

A SURVEY OF THE IMPLEMENTATION OF KNOWLEDGE MANAGEMENT IN CONSTRUCTION ENTERPRISES IN KOREA

Tai Sik Lee

Professor, Hanyang University, Ansan, Korea

Dong Wook Lee

Candidate for the Ph.D., Hanyang University, Ansan, Korea

Sung Hyun Yi

M.S., Hanyang University, Ansan, Korea

ABSTRACT

With the growing importance of intellectual capital, corporations are developing Knowledge Management Systems(KMS). The concept of knowledge management in the Korean construction industry was introduced in the mid 1990's by large enterprises. Construction enterprises are trying to develop KMS for Information Technology(IT) application. CEOs are aggressively pushing KMS in a top-down manner. These CEOs are establishing Information Strategic Planning(ISP), organizing taskforce teams, and using external consultants. The results of this paper show that top level CEOs are ambitiously developing strategic approaches to KMS and that technical IT systems exist on a high level. However, this paper identifies the absence of tools for companies to assess the status of their knowledge management, the lack of techniques for finding and creating knowledge, and the lack of knowledge about developing processes and knowledge-sharing culture. Continued commitment by CEOs is required for knowledge management to become a common practice.

KEYWORDS

Knowledge Management, Knowledge Management System(KMS), Information Technology(IT)

1. INTRODUCTION

Land, labor, and money were the bases of competition in the Industrial Age. As people increasingly recognized the importance of information, the age gave way to an Information Society. The Internet, however, has dramatically increased access to information, so the value of information has consequently fallen, and an information paradigm has been replaced by a Knowledge Paradigm. Following this trend, many nations have carried out Knowledge driven policies. In Korea, the government has implemented Cyber Korea 21. Both corporations and national governmental departments are developing KMS for Knowledge Management. Korean Construction Enterprises are implementing Knowledge Management to enhance efficiency in bidding construction projects and to increase productivity through the sharing of engineers' know-how in the field.

2. KNOWLEDGE MANAGEMENT AND KMS

2.1 Knowledge Management

Knowledge management refers to all activities for creating added value to specific goals or purposes by managing knowledge possessed by enterprises, organizations, and individuals such that the knowledge is transformed into realizable worth. A resource-based view is a theory that the competitive power of an organization depends on the

resources possessed by an organization and its strategic management of those resources. It provides the theoretical base of knowledge management. This view was applied to the knowledge-based view that highly values knowledge in an organization.

Knowledge has a life-cycle from its generation to its extinction. Nonaka(1995) distinguished between Tacit Knowledge and Explicit Knowledge, and he proposed the processes involved in the creation and conversion of knowledge in organizations. Lee, Tai Sik(2000) suggests a knowledge life-cycle comprised of “identification”, “accumulation”, “leverage”, and “refinement” processes in KMS (figure 1). The Delphi Group surveyed the condition of Knowledge Management in 700 enterprises. The results show that 42% of knowledge exists in employee brains and 26% in paper documents (figure 2-a). 52% of respondents use personal experience as a means to transfer knowledge. These results show that knowledge is not being efficiently shared in organizations (figure 2-b).

