An integrated view of knowledge management for performance

Sangjae Lee, Byung Gon Kim and Hoyal Kim



Sangjae Lee is a Professor in the Department of E-business, College of Business Administration, Sejong University, Seoul, South Korea.
Byung Gon Kim is an Associate Professor of Business Administration in the Department of Digital Business Administration, Namseoul University, Chon-An, South Korea.
Hoyal Kim is based at Korea Information System Consulting and Audit, Seoul, South Korea.

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Abstract

Purpose – *This study aims to analyze the relationship between KM infrastructures, knowledge process capabilities, creative organizational learning, and organizational performance. The primary research focus is on the relationships between the KM infrastructure, which includes cultural, structural, management, and technology related factors, and the knowledge process capability by elaborating on the significance of knowledge processes as the determinants of organizational performance.*

Design/methodology/approach – *The unit of analysis is a company that has adopted a KMS. A mail survey was used to collect the data and an internet-based survey was also used to provide more convenience in the response. The response sample included 120 responses. The structural relations among variables were tested using the partial least squares (PLS) method.*

Findings – *The results of this study indicate that collaboration, learning culture, top management support, and IT support affect the knowledge process capabilities. Knowledge process capabilities and creative organizational learning in turn mediate the relationship between KM infrastructure and organizational performance, which demonstrate the relevance of KM infrastructure for organizational performance.*

Originality/value – *Previous studies on KM have been fragmented in that they have explained some aspects of KM performance but have not provided a holistic view of a KM performance framework. Using a holistic view of the KM performance framework, this study has provided insights to KM for researchers because it explains the integrated aspects of KM performance by examining the relationships between the KM infrastructure, knowledge process capabilities, and organizational outcomes.*

Keywords *Knowledge management, KM infrastructure, Knowledge process capability, Creative organizational learning, Organizational performance, Critical success factors*

Paper type *Research paper*

1. Introduction

A key to understanding the successes and failures of knowledge management (KM) within organizations is the identification of ''capabilities'' or ''resources'' that allow firms to recognize, create, transform, and distribute knowledge. KM infrastructure can be defined as the technical, structural, and cultural factors that enable the maximization of social capital for KM (Gold *et al.*, 2001). The technological dimension is concerned with the technology-enabled ties that exist within the firm. The structural and cultural dimensions represent the presence of norm and trust mechanisms, and collaborative learning atmospheres. The key to understanding the successes and failures of KM initiatives is the evaluation of the KM infrastructure that allows the firm to recognize, create, transform, and distribute knowledge. Many researchers have emphasized the importance of knowledge infrastructure and processes for KM (Cha *et al.*, 2008; Choo *et al.*, 2007; Lee and Steen, 2010; Tanriverdi, 2005). Previous studies on KM have been fragmented in that they have explained some aspects of KM performance but have not provided a holistic view of a KM performance framework. Most studies have investigated the relationships of

KM enablers, processes, or performance in isolation. For example, Gold *et al.* (2001) suggested that the knowledge infrastructure capabilities (technology, structure, culture) and the knowledge process capabilities (acquisition, conversion, application, protection) directly affect the organizational effectiveness, but did not show the relationships between the knowledge infrastructure capabilities and knowledge process capabilities. While Lee and Choi (2003) showed the integrated relationships between KM enablers, knowledge creation processes, KM intermediate outcomes, and organizational performance, their study did not consider the whole knowledge process capability but rather focused on the knowledge creation process. Furthermore, some important antecedents, such as management related factors, were missing from the study by Lee and Choi. More comprehensive studies on the integrated model of KM encompassing KM infrastructure, knowledge process capabilities, and organizational outcomes are lacking; however, this study begins to fill the void.

An integrative research model is important for KM because its complex and dynamic characteristics are better described within a framework of systems thinking. A holistic view improves the understanding of the interactions between the KM infrastructure, knowledge process capabilities, organizational creativity, and performance. This study analyzes the relationship between KM infrastructures, knowledge process capabilities, creative organizational learning, and organizational performance. The primary research focus is on the relationships between the KM infrastructure, which includes cultural, structural, management, and technology related factors, and the knowledge process capability by elaborating on the significance of knowledge processes as the determinants of organizational performance. An integrative research model is built based on relevant theories and is empirically tested using a sample of companies that have adopted knowledge management systems (KMS).

2. Research model

Previous studies on KM have been fragmented because they only consider some aspects of KM performance rather than using a holistic view of the KM performance framework: they have examined the relationship between one or two facets of KM enablers and process capability, or between KM process capabilities and organizational performance. For example, Tanriverdi (2005) posited that IT relatedness enhances KM capabilities which, in turn, leads to superior firm performance. Kulkarni *et al.* (2007) examined a KM success model that incorporated the organizational support structure as a contributing factor to the success of the KMS implementation.

A holistic view where the complex and dynamic characteristics of KM are better described improves the insights of the interaction between the KM infrastructure, knowledge process capabilities, organizational creativity, and performance. The rationale for the relationships between these constructs is grounded in the core results of previous studies:

- KM infrastructure improves knowledge creation (Lee and Choi, 2003) and knowledge process capabilities, i.e. acquisition, conversion, application, and protection (Hoffman *et al.*, 2005);
- creative organizational learning is increased from knowledge process capabilities that create, transfer, and use knowledge (Malhotra, 2004); and
- the result of increased organizational creativity is improved organizational performance (Pfeffer, 2005; Shani *et al.*, 2000).

Previous studies have suggested that knowledge infrastructure includes culture, people, organizational hierarchy, structure, and IT (Lee and Choi, 2003; Gray and Durcikova, 2005). While Lee and Choi (2003) suggested that culture, structure, people, and information technology are related enablers for KM, management related factors that are important antecedents for KM process capabilities were missing in the study. Thus, this study suggests that KM infrastructure is composed of four groups of KM enablers: culture, structure, management, and technology. These four groups were

selected because each is treated as an important facet for KM processes, i.e. knowledge creation, sharing, contributing, transfer, or knowledge process capabilities (Alavi *et al.*, 2005; Bock *et al.*, 2005; Kankanhalli *et al.*, 2005; Kulkarni *et al.*, 2007; Tanriverdi, 2005).

