African Journal of Business Management Vol. 5(15), pp. 6597-6607, 4 August, 2011
Available online at http://www.academicjournals.org/AJBM
DOI: 10.5897/AJBM11.470
ISSN 1993-8233 ©2011 Academic Journals

Full Length Research Paper

The taxonomy of knowledge management strategies in manufacturing firms: Use of target costing and IT infrastructure

Jong-Min Choe

School of Business, Kyungpook National University, Buk-ku, Sankyuk-dong 1370, Taegu 702-701, South Korea.
E-mail: choejj@knu.ac.kr. Tel: 53-950-5445.

Accepted 5 May, 2011

Based on the usage levels of target costing systems (TCS) and information technology (IT) infrastructure, this study aimed to develop a framework useful for classifying four types of knowledge management (KM) strategies in manufacturing firms: explorative, exploitative, mixed and negative. We adopted a multi-methodological approach by mixing both qualitative and quantitative methods. Before developing a framework, through a mini-case study of the H Motor Company in Korea, this paper aimed to investigate the functions of TCS in the management of tacit knowledge. The mini-case study indicated that with the use of TCS, a firm can create, transfer and share diverse kinds of tacit knowledge among employees for the facilitation of process innovation. We also empirically confirmed the four types of KM strategies, and demonstrated the characteristics (such as, size, total sales, age, and knowledge intensity) of the organizations adopting each strategy.

Key words: Knowledge management strategies, target costing, IT infrastructure, personalization.

INTRODUCTION

Business organizations have long viewed knowledge as one of the most valuable and strategic resources. For organizations to sustain competitive advantages under uncertain environments, their intellectual resources must be explicitly and effectively managed. Effective knowledge management (KM) is a key method that can assist organizations to create, acquire and utilize their unique knowledge resource. KM is defined as the systematic and organizationally specified processes for acquiring, organizing and transferring both tacit and explicit knowledge of employees in organizations (Bollinger and Smith, 2001). In prior research, two alternative approaches to KM were suggested; codification and personalization (Hansen et al., 1999).

A codification strategy is an approach that seeks to obtain and store knowledge in explicit form for subsequent use and transfer or sharing by employees (Greiner et al., 2007). A personalization approach, on the other hand, seeks to link people to each other to communicate and share knowledge across the organization in tacit or explicit form. Depending on the degree to which both approaches are adopted, diverse types of KM strategies, which can be well suited to organizations' goals, business strategies and culture, can be classified and proposed. Although previous research has built a framework to identify various kinds of KM strategies (Merono-Cerdan et al., 2007), a concrete framework for the classification and taxonomy of KM strategies in manufacturing firms has never been developed or suggested.

It is generally accepted that information technology (IT) infrastructure, such as a database or electronic repository, search engines and intelligent filters, supports the implementation of a codification strategy (Kuo and Lee, 2009). Compared to the codification approach, the personalization strategy, which depends on interpersonal interactions, requires a moderately low degree of usage of IT infrastructure for the sharing and communication of tacit knowledge (Jasimuddin, 2007). The functions of IT infrastructure are a bit limited in the management of tacit knowledge (Alwis and Hartmann, 2008). To support the flow and sharing of tacit knowledge, other systems or mechanisms that assist the implementation of a personalization strategy are required.

In manufacturing firms, target costing systems (TCS) may be considered as the cross-departmental mechanisms that can support the realization of a personalization strategy (Lin et al., 2005). TCS can be defined as a cost management tool designed to reduce the overall cost of a product over its entire life cycle with the help of the production, engineering, R&D, marketing and accounting departments, etc. (Cooper, 2002). In this exploratory study, we employ a multi-methodological approach by mixing both qualitative and quantitative methods. As a qualitative approach, to demonstrate the roles of TCS in the management of tacit knowledge, this study presents and articulates the mini-case study of the H Motor Company. With this study, we can propose and explain the roles of TCS, which are different from those of IT infrastructure, in the KM of manufacturing firms.

The types of KM strategies can be decided and developed based on the usage degrees of KM instruments, such as IT infrastructure for the codification and TCS for the personalization (Scheepers et al., 2004; Saito et al., 2007). Thus, in this study, based on the usage levels of IT infrastructure and TCS, we suggest a framework that is useful to identify the kinds of KM strategies in manufacturing firms. With the framework, this research identifies and proposes four types of KM strategies, and conceptually explains the characteristics of each strategy. We also empirically confirm the framework, and demonstrate the characteristics of the four kinds of strategies. The framework developed can be used to identify and adopt manufacturing firms' types of KM strategies and to assess whether a firm's KM strategy is appropriate or not.

A PERSONALIZATION STRATEGY AND TARGET COSTING SYSTEMS

Elements of a personalization strategy

Tacit knowledge is personal and deeply rooted in an individual's action, experience and value or commitment (Plessis, 2008). New knowledge creation, especially in tacit knowledge, occurs when people combine and exchange their personal knowledge with others. The personalization approach, which mainly supports the creation, transfer and sharing of tacit knowledge, comprises diverse elements or means, such as interpersonal interactions and communication, personal experience and job rotation (Chen and Huang, 2007; Erden et al., 2008).

Since new knowledge creation involves the sharing of existing knowledge by individuals, it is inherently a group process. The physical interactions and communication among group members represented by the organizational practice of forming task forces or working teams are a means for organizations to pool and share tacit knowledge of their members (Jasimuddin, 2008).

Therefore, they are the important preconditions for tacit knowledge management. The sharing of tacit knowledge is also affected by the extent to which members have experience with the task and the training they receive (Erden et al., 2008). Diverse groups whose members possess different explicit or tacit knowledge due to variations in their backgrounds, training or experiences are more likely to share their various unshared knowledge than homogeneous groups composed of similar members.