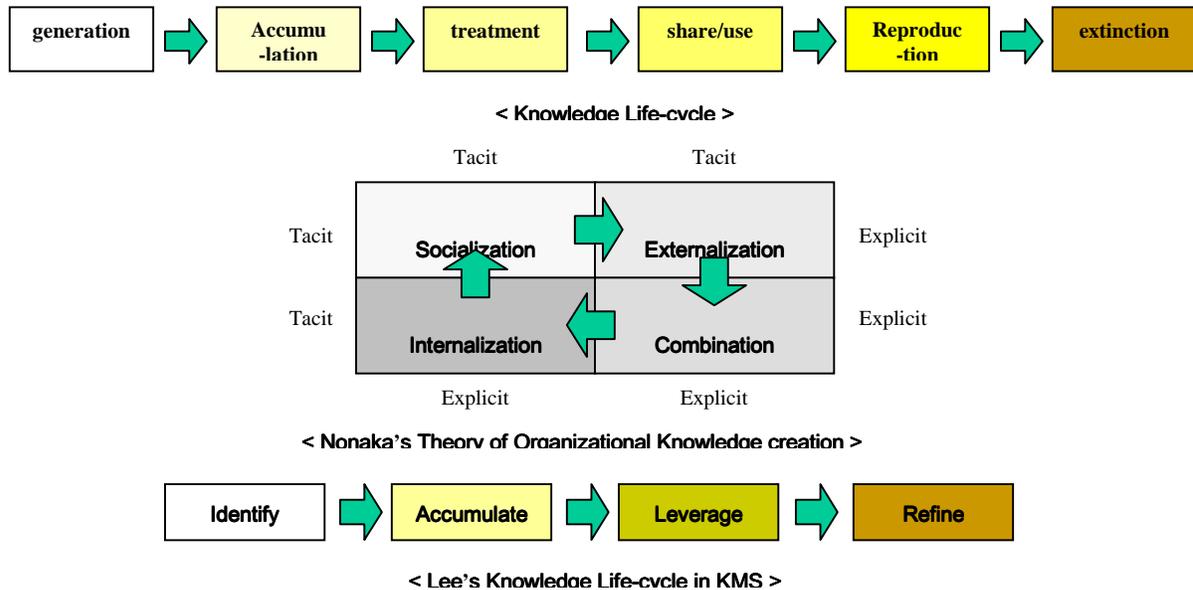


Figure 1: Process of Knowledge Treatment

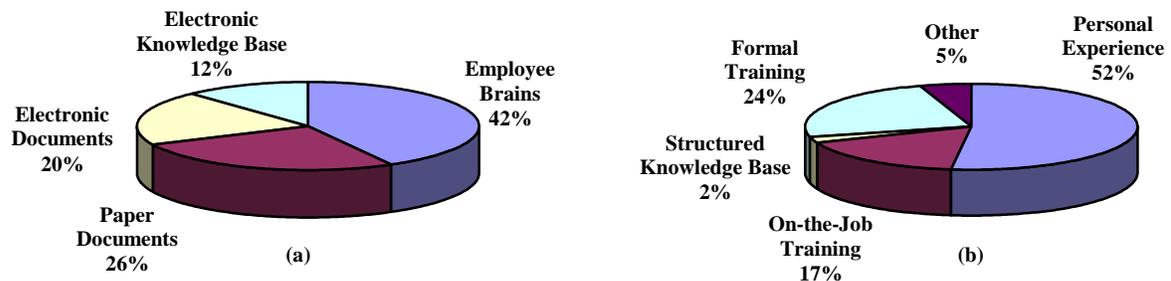


Figure 2: Knowledge Repositories and Means of Transfer

2.2 KMS(Knowledge Management System)

There are two ways of performing Knowledge Management: the Information Technology(IT) approach and the Non-IT approach. The IT approach focuses on developing KMS, and the Non-IT approach focuses on intangible assets, learning in the organization, organizational culture, and policy (table 1). KMS is a strategic means for knowledge management, meaning that it is a system that manages the knowledge of the organization more systematically and effectively, making individual’s personal knowledge the knowledge of the organization. KMS, then, requires many functions so that users are able to create, input, survey, edit, and use knowledge. It also requires technical system components.

Existing information systems, for the most part, can be classified as Data Processing Systems(DPS) and Management Information Systems(MIS). DPS enables the making of structured decisions by dealing with large

amounts of data rapidly and repeatedly. DSS, ES and EIS, which were developed after DPS, enable us to make semi-structured decisions for specific operations. KMS enables us to make unstructured decisions by managing knowledge efficiently through harmoniously connecting with existing systems.

