KNOWLEDGE MANAGEMENT AND ORGANIZATIONAL PERFORMANCE

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ABSTRACT

Because of the increasing interests on knowledge management (KM), various researches have been accomplished. However, most researches are investigated within the conceptual framework. As a result, these studies are not likely to give substantial benefits for the firms which attempt to introduce KM. Therefore, it is necessary to shift the focus of KM to the empirical researches. To meet this requirement, this study focuses on the following objectives. First, this research analyzes the current research frameworks and finds their relationship. The research model is built by incorporating KM processes into organizational performance. Second, to analyze correlation between firm's internal activities for KM and organizational performance, the various measures are identified for the empirical study. Third, it shows the relationship between KM processes and influencing factors such as organizational structure, organizational culture, and information technologies.

KEYWORDS
Knowledge management, Knowledge management process, Organizational performance

1. Introduction

In the past few years, the interests in knowledge management (KM) have grown rapidly, and various researches have performed. Despite all these activities and prospectives, KM still remains hazy to many people [19]. There are two reasons. First, there is no generic framework that unifies KM concepts. Although many researchers and consulting companies have their own KM framework, there is no individual KM framework that subsumes the others [17]. Second, there are no integrated empirical studies on KM. Previous researches show only relationship between KM influencing factors and KM processes or show only relationship between KM processes and organizational performance [6].

The purpose of this research is to show the relationship between KM and organizational performance. This approach can help understand major KM components and establish some practical guidelines for each company that struggles to introduce KM.

2. KM Framework

Holsapple and Joshi [17] classified KM frameworks into descriptive and prescriptive frameworks. In this research, we investigated twenty descriptive KM frameworks. We classified KM frameworks into broad frameworks that focus on whole KM processes and specific frameworks that focus on specific processes in KM (shown in Table 1).

Broad KM Framework

There are many broad KM frameworks in academia. Choo [7] described the principal ways in which an organization

uses information strategically, and those were sensemaking, knowledge creation, and decision making. Pan and Scarbrough [28] addressed socio-technical view of KM by highlighting the experience of Buckman Laboratories. Probst [31] tried to define the standard for KM concept or model that have basic aspects such as compatibility, problem orientation, comprehensibility, action orientation, and appropriate instrument. Schuppel et al [34] described four bipolar dimensions for forming KM. Along with the bipolar dimension, they create options and install instruments for KM tailored to the specific situation of the focal organization. Demarest [11] discussed KM as a new discipline and defined the relationship between KM and traditional measures of firm performance. Van der Spek and Spijervet [39] described the core of KM as a learning process of conceptualizing, assessing, acting on, and evaluating alternates in cycles. Pentland [29] introduced a framework for the analysis of organizations as knowledge systems composed of a collection of knowledge processes. Wiig [43] illustrated KM framework as being supported by three pillars that are exploring the knowledge management and its adequacy, establishing the value of knowledge, and managing knowledge explicitly.

Arthur D. Little [3] proposed a process for introducing KM based on four integrated dimensions of KM. They insisted that KM include both codifying tacit knowledge for broader access and applying explicit knowledge for gaining mastery. Delphi [11] has constructed a knowledge chain. They represented the organization's ability to develop its internal and external awareness and responsiveness. Ernst & Young [14] proposed KM framework that linked knowledge to business results and values. KPMG [20] presented knowledge cycle that helped identifying knowledge problems and solutions in organization. Arthur Anderson and APQC [2] designed to capture tacit knowledge and make it explicit for all individuals within an organization.

Specific KM Framework

Leonard [22] introduced knowledge-building activities framework. These activities create and control the knowledge necessary for organization's current and future operations. Nonaka and Takeuchi [24] proposed five-phase model of the organizational knowledge creation process. They assumed that knowledge was created through the interaction between tacit and explicit knowledge. Szulanski [38] proposed knowledge transfer process through analyzing internal stickiness. This model suggested knowledge transfer processes that were made up of initiation, implementation, ramp-up, and integration. Jang and Lee [18] suggested knowledge creating organizational memory model focusing on knowledge creation based on Asian Yin Yang theory. Wijnhoven [44] proposed framework for organizational memory contents and means for storing organizational knowledge. Stewin and Zwass [37] developed a model for an organizational memory information system that was rooted within the context of organizational effectiveness. Walsh and Ungson [40] proposed a structure of organizational memory which referred to the stored information from organization's history that could be brought to bear on present decisions.