Nonaka (1995) proposed that the members of an organization should shift repeatedly among several physical settings (for example, lab and plant), because the experiences of employees in diverse settings contribute to the development of organizational or group redundancy. The organizational redundancy helps to create a common cognitive ground among employees, and thus, facilitates the transfer or sharing of tacit knowledge. Job rotation or exchanges between functions such as R and D and marketing, is a mechanism to promote the formation of organizational redundancy. Rotation also helps the members of an organization understand the business from a multiplicity of perspectives. This makes the explicit or tacit knowledge more fluid and easier to put into practice.

Nonaka indicated the importance of the role of key middle managers for the creation and synthesis of tacit knowledge in company teams. When a firm's traditional categories of knowledge no longer work, they suggest a fresh way to think about things or a new sense of direction, which stimulates the creation of new tacit knowledge by employees (Senge, 1990). As leaders of working teams, key middle managers are at the intersection of the vertical and horizontal flows of knowledge in the firm. They serve as a bridge between the vision of the top and the practical issues in lower level employees. Thus, they assimilate and synthesize the tacit knowledge of both senior executives and lower level employees, and incorporate it in the development of new technologies and products.

Characteristics of target costing systems

Target costing is applied in the developing and designing stages of a product. In the execution of TCS, the physical interactions among members of many departments are essential. TCS are normally applied in the product development style characterized as simultaneous engineering or 'rugby' style product development. 'Rugby' style development demands continuous involvement of members of related departments, and produces conditions which give rise to knowledge creation (Nonaka, 1994). In the target costing process, the functional manager who is responsible for a stage in product development should influence the activities of the functional managers of the subsequent and preceding stages to achieve, through cooperation, the targets of costs and quality, and the timely introduction of new products to the market.

Table 1. Personalization approach and TCS.

Element of a personalization approach	Characteristic of TCS
Interactions among members	Interactions among members of various departments
Smooth communication	Smooth communication through meetings and face-to-face interactions
Diversity in background, training and personal experiences	Diversity in experiences of members
Job rotation	Job rotation of members
Key middle managers	Chief engineer responsible for new product committee Continuous involvement of related members

Product planning and cost meetings in TCS are the devices used to promote interactions among functional managers or members of various departments. They are, therefore, very important for simultaneous engineering to work effectively. Through interactions, members of many departments can share knowledge and values. To increase the diversity in experience, members of the product planning meetings are rotated through several functional departments before being named to the product planning committee. In firms that use TCS successfully, knowledge flows smoothly among marketing researchers, product designers, manufacturing personnel and cost analysts, etc. (Cokins, 2002). TCS integrate diverse functions in the business, stimulate interactions and communication among important functions, and permeate the planning process of a firm. In Table 1, the characteristics of TCS are compared with the elements of a personalization approach.

The functions of TCS for the creation of tacit knowledge: A mini-case study

In this research, to validate the functions and efficacy of TCS in the manipulation of tacit knowledge, a case study approach was employed. The case of the H Motor Company (hereinafter, H motor) in Korea provided a description about the support of TCS in the creation, transfer and sharing of tacit knowledge among employees. Nowadays, the H motor's main slogan in the implementation of TCS is 'New thinking produces new value', which emphasizes the creation of new knowledge with TCS. The H motor employees interviewed for the case study included the executive of the product development division, the general manager of the development cost department and two assistants responsible for cost planning in that department, and the manager of the purchase cost department. The interview data was collected for a 3-month period between November 2007 and February 2008.

At the H motor, the target costing processes passed through two phases: the development of target costing, and the integration of target costing and the profit management system. The second oil crisis in the late-1970s caused the H motor's managers to scrutinize the organization to find places where costs could be cut and output increased. In the face of losses due to rising gasoline prices and falling car sales, the H motor decided to develop and adopt target costing to reduce or improve its own and suppliers' costs. In this stage, the accounting and purchasing departments had the authority for the construction and operations of target costing. The accounting division prepared a document called the 'Target Costing Implementation Manual' to define the target costing roles and responsibilities of each business unit in the organization.

The second jump in the target costing took place in the late1980s when the H motor developed the 'Accent', the first subcompact car that was designed on its own. The managers of the H motor have realized that the greatest potential for cost reduction would come from new developments in technology that could produce products with high quality and low price. Consequently, the target costing activities, which were scattered throughout the company, were consolidated into a new group called the managing division of product development that totally controls and manages the technology and cost related matters in new product development. As a result, the cost management activities were moved even further upstream (that is, product planning and design) in manufacturing processes, and were combined with the production technology or process innovation. As the further upstream the target costing process moved, the more it resembled the management planning system, and thus, it was considered a comprehensive profit management tool that applies to the entire organization. In the H motor, the TCS for the full or minor changes to existing automobiles' models are roughly composed of three main procedures: product and cost planning, and product design.

The H motor begins the development stage by forming a cross-functional committee chaired by the chief engineer of product planning for each car model changed. Committee members include personnel from the product development, product engineering, production, purhasing, sales and cost control departments. The H motor's passenger cars usually undergo full or minor model changes every three or four years. The new model basically maintains the same product concept as its predecessor. At the product planning meetings, the committee finally defines some specifications for the new model, determines the development budget and schedule, and concretely decides the sales price and volume of the changed model. Although new product concepts can be prepared and suggested by the product development division, with socialization such as a face-to-face meeting, tacit or explicit ideas of members are reflected and infused into the specifications of a new model. The retail price and the sales target are usually proposed by the sales department. However, the principle used in setting the sales price is based on the added value of the new model over the old one. For example, increases in the sales price are decided by market recognition of addi-tional value from new functions (for example, DOHC engine functions in the 1993 'Sonata II') or better performance (such as, better fuel efficiency). Therefore, for the decision of the retail price and the sales volume, various kinds of knowledge from diverse members must be shared and combined.

