



Contents lists available at ScienceDirect

Expert Systems with Applications

journal homepage: www.elsevier.com/locate/eswa

Performance implications of knowledge management processes: Examining the roles of infrastructure capability and business strategy

Tin-Chang Chang, Shu-Hui Chuang*

Department of Business Administration, Asia University, 500, Liufeng Rd., Wufeng, Taichung, Taiwan

ARTICLE INFO

Keywords:

Knowledge management
Infrastructure capability
Business strategy

ABSTRACT

Knowledge management (KM) has attracted significant attention from researchers and practitioners as a facilitator of firm performance. Even though companies have implemented KM, they offers inconsistent support that KM enhances firm performance. Thus, we examine that KM process is a critical variable through which infrastructure capability and business strategy effect firm performance. Data from 135 firms provide empirical support for this issue. We found the roles of infrastructure capability and business strategy have a positive association with the KM process. We confirmed the relationship between KM and firm performance.

Crown Copyright © 2010 Published by Elsevier Ltd. All rights reserved.

1. Introduction

Knowledge is recognized as an important weapon for sustaining competitive advantage and improving performance. The twenty first century is the era of knowledge economy, in which most firms possess knowledge that enables them to improve firm performance. How does the firm enhance organizational capabilities to boost internal performance and external competitiveness through the creation of effective knowledge management is a critical task.

Recent research interest in the information systems (IS) literature indicates that infrastructure capability (e.g., structure, culture, etc.) can enhance the knowledge management processes (Gold, Malhotra, & Segars, 2001; Lee & Choi, 2003). For example, Some enterprises emphasize organizational culture to build supportive knowledge sharing (Grant, 1996a, 1996b). Other firms improve the knowledge access to make the collect, storage, and exchange knowledge more accessible (Lee & Choi, 2003) and to integrate fragmented flows of knowledge (Gold et al., 2001). Infrastructure capability operates as a two-edged sword. Because organizational culture with traditional thinking tends to value existing relationship with firms or contact point persons as a standard of selecting products in comparison to knowledge-based culture with knowledge thinking focusing on attributes of products, knowledge management processes in knowledge-based culture can be more effective to improve firm performance. Considering the possibility of more powerful influence of knowledge management processes on firm performance in knowledge-based culture, IS research in knowledge-based culture is expected to show the process by which infrastructure capability translates into organiza-

tion's outcomes more definitely and to generalize successful knowledge management processes.

The research of enterprise internal knowledge management also focuses on the connection of knowledge management and organization performance or the introduction through the effectiveness of knowledge management organization innovation (Andrew, Arvind, & Albert, 2001). Before, less attention is paid to the companies' implementation of the strategy of knowledge management within the company and the influence of its related activities. On the other hand, the importance and the value of business strategy are highly valued. In contrast less study focuses on knowledge management process. Thus this research hopes, through the exploration of the infrastructure capability and business strategy to understand more deeply these two roles influencing on performance. Thus, the objectives of this paper are to suggest an integrative framework describing how infrastructure capability use translates into firm performance and to make a generalization of the mechanisms involved in the successful knowledge management processes. Specifically, we discussed some antecedents and outcomes of knowledge management processes. In our proposed model, we suggest that business strategy operates as an independent variable. Moreover, this study summarize model from the result of this in-depth case study, and to understand that the next step is to combine the infrastructure capability and business strategy in order to offer many industries to utilize knowledge management process to increase their competitiveness.

2. Theoretical background and conceptual model

Researchers have studied knowledge management processes using a variety of infrastructure capability. However, more recent

* Corresponding author. Tel.: +886 4 2332 3456; fax: +886 4 2332 1176.
E-mail address: joyce@asia.edu.tw (S.-H. Chuang).

treatments have depicted the capability as more expansive and traditional approach, while infrastructure capability of this study, one of major components of knowledge-based, has been defined as the knowledge resource that is deployed for the specific purpose of managing knowledge. Fig. 1 presents the research model. Infrastructure capabilities, such as knowledge-based culture, structure, technology, and human resource, are proposed to have an impact on the knowledge management processes. The processes would then influence the firm performance. The rationale for these factors and the relationship among them is described in the following sections.

2.1. Knowledge management process

The knowledge management processes is defined as the degree to which the firm creates, shares, and utilizes knowledge resources across functional boundaries. Spek and Spijkervet (1997) consider that the major knowledge management lays in the flow of the organization including the development of innovative knowledge, the distribution of knowledge when needed, the storage of knowledge for the future and the field of application and the integration of the knowledge within the entire organization. Beckman (1997) considers that there are eight steps within the knowledge management processes including the definition, the access to knowledge, the selection of knowledge, the storage of knowledge, the sharing of knowledge, the application of knowledge, the creation of knowledge and the selling of knowledge. This study is based on Beckman's (1997) research to define knowledge management processes: knowledge choice, access, storage, and sharing. First, knowledge choice: based on the value to carry out an appropriate access to knowledge and to filter out knowledge based on the value. Second, knowledge access can be defined through internal working experience in the firm, external information such as market, technology, and product. Third, knowledge storage can be extracted into different categories with proper methods. Four, knowledge sharing can be understood through internal organization users and it should be able to exchange information in a regular place with contexts not only limited internal corporate best practice, also with the suppliers', the employees' and customers' interactions.