Research scope		Researcher
Broad Framework	Academic research	Choo [7], Pan and Scarbrough [28], Probst [30], Schuppel et al [34], Demarest [11] , Van der Spek and Spijervet [39], Pentland [29], Wiig [43]
	Practical research (Consulting co.)	Arthur D. Little [3], Delphi group [10] Ernst & Young [14], KPMG [20], Arthur Anderson and APQC [2]
Specific Framework	Knowledge Creation	Leonard [1995], Nonaka and Takeuchi [24]
	Knowledge Transferring	Szulanski [38]
	Knowledge Storing	Jang and Lee [18], Wijnhoven [44], Stein and Zwass [37], Walsh and Ungson [40]

Table1. Classification of KM frameworks

Comparative Analysis on KM Processes and Knowledge Influencing Factors

We classified influencing factors into strategy, knowledge content, organizational, and technological context. Organizational context includes organizational structure, organizational culture, and organizational people (shown on Table 2). The comparative analysis revealed several distinguished observations in influencing factors. First, many researches do not consider strategy in KM [7, 18, 30, 40, 43, 44] although an organization's strategic context helps

identify KM initiatives that support its purpose or mission, strengthen its competitive position, and create shareholder value. Second, most researchers referred to the importance of organizational context. N-form or hypertext organization is an example of organizational structure in KM [16,24]. Many researches also showed culture to be the principal determinant of the success of KM. Third, knowledge creation frameworks and transfer frameworks excessively disregard the information technology although it is important in KM [31]

Author \ Context	Strategy	Knowledge Content	Organization	Technology
Choo	N/A	N/A	N/A	N/A
Pan & Scabrough	Strategy		Culture, Organizational learning, Measurement	Technology
Probst	N/A	N/A	Top management support, Organizational structure, Culture	N/A
Schuppel et al	N/A	N/A	N/A	N/A
Demarest	N/A	Organizational knowledge	Cultural, Operational	Technical
Van der Spek & Spijervet	N/A	N/A	Organization and personnel, Culture, Motivation, Management	IT
Pentland	N/A	N/A	Social interaction	N/A
Wiig	N/A	Organizational knowledge	Task/process, People, Structure, Power	N/A
Arthur D. Little	Strategy	Content	Culture, KM process	IT
Delphi	Strategy	N/A	Culture, KM process	IT
Ernst & Young	Strategy	Content	Culture, KM process	IT
KPMG	Strategy	N/A	Culture, KM process	IT
AA & APQC	Strategy	Content	Culture, KM process, Leadership, Evaluation	IT
Leonard-Barton	Strategic intent	N/A	Signature skill, Creative abrasion, Continuous abrasion, Information-porous boundaries, Information, redundancy, Requisite variety	N/A
Nonaka & Takeuchi	Organizational intent	N/A	Autonomy, Fluctuation and creative chaos, Information redundancy, Requisite variety	N/A
Szulanski	N/A	Knowledge content	Source and recipient, Context	N/A
Jang & Lee	N/A	N/A	N/A	N/A
Wijnhoven	Strategy	N/A	Individual, Culture, Transformation, Structure, Ecology, External archives	System
Stein & Zwass	N/A	N/A	N/A	N/A
Walsh & Ungson	N/A	N/A	Individual, Culture, Transformation, Structure, Ecology, External archives	N/A

Table 2. Comparing KM Influencing Factors

Comparing KM processes showed two interesting observations (in Table 3). First, knowledge store process in knowledge creation and transfer frameworks has received little attention comparatively. However, knowledge store process is very important for KM. Second, there has been little attention to tacit knowledge in knowledge store frameworks.