The goal of cost planning in the H motor is to determine the profit needed to achieve the profit target of a new model and the amount to be trimmed from the estimated cost of the changed model. The profit target is calculated and provided from the medium-term (approximately three years) profit plan of the H motor. The target cost of a new model is simply determined as the difference between sales price and target profit. To compute and settle the estimated cost or profit and the target cost, the cost planning meetings are held. These meetings include managers in charge of product development and engineering, production, sales, purchasing, and accounting departments. If the target profit cannot be attained, diverse ideas or knowledge to reduce the estimated cost are actively proposed and applied in the meetings. For example, the 'design-in technique' that implies the active participation of major suppliers in the product planning or design stage to reduce the estimated product cost was devised and adopted in the development of the 1993 'Sonata II'. Occasionally, to match the estimated cost with the target cost, the TCS stage goes back to the previous procedure (that is, product planning), and the specifications of a new model can be revised.

The TCS of the H motor in the product design phase focus on value engineering, which proposes design methods and process changes for attaining the target cost. Engineers perform numerous value engineering studies on parts, production processes, facilities, and spoilage levels to search for ways to bring the estimated cost, which is calculated under a particular design type, within the range of the target cost. If the target cost cannot be attained, further value engineering occurs and additional design types can be prepared. According to the design change, concomitant revisions can take place in the manufacturing methods and processes, and parts' design. However, design engineers often lack hands-on experience on the production shop floor. Therefore, engineers must work closely with production divisions and suppliers to share their tacit knowledge. Their tacit ideas are absolutely needed for the change of production processes and parts' design in achieving the target cost. The intensive interaction among engineers, shop floor workers and suppliers results in a very rapid spiral process of knowledge conversion within them, significantly expanding the H motor's tacit and explicit knowledge in designing and production technology.

To improve product quality and reduce costs, the ideas for process changes and new manufacturing methods (that is, process innovation) are prerequisites and indispensible. Process innovation is a process in which a firm can provide a better manufacture or service process than what is in current operation in order to achieve high quality and low cost (Gopalakrishnan et al., 1999). Since process innovation is typically the result of hands-on experience and intimate familiarity with the processes, the knowledge associated with major or minor process innovation is relatively more tacit and internal-oriented (Gopalakrishnan and Bierly, 2001; Abou-zeid and Cheng, 2004). The implementation of TCS in the H motor certainly reinforced the creation, sharing and transfer of tacit knowledge demanded for the attainment of process innovation. During the three years from 2002 to 2005, to develop and show the medium-sedan named 'NF Sonata', which was the sixth updated version of the 'Sonata', almost 200 process changes (that is, minor process innovation) with the operations of TCS were internally obtained and reported. The overall processes of TCS in the H motor and their knowledge creation functions are described in Figure 1.

IT INFRASTRUCTURE AND CODIFICATION STRATEGY

Although a personalization approach can be applied in the sharing and transfer of explicit knowledge, a codification strategy is mainly used for the management of knowledge that can be converted into comprehensible forms. A codification approach assumes that knowledge can exist independently of human action and perception. In the codification strategy, various kinds of knowledge are codified and stored in the firm's memory system, and ultimately, treated as a structural asset owned by the firm. If knowledge is codified and systematically stored, everyone in the organization can access, retrieve and utilize

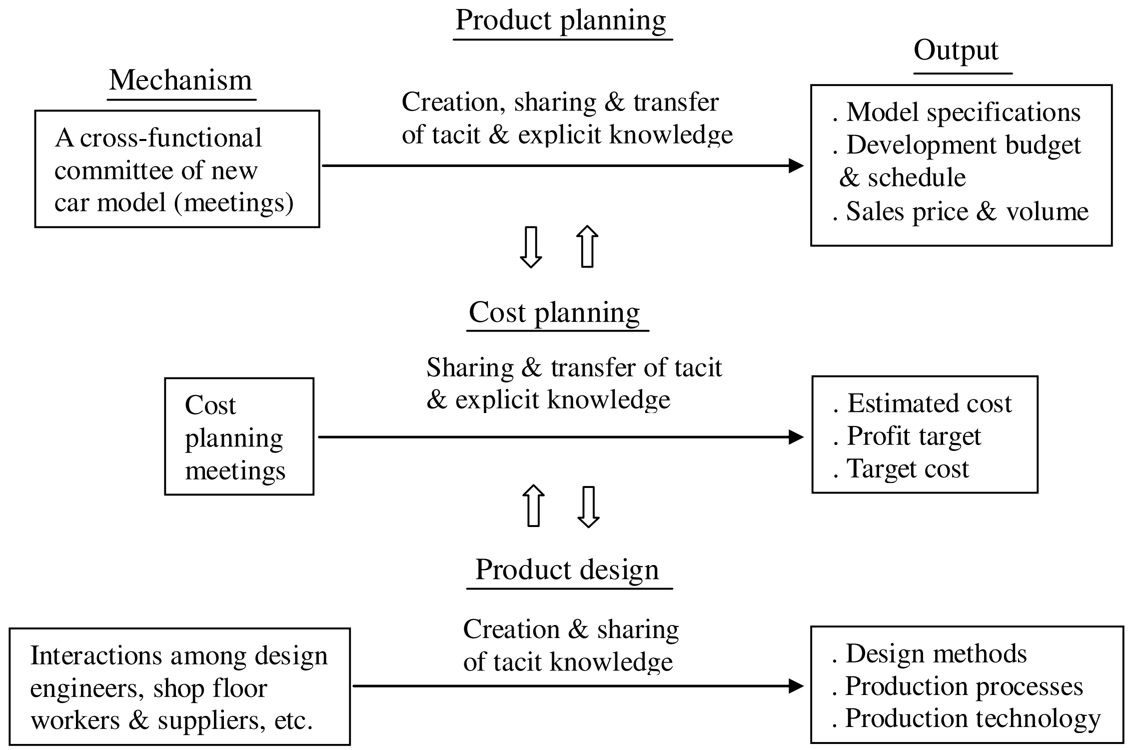

Figure 1. The processes of TCS in the H motor.

the knowledge without having to contact the individual who originally developed it. Through a codification approach, codified knowledge is retained as an asset of the firm even if the person who contributed the knowledge leaves the organization.