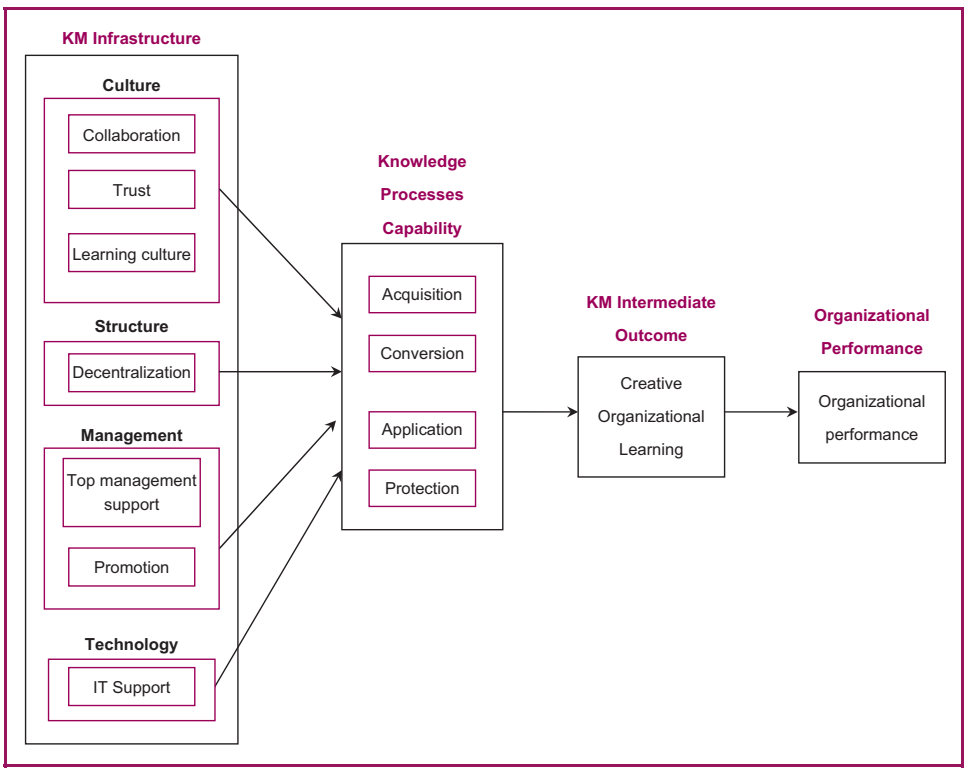
After considering the candidate variables in each group of knowledge infrastructure, seven factors were chosen for inclusion in the KM infrastructure: the collaboration, trust, and learning cultures in culture, decentralization in structure, top management support and promotion in support, and IT support in technology. The organizational culture is an important factor for KM, and Lee and Choi (2003) suggested three factors for organizational culture (collaboration, trust, and learning) on the basis of the concept of care. Structure is also crucial for KM as it is rationalizes functions or units within an organization and is important in leveraging technological architecture in technology. This study focuses on decentralization, which is as a key structural factor. Management support is important for KM as it supports the employees who are at the heart of creating organizational knowledge. This study adopts top management support and promotion as KM enablers within the organizational support systems. Lastly, technology is a crucial knowledge enabler because it can mobilize social capital for the creation of new knowledge. This study includes IT support in order to represent IT infrastructure services.

This study categorizes knowledge process capabilities into four subprocesses:

1. Acquisition to enable knowledge retention.
2. Conversion to allow the present knowledge to be more useful.
3. Application to enable the realization of the practical values of knowledge.
4. Protection to prevent the abuse of knowledge.

The research model is presented in Figure 1.

Figure 1 Research model



2.1 KM infrastructure and knowledge process capability

2.1.1 Collaboration. Collaboration is the extent to which people in a group actively help one another in their work (Hurley and Hult, 1998). This is possible when people are willing to share information and knowledge, and effective KM requires a collaborative culture (Gold *et al*., 2001). Organizations emphasize the importance of supportive and reflective communication and aim to foster interaction among organizational members to share different viewpoints (O'Dell and Grayson, 1999). Collaborative culture positively influences knowledge creation through open communication and increasing knowledge exchanges. For example, knowledge is created when employees share practical experience and knowledge in communities of practice; this is critical for the creation of implicit knowledge. Collaboration supports a shared understanding of the organization's internal and external environments through communication and individual exchanges. Partnerships in research and development and participation in technology communities are important for knowledge transfer and technology development in interorganizational relations (Powell, 1998). Many studies posit that collaboration is a key determinant for knowledge creation and transfer (O'Dell and Grayson, 1999). Thus, the following hypothesis is suggested:

H1. Collaboration positively affects knowledge process capabilities.

2.1.2 Trust. Knowledge can be a source of power as it allows difference in organizational members' hierarchical positions (Hart and Saunders, 1997). Thus, sharing knowledge indicates sharing power; however, sharing knowledge may jeopardize the hierarchical position of employees because they can lose their competitiveness within the organization (Hinds and Pfeffer, 2003). High trust, however, may help decrease the risks of losing individual competitiveness as a result of sharing knowledge (Roberts, 2000; Scott, 2000). Trust can be defined as maintaining reciprocal faith in each other in terms of intention and behavior (Kreitner and Kinicki, 1992). As the sharing of valuable knowledge can increase the risk of lowering individual competitive positions within an organization, lack of trust is a major inhibitor of knowledge transfer (Szulanski, 1996). Trust can reduce the fear and risk of sharing knowledge leading to disadvantages in the employees' competiveness. When people are in relationships with high levels of trust, they are more willing to participate in knowledge exchange and social interaction (O'Dell and Grayson, 1999). Efforts to increase trust among organizational members is the cornerstone for knowledge transfer (Nelson and Cooprider, 1996), because distrust encourages employees to hide their knowledge and keep it to themselves (Jarvenpaa and Staples, 2000). Thus, fostering trust among members in a cross-functional or interorganizational team is the basis for knowledge creation (Scott, 2000). Therefore, the following hypothesis is suggested:

H2. Trust positively affects knowledge process capabilities.

2.1.3 Learning culture. The learning culture is defined as the degree to which organizations encourage learning through various means such as education, training, and mentoring (Hurley and Hult, 1998). All organizational learning is based on the individual learning that occurs in the brains of individuals (Simon, 1991). Thus, an emphasis on individual learning leads to an increased expectation of knowledge creation in organizations. Therefore, organizations should focus on both individual learning and group learning in order to increase organizational performance through learning (Huysman and DeWit, 2003). For example, knowledge learned from failures in the development of new products can be the basis for success in the future, and this indicates that organizations should develop a deeply ingrained culture to promote learning from failure. Knowledge can be infused throughout organizations by large-scale meetings of best policies, practices, and work processes, by job rotation of experts, and by education programs. In particular, in order to leverage implicit organizational knowledge, the knowledge transfer processes including communication and mentoring among people from different departments, hierarchies, and positions, becomes important (Swap *et al*., 2001). Thus, intellectual organizations attempt to ingrain learning culture deeply within the organization itself (Quinn *et al*., 1996). Hence, the following hypothesis can be proposed:

H3. Learning culture positively affects knowledge process capabilities.