Author \ Context	Creation	Store	Share	Use
Choo	Knowledge creation	Sense making	Knowledge creation	Decision making
Pan & Scabrough	Generation	Processing, Storage	Dissemination	Use/reuse
Probst	Identification, Acquisition, Development	Preservation	Distribution	Use
Schuppel et al	Development and acquisition, Institutionalization	N/A	Transfer	Use and multiplication
Demarest	Construction	Embodiment	Embodiment, Dissemination	Use
Van der Spek & Spijervet	Developing	Holding	Distributing	Combining
Pentland	Construction	Organization	Distribution	N/A
Wiig	Creation	Manifestation	Transfer	Use
Arthur D. Little	Identify (Creation)	Save	Disseminate	Use
Delphi	Externalization, Internalization	Externalization, Internalization	Intermediation	Cognition
Ernst & Young	Acquire	N/A	Apply	Apply
KPMG	Create, Learning	Encapsulation (Record), Source	Share (Dissemination)	Apply, Exploitation
AA & APQC	Create (Identify)	Collect, Adapt, Organize	Share	Apply
Leonard-Barton	Shared problem solving, Experimenting and prototyping, Implementing, Importing	N/A	Shared problem solving, Experimenting and prototyping, Implementing, Importing	N/A
Nonaka & Takeuchi	Socialization, Externalization, Combination, Internalization	N/A	Socialization, Externalization, Combination, Internalization	N/A
Szulanski	N/A	N/A	Initiation, Implementation, Ramp-up, Integration	N/A
Jang & Lee	Creation	Codification	Share	Use
Wijnhoven	Acquisition	Retention, Maintenance	Dissemination	Retrieval
Stein & Zwass	Acquisition	Retention, Maintenance	N/A	Retrieval
Walsh & Ungson	Acquisition	Retention, Maintenance	N/A	Retrieval

Table 3. Comparing KM Processes

3. Empirical Study

Previous Empirical Research in KM

In this paper, we focused on creation and sharing process on the basis of these three reasons. First, the creation and share of knowledge has been emerging as one of the most important and widespread practical management issues of the latter half of the 1990s [22, 38, 46]. Second, there are some objective measurements in this area. Third,

knowledge creation and sharing are affected by various influencing factors. The comparison of previous empirical studies yielded some observation. First, there were no integrated empirical studies on KM. Second, there were few empirical studies on organizational performance in KM. Third, most empirical researches did not consider strategy in KM.

Authors \ Criteria	Influencing Factore				KM Processes		Org. Performance
	Strategy	Content	Org.	IT	Create	Share	
Bock [5]		●	●			●	
Hansen [15]		●	●			●	
Drew [13]	●		●			●	●
Simonin [36]		●					●
Amabile et al. [1]			●				
Bierly & Chakrabrti[4]	●						●
Massetti [23]				●	●		
Oldham & Cummings[27]			●		●		
Szulanski [38]		●	●			●	
Zander & Kogut[46]		●	●			●	
Couger [8]			●		●		
Nonaka et al. [25]					●		
Reed & DeFillipi[32]		●				●	
This study			●	●	●	●	●

Table 4. Comparative analysis of previous empirical study

Amabile et al [1] developed new instrument, KEYS, designed to assess perceived stimulants and obstacles to creativity in organizational work environments. Oldham and Cummings [27] examined the independent and joint contributions of employees' creativity relevant to personal characteristics of organizational context to employees' creativity. Nonaka et al [25] conducted confirmatory factor analysis to test Nonaka's organizational knowledge creation model. Masseti [23] insisted individual creativity support system have positive influence on individual and organizational creativity. Couger [8] measured the climate for creativity of the representative in IS organization based on the work environment inventory.

Bock [5] proposed the theoretical framework for knowledge sharing behavior on the basis of the theory of reasoned action. Hansen [15] combined the concept of weak ties from social network research with the notion of complex knowledge to explain the role of weak ties in sharing knowledge across organization subunits in a multiunit organization. Szulanski [38] suggested that characteristics of knowledge, characteristics of sources of knowledge, characteristics of recipients of knowledge, and characteristics of organizational contexts influenced on knowledge transfer process. Zander and Kogut [46] showed that the degree of codification and the degree of teachability had significant influence on the speed of transfer.