IT infrastructure in KM represents a firm's basic IT platform and features needed to implement effective KM (Gold et al., 2001; Chua, 2004). IT infrastructure that generally supports the realization of a codification strategy is classified into three broad types; knowledge storage (memory), search and transfer or cooperation infrastructure (Ko et al., 2005). IT infrastructure for knowledge storage utilizes a common database or electronic knowledge repository that stores codified and text-based knowledge as well as video, audio and graphics. The search infrastructure helps knowledge seekers to locate and retrieve requisite codified knowledge. It includes IT tools such as powerful search engines and intelligent filters. The transfer and collaboration infrastructure are employed to communicate information or knowledge between individuals, and to promote the cooperation among employees of the firm and other related firms, as well as the learning of members of the organization (Mohamed et al., 2010). To electronically exchange codified knowledge between individuals, e-mail and other internet-based technologies are used. For the collaboration and learning of members, some kinds of transfer or cooperation infrastructure, which comprise electronic discussion groups, electronic bulletin boards, chat facilities and other interactive technologies, are adopted and utilized (Pan and Leidner, 2003).

Some kinds of IT tools are recommended to connect experts in the firm with knowledge seekers, and to facilitate one-to-one interaction. They may include video-conferencing, on-line directories and knowledge maps that identify 'who knows what' in the organization. These tools are also helpful to assist the implementation of a personalization approach to KM. Through these kinds of IT tools, interpersonal networks and the ability to connect and communicate with one another can be extended. The positive effects of IT infrastructure on KM processes, such as knowledge acquisition, storage and transfer, have been empirically or conceptually suggested and demonstrated (Kwok et al., 2003; Lee et al., 2005; Artail, 2006).

A FRAMEWORK FOR THE TYPES OF KM STRATEGIES

KM strategies, which refer to strategies for implementing KM, are a general plan that provides guidelines for making decisions and attaining results from KM initiatives, such as creation and transfer (Saito et al., 2007). The types of KM strategy can be decided, formed and identified based on the usage degrees of KM instruments

		IT infrastructure: Low	IT infrastructure: High
TCS	High	The explorative strategy	The mixed KM strategy
	Low	The negative strategy	The exploitative strategy

Figure 2. A framework for knowledge management strategies.

(Maier and Remus, 2003; Scheepers et al., 2004). KM tools are broadly classified into two main groups: technological (for example, IT infrastructure) and non-technological instruments (for example, TCS). The choice of KM instruments also must depend on the firm's strategic orientation to KM (Merono-Cerdan et al., 2007). Thus, the use degrees of KM instruments in an organization and the kinds of KM strategy adopted by a firm are closely related.

In this study, it is suggested that to implement and activate KM in manufacturing firms, both TCS and IT infrastructure can be adopted, since striking differences exist between the roles of TCS and those of IT infrastructure in KM. According to the adoption degrees of the TCS or IT infrastructure, manufacturing firms may pursue different kinds of KM strategies. Thus, based on the usage levels of the TCS and IT infrastructure, a framework that represents forms of KM strategy can be developed and proposed. Figure 2 shows the framework and the four types of KM strategies in manufacturing firms: explorative, exploitative, mixed and negative KM strategies.

The explorative KM strategy

The explorative strategy in manufacturing firms primarily uses TCS, and stresses a personalization approach in KM. To the extent that knowledge in the industry is changing quickly, the company needs to be creating new knowledge just to keep pace. In this situation, the organization must employ the explorative KM strategy to acquire new knowledge, which is required to become and to remain competitive in its strategic condition. The emphasis of the exploration strategy is on creating new types of tacit knowledge, and sharing them between individuals. Diverse kinds of tacit knowledge originate from informal social networks, and so, human dimensions are critical for the effective management of tacit knowledge. Through the usage of TCS, the explorative KM strategy provides interpersonal interactions, trust and communication. According to Hansen et al. (1999), the manufacturing firms adopting the exploration strategy are innovative, and produce customized products.

The exploitative KM strategy

The exploitative KM strategy mainly depends on the use of IT infrastructure, and emphasizes the codification approach for KM. When knowledge resources and capabilities of a firm are sufficient for satisfying the knowledge requirements in an organization, the exploitation strategy can be employed. Under this strategy, companies put more emphasis on codifying, storing and reusing an enormous amount of knowledge. Through IT infrastructure, they can increase codifiability and ease of storage, and thus, decrease the complexity of accessing and using explicit knowledge. In the manufacturing firms that adopt the exploitative strategy, the stage of their products in the product life cycle is apt to be a more mature one. Accordingly, their manufacturing strategies are likely to be mass production oriented, and to be focusing on the production of standardized goods (Zack, 1999).

The mixed KM strategy

The mixed KM strategy stresses both personalization and codification methods, and thus, it is integrative and aggressive approach in KM. It depends on TCS to acquire new types of tacit knowledge as well as IT infrastructure to exploit various kinds of explicit one. The exploration of novel knowledge and the exploitation of present one are not mutually exclusive. While existing knowledge is applied in practical works, new one also must be produced to respond to continuous knowledge demands in an organization. To cope with the turbulent and volatile environments, and so, to continually create,

Table 2. Sample characteristics.

Type of industry	Chemical industry	Machine industry	Auto-mobile	Electronic industry	Textile	Food	Paper and pulp	Non-metal	Metal industry	Rubber	Total
No. of firms	19	20	21	22	8	8	4	16	10	2	130
No. of employees	Below 100		100 - 300		300 - 500		500 - 1,000		Above 1,000		
No. of firms	12		31		35		24		28		130

integrate and reconfigure new knowledge resources, companies have to maintain both the balance and the integration between knowledge exploitation and exploration. Under the mixed strategy, the combining and balancing of the exploitation and exploration are well achieved and maintained (Greiner et al., 2007). The manufacturing firms that employ the mixed strategy are active innovators, pursue the continuous improvement in production, and provide highly customized products.