2.1.4 Decentralization. Decentralization indicates the extent to which the decision making authority is dispersed throughout the organization (Daft, 1986). Centralization, however, refers to the degree to which the decision making authority is concentrated (Caruana *et al.*, 1998). The dispersion of power promotes spontaneity, experimentation, and freedom of expression; the concentration of authority hinders creative solutions which can be critical for knowledge creation (Graham and Pizzo, 1996). Many researchers posit that it is difficult to create knowledge in centralized organizations (Stonehouse and Pemberton, 1999; Teece, 2000) because communication can become a time consuming process in centralized organizations (Bennett and Gabriel, 1999) that results in inter-departmental communication and idea sharing being hindered. This can lead to the distortion of ideas and reduced generation of ideas (Stonehouse and Pemberton, 1999). In competitive environments, decentralization is necessary in order to obtain information about markets and behaviors of competitors, and to allow prompt action. For these reasons, researchers insist that the concentration of the decision making authority should be relaxed in a knowledge based organization (Szulanski, 1996). Sharing and collaborating across boundaries within the organization and across the supply chain can be facilitated if the organizational structures are designed for flexibility (Gold *et al.*, 2001). Thus, the more decentralized the organization structure is, the greater the possible knowledge creation and utilization is. Thus, the following hypothesis can be suggested:

H4. The decentralization of organizational structures negatively affects knowledge process capabilities.

2.1.5 Top management support. Many researchers have emphasized the role of top management in KM (Klein, 1998; Carpenter and Fredrickson, 2001). Top management support depends on the organizational vision and strategy, and assists organizational members to further their interests in knowledge sharing and knowledge utilization. Thus, the top management strongly affects the organizational culture, norms, and strategic actions (Carpenter and Fredrickson, 2001; Schein, 1985). Carpenter and Fredrickson (2001) posited that the influence of the top management increases in uncertain environments. Top management leadership exerts a significant influence on organizational members and their KM activities, which are based on their beliefs and values related to knowledge (Allee, 1997). A serious barrier to knowledge transfer is when top management does not communicate the importance of KM to their employees (Ruggles, 1998). Thus, top management should undertake an active and compensating role to stimulate knowledge creation and transfer (O'Dell and Grayson, 1999). The following hypothesis is proposed:

H5. Top management support positively affects knowledge process capabilities.

2.1.6 Promotion. Knowledge sharing demands time and effort of participants in the knowledge search, register, and acceptance (Davenport and Prusak, 1998). Promotion and incentive systems are typical methods to encourage effort in order to accomplish organizational objectives by providing extrinsic rewards (Bock and Kim, 2002). The promotion and incentive systems are prerequisite means to attract the participation of organizational members in effective KM activities. O'Dell and Grayson (1999) suggested that nonfinancial incentives from work such as ''being respected as experts'' are more important than financial incentives. Organizations may be pressured to provide incentives to employees who provide and share knowledge and these incentives are a basis for the organizational support for KM (Keltner and Finegold, 1996). Kankanhalli *et al.* (2005) posited that when intrinsic benefits exist, employees contribute their knowledge to knowledge repositories regardless of the trust that they have. Thus, expectations of appropriate evaluations and rewards lead to greater participation in KM activities. From this reasoning, the following hypothesis can be suggested:

H6. Promotion positively affects knowledge process capabilities.

2.1.7 IT support. Many researchers have suggested that IT is a critical factor in knowledge creation and transfer (Davenport and Prusak, 1998; Gupta and Govindarajan, 2000; Gold *et al.*, 2001). Well developed technology supports knowledge creation, flow, and utilization

(Alavi and Leidner, 2001). IT affects the KM process in two significant ways. First, the database and data warehousing technology enables rapid collection, storage, and exchange of knowledge on a large scale. Various types of knowledge can be stored and accessed, including images, audio, and video (Ndlela and DuToit, 2001), thereby assisting the knowledge sharing process (Roberts, 2000). Second, groupware and workflow technology facilitates the integration of fragmented flows of knowledge (Gold *et al.*, 2001; Rao, 2004).

Thus, IT supports KM processes such as knowledge creation, collaboration, communication, searching, access, and systematic storage (Roberts, 2000; Gold *et al.*, 2001; Ndlela and DuToit, 2001). IT contributes to the improvement of organizational learning and performance by facilitating KM processes (Handzic, 2004). ''Best practices'' embedded in IT can support learning in order to perform work processes effectively. IT based KM processes allow increases in the breadth and depth in knowledge creation, storage, transfer, and utilization (Alavi and Leidner, 2001). Therefore, the broader the scope of the IT infrastructure is, the stronger the capability of KM processes is. Thus, this leads to the hypothesis:

H7. IT support positively affects knowledge process capabilities.

2.2 Knowledge process capability and creative organizational learning

Creative organizational learning is defined by the degree to which organizational members can update or upgrade existing knowledge and improve understanding of new environments through obtaining new knowledge. Creative organizational learning is based on strengthening creativity, enhancement of insights, generation of new viewpoints on existing ideas, and constructively criticizing existing opinions on businesses. While many firms have developed KMS, companies that have considered the effect of KM on organizational learning are few.

Enhanced KM processes through IT can increase organizational learning. For instance, Knowledge directories enable the interconnection of employees who have specialized creative knowledge that has not been publicized in organizations (Ruggles, 1998). Videoconferencing, teleconferencing, whiteboards, and messenger programs help improve the exchange of implicit creative knowledge among people who are geographically separated (Davenport and Prusak, 1998; Thomas *et al.*, 2001). Discussions through computer networks and electronic bulletin board systems increase the opportunity of creativity learning by integrating and utilizing existing knowledge. The creation of knowledge obtained from external organizations, experts, and new products for markets that organizations have not yet experienced enables creative organizational learning based on changes in the existing organizational processes. Thus, this leads to the following hypothesis:

H8. Knowledge process capabilities positively affect creative organizational learning.