2.2. Infrastructure capability

2.2.1. Knowledge-based culture

Knowledge-based culture describes the degree to which organization culture provides support for viewing knowledge as valuable assets and resources. The culture is the most important factor for successful KM. For example, Dialogue between individuals or

groups are often the basis for the creation of new ideas and can therefore be viewed as having the potential for creating knowledge.

An appropriate culture within a firm can encourage people to create and share knowledge (Holsapple & Joshi, 2001; Leonard-Barton, 1995). A knowledge-based culture fosters this knowledge dissemination so that employees understand the value and significance of knowledge (Leonard-Barton, 1995). Therefore, we expect that knowledge-based culture should have a positive impact on KM processes.

H1a: Knowledge-based culture has a significant positive influence on KM processes.

2.2.2. Knowledge-based structure

Knowledge-based structure refers to the extent of an organization's structural disposition toward encouraging knowledge-related activities. The structures must be possible to encourage these vital interactions, as well as to give the firm the ability to adapt to an ever-changing environment (Sanchez & Mahoney, 1996).

The structure within a firm may encourage or inhibit knowledge creation, sharing, and application (Nonaka & Takeuchi, 1995). Our study examines the knowledge-based structure within a firm that may encourage knowledge, a practice seen as vital in the effective management of knowledge. The structure must be appropriate to the firm in order to adapt to an ever-changing environment. Therefore, we expect that knowledge-based structure should have a positive impact on KM processes.

H1b: Knowledge-based structure has a significant positive influence on KM processes.

2.2.3. Knowledge-based technology

Knowledge-based technology is defined as the technical systems within a firm, which determine how knowledge travels throughout the enterprise and how knowledge is accessed. It includes information technology (IT) and its capabilities (Scott, 1998). IT contributes to knowledge management effectively (Sher & Lee, 2004). For example, business intelligence technologies enable a firm to generate knowledge regarding its competition and the broader economic environment. Knowledge application technologies enable a firm to use its existing knowledge.

With the improvement of science and technology, the techniques of information system become more and more important in recent years. Information system can be used to support and promote knowledge management processes. Knowledge-based technology is essentially an organizational capability for effective KM. Organizations should establish an appropriate IT that encour-

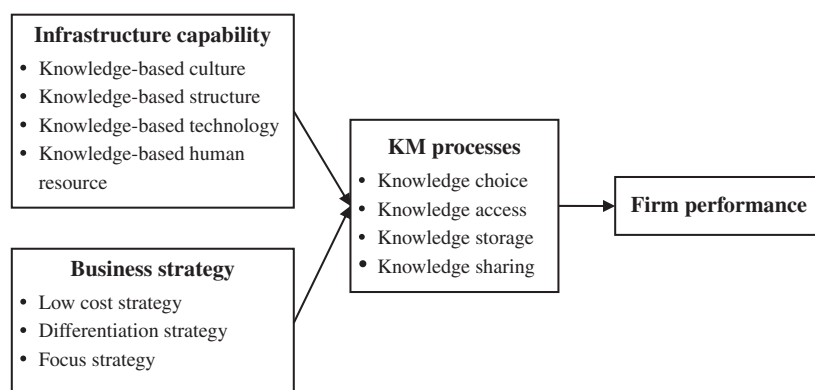


Fig. 1. Research model.

ages people to generate knowledge. IT can facilitate rapid knowledge collection, storage, and exchange (Sher & Lee, 2004); thus, it not only integrates fragmented knowledge flows (Gold et al., 2001) but also conserves existing knowledge and helps to create new knowledge. Therefore, we expect that knowledge-based technology should have a positive impact on KM processes.

H1c: Knowledge-based technology has a significant positive influence on KM processes.

2.2.4. Knowledge-based human resources

Knowledge-based human resource describes the extent to which employees specialize in a particular domain and demonstrate the capability of applying that knowledge to interact with others. The human resource is at the heart of creating knowledge resources (Holsapple & Joshi, 2001).

The knowledge embodied in humans is most often associated with KM. For example, Iansiti (1993) insisted that humans possess knowledge of not only being competent with a discipline but also of knowing how the discipline interacts with other disciplines. Humans possess knowledge that is extremely valuable for creating further knowledge because they are capable of integrating diverse knowledge resources (Leonard-Barton, 1995). Therefore, we expect that knowledge-based human resources should have a positive impact on KM processes.

H1d: Knowledge-based human resources have a significant positive influence on KM processes.

2.3. Business strategy

The objective of business strategy is to create competitive advantages in the industry in which a firm operates with the strategy which represents a way how firms arrives a decision (Porter, 1985). Generic business strategies, that is, low cost, differentiation, and focus—have been actively addressed in strategic management studies (Rivard, Raymond, & Verreault, 2006; Spanos & Lioukas, 2001). For the difference between the businesses of corporation itself, business strategy is due to the difference in relation with knowledge management process. Grant (1996a, 1996b) believes that corporation is the convergence of individual and organizational knowledge. Zack (1999) mentions that in order for the sole firm performance of that organization to be increased, the application of information technology in knowledge management and the corporate business strategy should be used intangibly. Business strategy should effectively use as unique knowledge resources so that the relationship of knowledge and strategy can be mutually connected.