The negative KM strategy

The manufacturing firms employing the negative KM strategy have little interest in KM. Both TCS and IT infrastructure are not positively used for managing knowledge, and thus, it is not managed in a systematic manner. Under the negative strategy, firms are less learning efficient, and they are just in isolation (Pablos, 2002). In these firms, knowledge exploitation and exploration do not actively occur, and the organizations' capabilities to respond to competitive environments are limited and reduced. They are inclined to provide highly standardized products through mass production, and innovations almost never take place.

RESEARCH METHODOLOGY

Data collection

Data for this study were drawn from a survey of the current status of TCS and IT infrastructure used in Korean manufacturing firms. In total, 330 organizations were randomly selected from a population of about 1,000 firms that are listed on the Korean stock market. The manufacturing firms listed are medium to large in size and consequently, are likely to have more experience with TCS and IT applications than are smaller firms. First, the chief production managers or executives of the selected firms were contacted to ask them for their participation in the research. At the beginning, 154 organizations responded to the request for information. However, during the survey, 24 firms withdrew from the survey, and as a result, 130 firms were finally included in the study.

In order to collect data, this research both administered questionnaires and conducted interviews with the participating firms. We pre-tested our Korean questionnaire by asking four professionals in the KM and information systems areas to assess its logical consistency, ease of understanding and sequence of items, *etc.* Based on the collected comments, we made several minor modifications in the wording and readjusted the item sequence. For the validation of the questionnaire, a pilot study was also conducted with the production managers of seven manufacturing firms. Through the pilot test, the instrument was refined again to improve respondents' comprehension and to adapt the questions they found unclear.

Only chief production managers or plant executives were selected as respondents. Before mailing the questionnaire, through a first telephone interview with the respondent, the researcher of this study roughly asked him the firm's present conditions, such as TCS usage and adoption degree of IT infrastructure. The results of the first interview generally concurred with the results of questionnaire response. A questionnaire with a cover letter was mailed to each respondent. After distributing the questionnaire, through the second telephone interview, the contents of the questionnaire and the answering method were explained. The survey was conducted during a 4-month period between September and December 2008. Table 2 summarizes the sample characteristics according to the industrial type of the firms.

Non-response bias is often approximated by simply comparing the answer patterns of early respondents with those of late respondents. The final sample was partitioned into two groups according to early and late responses. The results of t-tests showed no significant differences between the two groups regarding number of employees ($t = -1.15$, $p = 0.25$), total assets ($t = -0.80$, $p = 0.42$), total sales ($t = -0.85$, $p = 0.39$), industry type ($t = 0.79$, $p = 0.42$), and organization age ($t = 0.99$, $p = 0.32$).

Measurements

TCS are concerned with simultaneously achieving a target cost along with planning, development and detailed design of new products by using methods such as value engineering (VE) and cost table (Cooper and Slagmulder, 2002). The distinctive features of TCS include: cooperation of many departments, collaboration with suppliers, use of VE and cost table, consideration of corporate planning, and emphasis on the developing and design phases of a product. We can utilize these characteristics to assess the degree of adoption or usage of TCS. Ten questionnaire items were developed with these characteristic features. They are: in the planning, developing and design stage of a product, the cooperation with the Marketing, Accounting and other departments for cost management, the collaboration with suppliers to reduce cost and the utilization of the technical information of production floor (Yu-Lee, 2002), the consideration of the medium or long-term profit plans and business planning, the extent of the introduction and utilization of VE and cost table (Tani et al., 1994), and the degree of emphasis being placed on the planning and design stage to manage cost. The usage degree of TCS was measured on a seven-point Likert-type scale that ranged from 'not at all' to 'to a great extent'.

Types of IT infrastructure are grouped into three kinds: the transfer or cooperation, storage and search infrastructure. Based on previous studies (Gold et al., 2001; Sher and Lee, 2004), the 13 question items were constructed to measure the adoption and usage levels of IT infrastructure. For the transfer or cooperation IT,

Table 3. Distance coefficients of cluster analysis.

Stage	120	121	122	123	124	125	126	127	128	129
Coefficient	91.4	99.0	108.3	118.7	132.3	152.3	172.8	215.4	288.2	468.2
Increasing rate of coefficient (%)	-	8.7	9.0	9.0	11.0	15.0	13.0	25.0	33.0	62.0
No. of cluster	10	9	8	7	6	5	4	3	2	1

the 6 items were used. They include the usage of IT in collaboration with other people inside and outside the organization, the use of IT for communication with other people inside and outside the firm, and the IT usage for employees to learn from a single source as well as multiple sources. The two items, which measure the storage infrastructure, comprise the clear rules and procedures for knowledge classification, and the use of database or data warehouse to store knowledge (Chua, 2004). The five items used for measuring the search IT represent the usage of IT to seek for new knowledge, to find out the location of an individual and the specific area of database for obtaining knowledge, and to retrieve knowledge about firm's products and markets or competition. The usage levels of IT infrastructure were measured on a seven-point Likert-type scale, anchored by 'strongly disagree' and 'strongly agree'.

DATA ANALYSES AND RESULTS

Reliability and validity

Item analyses were performed with Cronbach's alpha coefficients for all multi-item scale measurements. All alpha coefficients were above 0.8, which is considered to be satisfactory for the reliability of a multi-item scale. Principal component analysis with a varimax rotation was used to verify the construct validities of the questionnaire items. Two separate joint factor analyses for TCS and IT infrastructure were carried out to acquire a more stable solution by increasing the ratio of the sample size to the number of items. Using a 0.4 criterion for significant item loading on a factor, the results show that all items within each index except for IT infrastructure are represented by a single factor. In the case of IT infrastructure, two factors with Eigen values greater than one were extracted. However, item 9 (seeking for new knowledge) in Factor 2 was replicated with the items of Factor 1. Item 9 was removed, and the factor analysis was performed again. In the second factor analysis, the items of each factor did not confound with the items in another factor. Factor 1 includes both the items of the storage infrastructure and the question items for the transfer or cooperation IT. Hence, Factor 1 is titled as 'the storage and transfer infrastructure'. Factor 2 is composed of the items regarding the search IT. The Alpha values for storage and transfer infrastructure and search IT were 0.93 and 0.84, respectively.