2.3 Creative organizational learning and performance

Many researchers in KM have emphasized the role of learning in KM based on the interrelatedness of learning and knowledge (Mason, 2004). However, the effect of KM on organizational performance has not been sufficiently understood. KM performance should be explained as the performance from the use of knowledge obtained from the KMS. In order to fully understand the performance of KM, organizational learning outcomes should be evaluated as a measure of KM performance (Tiwana, 2002). Pfeffer (2005) demonstrated that organizational perceptions can determine organizational performance and that creative learning can result in organizational innovation and dramatic improvements in performance. This leads to the following hypothesis:

H9. Creative organizational learning positively affects organizational performance.

3. Research methods

3.1 Measures of variables

The definitions and measurement items for the research variables in this study are outlined in Tables I and II. The items are adapted from previous studies which have been validated and used for studies in KM. This study adopts and measures four broad dimensions of process capabilities as suggested by Gold *et al.* (2001): the acquisition, conversion, application, and protection of knowledge. The knowledge process capabilities are a second-order construct comprised of four complementary first-order dimensions: knowledge acquisition, conversion, application, and protection. Creative organizational learning includes the extent of the ability to make existing knowledge invalid and adjust the understanding of new environments through acquiring new knowledge.

Most variables in the model are measured by items written in the form of statements that the respondent agrees or disagrees with to varying degrees using a seven-point Likert scale. The items were revised based on the reviews by two KM practitioners, three researchers in MIS, 20 graduate students in MIS, and their comments to improve understandability and clarity to revise vague or specialized terms.

Table I Definitions of variables

Research variables	*Definitions*	*Sources*
KM infrastructure		
Collaboration	The extent that people support and help others' tasks while performing their tasks	Hurley and Hult (1998), Lee and Choi (2003)
Trust	The extent of beliefs in others' behaviors, skills and attitude toward organizational goals	Kreitner and Kinicki (1992), Lee and Choi (2003)
Learning culture	The extent that organizations facilitate and encourage opportunities of development and learning.	Hurley and Hult (1998), Lee and Choi (2003)
Decentralization	The extent that the decision making authorities and controls are decentralized in organizations	Caruana *et al.* (1998), Ein-Dor and Segev (1982), Lee and Choi (2003)
Top management support	The extent that top management understands and supports knowledge management	Carpenter and Fredrickson (2001), O'Dell and Grayson (1999), Schein (1985)
Promotion	The extent that the participation in knowledge management activities are promoted using financial and nonfinancial rewards	Bock and Kim (2002)
IT support	The collaboration, communication, search and access, decision making, and systematic storage of information are supported by IT	Gold *et al.* (2001), Lee and Choi (2003)
Knowledge process capability		
Knowledge acquisition	The capability to obtain knowledge and its sources	Alavi and Leidner (2001), Gold *et al.* (2001)
Knowledge conversion	The capability to change the state or format of knowledge for its reuse	Alavi and Leidner (2001), Gold *et al.* (2001)
Knowledge application	The capability to transfer and use knowledge for realization of its values	Alavi and Leidner (2001), Gold *et al.* (2001)
Knowledge protection	The capability to exclusively protect knowledge	Alavi and Leidner (2001), Gold *et al.* (2001)
KM intermediate outcome		
Creative organizational learning	The extent to change the understanding of existing business practices or make them invalid	Vandenbosch and Higgins (1996)
Organizational performance		
Organizational performance	The capability to develop new products/services, the capability to predict business or risks, the improvement of capability to cope with new information of markets	Gold *et al.* (2001)

Table II Items for variables

Variables	*Items*	*Sources*
Collaboration		
CO1	The members of our company are willing to take responsibility in the faults which we make	Lee and Choi (2003)
CO2	The members of our company are cooperative with each other	
CO3	The members of our company are willing to provide support to each other	
CO4	The members of our company share cooperative inter-departmental atmosphere in performing works	
CO5	The members of our company are satisfied with each other in our cooperation	
Trust		
TR1	The members of our company believe that they treat each other truthfully	Lee and Choi (2003)
TR2	The members of our company understand and believe in the reason of behaviors of others	
TR3	The members of our company trust the capability of others to perform works	
TR4	The members of our company believe that others will make decisions for the benefits of entire organizations not individuals	
TR5	The relations among organizations are based on mutual trust	
Learning culture		
LE1	In our company, education programs for the performance of tasks are facilitated	Lee and Choi (2003)
LE2	In our company, the opportunities for career development are provided to employees through job rotation and participation in various tasks	
LE3	In our company, the members' participation in self development activities such as seminar and symposium is encouraged	
LE4	In our company, various opportunities for career development other than formal job training are provided to employees	
LE5	In our company, employees are generally satisfied with education and career development programs	
Decentralization		
DE1	In our company, employees can perform necessary activities in their works without command of boss	Lee and Choi (2003)
DE2	In our company, autonomous decision making is encouraged	
DE3	In our company, employees are not interfered in decision making in their tasks	
DE4	In our company, employees can autonomously make decisions without permission of boss	
DE5	In our company, decision making authority is delegated to the employees who actually perform tasks	
Top management support		
CE1	Top management of our company is interested in knowledge management	Carpenter and Fredrickson (2001)
CE2	Top management of our company is well aware of the concepts of knowledge management	
CE3	Top management of our company invests much human and financial resource for knowledge management	
CE4	Top management of our company emphasizes the importance of knowledge management to organizational members	
CE5	Top management of our company participates in and leads knowledge management activities (e.g. knowledge sharing and utilization)	
Promotion		
RE1	Our company provides much financial incentives for knowledge sharing	Kankanhalli *et al.* (2005)
RE2	Our company reflects contribution to knowledge sharing activities in personnel evaluation of work performance	
RE3	Our company sufficiently provides opportunities for education and training as incentives for knowledge sharing activities	
RE4	Our company sufficiently rewards employees if their contribution or sharing of knowledge leads to organizational performance such as sales growth and cost reduction	
RE5	Our company respects and acknowledges the honors of employees who contribute to knowledge sharing activities	

(*Continued*)