Drew [13] presented results of a research study into benchmarking and its links to improvements in organizational performance. In his research, he used self-reported measures of organizational performance. Simonin [36] proposed a model of how firms learn from their strategic alliance. He tested the relationship between collaborative experience and collaborative know-how, and between collaborative know-how and the achievement of both tangible and intangible performance. Bierly and Chakrabarti [4] tried to identify groups of firms with similar generic knowledge strategies, determine how these strategies change over time, and compare profit margins of the group. The summary of previous empirical studies on KM is shown on Table 5.

Focus \ Criteria	Authors	Characteristic
Creation	Amabile et al [1]	Developed new instrument for organizational creativity
	Couger [8]	Climate for creativity in IS organization
	Massetti [23]	Individual creative support system positive influence on idea generation
	Nonaka et al [25]	Test Nonaka's creation model
Share	Bock [5]	Theoretical framework for sharing behaviors
	Hansen [15]	Role of weak ties in sharing knowledge
	Zander and Kogut [46]	Codifiability and teachability
	Reed and DeFillippi [32]	Causal ambiguity and imitation
	Szulanski [38]	Knowledge transfer
Performance	Drew [13]	Benchmarking as knowledge acquisition solution
	Simonin [36]	Collaborative experience and know-how
	Bierly and Chakrabarti [4]	Generic knowledge strategies

Table 5 Empirical study in KM

Research Model and Its Hypotheses

The objective of this study is to propose integrative view of KM by identifying the relationship between KM and organizational performance. We suggested a research model as shown on Figure 1 based on input-process-output model. Influencing factors affect organizational performance through KM process. However, we did not consider all influencing factors and KM processes because of limited time and cost. Out of the influencing factors of KM, we selected organizational context and technology context. We also selected creation and sharing in KM processes.

Influencing Factors
of Knowledge Management

Organizational
Context
- Structure
  • Formalization
  • Centralization
- Culture
  • Collaboration
  • Trust
  • Learning and
    development
- People
  • T-shaped skill of members

Technological
Context
- Information Technology
  • Support of IT

Knowledge Management
Process

Process

- Creation
  • Creation process
- Sharing
  • Transfer process

Organizational
Performance

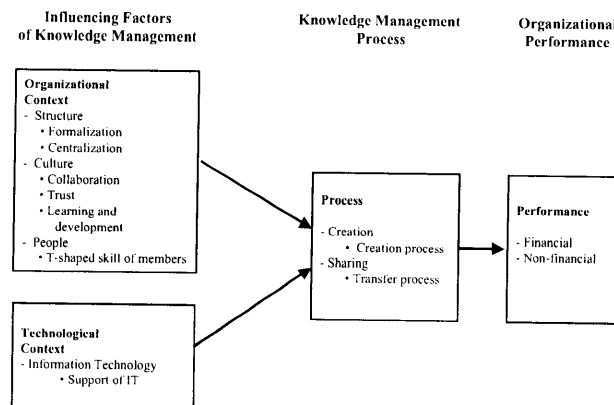Performance

- Financial
- Non-financial

Figure 1. Research model of KM

For KM processes, we adopted and modified Nonaka's construct for measure knowledge creation process and Szulanski's construct for measure knowledge sharing process.

KM is related to organization structure [16, 26]. It has profound implication for organizational structure [24]. Two of the most common dimensions of structural frameworks are centralization and formalization. Centralization refers to the locus of decision authority and control within an organizational entity. Formalization refers to the degree to which decisions and working relationships are governed by formal rules, standard policies, and procedures. Centralization and formalization are the important variables in our study.

H1a: There is a negative relationship between centralization and knowledge creation.
H1b: There is a negative relationship between centralization and knowledge sharing.