Empirical evidence of the four types of KM strategy

With a cluster analysis, this study classified sample firms according to the usage levels of TCS and IT infrastructure. In the current study, cluster analysis provides groups of companies that are similar in terms of the use degrees of TCS and IT infrastructure. In the cluster analysis, we used the hierarchical agglomerative method to form clusters because it generates non-overlapping clusters and it has been the dominant method (Aldenderfer and Blashfield, 1984). For the sorting or linkage rules, Ward's method was chosen since this technique optimizes minimum variance within clusters (Everitt, 1993). We also used the squared Euclidean distance as the proximity measure.

Based on the values of TCS, the storage and transfer IT, and the search infrastructure, a cluster analysis was performed to find four clusters of organizations: the explorative, exploitative, mixed and negative strategies. In addition, the mean scores of TCS, the storage and transfer IT, and the search IT were calculated for each cluster. A critical issue in cluster analysis is to determine the optimal number of clusters. While there are formal decision rules to guide this process, heuristics are commonly used. A formal approach in determining the most appropriate number of clusters is to examine the distance coefficient. The distance coefficient is presented in Table 3. The points at which the distance coefficient suddenly jumps indicate suitable stages in the clustering sequence for analysis.

In Table 3, the distance coefficient increases greatly at three points - between the fifth and sixth clusters, between the fourth and fifth clusters, and between the third and fourth clusters. This implies that the six-cluster, five-cluster and four-cluster solutions may be appropriate points for analysis. To show various cases in the combination of the usage levels of TCS and IT infrastructure, the six-cluster solution can be selected. The six-cluster result provides suitable data to examine the variations in TCS, the storage and transfer IT, and the search infrastructure. Therefore, the six-cluster solution is used in the analysis. The mean values of variables within each cluster are presented in Table 4, along with the Kruskal-Wallis test results (χ^2 values) for each clustering variable. The χ^2 scores indicate that statistical differences exist for the individual variables across clusters.

Since in this study, a seven-point Likert-type scale was used for the measurements of TCS and IT infrastructure, the middle score (that is, four-score) can be employed as the common dividing point, with which the usage levels can be roughly classified into two groups: high and low. In the cases of clusters A, D and E, the mean values of TCS and IT infrastructure are higher than the middle point. Thus, clusters A, D and E may represent the firms that

Table 4. Results of cluster analysis.

Cluster	A (N=32) mixed strategy	B (N=11) exploitative strategy	C (N=18) explorative strategy	D (N=27) mixed strategy	E (N=38) mixed strategy	F (N=4) negative strategy	χ^2
Target costing	5.0(3)	3.0(5)	4.5(4)	5.2(2)	5.9(1)	2.9(6)	80.4 [a]
Storage & transfer IT	4.6(4)	4.9(3)	3.6(5)	5.8(1)	5.8(1)	2.2(6)	87.2 [a]
Search IT	4.7(3)	4.4(4)	3.1(5)	4.9(2)	5.9(1)	1.8(6)	90.0 [a]
Size	711(3)	627(4)	341(5)	3986(1)	1056(2)	225(6)	10.8 [c]
Age	31(3)	34(1)	20(6)	32(2)	30(4)	30(4)	12.8 [b]
Total sales (a hundred million $)	9(3)	3.2(4)	2.6(5)	31.6(1)	16.5(2)	1.6(6)	11.4 [b]
Knowledge-intensity	5.9(4)	4.7(5)	6.5(3)	7.0(1)	6.9(2)	4.0(6)	13.8 [b]
ROS	0.030(6)	0.070(2)	0.067(3)	0.038(4)	0.072(1)	0.035(5)	0.56
ROA	0.034(6)	0.064(3)	0.079(1)	0.046(4)	0.070(2)	0.045(5)	0.80
RCGS	0.84(5)	0.77(1)	0.81(3)	0.85(6)	0.79(2)	0.82(4)	0.58

The numbers are mean values, and the numbers in parentheses are rankings. a: $p < 0.01$, b: $p < 0.05$, c: $p < 0.1$.

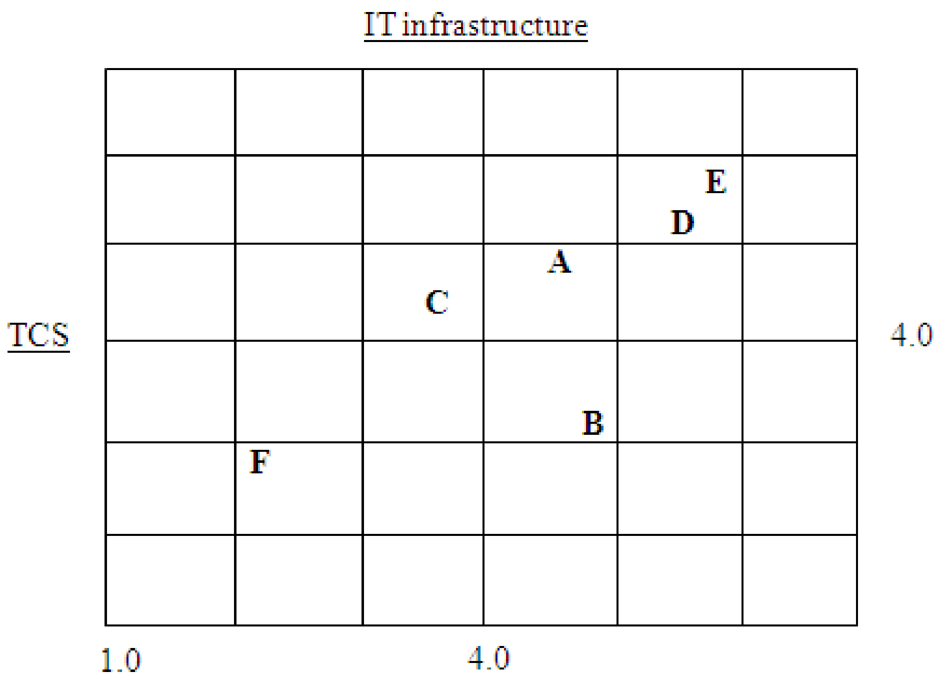

Figure 3. Location of each cluster on the grid.