Table II

Variables	*Items*	*Sources*
IT support		
IT1	IT in our company provides environments which enable cooperative working in anytime and anyplace	Lee and Choi (2003)
IT2	IT in our company provides environments which enable fast and easy exchange of opinions among organizational members	
IT3	IT in our company supports fast and easy access to necessary information and knowledge	
IT4	IT in our company supports various software tools for decision making	
IT5	IT in our company supports systematic storage of necessary information and knowledge	
Knowledge acquisition		
PA1	The KM processes in our company effectively enables the creation of new knowledge from existing knowledge	Gold *et al.* (2001)
PA2	The KM processes in our company enables learning of useful lessons from previous work experiences	
PA3	The KM processes in our company facilitates exchange of knowledge with other departments (or trading partners)	
PA4	The KM processes in our company enables the acquisition of knowledge of new products and services in industry	
PA5	The KM processes in our company facilitates the acquisition of new knowledge about competitors in industry	
Knowledge conversion		
PC1	The KM processes in our company enables the appropriate filtering of large amount of knowledge	Gold *et al.* (2001)
PC2	The KM processes in our company enables the absorption of employees' knowledge into organizational knowledge	
PC3	The KM processes in our company enables transfer of partners' knowledge into our company's knowledge	
PC4	The KM processes in our company enables the execution of activities for the integration of knowledge from different sources and types	
PC5	The KM processes in our company enables the execution of activities for the abandonment or replacement of outdated knowledge	
Knowledge application		
PU1	The KM processes in our company enables learning knowledge from mistakes and failures, and utilizing the knowledge in works	Gold *et al.* (2001)
PU2	The KM processes in our company enables utilization of retained knowledge in order to solve new problems	
PU3	The KM processes in our company enables diffusion and utilization of knowledge which is necessary to improve work efficiency	
PU4	The KM processes in our company enables the distribution of knowledge to organizational members for applying the knowledge to their works	
PU5	The KM processes in our company enables the capture and application of knowledge in critical issues for competition	
Knowledge protection		
PP1	The KM processes in our company enables the execution of activities for the prevention of inappropriate usage of knowledge	Gold *et al.* (2001)
PP2	The KM processes in our company enables the execution of activities for the prevention of disclosure of knowledge into outside of organization	
PP3	The KM processes in our company use technology for restricting access to important knowledge sources	
PP4	The KM processes in our company clearly defines knowledge into which access is restricted	
PP5	The KM processes in our company clearly deliver the importance of knowledge protection into employees	

(*Continued*)

Table II

Variables	*Items*	*Sources*
Creative organizational learning		
MB1	The knowledge acquired from KMS enables the questioning of our view on the current business practices	Vandenbosch and Higgins (1996)
MB2	The knowledge acquired from KMS enables the development of our creativeness	
MB3	The knowledge acquired from KMS improves our perspectives on the execution of business processes	
MB4	The knowledge acquired from KMS enables having views in new direction	
MB5	The knowledge acquired from KMS broadens our views on business practices	
MB6	The knowledge acquired from KMS enables the questioning of our prejudices	
Organizational performance		
OE1	After knowledge management systems are introduced, the capability to capture new business opportunities is improved	Gold *et al.* (2001)
OE2	After knowledge management systems are introduced, the capability to predict potential markets for products/services is improved	
OE3	After knowledge management systems are introduced, the capability to develop new products/services is improved	
OE4	After knowledge management systems are introduced, the capability to predict unexpected incidents and crises is improved	
OE5	After knowledge management systems are introduced, the capability to rapidly adjust organizational objectives according to change in industry/markets is improved	
OE6	After knowledge management systems are introduced, the capability to respond to new information regarding industry/markets is improved	
OE7	After knowledge management systems are introduced, the capability to respond to new market demands is improved	

3.2 Sample

The unit of analysis is a company that has adopted a KMS. The sample of KMS adopting companies was obtained from a list of companies whose top managers have enrolled in business courses sponsored by Maeil business newspapers, company websites that indicate KMS development, business newspapers, and the top 1,000 organizations in Korea. The sample was composed of 800 firms. The chief knowledge officer (CKO) or chief information officer (CIO) was the company representative respondent.

A mail survey was used to collect the data and an Internet-based survey was also used to provide more convenience in the response. In order to increase the response rate and response accuracy, the researchers in this study also conducted phone and email survey. Furthermore, when the respondents had questions, they could call or send an email for clarification. The response sample included 120 responses: 101 responses were received through the mail survey and 19 responses were obtained through the Internet-based survey. The response rate was 15.2 percent. A total of 15 responses were excluded from the sample as these had missing values in certain items or the firm had not adopted a KMS. Thus, the final sample included 105 responses.

The industry distribution of the responding companies and the characteristics of respondents are presented in Tables III and IV. Table V provides the KMS functions and type of implementation.

4. Results

4.1 Measurement properties

This study assesses the measurement properties of the variables using the partial least squares (PLS) method, one of most widely used structural equation modeling (SEM) approaches in information system (IS) research. The reliability of the inherent variable and individual item is tested using internal consistency reliability (ICR) and Cronbach's α. ICR is the stability of the scale based on an assessment of its internal consistency of the constructs that measure the same latent variable for the collected data. The ICRs of the inherent

Table III Characteristics of responding companies

	Frequency	*Proportion (%)*
Industry type		
Steel, machinery, construction	23	22
Finance, insurance, stock	13	12
Distribution, transportation, service	10	10
Electrical and electronic engineering, telecommunication	21	20
Chemical, medical, food and beverage	24	23
Others	14	13
Total	105	100
Number of employees		
Less than 500	18	17
500- 1,000	35	33
1,000-5,000	38	37
More than 5,000	14	13
Total	105	100
Yearly gross sales		
Less than 50 billion won	1	1
50 billion-100 billion won	2	2
100 billion won-500 billion won	47	45
More than 500 billion won	55	52
Total	105	100

variables in this study are presented in Table VI. As the ICR and Cronbach's α is greater than 0.7, the inherent variables of this study exhibit sufficient reliability.

Convergent validity tests if all items measuring a construct cluster together and thereby form a single construct. The PLS uses confirmatory factor analyses to generate the factor loadings. The convergent validity can be ensured from the high values of average variance extracted (AVE), and specifically if the AVE is greater than 0.5 (or the square root of AVE is greater than 0.7). Table VII demonstrates that the square root of AVE for all latent variables exceeds 0.7. The convergent validity was investigated using the measurement model by finding whether the estimated parameters (loadings) of each construct are significant. Convergent validity is ensured if the loadings exceed 0.7 (Chin, 1998). All loadings in this study are greater than 0.7; furthermore, the high values of the AVE, loadings, and significant parameter estimates also indicate the presence of convergent validity.