H2a: There is a negative relationship between formalization and knowledge creation.
H2b: There is a negative relationship between formalization and knowledge sharing.

Most researches have shown culture to be the principal determinant of the success of KM [26, 9, 24]. Concerned with cultural factors, support and collaboration reduces fear and increases openness and therefore encourages new ideas and risk taking [35]. Collaboration is also one of the fundamental problems of sharing knowledge [21]. Support and collaboration is the degree to which people in the group actively help one another in their work. Trust is critical in a cross-functional or an interorganizational team, because the withholding of information by the lack of trust can be especially harmful to the processes of knowledge articulation, internalization, and reflection [21]. Learning and development is one of important factors in KM. Learning and development is the degree to which learning and development is encouraged in an organization. Therefore, collaboration, trust, and learning and development are the important variables in our study.

H3a: There is a positive relationship between collaboration and knowledge creation.
H3b: There is a positive relationship between collaboration and knowledge sharing .
H4a: There is a positive relationship between trust and knowledge creation.
H4b: There is a positive relationship between trust and knowledge sharing.

H5a: There is a positive relationship between learning &development and knowledge creation.
H5b: There is a positive relationship between learning &development and knowledge sharing.

People is one of the most important influencing factor in KM. Among the components related with people, skills and knowledge embodied in employees are the dimension most often associated with KM. People who have T-shaped skills are extremely valuable for managing the integration of very diverse knowledge sets [22]. T-shaped skill of organizational people is an important variable in this study.

H6a: There is a positive relationship between T-shaped skill and knowledge creation.
H6b: There is a positive relationship between T-shaped skill and knowledge sharing.

Technology context is the existing information technology infrastructure and capabilities supporting the KM architecture [45]. Information technology is pervasively used in organizations, and so qualifies as a natural medium for flow of knowledge. Therefore, support of information technology is an important variable.

H7a: There is a positive relationship between support of information technology and knowledge creation.
H7b: There is a positive relationship between support of information technology and knowledge sharing .

To measure organizational performance in KM, we selected financial measurement to measure organizational performance because of easiness and objectivity. For financial measure, we adopt return of invest (ROI). We also adopted subjective measurement to measuring organizational performance. Subjective measurement is self-reported one of organizational performance [12,13].

H8a: There is a positive relationship between knowledge creation and nonfinancial performance.
H8b: There is a positive relationship between knowledge sharing and nonfinancial performance.
H8c: There is a positive relationship between knowledge creation and financial performance.
H8d: There is a positive relationship between knowledge sharing and financial performance.

4. Research Design

Research constructs are operationalized based on pretest, the related literature reviews and various theories. For the questionnaire, the multiple-item method was used and each item was based on 6 point Likert scale form 'very low' to 'very high'. We used multiple regression method to test the gathered data.

The unit of analysis in this study was organization. For this study, we selected 200 organizations in Korea as a convenience sample. At our request, these organizations identified the representatives in charge of the firm's KM project or similar project. We focused on the middle managers that were emphasized in Nonaka and Takeuchi [24]. The survey was performed by mail survey in parallel with visiting. We collected 75 questionnaires, but three were not appropriate for our study. In sum, we collected 72 valid respondents.

Since each variable was measured by the multi-item constructs, factor analysis with varimax was conducted to check the unidimensionality among the items. Analysis was performed on the 26 items that measured the components of KM processes, on the 43 items that measured the components of influencing factors, and on the 6 items for nonfinancial performance and return on investment (ROI) for financial performance. Items with factor loading values lower than 0.5 were abandoned for further analysis. Among them, 7 items related to KM process and influencing factor had loading of less than 0.5 or had item-to total correlation less than 0.4 was dropped. There was one item with factor loading of lower than 0.5 for organizational performance.