Davenport and Prusak (1998) believe that knowledge management should combine internal Infrastructure capability and competitive advantages. As a result, the business strategy will enable the knowledge management process to be the definition of knowledge management strategy in order to support corporate goals and the missions to secure the status of competition (Gronhaug & Nordhaug, 1992).

In recent years, knowledge management implementation is popular among companies. Organizational knowledge is considered a highly valuable strategic asset which mainly includes tangible and intangible organization assets. Knowledge management must be the reflection of the business strategy in order to create customers' value, earn profit for the organization, and to manage employees. Therefore, business strategy will also directly influence knowledge management process.

H2: Business strategy has a significant positive influence on KM processes.

2.4. Firm performance

In general, the method of measurement of firm performance is mainly divided into financial indicators and non-financial indicators. Financial indicator is the utmost fundamental measurement method of organization performance. The general uses are profit ratio, revenue growth rate, investment output ratio, and capital return ratio (Dess & Robinson, 1984; Venkatraman & Ramanujam, 1986). When corporate organizations adapt knowledge management, it will speed up the knowledge utilization and knowledge sharing. As a whole, it will enhance competitive advantages. Laurie (1997) also holds the impression that knowledge management has gone through a serious of knowledge creation, knowledge acquirement, and knowledge utilization. With such processes, it can increase management activities of that organization performance. Ruekert, Walker, & Roering (1985) divide performance into three categories – effectiveness, efficiency, and adaptation. First, effectiveness is the ratio of output to input resource as a rate of investment to performance. Next, efficiency is the product or the service provided by the rate of sales growth or the rate of market share. Final, adaptation is the responsive ability when firms face environmental threat or opportunity and measured as sales number or sales rate during the first period of that product enters the market successfully.

In the past, much of researches address on the knowledge management process and firm performance. Sharp (2003) considers that knowledge is the key factor in corporate competition and corporate future value. To invest knowledge management, companies usually realize the great benefits involved. Thus, this research proposes that knowledge management process has direct influence on firm performance.

H3: Knowledge management processes have a significant positive influence on firm performance.

3. Methods

3.1. Measures

A multiple-item method was used to construct the questionnaires. All of the items were rated on a seven-point Likert scale ranging from strongly disagree (1) to strongly agree (7). Infrastructure capabilities were operationalized based on the works of Gold et al. (2001) and Grover and Davenport (2001). The index measures organizational resources by focusing on four dimensions such as knowledge-based culture, knowledge-based structure, knowledge-based technology, and knowledge-based human resource. The business strategies were operationalized based on Porter (1985), such as low-cost strategy, differentiation strategy, and focus strategy. Next, we will measure the extent to which the knowledge management processes that the firms are involved such as the choice of knowledge, the storage of knowledge, and the sharing of knowledge. The last construct is built to measure the firm performance. Firm performance includes market share gain, sales growth, profitability, efficiency of operations, and quality of services. This study adopts a specific measure, which is developed and validated by Deshpande, Jarley, and Webster (1993).

3.2. Data procedures

First, we adopt empirical studies to analyze the impact of infrastructure capability and business strategy on knowledge management processes and in turn to improve the firm performance. The empirical analysis focuses on the manufacturing industry in Taiwan. The sample frame consists of a relatively homogenous sample of larger manufacturing firms in order to reach a higher de-

gree of internal validity. These firms maintain similar applications and organizational resources, alleviating moderating effects of the economy and industry.

Second, in order to better understand the knowledge management processes and the characteristics of a firm in this industry, researchers interview the manufacture of the industry through an in-depth case study method. The scope of the case study is defined to avoid irrelevant data collection. In this paper, only data in the area of our research constructs are collected. This study has case studies listed as case K, L, M, and N. Company K was founded in 1980 and is a professional optical lenses manufacturer. Company L was founded in 1997 and is a professional optical discs manufacturer. Company M is a global research firm in industrial computer accessories and was founded in 1995. It is the only firm to implement six sigmas and passed international corporate professional audit in production process. Company N was founded in 1995 and focuses on communication, motion, wireless and broadband, and core communication technologies.

4. Results

4.1. Empirical study

The intent of our study is to prove the relationship among infrastructure capability, knowledge management processes, and firm performance. The hypothesized relationships are tested using regression analysis. Fig. 2 summarizes our regression results.