The discriminant validity refers to the degree to which a latent variable differs from the other latent variables. Discriminant validity is ensured if the intercorrelations among the latent variables do not exceed the square root of the AVE (Chin, 1998). Table VII demonstrates the discriminant validity of the study measures because all intercorrelations among the latent variables are smaller than the square root of the AVE.

4.2 Hypotheses tests

The knowledge process capability is a second-order formative construct comprised of four dimensions and the value for the second-order construct is produced using the weights of the first-order construct (Chin *et al.*, 2003).

Table VIII suggests the weights and factor loading of the first-order construct for the second-order construct, and the correlations between the second-order construct and the other inherent variables. The weights for knowledge acquisition and knowledge application are 0.487 and 0.424, respectively, and these are greater than the weights of the other subprocesses. Thus, knowledge process capabilities are largely determined by knowledge acquisition and application. The factors in the KM infrastructure, KM intermediate outcome, and organizational performance are significantly related to the knowledge process capabilities. For instance, the correlation between knowledge process capabilities and creative organizational learning is 0.814.

Table IV Characteristics of respondents

	Frequency	*Proportion (%)*
Position		
Executives	3	3
Team Manager	46	44
Manager/assistant manager	41	38
Vice assistant manager	8	8
Others	7	7
Total	105	100
Department		
Planning/administration	27	25
Personnel/education	6	6
Research/development	4	4
Sales/marketing	6	6
IT	56	53
Others	6	6
Total	105	100
Age		
Less than 25	1	1
26-35	27	26
36-45	61	58
46-55	16	15
Total	105	100
Gender		
Male	97	92
Female	7	7
No response	1	1
Total	105	100
Number of working years		
Less than 5 years	23	22
5-10 years	26	25
10-15 years	19	18
More than 15 years	36	34
No response	1	1
Total	105	100

Table IX and Figure 2 presents the test results of the hypotheses. The effects of collaboration, learning culture, top management support, and IT support on knowledge process capabilities are significant. The variances explained by each inherent variables are over 60 percent and this indicates the explanatory power and validity of the structural model used in this study.

5. Discussion

Collaboration significantly affects knowledge process capabilities and this indicates that the culture of collaboration contributes to the creation of new knowledge by sharing experiences and knowledge among organizational members and by assisting others in performing tasks. The culture of collaboration facilitates the exchange of knowledge among organizational members, and the reorganization of knowledge for knowledge transfer and reuse.

The results of the study indicate, however, that the role of trust in knowledge process capabilities is relaxed and employees do not consider the relationship between trust and knowledge process capabilities as important. The learning culture has a positive effect on knowledge process capability and this indicates that the learning culture facilitates the acquisition of new knowledge and the creation of new knowledge from knowledge exchanges and experiences. This indicates that the learning culture has an indispensable relationship with KM as learning is the process of knowledge acquisition through knowledge

Table V KMS functions and the type of implementation

	Frequency	*Proportion (%)*
KMS functions[a]		
Knowledge register/sharing	88	84
Knowledge search/indexing	62	59
Knowledge agent	15	14
Corporate portal	42	40
Workflow	34	32
Electronic document management	57	54
E-learning systems	42	40
Groupware	98	93
Integration with legacy systems	47	45
Type of implementation		
Purchase of package	39	37
Development by IT department	26	25
Others (including outsourcing)	40	38
Total	105	100
Year of adoption		
Before 2000	24	23
2000-2001	32	30
2002-2003	28	27
2004-2005	21	20
Total	105	100

Note: [a]More than one response for each firm is possible

exchange, knowledge utilization, and the maintenance process of existing knowledge. A culture that promotes and facilitates learning has a strong influence on the capabilities of knowledge creation, acquisition, transfer, and application.

The results of the study, however, contradict the previous notion that ensuring autonomous decision making hierarchy will improve KM processes by facilitating active participation in organizational problem solving and the execution of necessary tasks. This indicates that the delegation of autonomous decision making rights does not lead to an increased chance to use individual creativeness, and thereby weakening the relationship between decentralization and the capability of knowledge acquisition and utilization. Furthermore, the decentralization of the organizational structure inappropriately increases competition among departments for short term performance and decreases the knowledge process activities for inter-departmental cooperation and learning.

Top management support has an strong effect on knowledge process capabilities, and this shows that top management has a strong influence on building organizational culture and norms (Schein, 1985), and that it has an equal effect on motivation in KM processes. The support from top management may not be required less after KMS and incentive systems are developed and completed. Knowledge acquisition and conversion processes are activities undertaken early in building KMS for accumulating organizational knowledge (Alavi and Leidner, 2001), and strong leadership from the CEO is required for these knowledge processes.

The effect of promotion on knowledge process capabilities is not supported and this contradicts the notion that promotion and incentive systems for times and effort spent in sharing knowledge may improve knowledge process capabilities by providing extrinsic benefits to organizational members. As the KMS is in the early stage of implementation, it leads to a weak relationship between promotion and knowledge process capabilities. The difference in recognition of extrinsic benefits that increase motivation for KM activities between top management and employees may also contribute to this weak relationship (Bock *et al.*, 2005).

Table VI Reliability and convergent validity

Inherent variables	*Items*	*Loadings*	*ICR*	*Cronbach's alpha*
Collaboration	CO1	0.779	0.944	0.922
	CO2	0.910		
	CO3	0.907		
	CO4	0.909		
	CO5	0.885		
Trust	TR1	0.856	0.936	0.913
	TR2	0.840		
	TR3	0.852		
	TR4	0.864		
	TR5	0.912		
Learning culture	LE1	0.802	0.933	0.908
	LE2	0.835		
	LE3	0.881		
	LE4	0.888		
	LE5	0.884		
Decentralization	DE1	0.773	0.921	0.892
	DE2	0.881		
	DE3	0.812		
	DE4	0.845		
	DE5	0.867		
Top management support	CE1	0.839	0.935	0.913
	CE2	0.836		
	CE3	0.918		
	CE4	0.844		
	CE5	0.876		
Promotion	RE1	0.700	0.925	0.899
	RE2	0.910		
	RE3	0.885		
	RE4	0.866		
	RE5	0.828		
IT support	IT1	0.848	0.940	0.920
	IT2	0.885		
	IT3	0.908		
	IT4	0.854		
	IT5	0.869		
Knowledge acquisition	PA1	0.864	0.934	0.911
	PA2	0.871		
	PA3	0.870		
	PA4	0.835		
	PA5	0.877		
Knowledge conversion	PC1	0.881	0.932	0.907
	PC2	0.878		
	PC3	0.790		
	PC4	0.910		
	PC5	0.807		
Knowledge application	PU1	0.827	0.941	0.920
	PU2	0.904		
	PU3	0.909		
	PU4	0.846		
	PU5	0.871		
Knowledge protection	PP1	0.744	0.925	0.899
	PP2	0.889		
	PP3	0.816		
	PP4	0.873		
	PP5	0.887		
Creative organizational learning	MB1	0.870	0.962	0.953
	MB2	0.920		
	MB3	0.921		
	MB4	0.933		
	MB5	0.898		
	MB6	0.874		
Organizational performance	OE1	0.841	0.958	0.949
	OE2	0.928		
	OE3	0.903		
	OE4	0.870		
	OE5	0.813		
	OE6	0.890		
	OE7	0.880		

