing their knowledge management systems. Although the findings of this study may be generalized to other environmental settings, following is a discussion of the potential limitations of the study.

One limitation is the limited population of the samples. The sample size of 188 respondents might not be sufficient for a thorough analysis of higher power. Although the sample size for this study is sufficient to have enough explanatory power; it would be advisable to have a larger sample size for a more thorough analysis, which might allow for additional detailed analyses. Second, the sample selection might be another limitation to this study. The companies that are Fortune and Forbes ranked companies were chosen for the sample in the U.S., that is, those companies that have high brand name awareness and a large organizational size, as compared to the samples selected in China and Taiwan, which may not have brand name awareness or market power.

This might have caused problems of homogeneity in the data analysis section. One solution to this problem would be to include control variables such as organizational size.

Another limitation to this study includes the use of only one respondent from each organization. Because of the use of one individual as a respondent on behalf of the organization, the level of analysis is the individual and his or her perception of the organization. While there is support for using this method from previous research (e.g., Maloni & Benton, 2000; Niu & Miles, 2005), the individual responding on behalf of the organization may not be a true representative for the entire company. Rather, the one individual may have seen relationships through a lens that does not capture the true perceptions of the many actors within the organization. It would be interesting to take a group of individuals from within the each organization and average their scores to use in a future study.

Using self-reported data could be a potential limitation of this study. It would be preferable to have other forms of data for a study. One type of data would be the actual performance data provided by each participating company. The use of self-report data is widely used, but it does limit, to some degree, the validity of this study. In addition, there may be a common method bias. With only one type of data collected, the responses may not accurately reflect the processes and outcomes. Other possible methods for collecting this data may provide additional insight into the relationships between the variables.

In addition, the proposed research model consisted of many theoretical foundations and constructs. Given the large research model, the difficulties of having a

more thorough examination of each construct and related variables are increased. Although this study is exploratory in nature, it would be better if a smaller and model with more thorough analysis was performed.

Future Research

Research related to knowledge management has been underspecified for quite some time, and often people equate it with organizational learning. This study adopts a different approach by viewing knowledge management as a dynamic process with the addition of a new element: knowledge applying. By adding knowledge applying, some gaps in the knowledge management related research are fulfilled. Rather than using performance measures, organizational adaptation was used as the dependent variable, and it is believed to be a more meaningful measure for measuring organizational long term survival. In addition, trust and industrial cluster involvement were included in this study to add more explanatory power to the overall proposed research model. Overall, this research was exploratory and ambitious in nature.

The findings provide evidence to support the model. The fings also suggest directions for future research. Knowledge management includes knowledge obtaining, knowledge organizing and knowledge applying. Based on the literature, knowledge obtaining can lead to better organizational performance. This argument is supported in the path analysis in this dissertation. However, the definition of knowledge obtaining and learning should be clarified. That is, one should distinguish learning from other knowledge management related activities. One should not assume that once organizational learning starts, all other knowledge management related activities will

naturally occur. Therefore, to distinguish the difference between knowledge obtaining and learning will be one of the directions for future research.

It is argued that knowledge obtaining or learning can be from either internal (i.e., knowledge creation) or external sources (i.e., knowledge acquisition). However, with different organizations' strategic objectives, firms might put more focus on one or the other. It would be interesting to explore the relationship between a firm's knowledge obtaining activity and its strategic objectives. Moreover, the industry chosen for this study was high technology, which has a turbulent and fast changing environment. Another possible future research direction might be the examination of the relationship between a firm's knowledge obtaining activity and its industry type.

Industrial cluster is a newly emerging research topic, and it needs more academic attention. From the findings of this study, it seems that the nature of the industrial clusters might be influential regarding the speed of industrial cluster development. For example, Silicon Valley was neither government supported nor sponsored at the beginning, and instead was a naturally evolved setting, compared to industrial clusters in developing countries, where they are more government sponsored and planned with the aim of enhancing regional or national competiveness. The difference between naturally evolved clusters and government sponsored ones is research worthy and the results of this difference should give government authorities ideas about how to improve regional competiveness. Therefore, examination of the differences between naturally evolved and government sponsored industrial clusters is suggested as a possible source for future research.