Table 1: Two Way of Performing Knowledge Management

	IT approach	Non-IT approach
Important Branch	Construction/Maintenance of Information System and KMS	Learning Organization, Organization Culture, Incentives
Period	1 Year	2-3 Years
Cost	Much	Little than IT approach
Effect	After 6 Months	After 2-3 Years
Department	IT(Information Technology) Team	Planning Department, Taskforce Team

Source : CREDU(2002)

3. KNOWLEDGE MANAGEMENT AND KMS IN CONSTRUCTION ENTERPRISES IN KOREA

3.1 Knowledge-based Infrastructure and Knowledge Management

The extent to which management is knowledge-based is evaluated by the R&D investment ratio, technology level, and the extent to which a society is information-based. Since the recent economic crisis in Korea, there has been a decrease in sales, and the R&D investment ratio has become smaller. The decrease in R&D investment is especially evident in the construction industry in contrast to other industries (figure 3). When asked to evaluate the technology level in Korea compared to other developed nations, respondents from industrial circles replied that Korea is 69.3%; professional researchers replied 54.8%, and academics answered 30%, so the gap of perception is quite broad (table 2). The investment and equipment for information technology and use of information in construction are low compared to other industries (figure 4). That result shows the construction industry needs an improved infrastructure in information technology.

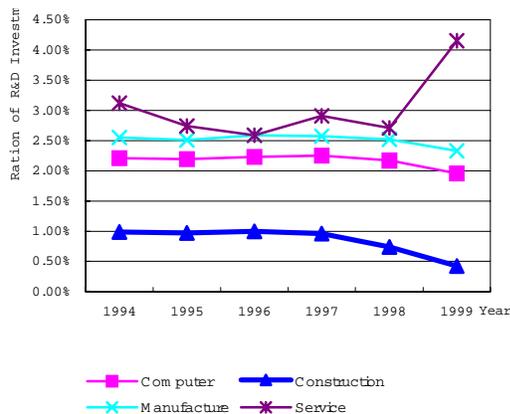


Figure 3: Ration of R&D Investment

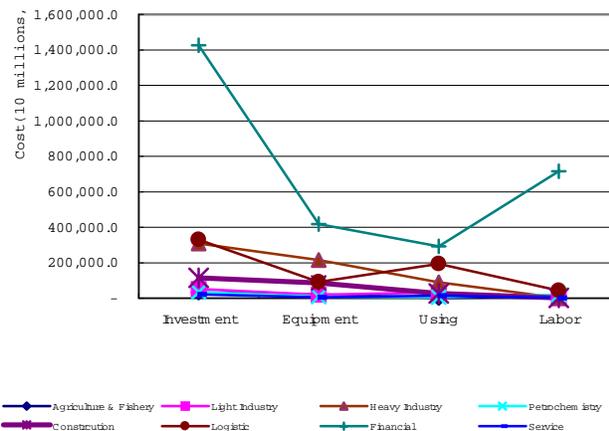


Figure 4: Investment of Information Technology

According to a survey by the Federation of Korean Industries(FKI, 2000), most of enterprises (86.7%) recognize the need for and importance of knowledge management, and there are growing interests in knowledge management. The purpose of implementing knowledge management appears to be improvement of organization members' skills(42.1%), enhancement of productivity(26.3%) and effective decision-making(18.4%).

The survey identified the primary factors for success in knowledge management as the CEO's strong commitment(41.5%) and organizational climate and culture(20.8%), and identified the obstacles as organization

members' lack of awareness(32.1%), organizational culture(17.9%), and the lack of a driving force(16.1%). The domestic market size of KMS reached 72 billion in 2000, and it is expected to reach 102 billion in 2001 (table 3).

Table 2: Technology Level by Advanced Nation

Unit : %

Field	Industrial	Academic	Research
Information• electronic• Telecommunication	76.2	59.5	59.9
Mechanical• Equipment	74.3	58.7	54.7
Material• Process	79.0	65.4	58.9
Life• Health• Medical	72.2	58.7	64.6
Engery• Resources• Nuclear	78.3	57.7	55.5
Environmental• Earth	74.4	59.7	54.9
Construction• Civil	69.3	30.0	54.8

Source : MOST & KISTEP(1999)