Hypothesis 1a, 1b, 1c, and 1d examine the effects of infrastructure capability on the knowledge management processes. First, results show that 79.3% of the variance of the knowledge choice is explained by knowledge-based culture, structure, technology and human resource. Knowledge-based culture has a significantly strong and positive influence on the knowledge choice ($\beta = 0.453$, $p < 0.001$). Knowledge-based technology has a significant effect on the knowledge choice ($\beta = 0.222$, $p < 0.01$). Knowledge-based human resource has a significant effect on the knowledge choice ($\beta = 0.467$, $p < 0.01$). Second, results show that 53.5% of the variance of the knowledge access is explained by knowledge-based culture, structure, technology, and human resource. Knowledge-based structure has a significantly strong and positive influence on the knowledge access ($\beta = 0.493$, $p < 0.01$). Knowledge-based human resources have a significantly strong and positive influence on the knowledge access ($\beta = 0.398$, $p < 0.05$). Third, results show that 43.7% of the variance of the knowledge storage is explained by knowledge-based culture, structure, technology, human resources. Knowledge based technology has a significantly strong and positive influence on the knowledge storage ($\beta = 0.412$, $p < 0.01$). Knowledge based human resources have a significantly strong and positive influence on the knowledge storage ($\beta = 0.456$, $p < 0.01$). Finally, results show that 34% of the variance of the knowledge sharing is explained by knowledge-based culture, structure, technology, human resources. Knowledge based human resources have a significantly strong and positive influence on the knowledge storage ($\beta = 0.357$, $p < 0.05$). Therefore, hypothesis 2 is partially supported.

Hypotheses 2 examines the effects of corporate business strategy on the knowledge management processes. Results show that 45.2% of the variance of the knowledge choice is explained by low-cost strategy, differentiation strategy, and focus strategy. Low-cost strategy has a significant effect on the knowledge choice ($\beta = 0.171$, $p < 0.05$). Also, focus strategy has a significantly strong and positive influence on the knowledge choice ($\beta = 0.584$, $p < 0.001$). Focus strategy has a significant positive influence on the knowledge access ($\beta = 0.482$, $p < 0.001$). Results show that 34% of the variance of the knowledge storage is explained by

low-cost strategy, differentiation strategy, and focus strategy. Low-cost strategy has a significant effect on the knowledge sharing ($\beta = 0.171$, $p < 0.05$). Also, focus strategy has a significantly strong and positive influence on the knowledge sharing ($\beta = 0.490$, $p < 0.001$). Therefore, hypothesis 2 is partially supported.

Hypothesis 3 examines the effects of knowledge management processes on the firm performance. To investigate the hypothesis, entering all variables in a single block, researchers found that the proposed model explains a significant percentage of variance in firm performance ($R^2 = 38.9\%$, F -value = 2.227). Specifically, the study results show that the knowledge choice has a significant positive influence on firm performance ($\beta = 0.891$, $p < 0.05$). Furthermore, the knowledge access ($\beta = 0.625$, $p < 0.05$), the knowledge storage ($\beta = 0.621$, $p < 0.05$), and the knowledge sharing ($\beta = 0.688$, $p < 0.05$) variables are all found to be essential for firm performance. Therefore, hypothesis 3 is supported.

4.2. Case study

In order to create measurable questions and to investigate the compatibility of the research constructs, researchers interviewed the manufacturers of the industry through in-depth case study method. Appendix A shows the content of the in-depth interview.

This study found that there is a direct connection between culture and knowledge management process in that knowledge management process implied that value is also part of the organization. These four individual companies all use information technology system to execute the access, selection, storage and sharing in knowledge management process. To divide organization structure, they all undertake internal knowledge sharing to help each department to overcome obstacles through knowledge sharing mechanisms to expand their experience. Therefore, this research hypothesizes that: (1) infrastructure capability can positively influence the knowledge management process. This also reflects on the data analysis.

In the competitive market, companies can only lower their cost to compete with rivals in order to increase their profits. Also, in long term, work together with the suppliers to lower their cost and lower the likelihood of fixed inventory. These four firms all focus partial influence on strategy and strategic differences. Currently, due to the popularity of internet, placing orders can be done through the use of Internet. There is no need in market segmentation. Instead, it can use internal knowledge management as knowledge management platform and external strategy such as supplier selection. These all belong to strategic application to promote accurate company knowledge and precise access to knowledge. Based on the content of interview, this research hypothesizes that (2) the business strategy has its desirable influence on knowledge management process in a unique fashion.

To promote knowledge management process, using database and experience employees, organization structure enables the firms to store knowledge and use message communication to achieve knowledge sharing objectives. It has its great impact on making the employees to understand knowledge selection, the access to knowledge, the storage of knowledge and the sharing of knowledge for the entire firm performance. These four individual companies all use activities related to knowledge management to offer outstanding assistance and to control the firm performance. The third hypothesis of this study has been carried out: knowledge management processes have positive influence on the firm performance.