Trust was also included in this study. Although the path analysis did not reveal a significant relationship between trust and knowledge obtaining, this relationship still needs further investigation. Trust is merely a perception of an individual, and the question of what factors influence that perception of trust is still unanswered. Research about what factors may impact the decision to trust is needed. Further, one should also distinguish the difference between inter-organizational trust and intra-organizational trust as well as the difference between individual level trust, and organizational level trust. All the questions discussed above have not been answered and research should continue on this subject.

Another possible future research direction might examine the difference among industrial cluster,s knowledge obtaining, and organizational adaptation. From the findings, trade interdependences are significant to knowledge acquiring, and it leads to exploitation, whereas non-trade interdependencies are significant to knowledge creation. This finding is important for both academics and business communities and continued research is advisable.

The data were collected from four different international industrial clusters. The question of whether national or regional culture influenced respondents' answers about trade and non-trade interdependences are as yet unanswered. Although it is believed that national culture or regional culture might provide the answer to questions about industrial cluster involvement, it needs further detailed analysis to obtain better insights. More ambitious future research that might arise from this study would be a more macro scoped exploration of regional competitiveness. It is argued that industrial clusters

enhance regional competitiveness. However, the question remains about how to operationalize regional competitiveness for future empirical examination.

Summary

In this chapter, the findings of the analysis, limitations, and future direction research are discussed. From the results of the analysis, knowledge obtaining, organizing, and applying have positive relationships to each other and together, and they contribute significantly to organizational adaptation. Further, the results of the analysis suggest that knowledge management should be viewed as a linear, systematic process so the value of knowledge can be maximized.

Trust, by itself, has a positive impact on knowledge obtaining, but the influence vanishes once industrial cluster involvement is in place. Possibly it is because non-trade interdependence captures some of the variances of trust, and the industrial cluster environment has a more powerful influence on a firm's knowledge obtaining activity.

APPENDIX A

PARTICIPANT CONSENT FORM

July 15 2007

Dear Sir/Madam,

I am conducting research on knowledge management and organizational adaptation with a focus on exploring what activities are involved in knowledge management and how knowledge management practices affect organizational adaptation. The questionnaire is designed to gather information about individuals' perceptions related to his/her own companies' adaptive attempts.

It may take approximately 20 minutes to complete, and you may decline to participate or stop participating at any time without penalty. Your participation in this study is entirely voluntary and this survey involves no foreseeable risks. Your input, however, makes a valuable contribution to advance business related research and practice. Please be assured that your responses are confidential and for academic research purposes only. In order to ensure confidentiality, please do not write your name or any identifiable information on this survey. There are no right or wrong answers, only your opinions matter. All of your responses will be combined with other respondents in this survey.

If you have any concern or question regarding the study, please do not hesitate to contact Mr. Kuei-Hsien Niu at (940) 565-3166 or Dr. Grant Miles at (940) 565-3140. You can also contact the Department of Management at University of North Texas at (940) 565-3120. You may print this notice for your records.

Sincerely yours,

Kuei-Hsien Niu

APPENDIX B

SURVEY INSTRUMENT

	Items
Knowledge Obtaining	1. My company frequently acquires information or knowledge *from outside* out company.
	2. My company receives valuable information or knowledge *by benchmarking*.
	3. My company frequently communicates with *partners/alliances*.
	4. My company is able to get needed knowledge from *contractual relationships from strategic partners*.
	5. My company frequently receives feedback from *customers*.
	6. My company is capable of *analyzing, categorizing, or systematizing* general knowledge and transforming it into specific knowledge.
	7. My company is able to *initiate various experimentations* to explore new knowledge.
	8. My company is able to generate needed knowledge *internally*.
	9. My company has *formal procedures or departments* to develop valuable and useful knowledge.
	10. My company has *informal procedures* to develop knowledge.