Table 3: Market of KMS in Korea

Unit : millions won, %

Field		Construction/ Transportation	Public/ Administrative	Defense	Education	Finance/ Insurance	Leisure/ Entertainment
2000Yr	Scale	4,012	19,256	3,680	1,720	8,156	680
	%	5.54	26.59	5.08	2.38	11.26	0.94
2001Yr (expected)	Scale	5,002	25,311	4,980	2,010	14,205	841
	%	4.91	24.81	4.88	1.97	13.92	0.83
Field		Trade/ Logistic	Manufacture	Service	Electric/ Gas	Others	Total
2000Yr	Scale	3,084	11,962	8,245	741	10,895	72,431
	%	4.26	16.52	11.39	1.03	15.05	100
2001Yr (expected)	Scale	4,985	16,651	10,526	1,578	15,953	102,042
	%	4.89	16.32	10.32	1.55	15.64	100

Source : KOSA(2001)

3.2 Knowledge Management and KMS in Construction Enterprises in Korea

In the construction industry, systematic management of various projects is very difficult because the competition for receiving orders is stiff, the number of orders varies rapidly with the condition of the market, and construction projects are accomplished in the field. Considering that the efficient and effective securing and application of relevant knowledge is a major way to succeed in any industry, the construction industry is certainly one of the areas that can benefit greatly from knowledge management. The high degree of knowledge concentration for products and business processes in construction and field-project management, especially, can provide a good foundation for implementing knowledge management. Recently, with the increasing requirement of enhancing clean management, adopting an effective business process, and making project data public, there are growing needs for sharing knowledge.

In order to examine the status of knowledge management and implementation of KMS among Korean construction companies, this paper provides findings from analyses of relevant documents and interviews with experts and people who are in charge of knowledge management.

Implementation of Knowledge Management

Since the introduction of knowledge management into the Korean construction industry in the mid 1990's, large organizations have been the major driving force in implementing it. Knowledge management is performed with

benchmarking, preparation of master plans for information-oriented enterprises, establishment of knowledge classification systems, and analyses of business processes, core knowledge, and users' needs (table 4).

Reasons for Promoting Knowledge Management

A majority of organizations attribute the reasons for promoting knowledge management to enhancing efficiency of business operations and increasing productivity by generating core knowledge, sharing of knowledge, and improving members' skills. Organizations show their efforts in transforming themselves from a construction-based industry to a high value added industry (table 5).

Organizing Independent Departments

It was found that CEOs or executives hold the additional responsibility of being the Chief Knowledge Officer(CKO). All the organizations surveyed operate an independent department for knowledge management. It was also found that the independent department runs various teams for planning, developing and constructing systems, and providing support. It was also found that some organizations used their own SI companies, while other organizations used external consultants (table 6).

Table 4: Implementation of Knowledge Management

Samsung	Hyundai	Daewoo	Daelim	Korea Development
<ul style="list-style-type: none"> -Planning mid/long term(94) -Accumulate data(97) -Planning of EP's strategy(01) -Construction of systems & policies(01) -Analysis of business process & core knowledge(01) -Departure of EP system(02) 	<ul style="list-style-type: none"> -Performing knowledge management(95) -Opening of KMS(00) -Reforming of KMS(01) 	<ul style="list-style-type: none"> -Performing knowledge management(95) -ISP(97) -Groupware(BARONET)(97) -Establishment of master plans(98) -Basic plan for construction of synthetic knowledgement management system (98) -Performing of 1st knowledge management(99) -Construction of ERP(01) -Performing of 2st knowledge management(02) 	<ul style="list-style-type: none"> -Constructing of CHORUS(97) -Establish visions of knowledge management(98) -Analysis of users's needs(98) -Knowledge contest(98) -Plans of knowledge management(98) -Construct space of knowledge management(98) -Settlement of knowledge classification systems(98) -Construct knowledge repositories(99) 	<ul style="list-style-type: none"> -Establishment of mission/vision -Questions & Interviews for needs of members -Benchmarking -Classification of existing knowledge