First, among four cases, only company N has set up organization administer knowledge management process to enhance knowledge choices. The employees and managers are from domestic areas. And the firms are both from local and foreign areas. These two aspects mainly are to promote choices of corporate knowledge

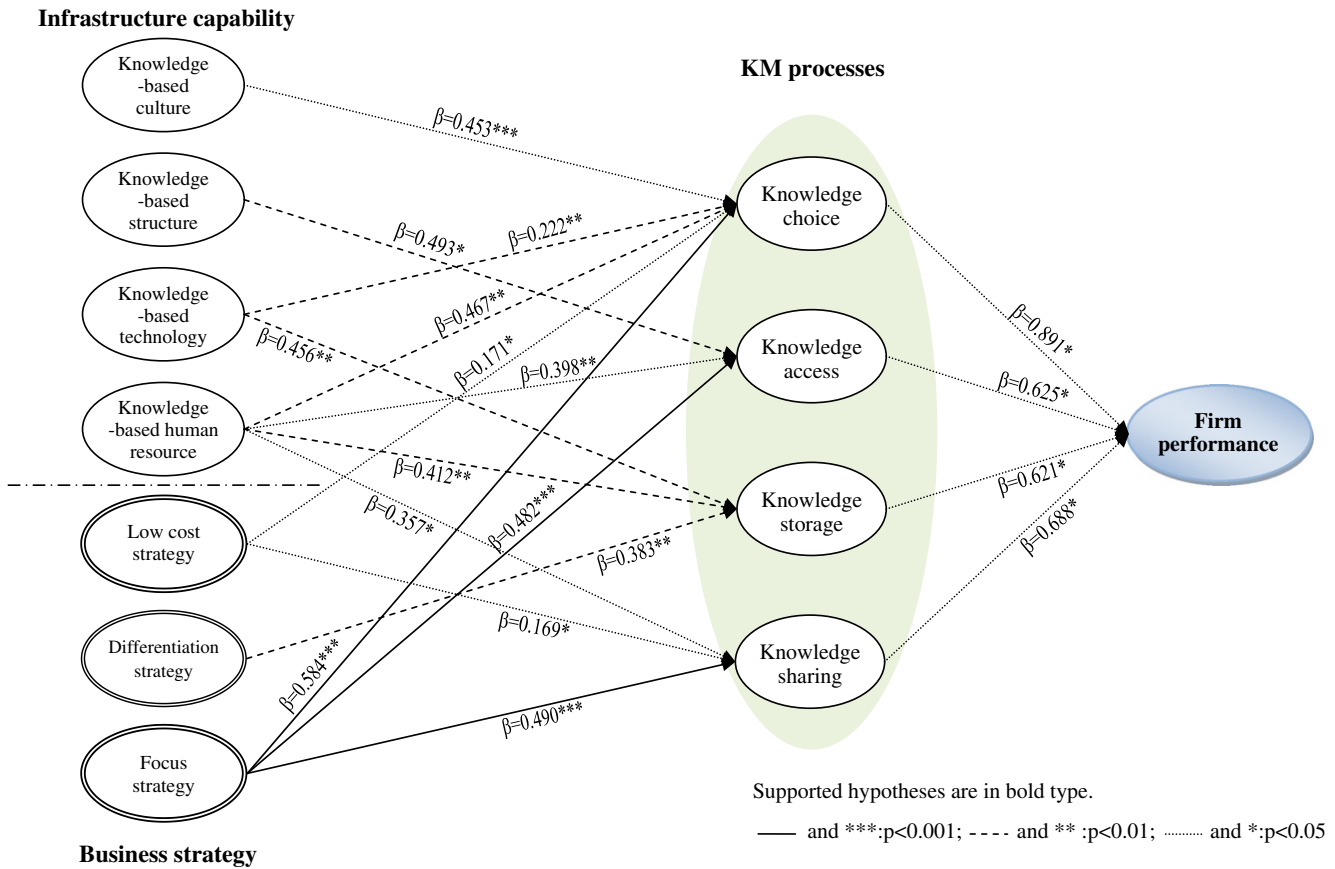


Fig. 2. Significant relationships in regression results.

in order to enhance knowledge broadness. As a result, the choices of knowledge can be offered. Second, the four individual companies in the access to knowledge aspect is through their employee experience and outside information such as supplier selection, vendor long term corporation relationship as sources of the access to knowledge and access to achieve correct decision making. Third, these four companies all utilize knowledge platform to filter out knowledge and to store their knowledge. Company N is different from other three firms in setting up a designated department to utilize management information system as a means to store their knowledge. Also, it fosters the knowledge transfer to enhance educational training as a means to store knowledge. Finally, these four companies all use knowledge platform such as exhibition seminar, focus group, organization structure to offer internal corporate knowledge sharing and to promote learning among members. Knowledge flows between upstream and downstream increase the interaction between the two parties and therefore the purpose of knowledge sharing is achieved.

5. Conclusions

5.1. Discussion

The advantages that the infrastructure capabilities bring can be described using four categories to reflect knowledge management processes: knowledge-based culture, structure, technology, and human resource. The knowledge-based culture has been proven to be supportive for knowledge-related processes. This structure grants the firm the necessary capability to adapt to a knowledge-intensive environment. Knowledge-based technology is important to establish new knowledge and provide rapid retrieval of knowledge resource. Knowledge-based employees play a very important

role in shaping KM activities because they can be more innovative in various tasks.

Companies can strictly control the variety of manufacturing costs in management and lower the operational costs so that companies can utilize cost strategy to win their counterparts in the early stage. The difference in which companies run their businesses is derived from cost control strategy. Only the possession of outstanding ability in knowledge management can support the companies to achieve continuing competitive advantages (Liebeskind, 1996). Focus strategy can obtain through market segmentation concentrating on targeted customers, targeted geographic range, and targeted channels to build market survival advantages. Thus, focus strategy is one important task. Also by the execution of knowledge management processes combining with corporate business strategy, companies can enhance their performance efficiency.