5. Results

Testing the Hypothesis

For the organizational structure factors, we found that centralization was a significant predictor of knowledge sharing (β=-0.266, p <0.01), which support H1b. However, formalization was not significantly related to the KM processes. Thus H2 was not supported. For the organizational culture factors, collaboration, learning and development, and trust had significant positive influence on knowledge creation, which support H3a, H4a, and H5a. Contrary to knowledge creation, only collaboration had significant effect on knowledge sharing. That is to say, learning & development and trust was not significant in knowledge sharing. For the information technology factors, there was no significant effect on both knowledge creation and sharing. As proposed in hypothesis 8, the KM processes showed strong positive relationship with nonfinancial performance. The knowledge creation also had positive relationship with financial performance (β=0.240, p <0.01). The strength of this association indicated a very significant relationship between KM processes and organizational performance (shown on Table 6).

Hypotheses	S. beta	t-value	Results
H1a: Centralization and knowledge creation	-0.122	-1.135	Reject
H2a: Formalization and knowledge creation	-0.073	-0.815	Reject
H3a: Collaboration and knowledge creation	0.250	2.283	Not Reject
H4a: Learning & development and knowledge creation	0.238	2.460	Not Reject
H5a: Trust and knowledge creation	0.342	3.270	Not Reject
H6a: T-shape skill of organizational people and knowledge creation	-0.086	-0.894	Reject
H7a: Support of IT and knowledge creation	0.044	0.446	Reject
H8a: Knowledge creation and nonfinancial performance	0.530	5.226	Not Reject
H8c: Knowledge creation and financial performance	0.240	2.065	Not Reject
H1b: Centralization and knowledge sharing	-0.266	-2.122	Not Reject
H2b: Formalization and knowledge sharing	-0.124	-1.203	Reject
H3b: Collaboration and knowledge sharing	0.392	3.092	Not Reject
H4b: Learning & development and knowledge sharing	0.148	1.329	Reject
H5b: Trust and knowledge sharing	0.277	2.292	Not Reject
H6b: T-shape skill of organizational people and knowledge sharing	-0.073	-0.651	Reject
H7b: Support of IT and knowledge sharing	0.025	0.222	Reject
H8b: Knowledge sharing and nonfinancial performance	0.481	4.586	Not Reject
H8d: Knowledge sharing and financial performance	0.138	1.166	Reject

Table 6. Result for hypotheses

Findings and Implications

In the relationship between KM processes and organizational performance, we found that knowledge creation and knowledge sharing are significant predictors of organizational performance. The findings of this study indicate that KM processes are significant predictors for both nonfinancial and financial performance of organization. That is, organization can achieve strategic, economic benefits of KM from effective KM processes such as creation and sharing. In the relationship between KM processes and influencing factors, variables such as organizational structure and organizational culture are found to be significant in predicting the KM processes. When organizational culture variables have high values, the KM is likely to be greater. Centralization was found to be negatively related to the knowledge sharing. Factors such as perceived importance of information technology and support of information technology were not significantly related to the KM.

The nonsignificant findings in the pilot study bear discussion. In general, we expect that the technological contexts have positive relationship with KM. However, the study indicated that these contexts were not significantly related to the KM. These results may reflect the stage of KM in Korea. Since KM is in the introduction stage in Korea, many firms may have not considered technology context yet. Relationship between knowledge sharing and nonfinancial measure may reflect the unique economy environment in Korea between 1997 and 1998. During this period, Korea

had experienced the IMF. Therefore, many financial measures have great fluctuation. This implies that financial measure may not be stable.

6. Conclusion

We present an integrated view for KM frameworks and report results of relationships among KM influencing factors, KM processes, and organizational factors. There are several contributions in this paper. First, a theoretical framework is provided for empirical study on KM. Second, the relationship between KM processes and organizational performance is addressed. Third, this study attempts to find the relationships between influencing factors and each KM process such as socialization, externalization, combination and internalization.

In spite of the interesting implications, this study has the limitations as follows. First, this study is the snapshot research that did not consider the feedback effects. Second, we surveyed one individual in each organization. Even if we tried to avoid response bias through careful questionnaire design, we are not totally free from such bias. Finally, the results from this survey were limited to Korean firms. Therefore, the results of this study may have to be carefully interpreted.