Table 5: Reasons for Promoting Knowledge Management

Samsung	Hyundai	Daewoo	Daelim	Korea Development
<ul style="list-style-type: none"> -Enhancing of competitive power for core products -Creation of knowledge for leaping to E&C -Bring up experts -Changing from construction-based industry to high value added industry 	<ul style="list-style-type: none"> -Sharing of knowledge -Improving capability of members -Construction of infra -Concentration of DB 	<ul style="list-style-type: none"> -Enhancing productivity through improving capability of members 	<ul style="list-style-type: none"> -sharing of knowledge in employee's brains 	<ul style="list-style-type: none"> -Sharing of knowledge -Enhancing efficiency of business works -Enhancing productivity

Table 6: Organizing Independent Departments

Samsung	Hyundai	Daewoo	Daelim	Korea Development
<ul style="list-style-type: none"> -Organizing of independent department(in Planning department) -Formation of KM Part -KM supporting team -Expert group for business processes -External consultant (Samsung Data Systems Co.) 	<ul style="list-style-type: none"> -Organizing of business strategy team -CKO, KM Officer group, KM Master -External consultant (Hyundai Information Technology) 	<ul style="list-style-type: none"> -CKO, CKM, KM Team, IS Team, ERP Team, Baronet Team, Business Innovation TFT, Portal Team etc. 	<ul style="list-style-type: none"> -KM Team in Planning department -Assignment of Project Manager for receiving needs -Knowledge Registration Center -Organizing of KM master 	<ul style="list-style-type: none"> -Board of KM -Board for Best Idea -KM TFT -KM Master

Activities for Encouraging Knowledge Management

Activities for encouragement include education, special events, and incentives. Education programs contain presentations of the CEO's commitment and various learning programs suited to people in different ranks. Special events include presenting the company's knowledge management policy, community building, a policy of best practice, and various contests. For incentives, all enterprises run a knowledge mileage system and have their own system of knowledge assessment. But there are some enterprises that put their activities on hold because of financial difficulties (table 7).

Constructing Systems

It was found that all enterprises constructed web-based systems. The enterprises used groupwares that they developed by themselves or modified from someone else’s products. The enterprises showed efforts in connecting KMS with existing systems harmoniously in order to promote the efficiency of KMS (table 8).

Conditions of Accumulation of Knowledge

It was found that standards of business process and core knowledges were extracted through analyses of business processes. A major characteristic of knowledge accumulation conditions is that development of knowledge containers are done separately for the enterprise department and for construction projects. For example, the plant department of Daewoo Engineering & Construction Co. has accumulated 1,700,000 pieces of information. In addition, knowledges is shared through the groupware and bulletin board, and the frequency of seeking and checking that information is high (table 9).

Table 7: Activities for encouraging Knowledge Management

Samsung	Hyundai	Daewoo	Daelim	Korea Development
Education -Active concerns of CEO -Various educations and programs for innovation -Regular seminars and workshops -Special lectures of experts -Broadcastings in the firm Events -Supportings for activities of communities -Contests for best paper and practice -Notices for excellent project field -Proposals of knowledge Incentives -Incentives for organization supporting KM -Various incentives for knowledge input, excellent knowledges, monthly knowledges and yearly knowledges -Knowledge mileage -Prizes for excellent knowledge workers	Education -Active concerns of CEO -Various education programs Events -Supporting CoP -Proposals of knowledge -Knowledge experts and champions Incentives -Assessment for proposal by 6 grades -No awarding because of financial difficulty but establish incentive systems -Knowledge mileage	Education -Active concerns of CEO -Various education programs Events -Various supportings for vertical/horizontal, on/off-line communities Incentives -Establishment of incentive systematically -Performing assessment by the team	Education -Active concerns of CEO -Various education programs and public hearings Events -Proposals of knowledge -Q&A about knowledge Incentives -Connecting knowledge scores with promotion -Knowledge mileage -Awards for knowledge(5grades) : rewards, certificates and mileage -Yearly awards	Education -Weekly conference for KM Events -Best practices Incentives -Knowledge mileage