Through knowledge management processes, companies can have more related information to provide high level of management to select and compare, and come out with more effective strategy to gain the utmost benefits for companies themselves. Besides, flattened organization structure will contribute more in knowledge accumulation and sharing, and makes organizations more flexible to adopt all kinds of different environments. In the process of knowledge integration, it will increase organization efficiency and eventually increase corporate value and competitiveness to help improve firm performance more obviously.

5.2. Implications and limitations

Regression analysis used to study the relation of each research aspect to point out and proof previous built assumptions. Questionnaire analysis, is used to investigate the relation of each research aspect individually. After that, through individual case

interview, the researcher, therefore, summarized the structure of knowledge management processes to establish the basis of research aspects. Among those aspects, the more flattened the organization is, the higher employees' loyalty and in turn it helps the process of the sharing of knowledge to speed up. Furthermore, it helps to build a set of information system to store knowledge more effectively. Knowledge management has an advantage in establishing knowledge management processes in greater flexibility through the utilization of information technology and in turn to generate stronger competitive advantages for the firms. Also it will increase the gap from the competitors to catch up. There is partial proof in the influence of the characteristics of corporate management on knowledge management processes. Companies use different business strategy internally with various methods to execute knowledge management and to exhibit the partial influence of corporate business strategy's on knowledge management processes. Companies obtain effective management system through the use of knowledge. In turn, the companies will benefit the increase of effectiveness in business strategy and therefore, the greater and more desirable performance can be gained. It is obvious that knowledge

management processes have positive and outstanding influence on firm performance.

Although the results are interesting and promising, they need to be viewed with caution because there are limitations in this research. This study focused on manufacturing firms. Thus, caution should be exercised in generalizing the results to other firms that have a different environment and competitive structure. This study also suggests several promising avenues for future research. First, the researchers should investigate the key factors in determining various type of knowledge management in different aspects. Second, this research's interview cases are four computer companies and one optical lenses manufacturing firm. To other industries, this research's result is not sufficient and therefore, not representable. Therefore, it leaves some room for future researchers to conduct future study with subjects from different industries. Third, this research only divides knowledge management processes into choice, access, storage, and sharing are made through those aspects. As to other knowledge management processes, this study does not dig deeply. Thus researchers recommend further research will have a focus on other processes and to investigate accordingly.

Appendix A. Individual interview content

Company K	Company L	Company M	Company N
<i>1. What is your corporate culture and internal member's core value?</i>			
Company internally defines core corporate culture including continue study, innovation, team work and knowledge management. They are strongly related because knowledge sharing is outcome of continue studying, team work is mutual growth in knowledge broadcasting. Thus, the knowledge management processes are implied in the corporate value which is part of the organization	We value people oriented, mutual trust, business long term running, organization rules and procedures strengthen, good care of employees, leading company pursuit, and globalization. Internal core value is mainly to define clear appraisal and punishment working environment to stimulate creativity among employees, service quality and team work spirit	Conceptually honest devotion, outstanding technology and profession, happy work with defined role and responsibilities. Internal members' core value is to possess strategic thinking, innovation, risk taking, focus on work quality etc.	Team work, innovation oriented, outstanding quality, heartily service and environmental concerned are five main items. These also provide the faith to offer good manufactured quality through each department mutual support and corporation to create good business performance
<i>2. What is your organizational structure?</i>			
Organization structure is divided into six business groups: wireless communication, wireless, video, audio, storage, and multimedia	Divide into design, development, raw material, production four department along with high level management department to offer proposals to let members select	Divide into product R&D, technology, operations, and product marketing	System product, R&D, production resources, management and sales department
<i>3. What kind of information technologies does your company use to promote knowledge management processes?</i>			
Our firm has computer network, knowledge database system, and Intranet. Among these, knowledge database and Intranet include many tools and mechanism	Our company use tools such as search engine, database, cross platform functions	Our firm has knowledge platform to store much information and knowledge. As to projects and internal operations flow improvement, the platform will keep records and all the internal activities are also through this platform to communicate and promote	Currently, our firm not officially implement sound knowledge management system, only uses Internet, Intranet, Email and website to provide employees to search information and communicate information

(continued on next page)

Appendix A (continued)