REFERENCE

1. Amabile, T., Conti, R., Coon, H., Lazeby., and Herron, M. (1996), " Assessing The Work Environment for Creativity," *Academy of Management Journal*, Vol. 39, No. 5, pp. 1154-1184
2. Arthur Anderson and The APQC (1996), The Knowledge Management Assessment Tool
3. Arthur D. Little (1998), "Knowledge Management: Reaping the Benefits," *Prism*, Second Quarter
4. Bierly, P. & Chakrabarti, A. (1996), "Generic Knowledge Strategies in the U.S. Pharmaceutical Industry," *Strategic Management Journal*, Vol. 17 (Winter Special Issue), pp. 123~135
5. Bock, G. (1999), "Determinants of Knowledge Sharing in an Organization: The Theory of Reasoned Action Perspective," Working paper in KAIST
6. Choi, B., and Lee, H. (1999), " Business Process-Based Knowledge Management," 2nd *Knowledge Management Symposium*, pp. 261-291
7. Choo, C. (1998) "The Knowing Organization: A Process Model of Knowledge Management," (http://choo.fis.utoronto.ca)
8. Couger, J. (1994), "Measurement of the Climate for Creativity in IS Organizations," *Proceedings of the 27th Hawaii International Conference on System Sciences*, pp. 351-357
9. Davenport, T.H., Long, D., and Beers, M.C. (1998), "Successful Knowledge Management Projects," *Sloan Management Review*, Winter, pp.43-57
10. Delphi Group, Inc. (1997), "Delphi on Knowledge Management: Research & Perspectives on Today's Knowledge Landscape," (www.delphigroup.com)
11. Demarest , M. (1997), "Understanding Knowledge Management," *Long Range Planning*, Vol. 30, No. 3, pp. 374-384
12. Deshpande, R., Jarley, U., and Webster, F. (1993) "Corporate Culture, Customer Orientation, and Innovativeness in Japanese Firms : A Quadrad Analysis," *Journal of Marketing*, Vol. 57, January, pp. 23-37
13. Drew, S. (1997), "From Knowledge to Action: the Impact of Benchmarking on Organizational Performance," *Long Range Planning*, Vol. 30, No. 3, pp. 427-441
14. Ernst & Young (1998), *Consulting Methodology for Knowledge Management*, Ernst & Young Management Consulting
15. Hansen, M. (1999), "The Search-Transfer Problem: The Role of Weak Ties in Sharing Knowledge across Organization Subunits," *Administrative Science Quarterly*, Vol.44, pp.82-111
16. Hedlund, G. (1994) "A Model of Knowledge Management and the N-Form Corporation," *Strategic Management Journal*, Vol. 15, pp. 73-90

17. Holsapple, C. W., and Joshi, K.D. (1999), "Description and Analysis of Existing Knowledge Management Frameworks," *Proceedings of the 32nd Hawaii International Conference on System Sciences*, pp.1-15
18. Jang, J., and Lee, H. (1998), "Knowledge Architecture for Knowledge Creating Organizational Memory," *1st Knowledge Management Symposium*, pp. 211-235

19. Junnarkar, B. (1997), "Leveraging Collective Intellect By Building Organizational Capabilities," *Expert Systems With Applications*, Vol.13, No.1, pp.29-40

20. KPMG (1998), The Power of Knowledge: A Client Business Guide, *KPMG Consulting (kpmg.interact.nl)*

21. Krogh, G. (1998), "Care in the Knowledge Creation," *California Management Review*, Vol. 40, No.3, pp. 133-153

22. Leonard, B.D. (1995) *Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation*, Boston, Massachusetts, Harvard Business School

23. Massetti, B. (1996), " An Empirical Examination of the Value of Creativity Support Systems on Idea Generation," *MIS Quarterly*, Vol. 20, No. 1, pp. 83-97

24. Nonaka, I. and Takeuchi, H. (1995), *The Knowledge Creating Company*, New York, Oxford university press

25. Nonaka, I., Byosiere, P., and Konno, N. (1994), "Organizational Knowledge Creation Theory: A First Comprehensive Test," *International Business Review*, Vol.3, No. 4, pp. 337-351