Table 8: Constructing Systems

Samsung	Hyundai	Daewoo	Daelim	Korea Development
-Web based -Groupware : Single -Connecting KMS with HMS, PMS and SRM -Single Sign-on	-Web based -Utilizing messaging system developing by oneself -Replacement of Groupware (MS Exchange)	-Web based -Intranet(Baronet) based ‘Lotus Notes’ -Constructing DB for technology and DB synchronizing in difference conditons -Embodying the function of automatic backup with Domino server cluster	-Web based -Groupware(Lotus Notes) -Connecting and establishing GW & EDMS in field	-Wed based -Connecting KMS and CIM system(EVMS/PMIS)

Effects and Difficulties

All the enterprises surveyed indicate the benefits of knowledge management as the ability to manage knowledge systematically and to enhance field engineers’ capacity to solve problems. Taking Daewoo Engineering & Construction Co. as an example : Before implementing knowledge management, 80% of project data was lost. However, after implementation, 90% of data has been digitized. The amount of time required for preparing for the opening of a field office has been reduced from 2-3 months to 1-1.5 months. For bidding for a new project, the preparation period and accuracy has also been reduced from 2 months and 70% to 1 month and 90%. Another benefit of implementing knowledge management is that even with the absence of a person in charge, work stoppage is minimized.

One of the major difficulties in implementing knowledge management is related to problems encountered while integrating groupware with business processes. Another difficulty occurs when considering how naturally knowledge is created, accumulated, and shared while working. The third difficulty arises when promoting a climate in which project engineers are willing and ready to change their tacit knowledge to explicit knowledge. The final difficulty found in this study is an additional workload generated while transforming various drawings in the field into digital forms.

Table 9: Conditions of Accumulation of Knowledge

Samsung	Hyundai	Daewoo	Daelim	Korea Development
-Classifying knowledge repositories into 15 containers largely -Extracting standard business processes of 89 pieces -Extraction of core knowledge by departments	-Classifying knowledge repositories into 9 containers largely -Classifying containers considering business processes and projects -Accumulating knowledges of 2150 GBytes in KMS containers	-Classifying containers by departments and projects considering processes -Accumulating knowledges of 4700 pieces through groupware from Jan. 2001 to Sep. 2001 -Accumulating knowledges of 170 thousands pieces in plant department until now(Oct. 2001)	-Classifying knowledge repositories into 15 containers largely, 115 containers in detail -Classifying containers considering business processes -Establishment of document classification system(400 pieces)	-Classifying knowledge repositories into 14 containers largely, 59 containers in detail -Classifying containers considering business processes

4. EVALUATION OF CONDITIONS OF KNOWLEDGE MANAGEMENT

According to interviews with experts and people in charge of knowledge management divisions, the IT approach and Non-IT approach should be adopted simultaneously for effective knowledge management. More focus should be placed especially on the Non-IT approach than the IT approach for successful knowledge management (figure 5-a). But the experts and people in charge stated that the IT approach receives more attention in the construction industry in Korea (figure 5-b). The reasons for heavy reliance on this approach are (1) imprudent benchmarking, (2) pressure to produce fast results, and (3) the lack of awareness and education for knowledge management.

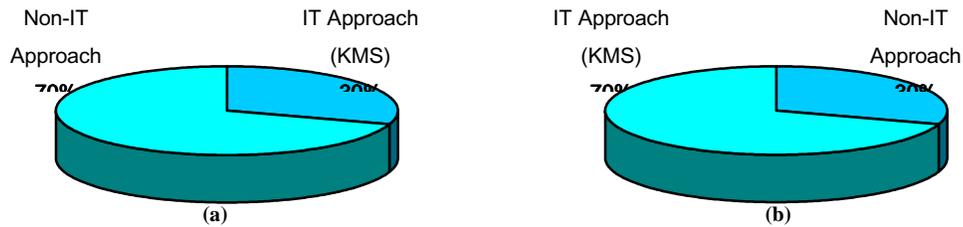


Figure 5: The Condition of Performing Knowledge Management in Korea

Knowledge management in the construction industry is introduced by CEOs in a top-down manner, and most organization members don't understand the purpose of knowledge management. This implies that knowledge management has been focused only on the areas of business strategies planning. Top level CEOs are ambitious in developing strategic approaches to KMS. Technical IT systems also receive a high level of evaluation. However, this paper identifies the absence of tools for a company to assess its own condition of knowledge management, the lack of techniques for the finding and creation of knowledge, and the lack of knowledge-development process and knowledge-sharing culture. The continuous commitment from CEOs is essential for making knowledge management a common practice.