Company K	Company L	Company M	Company N
<i>4. Does your company utilize any related knowledge management processes?</i>			
Knowledge management process is always the thing we are doing. Currently our firm use some incentives to make our employees interested in knowledge creation. The employees then create knowledge and through different kinds of methods to store knowledge	Currently we only proceed partial knowledge management such as internal portal website, internal employees' file server, unified video conference equipment	In Taiwan, we only do knowledge management. In the whole corporate research center sets up knowledge management system, but due to geography limitation there are still some areas without research centers. Thus these areas cannot include more solid knowledge management system	Currently we do not yet soundly implement knowledge, but there are still some proceeding knowledge management processes such as routine meetings, data, reports to build up files and then store and backup these data. These data will go through Intranet to communicate and every employees can receive these information
<i>5. Does your company have any connection to local or foreign firms to observe and learn new knowledge to select correct knowledge for your firm's adoption?</i>			
Although our company mainly wants to keep our root in Taiwan, we do not yet reach globalization business running. However, our firm also notice about importance of connection. Now we are not only have connection with Chinese, Japanese and other foreign firms, but only limited to Asian. To make correct knowledge selection is now to be one of our firm's management activities	Currently we do not have any connection with foreign firms about knowledge selection. Due to our team originally from Material Research Department in Industrial Technology Research Institute, the team did optical disc storage and multimedia search jobs many years. They have strong R&D capability and Taiwan has the leading advantages in these areas. Domestically we do technical exchange mutual benefits activities	Current knowledge management processes only limited internally, among every business units' communication. Later our firm should go through cooperative method to have technology knowledge exchange with foreign the type network information companies. In the same time, we can have more deep information sharing regarding to production technology, R&D technology. Our firm will surely support and share knowledge	Our firm believes that to have connection with other related firms is a good way to promote ourselves so our firm also contact related companies and has latest information about the current market. As to Taiwan division, there are regular gatherings for management level from Taiwan and other countries to promote knowledge sharing and to select proper knowledge to offer to other team members
<i>6. Does your company have designated organization or staff to be responsible for introduction and management of knowledge management processes and to keep knowledge sources closely connected?</i>			
In Taiwan headquarters, there are someone responsible to manage knowledge management system issues, especially regional research centers. They store, share and create important research knowledge into knowledge management system. But other regions do not have staff specialized in managing knowledge issues	Currently there is no special staff to be responsible for knowledge management and no specific database building to store knowledge. This will be future project for our firm to execute	Through specialized department to be responsible for collect and integrate new knowledge from knowledge officers in each division. Broadcasting the knowledge information to every knowledge officer through platform designed by information system and to ask officers to teach other division staff to search specific knowledge with his/her own demand and to refer variety of knowledge	There are one organization to take care management system issues especially in research centers. They store important research knowledge into knowledge management system for storage, share and innovation purposes. Other knowledge sharing is all by employees automatically proceed so employees will have closely interaction with the information
<i>7. What is your Taiwanese employees' perspective toward knowledge management processes in the firm?</i>			
Employees often through knowledge system to access required knowledge and most employees just use what they need, but seldom add more values and feedback to the system or to others	I think knowledge management related activities should be strange. In our firm, there is no one to instruct employees to do such kind of tasks. But there is a growing need for knowledge management processes and employees should have more deep understanding in this area	There are around 50% employees heard the term of knowledge management. But only about 20% people really know its activities. Few people really have a profound experience or knowledge about knowledge management	Most employees do not truly understand content of knowledge management processes. But there are still some members really understand. In contrast, some people does not even know they are involved with knowledge management processes

Appendix A (continued)

Company K	Company L	Company M	Company N
8. Does your firm send out experience members to store new knowledge, to offer learning and sharing?			
We will offer organization members to do the related new knowledge management training and foster experienced employees to store knowledge and promote sharing in the information platform	We will consider to execute after enough future knowledge accumulation	The head of knowledge management process department utilize education training to communicate knowledge sharing concept among employees, to solve employees' technical problems, and to come out with a system to evaluate performance and job promotion. In the end the employees will highly value the knowledge sharing and take knowledge sharing as one of their works	Yes. Because our firm is aggressively promote knowledge management process, each department will send out useful classes and related activities which help to promote corporate knowledge from experienced members to effective store and share among employees
9. Does your firm have related system for knowledge management processes to index data and through network to share knowledge among members?			
Although our firm doesn't fully implemented the system. However we early start related knowledge management processes. Though information system is not sound but there is early set information platform to offer internal members to absorb knowledge and to offer internal corporate knowledge sharing	That employees acquire needed information all depends on internal network. But this is not a whole and sound information database system to answer if employees inquiry data existence or not. There is no wonder employees think not user friendly enough. In the future, we will build more sound information database system to solve this problem	Knowledge storage, knowledge search, and knowledge broadcast these three type tools and system management mechanism to build information system environment. It will help knowledge sharing process more convenient and efficient. Internally besides previously mentioned knowledge officers to communicate, corporate internal information system in electronic database can search, upload, download various kind of new information and knowledge from every department	Our firm has built knowledge sharing platform with these recent years. Because of the need of work, repair and supporting staff, they will automatically put job related information upload into system, sharing to related group. When there is needed in knowledge or information, they will know where to search from this system and other regions do not need constantly to call to request headquarters to provide information
10. What is your firm's performance?			
<i>Profit capability</i> Operation Margin = 20.11% Operation Net Profit = 16.72% Earning before tax margin = 39.64% ROA = 6.77% Estimated profit = 2051 million NT Estimated profit before tax = 600 million Estimated profit after tax = 519 million NT Estimated Earnings per share = 7.73 NT Estimated Net profit per share = 6.68 NT	<i>Profit capability</i> Operation Margin = 7.52% Operation Net Profit = -13.11% Earning before tax margin = -16.38% ROA = -1.04% Estimated profit = 2344 million NT Estimated profit before tax = 203 million NT Estimated profit after tax = 205 million NT Estimated Earnings per share = .70 NT Estimated Net profit per share = .70 NT	<i>Profit capability</i> Operation Margin = 6.36% Operation Net Profit = -8.95% Earning before tax margin = -15.79% ROA = -3.19% ROE = -8.58%	<i>Profit capability</i> Operation Margin = 37.89% Operation Net Profit = 13.69% Earning before tax margin = 16.31% ROA = 2.96% Estimated profit = 1647 million NT Estimated profit before tax = 275 million NT Estimated profit after tax = 244 million NT Estimated Earnings per share = 4.37 NT Estimated Net profit per share = .88 NT