prefer the mixed KM strategy. In terms of cluster B, the mean of TCS is lower, but those of IT infrastructure are higher than the middle score. Accordingly, the B shows the manufacturing firms adopting the exploitative strategy. However, in the case of cluster C, the mean value of TCS is higher, but those of IT infrastructure are lower than the middle point. The firms of cluster C may prefer and pursue the explorative KM strategy. In cluster F, the mean values of TCS and IT infrastructure are remarkably lower than the middle score. Thus, cluster F indicates the manufacturing firms adopting the negative strategy. Figure 3 shows the location of each cluster on the grid of usage levels of TCS and IT infrastructure. These results seem to support the assertion that the KM strategies of manufacturing firms are generally grouped into the four types.

Characteristics of the four types of KM strategy

In Table 4, the mean scores of the contextual variables (that is, size, age, total sales and knowledge-intensity) and financial performances in each cluster are presented, and can be compared across clusters. Size is the number of employees of a firm in the year 2008, and the organizational age is measured by counting the years elapsed since the founding of a firm. The industry type is a surrogate measure of knowledge-intensity (Park et al., 1999). In Korean industries, food, textile and paper are relatively low knowledge-intensive industries, and on the other hand, chemical, electronic and automobile belong to high knowledge-intensity companies (Park et al., 1999). In categorizing industries from the most knowledge-intensive to the least, it is assumed to be food, textile, paper, non-metal, metal, machine, chemical and electronic industry, and automobile. According to this order, the scores from 1 to 9 can be assigned to each industry type.

In this study, the level of the knowledge- intensity of each cluster is measured by the arithmetic mean of the scores, which present the industry types of sample firms in each cluster. This study collected the objective financial performance data of sample firms, such as return on assets (ROA; operating profit/total assets), return on sales (ROS; net profit/total sales), and ratio of cost of goods sold (RCGS; cost of goods sold/total sales). Accounting data to compute the ROA, ROS and RCGS was collected from the firm's balance sheets and income statements for 2008, which were provided in the Korean annual report of listed companies.

Large organizations generally have more resources to develop strategic KM systems and to explore the social interaction aspect of knowledge within a wider populace of employees (Merono-Cerdan et al., 2007). However, small firms, which may experience resource poverty, can face more barriers to the adoption of IT infrastructure and are less likely to focus on a codification strategy. In Table 4, the sizes (including total sales) of clusters A, D and E, which employ the mixed strategy, are larger than those of clusters C or F that adopt the explorative or negative strategy. In cluster F employing the negative strategy, the size is the smallest among the clusters, and thus, the firms of cluster F may suffer from the erosion of knowledge because of scarce resource. In Table 4, cluster B adopting the exploitative strategy can be compared with cluster C pursuing the explorative strategy. The size and age of cluster C is smaller than those of cluster B. Since the age positively relates to organizational inertia that inhibits organizational learning and knowledge creation, the age of cluster C, which represents small innovative companies, may be the youngest among the clusters.

In the case of the levels of knowledge-intensity, clusters D and E adopting the mixed strategy as well as cluster C pursuing the explorative strategy are higher than the levels of clusters B and F. Thus, it seems that companies operating in highly knowledge-intensive industries focus more on the mixed and explorative strategies. In financial performances, it is found that the χ^2 values are non-significant, and thus, there are no significant differences among six clusters. However, in the case of ROS, the score of cluster E, which adopts the mixed strategy, is the highest, and the rank of cluster F employing the negative strategy is the lowest. In terms of ROA, the rank of the E is also the highest, but the score of the F is relatively low. In the RCGS, since the high value represents a low degree of performance, the rank of the E may be higher than that of the F.

DISCUSSION

With a mini-case study, we demonstrated that in manufacturing firms, TCS are likely to be more preferred and required for the creation and sharing of tacit knowledge. It seems that through TCS, manufacturing companies can produce and attain new capabilities or know-how about the production related works such as product development and design, manufacturing technology and cost management. Thus, in this study, based on the usage levels of TCS and IT infrastructure, we suggested a framework that is useful for classifying types of KM strategies in manufacturing firms. According to the framework, four types of strategies were proposed and explained: explorative, exploitative, mixed and negative strategies.

In the case of the characteristics of each strategy, the size and total sales of the firms adopting the mixed strategy were larger than those of the manufacturing companies pursuing the negative or explorative strategies. The ages of the organizations employing the explorative strategy were the youngest. The companies adopting the explorative KM strategy represented the small innovative organizations. Knowledge-intensity was the highest in the manufacturing firms pursuing the mixed and explorative strategies. In the financial performance measurements, significant differences or systematic patterns across the six clusters were not found. In ROS and ROA, the values of clusters A and D, which employ the mixed strategy, were unexpectedly lower than those of clusters B and C, which adopt the exploitative and explorative strategy, respectively. To attain a high performance, the KM strategy type of a firm must be matched to the contextual factors. Accordingly, the low scores of clusters A and D may be incurred by the misfit between strategy type and contingency factors.

The contingency factors, which influence the manufacturing firms' choice of each strategy, may include business strategy, culture, production technology and method, environmental competition and uncertainty, and product characteristics, etc. Future research can examine and uncover their effects on the firm's choice of each strategy, and the interaction impact of contingency factors and strategies on organizational performance. After the successful completion of these studies, with the framework, both a firm's type of strategy and its appropriateness can be assessed and identified, and the framework can help a firm to find the most suitable KM strategy for its situation. In this study, we failed to demonstrate the differences among clusters in the financial performances, and this failure is the limitation of this study, which was incurred by the non-consideration of contextual variables.

ACKNOWLEDGEMENTS

This research was supported by Kyungpook National University AS Research Fund (2010). The author also wishes to thank anonymous reviewers for their constructive comments and the editors of African Journal of Business Management for their editorial efforts.