	Items
Knowledge Organizing	1. My company has a formal way of *filtering* knowledge. 2. My company has a formal way of *categorizing* knowledge. 3. My company has a formal way of *integrating* knowledge. 4. My company has a formal way of *codifying* knowledge 5. My company has a formal way of *indexing* knowledge 6. My company has a *database* to store knowledge and information. 7. My company has a *dedicated area or storage* to keep knowledge and information in physical form (e.g., papers, reports, etc.). 8. My company adopts *data warehousing* activities. 9. My company uses *electronic means (e.g., internet, website…etc.)* to store and manage information and knowledge. 10. My company's database is easily *accessible*. 11. My company expects employees to *share knowledge* with others. 12. Employees have a willingness to share knowledge in *my company*. 13. My company has a willingness to share knowledge with *partnering firms*. 14. Employees can easily get knowledge from *different departments*.

	Items
Knowledge Applying	1. My company can apply knowledge *flexibly* to create more value.
	2. My company can apply knowledge *effectively* to create more value.
	3. My company can apply knowledge *efficiently* to create more value.
	4. My company can apply knowledge *consistently* to create more value.
	5. My company can apply knowledge *innovatively* to create more value.
	6. My company's units can apply knowledge *collaboratively* with each other to create more value.

	Items
Trust	1. I work with a number of companies who *tell the truth* in communication.
	2. I work with a number of companies who are *honest* in business dealings.
	3. I work with a number of companies who handle *joint expectations* fairly.
	4. I work with a number of companies who *have not misled* my company.
	5. I work with a number of companies who *succeed by stepping on others.*
	6. I work with a number of companies who try to *get the upper hand.*
	7. I work with a number of companies who *take advantage of my problems*.
	8. I work with a number of companies who *take advantage of people who are vulnerable*.
	9. I have *strong business confidence* in what my partners can do and achieve.
	10. I work with a number of companies who are *competent* in fulfilling my need.
	11. I work with a number of companies who have a good *reputation*.
	12. My company has a *culture* that promotes trustworthy relationship.
	13. My company is in an *environment* which promotes trust between partners.
	14. I work with a number of companies whom I have *worked with before.*

	Items
Industrial Cluster	1. Firms within this industrial cluster often engage in *subcontracting* with other buyers and suppliers. 2. Firms within this industrial cluster often engage in *collaboration* with other companies in a similar position on the supply chain. 3. Firms within this industrial cluster can often focus more on developing their *core value and activities*. 4. This industrial cluster encourages and stimulates more *economic activities* inside and outside the cluster. 5. This industrial cluster allows the participating companies to establish a *multiple interlinked relationship* with their partners. 6. Widespread local *product imitation* can be observed in this industrial cluster. 7. This industrial cluster represents a particular *technical competence* as a whole (e.g., semiconductor, biotechnology, software…etc.). 8. Many companies that reside in this cluster share a *joint social history.* 9. Companies in this cluster are located in *close geographic proximity* to each other. 10. The *social network* relationship among the companies and labors in this cluster are not based on purely economic or transactional relationships. 11. There are some or many *supportive institutions (e.g., research labs and universities…etc.)* around the cluster. 12. National and/or local *governments support* the development of this cluster. 13. Many companies and labors have a shared *cultural background.* 14. The *infrastructure (e.g., transportation and logistics)* are favorable and supportive of participating companies in this cluster.

	Items
	1. My company frequently *enhances* the *supply chain function*.
	2. My company frequently *improves and refines* its *financial strategies*.
	3. My company frequently *improves and refines* its *corporate/business strategies*.
	4. My company frequently *improves and refines* its *engineering function*.
	5. My company consistently *improves* the *features* of existing products/services/technologies.
	6. My company frequently *improves* the *product quality*.
	7. My company frequently *enhances* the *customer service*.
Organizational	8. My company's *existing product/service* can generate significant profit for a longer term.
Adaptation	
	9. My company consistently *patents new* products/services/technologies.
	10. My company frequently adopts *new ways* to *improve supply chain function*.
	11. My company frequently adopts *new ways* to *manage* its *financial strategies*.
	12. My company frequently adopts *new ways* to *manage* its *corporate/business strategies*.
	13. My company frequently adopts *new ways* to *manage* its *engineering function*.
	14. My company frequently *introduces new* products/services.
	15. A significant portion of my company's *sales* are from *new products/services*.
	16. My company's innovation opens up *new market opportunities*.

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