References

- Andrew, H. G., Arvind, M., & Albert, H. S. (2001). Knowledge management: an organizational capabilities perspective. *Journal of Management Information System, 18*(1), 185–214.
- Beckman, T. (1997). A methodology for knowledge management. In *Proceeding of the TASTED international conference on AI and Soft computing*.
- Davenport, T. H., & Prusak, L. (1998). *Working knowledge: How organization manage what they know*. Boston, Massachusetts: Harvard Business School Press.
- Deshpande, R., Jarley, U., & Webster, F. (1993). Corporate culture, customer orientation, and innovativeness in Japanese firm: A quadrad analysis. *Journal Marketing, 57*(1), 23–37.
- Dess, G. G., & Robinson, R. B. (1984). Measuring firm performance in the absence of objective measures: The case of the privately-held firm and conglomerate business unit. *Strategic Management Journal, 5*(3), 265–273.
- Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge management: An organizational capabilities perspective. *Journal of Management Information Systems, 18*(1), 185–214.

- Grant, R. M. (1996a). Prospering in dynamically-competitive environment: Organizational capability as knowledge integration. *Organization Science*, 7(4), 375–387.
- Grant, R. M. (1996b). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17(4), 109–122.
- Gronhaug, K., & Nordhaug, O. (1992). Strategy and competence in firms. *European Management Journal*, 10(4), 438–444.
- Grover, V., & Davenport, T. (2001). General perspectives on knowledge management: Fostering a research agenda. *Journal of Management Information Systems*, 18(1), 5–21.
- Holsapple, C. W., & Joshi, K. D. (2001). Organizational knowledge resource. *Decision Support Systems*, 31(1), 39–54.
- Iansiti, M. (1993). Real-world R&D: Jumping the product generation gap. *Harvard Business Review*, 71(3), 138–147.
- Laurie, J. (1997). Portfolios of control modes and is project management. *Information Systems Research*, 8(3), 215–239.
- Lee, H., & Choi, B. (2003). Knowledge management enablers, processes, and firm performance: An integrative view and empirical examination. *Journal of Management Information Systems*, 20(1), 179–228.
- Leonard-Barton, D. (1995). *Wellsprings of knowledge: Building and sustaining the sources of innovation*. Boston: Harvard Business School Press.
- Liebeskind, J. P. (1996). Knowledge, strategy and the theory of the firm. *Strategic Management Journal*, 17(1), 93–107.
- Nonaka, I., & Takeuchi, H. (1995). *The knowledge creating company*. New York: Oxford University Press.
- Porter, M. E. (1985). *Competitive advantage: Creating and sustaining superior performance*. New York, NY: Free Press.
- Rivard, S., Raymond, L., & Verreault, D. (2006). Resource-based view and business strategy: An integrated model of the contribution of information technology to firm performance. *Journal of Strategic Information Systems*, 15(1), 29–50.
- Ruekert, R. W., Walker, O. C., & Roering, K. J. (1985). The organization of structure and performance. *Journal of Marketing*, 49(1), 13–25.
- Sanchez, R., & Mahoney, J. T. (1996). Modularity, flexibility and knowledge management in product and organization design. *Strategic Management Journal*, 17, 63–76.
- Scott, J. E. (1998). Organizational knowledge and the internet. *Decision Support Systems*, 23(1), 3–17.
- Sharp, D. (2003). Knowledge management today: challenges and opportunities. *Information Systems Management*, 20(2), 32–37.
- Sher, P. J., & Lee, V. C. (2004). Information technology as a facilitator for enhancing dynamic capabilities through knowledge management. *Information and Management*, 41(8), 933–946.
- Spanos, Y. E., & Lioukas, S. (2001). An examination into the causal logic of rent generation: Contrasting Porter's business strategy framework and the resource-based perspective. *Strategic Management Journal*, 22(10), 907–934.
- Spek, R., & Spijkervet, A. (1997). *Knowledge management: Dealing intelligently with knowledge*. New York: CRC Press.
- Venkatraman, N., & Ramanujam, V. (1986). Measurement of business performance in strategy research: A comparison of approaches. *Academy of Management Review*, 11(4), 801–814.
- Zack, M. H. (1999). Developing a knowledge strategy. *California Management Review*, 41(3), 125–145.