Table VII Convergent and discriminant validity

Inherent variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*	*(13)*
Collaboration (1)	0.878												
Trust (2)	0.603	0.864											
Learning culture (3)	0.601	0.527	0.858										
Decentralization (4)	0.543	0.498	0.577	0.837									
Top management support (5)	0.565	0.452	0.487	0.518	0.862								
Promotion (6)	0.493	0.420	0.568	0.553	0.687	0.845							
IT support (7)	0.401	0.477	0.537	0.503	0.488	0.520	0.871						
Knowledge acquisition (8)	0.506	0.432	0.639	0.525	0.616	0.597	0.573	0.859					
Knowledge conversion (9)	0.497	0.380	0.427	0.396	0.573	0.566	0.467	0.642	0.856				
Knowledge application (10)	0.557	0.439	0.622	0.507	0.499	0.487	0.584	0.665	0.703	0.872			
Knowledge protection (11)	0.381	0.279	0.406	0.437	0.441	0.517	0.547	0.581	0.584	0.618	0.844		
Creative organizational learning (12)	0.610	0.513	0.631	0.552	0.582	0.605	0.624	0.732	0.666	0.762	0.574	0.900	
Organizational performance (13)	0.552	0.459	0.592	0.516	0.573	0.577	0.508	0.636	0.600	0.702	0.532	0.815	0.876

Note: The diagonals represent the square root of the average variance extracted

Table VIII Weights, factor loadings, and correlations for a second-order construct of knowledge process capability

	Correlations	*Weights*	*Factor loadings*
Inherent variables			
Collaboration	0.605		
Trust	0.490		
Learning culture	0.647		
Decentralization	0.578		
Top management support	0.625		
Promotion	0.638		
IT support	0.654		
Creative organizational learning	0.814		
Organizational performance	0.745		
First-order construct			
Knowledge acquisition		0.487	0.913
Knowledge conversion		0.137	0.809
Knowledge application		0.424	0.903
Knowledge protection		0.085	0.721

Table IX Test results of structural model

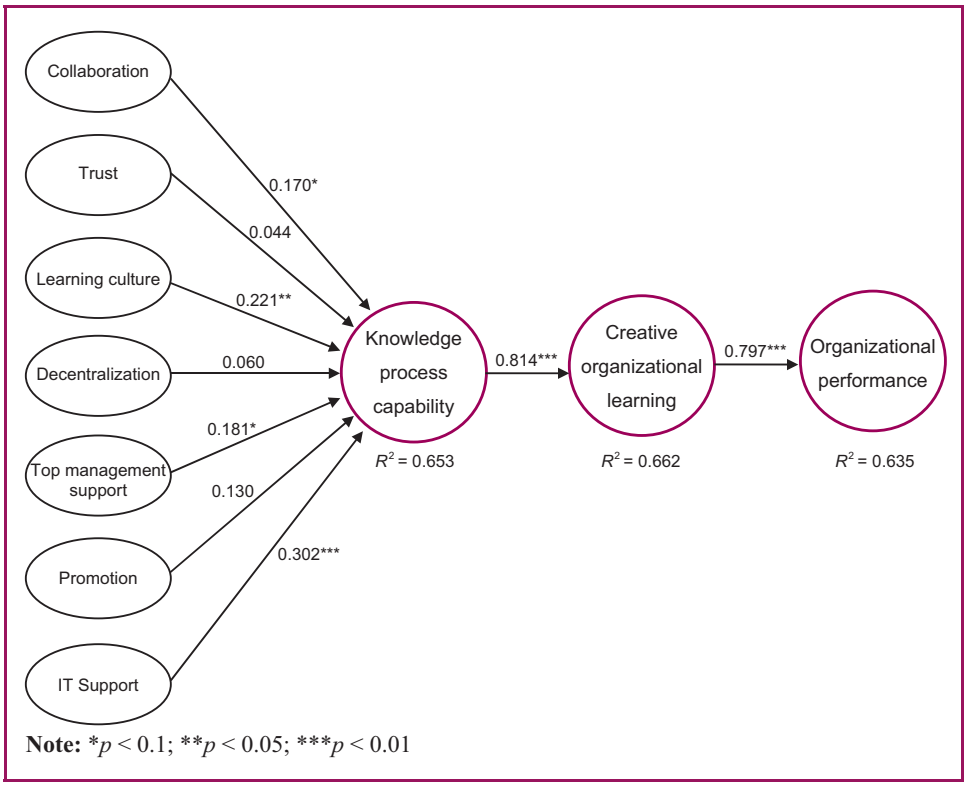
Hypotheses		*Path coefficient*	t-*value*	*Results*
H1	Collaboration → knowledge process capability	0.170*	1.647	Accepted
H2	Trust → knowledge process capability	−0.044	0.524	Rejected
H3	Learning culture → knowledge process capability	0.221**	2.475	Accepted
H4	Decentralization → knowledge process capability	0.060	0.681	Rejected
H5	Top management support → knowledge process capability	0.181*	1.782	Accepted
H6	Promotion → knowledge process capability	0.130	1.271	Rejected
H7	IT support → knowledge process capability	0.302***	4.011	Accepted
H8	Knowledge processes → creative organizational learning	0.814***	22.558	Accepted
H9	Creative organizational learning → organizational performance	0.797***	17.932	Accepted

Notes: *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

IT support has a strong effect on knowledge process capabilities as it contributes to the creation and sharing of knowledge with smaller costs and is a critical element in KM (Alavi and Leidner, 2001). The study results support the notion of previous studies that IT improves KM processes which in turn affects organizational learning and performance (Handzic, 2004). The KMS that facilitates the creation of new knowledge and updating knowledge enhances the opportunity to create learning (Malhotra, 2004). The results of this study demonstrate the role of the KMS in improving creative organizational learning rather than the role of efficiency.