REFERENCES

Abou-zeid E, Cheng Q (2004). The effectiveness of innovation: A knowledge management approach. Int. J. Innov. Manage., 8(2): 261-274.

Aldenderfer MS, Blashfield RK (1984). Cluster Analysis. Sage Publications. Beverley Hills.

Alwis RS, Hartmann E (2008). The use of tacit knowledge within innovative companies: knowledge management in innovative enterprises. J. Knowl. Manage., 12(2): 133-147.

Artail A (2006). Application of KM measures to the impact of a specialized groupware system on corporate productivity and operations. Inform. Manage., 43: 551-564.

Bollinger S, Smith D (2001). Managing organizational knowledge as a strategic asset. J. Know. Manage., 5(1): 8-18.

Chen C, Huang J (2007). How organizational climate and structure affect knowledge management-The social interaction perspective. Int. J. Inform. Manage., 27(2): 104-118.

Chua A (2004). Knowledge management system architecture: a bridge between KM consultants and technologists. Int. J. Inform. Manage., 24(1): 87-98.

Cokins G (2002). Integrating target costing and ABC. J. Cost Manage., 16(1): 13-22.

Cooper R (2002). Target costing for new product development. J. Cost Manage., 16(1): 5-12.

Cooper R, Slagmulder R (2002). Target costing for new product development: product-level target costing. J. Cost Manage., 16(1): 5-11.

Erden Z, Krohg G, Nonaka I (2008). The quality of group tacit knowledge. J. Strat. Inform. Syst., 17(1): 4-18.

Everitt BS (1993). Cluster analysis (3rd edn.). London. Heinemann.

Gold H, Malhotra A, Segars H (2001). Knowledge management: An organizational capabilities perspective. J. Manage. Inform. Syst., 18(2): 185-214.

Gopalakrishnan S, Bierly P, Kessler EH (1999). A reexamination of product and process innovations using a knowledge-based view. J. High Technol. Manage. Res., 10(2): 147-166.

Gopalakrishnan S, Bierly P (2001). Analyzing innovation adoption using a knowledge-based approach. J. Eng. Technol. Manage., 18: 107-130.

Greiner E, Bohmann T, Krcmar H (2007). A strategy for knowledge management. J. Know. Manage., 11(1): 3-15.

Hasen T, Nohria N, Tierney T (1999). What's your strategy for managing knowledge. Harv. Bus. Rev., 106-116.

Jasimuddin M (2007). Exploring knowledge transfer mechanisms: The case of a UK-based group within a high-tech global corporation. Int. J. Inform. Manage., 27: 294-300.

Jasimuddin M (2008). A holistic view of knowledge management strategy. J. Know. Manage., 12(1): 57-66.

Ko D, Kirsch J, King R (2005). Antecedents of knowledge transfer from consultants to clients in enterprise system implementations. MIS Q., 29(1): 59-85.

Kuo R, Lee G (2009). KMS adoption: the effects of information quality. Manage. Decis., 47: 1633-1651.

Kwok C, Ma J, Vogel D (2003). Effects of group support systems and content facilitation on knowledge acquisition. J. Manage. Inform. Syst., 19(3): 185-229.

Lee K, Lee S, Kang I (2005). KMPI: measuring knowledge management performance. Inform. Manage., 42: 469-482.

Lin TW, Merchant KA, Yang Y, Yu Z (2005). Target costing and incentive compensation. J. Cost Manage., 19(1): 29-42.

Maier R, Remus U (2003). Implementing process-oriented knowledge management strategies. J. Know. Manage., 7(1): 62-74.

Merono-Cerdan L, Lopez-Nicolas C, Sabater-Sanchez R (2007). Knowledge management strategy diagnosis from KM instruments use. J. Knowl. Manage., 11(2): 60-72.

Mohamed M, Murray A, Mohamed M (2010). The role of information and communication technology (ICT) in mobilization of sustainable development knowledge: a quantitative evaluation. J. Know. Manage., 14(6): 744-758.

Nonaka I (1994). A dynamic theory of organizational knowledge creation. Org. Sci., 5(1): 14-37.

Nonaka I, Takeuchi H (1995). The Knowledge Creating Company: How Japanese Companies Create the Dynamics of Innovation. New York. Oxford University Press.

Pablos PO (2002). Knowledge management and organizational learning: typologies of knowledge strategies in the Spanish manufacturing industry from 1995 to 1999. J. Know. Manage., 6(1): 52-62.

Pan L, Leidner E (2003). Bridging communities of practice with information technology in pursuit of global knowledge sharing. J. Strat. Inform. Syst., 12: 71-88.

Park Y, Kim C, Lee J (1999). On the characteristics of innovative firms in Korea: The role of R and D and innovation type. Int. J. Innov. Manage., 3(2): 111-131.

Plessis M (2008). What bars organizations from managing knowledge successfully? Int. J. Inform. Manage., 28: 285-292.

Saito A, Umemoto K, Ikeda M (2007). A strategy-based ontology of knowledge management technologies. J. Know. Manage., 11(1): 97-114.

Scheepers R, Venkitachalam K, Gibbs M (2004). Knowledge strategy in organizations: refining the model of Hansen, Nohria and Tierney. J. Strat. Inform. Syst., 13: 201-222.

Senge PM (1990). The leader's new work: building learning organizations. Sloan Manage. Rev., 7-23.

Sher J, Lee C (2004). Information technology as a facilitator for enhancing dynamic capabilities through knowledge management. Inform. Manage., 41: 933-945.

Tani T, Okano H, Shimizu N, Iwabuchi Y, Fukuda J, Cooray S (1994). Target cost management in Japanese companies. Manage. Account. Res., 5(1): 67-81.

Yu-Lee RT (2002). Target costing: what you see is not what you get. J. Cost Manage., 16(1): 23-28.

Zack MH (1999). Developing a knowledge strategy. Calif. Manage. Rev., 41(2): 125-145.