5. CONCLUSIONS

Since its introduction to the Korean construction industry in the mid 1990's, knowledge management has been implemented aggressively by large enterprises, and some enterprises are in the process of constructing a KMS. Most enterprises which implement knowledge management develop their own groupwares themselves or modify products of other companies. Systems are constructed while harmoniously connecting with existing systems. Knowledge containers are separated for the enterprise department and construction projects depending on the specialty of construction industry. Activities for encouragement include educations, special events and incentives, and most of enterprises try to accumulate tacit knowledge.

6. REFERENCES

- CREDU. (2002). CREDU(www.credu.com) on-line lecture literature
- Davenport, T.H. and Prusak, L. (1998). *Working Knowledge*. Boston, Massachusetts, Harvard Business School Press.
- FKI(The Federation of Korean Industries). (2001). *The results of survey on conditions of knowledge management in Korean industries*. CEM-2001-08.
- FKI. (2001). *The results of survey on managing knowledge in Korean industries*. CEM-2001-17.
- FKII(The Federation of Korean Information Industries). (2000). *KMS Korea conference 2000 report*. pp 139-156.
- FKII. (2001). *KMS Korea conference 2001 report*. pp 145-167
- I-biz. (2000). I-biz(www.i-biznet.com) reports
- IT Business. (2000). *Infra of IT in major enterprises*. IT Business(www.itbiz.co.kr)
- Kim, Young Gul (1999). “Knowledge management and KMS”. Management of information system lab.(<http://mofis.kaist.ac.kr>), KAIST.
- KOSA(Korea Software Industry Association). (2001). *Research report on the trend of software industry – KMS*. research report 2001-5.
- Kwon, Tae Hyung. (1999). “The survey on the evaluation of intellectual capital”. *Report of National Credit Union Federation of Korea*, Vol. 34.
- Lee, Jang Hwan and Kim, Young Gul. (1999). “A management framework and stage model for organizational knowledge management”. Graduate School of Management. KAIST.
- Lee, Tai Sik. (2000). *National Research Laboratory(NRL) proposal : Development of Knowledge Management System(KMS) for Field Construction Management*. MOST(Ministry of Science & Technology).
- Lee, Tai Sik and Lee, Dong Wook. (2001). “Methodology for development of KMS(knowledge management system)”. *Proceeding of KSCE*, CD for proceeding.
- Lee, Tai Sik et al. (2000). “A study on developing knowledge management system(KMS) for construction enterprises in Korea”. *Proceeding of KSCE(Korean Society of Civil Engineers)*, Vol. 4, pp 381-384.
- Lee, Tai Sik et al. (2001). “A survey for conversion into knowledge based industry of construction industry”. *Proceeding of KICEM(Korean Institute of Construction Engineering & Management)*, pp 462-467.
- Ministry of Commerce, Industry and Energy. (2002). “Secure of core solutions of e-business”. *Official report of MOCIE*.
- MOST and KISTEP(Korea Institute S&T Evaluation and Planning). (1999). *Research report on the Science & Technology in Korea*. pp. 4-20.
- Nonaka, I. and Hirotaka, T. (1995). *The Knowledge-Creating Company – How Japanese Companies Create the Dynamics of Innovation*. Oxford University Press.
- Nonaka, I. and Konno, N. (1998). *The concept of Ba’ : Building a Foundation for Knowledge Creation*. California Management Review. Vol. 4, No. 3, pp 40-54.
- SK C&C. and You, Young Man. (2000). *Knowledge Management and KMS*, 3rd edition, KPI Publishing Co., Korea.
- Wiig, K.M. (1997). *Supporting Knowledge Management : A Selection of Methods and Techniques*. Expert Systems with Application, Vol. 13, No. 1, pp 15-27.