This study shows that the KM processes can mediate between factors in the KM infrastructure (i.e. collaboration, learning culture, and IT support), and creative organizational learning. These results agree with Lee and Choi (2003) who demonstrated that the knowledge creation process is a mediator between KM enablers (such as collaboration, trust, learning, and decentralization), and organizational creativity. The results of the study demonstrate that IT support has the most crucial role in knowledge process capabilities. This supports the results from previous studies that KM processes based on IT enhance the breadth and depth for knowledge creation, transfer, and application (Alavi and Leidner, 2001).

Figure 2 Test of structural model



Aligning with the previous studies that proposed creative learning as a predecessor of organizational performance (Pfeffer, 2005; Tiwana, 2002), this study demonstrates that creative organizational learning positively affects organizational performance. While Lee and Choi (2003) introduced organizational creativity as a predecessor for organizational performance, this study considers organizational creativity as part of organizational effectiveness, which is a concept of organizational performance and is a direct and ultimate effect of KM (Gold *et al.*, 2001).

The significant effect of creative organizational learning on organizational performance demonstrates that organizational learning is a KM intermediate outcome that exists between the knowledge process capabilities and organizational performance, which supports the results of Lee and Choi (2003) who posited that organizational creativity mediates the relationship between the knowledge creation process and organizational performance. Knowledge process capabilities affect organizational performance through their effects on creative organizational learning, and this agrees with Gold *et al.* (2001) who state that knowledge process capabilities are related to organizational effectiveness. Organizational performance depends on the extent to which the knowledge process capabilities increase organizational learning.

6. Implications

6.1 Implications for practitioners

This study can provide KM managers and practitioners with guidelines and implementation strategies for KMS by examining cultural, structural, management, and IT related factors. The accumulation of knowledge is inseparable from companies' activities: the products and services provided by companies are dependent upon the unique method that combines companies' tangible resources, and this is the role of KM. The continuous learning and experiments are necessary in order to produce new ideas and products: it is critical to

emphasize the importance of an KM infrastructure that supports and encourages learning in organizations.

The enterprise-wide enhancements of collaboration are more effective than facilitating collaboration within departments through decentralization. Top management support promotes the organizational culture and motivation for KM. In particular, top management support has a strong effect on the process of acquiring organizational knowledge and building initial knowledge repositories for knowledge sharing and utilization.

Furthermore, IT is the core infrastructure of KM and IT support is the most crucial factor in determining knowledge process capabilities. While human factors remain important in KM activities, IT based methods cannot be underestimated. It is not meaningful to separate the disparate views of human factors and IT factors; rather, it is necessary to suggest how various tools appropriately support content-based or collaborative-based systems (Alavi *et al.*, 2005).

The creative learning in turn affects organizational performance indicating that without learning, organizations cannot overcome the boundary of old business practices and adjust to change in environments. The tasks of knowledge work are less determined and planned in advance than other work. In order to manage rapid change and global competition in business environments, knowledge workers should create new business opportunities and continuously question what and how they can contribute to these chances. Organizational KMS should support the learning processes of their knowledge workers.

Knowledge acquisition, conversion, application, and protection should be performed in accordance with enterprise-wide plans and visions in order to optimize knowledge capabilities. The four KM subprocess should be consistently managed by the KM department under careful plans of the KM organizational learning and e-business focusing on improving enterprise-wide knowledge process capabilities rather than specific parts of the KM subprocess.

6.2 Implications for researchers and limitations

Using a holistic view of the KM performance framework, this study has provided insights to KM for researchers because it explains the integrated aspects of KM performance by examining the relationships between the KM infrastructure, knowledge process capabilities, and organizational outcomes. By introducing the knowledge process capability construct, this study found that the KM infrastructure is composed of cultural, structural, management, and technology related factors which have effects on the creative organizational learning and organizational performance through the mediation of knowledge process capabilities that exploit balanced and cyclic views of knowledge processes.

Although this study provides interesting results regarding KM, the results should be interpreted in light of the study's limitations and provide some future directions for research. First, this study adopts a snapshot research method that does not consider feedback effects, and the posited causal relationships were only inferred rather than proven. These limitations can be overcome through a longitudinal study to investigate the longitudinal changes in the relationships. Second, the sample is based on Korean firms. Because the collections were limited to organizations in a highly collectivist national culture, any attempt to generalize the results to other countries with distinctly different national cultures should be proceeded with caution. Third, the study cannot be free from the potential of response bias associated with the ''single informant''. While such practice is widely used in survey research, it is not an ideal method of data collection. In order to acquire the most accurate data regarding KM infrastructure, processes, and performance, multiple informants and structured methods of triangulations would be beneficial.

7. Conclusion

This study integrates the theory of organizational strategy, IT, and organizational learning in order to build an integrated model for KM that examines the relationship between KM infrastructure, knowledge process capability supported by KMS, creative organizational

learning, and organizational performance. The results of this study indicate that collaboration, learning culture, top management support, and IT support affect the knowledge process capabilities. Knowledge process capabilities and creative organizational learning in turn mediate the relationship between KM infrastructure and organizational performance, which demonstrate the relevance of KM infrastructure for organizational performance.

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About the authors

Sangjae Lee is a Professor at the College of Business Administration in Sejong University. He received his PhD in Management Information Systems from the Graduate School of Management, KAIST. His research interests include decision support systems, electronic commerce, information systems controls, data mining, and IS planning. He has published in such journals as *Decision Support Systems* and *Information and Management*. Sangjae Lee is the corresponding author and can be contacted at: sangjae@sejong.ac.kr

Byung Gon Kim is an Associate Professor of Business Administration at Namseoul University, Cheonan, Korea. He has been on the faculties of Andong National University. He received his MS and PhD in Management Information Systems from Kyungpook National University, Taegu, Korea. He has published in journals such as *Expert Systems with Applications*, *Electronic Commerce Research and Applications*, *Computers in Human Behavior*, and *Data Base*.

Hoyal Kim is working as an auditor of information systems and he taught MIS courses at the college before that. He received his PhD in Management Information Systems. His research interests include managing knowledge, mental models, and human computer interaction. He has published several papers in journals and books.