26. O'Dell, C., and Grayson, J. (1998), "If Only We Knew What We Know: Identification and Transfer of Internal Best Practices," *California Management Review*, Vol. 40, No.3, pp.154-174

27. Oldham, G., and Cummings, A. (1996), "Employee Creativity: Personal and Contextual Factors at Work," *Academy of Management Journal*, Vol. 39, No. 3, pp. 607-634

28. Pan, S., and Scarbrough, H. (1998), " A Socio-Technical View of Knowledge-Sharing at Buckman Laboratories," *Journal of Knowledge Management*, Vol. 2, No. 1, pp. 55-66

29. Pentland, B. (1995), "Information Systems and Organizational Learning: The Social Epistemology of Organizational Knowledge Systems," *Accounting, Management, and Information Technology.*, Vol. 5, No.1, pp.1-21

30. Probst, G.B. (1997), "Practical Knowledge Management: A Model That Works," *Prism*, Second Quarter, pp. 17-30

31. Radding, A. (1998), *Knowledge Management: Succeeding in the Information-based Global Economy*, South Carolina, Computer Technology Research Corp.

32. Reed, R., and DeFillipi. (1990), " Causal Ambiguity, Barriers to Imitation, and Sustainable Competitive Advantage," *Academy of Management Review*, Vol. 15, No. 1, pp. 88-102

33. Ruggles, R.L. (1998), "The State of Notion: Knowledge Management in Practice," *California Management Review*, Vol. 40, No.3, pp.80-89

34. Schuppel, J., Muller-Stewens, G., and Gomez, P (1998), "The Knowledge Spiral," In G. Krough, J. Roos, and D. Kleine (Ed.), *Knowing In Firms*, pp. 223-252, SAGE Publication

35. Scott, S., and Bruce, R. (1994), "Determinants of Innovative Behavior: A Path Model of Individual Innovation in the Workplace," *The Academy of Management Journal*, Vol. 37, pp. 580-607

36. Simonin, B. (1997), "The Importance of Collaborative Know-how: An Empirical Test of the Learning Organization," *Academy of Management Journal*, Vol. 40, No. 5, pp. 509-533

37. Stein, E.W. and Zwass, V. (1995), "Actualizing Organizational Memory with Information Systems," *Information Systems Research*, Vol. 6, No.2, pp. 85-117

38. Szulanski, G. (1996), "Exploring Internal Stickiness: Impediments to the Transfer of Best Practice Within the Firm," *Strategic Management Journal*, Vol. 17, Winter, pp. 27-43

39. Van der Spek, R., and Spijkervet, A. (1997) "Knowledge Management: Dealing Intelligently with Knowledge", In J. Liebowitz, and L. Wilcox (Ed.), *Knowledge Management and Its Integrative Elements*, pp.31-59, CRC press

40. Walsh, J.P. and Ungson, G.R. (1991), " Organizational Memory," *Academy of Management Review*, Vol. 16, No. 1, pp. 57-91

41. Wiig, K. (1997), "Integrating Intellectual Capital and Knowledge Management," *Long Range Planning*, Vol. 30, No. 3, pp. 399-405

42. Wiig, K., Hoog, R., and Spek, R. (1997), Supporting Knowledge Management: A Selection of Methods and Techniques," *Expert Systems With Applications*, Vol. 13, No. 1, pp.15-27

43. Wiig, K. (1995), "Knowledge Management Methods," Schema Press

44. Wijnhoven, F. (1998), "Designing Organizational Memories: Concept and Method," *Journal of Organizational Computing and Electronic Commerce*, Vol.8, No.1, pp.29-55

45. Zack, M. (1999), "Developing a Knowledge Strategy," *California Management Review*, Vol. 41, No. 3, (Spring), pp.125~145

46. Zander, D., and Kogut, B. (1995), "Knowledge and the Speed of the Transfer and Imitation of Organizational Capabilities : An Empirical Test", *Organization Science*, Vol. 6, No. 1, pp. 76~92