

The Information Infrastructure of Knowledge Management for Dynamic Work Team : A Case Study of Managerial Consultant

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Abstract

Every enterprise is facing radical change in business environment. To cope with such challenge, enterprises must focus on organization structure flattening, core competence, dynamic knowledge team, and organizational learning. With newly developed data communication technology, virtual organization becomes a new trend of organization structure. Under such circumstance, effective management and creation of organization knowledge will be the main source of competing power.

This paper is aimed at developing and describing approaches to the research of management and creation of organization knowledge. We also sought cases in Mckinsey Taiwan as an example. Deep interview method is used in order to explore the relationships of dynamic team working, knowledge management, and the role of enabling information technology. Finally we try to find resolutions of the information infrastructure design of knowledge management for dynamic team working.

Keyword : Virtual Organization ; Dynamic Network Organization ; Knowledge Management ; Information Infrastructure

1. Introduction

Every enterprise is facing radical change in business environment. To cope with such challenge, contemporary enterprises must develop two strategies: the first is Co-optation and dynamic reciprocal alliance. The principles of organizational design focus on flattening, fast response, core competence, dynamic knowledge team, empowerment, strategic alignment, and organizational learning. The second strategy is agility competition. With newly developed data communication technology, virtual organization becomes a new trend of organization design. In a specific period and task, inter-organization can dynamic interconnection with each core resources. Inter-organization will intensive corporate and integrate human resources, facilities, knowledge and skills as a productive resources pool. Under such circumstance, effective management and creation of organization knowledge will be the main source of competing power.

The enabling capability of information technology can compress time and space. It's not only stimulated turbulent competition of industries, but also reengineering the business process. Laudon defined information system from a business perspective "an information system is an organizational and management solution, based on information technology, to a challenge posed by the environment." Examine this definition closely because it emphasized the organizational and management nature of information systems. To understand information systems, a manager must understand the broader organization, management, and information technology dimensions of systems and their power to provide solutions to challenges and problems in the business environment. [1]

Managerial consultant group is operated in dynamic team working with professional knowledge workers and enabling information technology. Knowledge is the main source of strategic competition weapon. Therefore, this paper is aimed at exploring how to apply the virtual organization concepts in a dynamic team working and try to find resolutions of the information infrastructure design of knowledge management for dynamic team working. We try to find out some alternative for knowledge management of virtual organization, and integrate information technology, knowledge management and team working in system view.

2. Knowledge Management

Research of Nonaka & Takeuchi indicate that scholar do not understand the proactive role of human being in knowledge creation and changing the world in dynamic. Traditional management theories focus on knowledge

acquisition, accumulation, and utilization. Neglecting a new innovation theory of the transforming implicit knowledge to explicit knowledge. Therefore, Nonaka & Takeuchi develop the organizational knowledge creation theory from organizational theory perspective. They also predict two approaches of integrated studying: organizational learning theory and strategic perspective of resource-based. [2]

We believe that organizational knowledge creation management is the essential of knowledge management. Since organization is an artificial design, it is unable to create knowledge itself. The capability of organizational knowledge creation is beginning from individual learning, then transforming through group dynamic interactive. The development of knowledge creation capability is based on resource-based strategic theory, which consider that competitive advantage come from the core competency of enterprise. Therefore, the organizational learning theory is fundamental approaches of studying organizational knowledge management.

2.1 Definition of Knowledge Management

Machlup consider that the meaning of knowledge has two definitions: the one is a thing already known; the other is knowing status. We can distinguish knowledge from intelligent by the process of learning behavior. Tobin indicates that information turn to be knowledge via applying information in problem solving. Knowledge will turn to be intelligent via intuition. This intuition capability is the power of knowledge creation. [3]

Definition from Harris depicts the situation of knowledge transfer in individual: ***“Knowledge is the combination of information, context, and experience. Context*** is an individual's framework for viewing life. This includes influences like social values, religion, heritage, and gender. ***Experience*** is previously acquired knowledge. When knowledge is transferred from one person to another, the knowledge is drawn into the receiver's context and experience. The new knowledge is interpreted according to the receiver's context and experience. If the receiver does not have an appropriate background for interpreting the new knowledge, the new knowledge will not be interpreted correctly and the knowledge will have little or no value.” [4]

Relative to the definition of knowledge, the classification of knowledge is more complicate. As the scope of this study, type of knowledge can be divided into explicit knowledge and tacit knowledge. [2, 5, 6]

The content of knowledge is kept in organizational memory. Organizational memory is the stored information from an organization's history that can be brought to bear on present decisions. [7] Wijnhoven suggested the contents of organizational memories consist of: [8]

- (1) *Know-how*: Knowledge and information that can be applied in operational activities. This type of organizational memory is mostly limited to operating rules or practical and facts.
- (2) *Know-why*: Knowledge and information that gives the theoretical, conceptual, and background understanding of know-how. It can consist of science and other abstract models.
- (3) *Meta-memory*: Knowledge and information about the value and quality of existing skills, assets capabilities, and information.
- (4) *Memory-information*: Organizational memories contain information about knowledge and information that are important for retrieving and using operational memory and meta-memory.

2.2 Operation of Knowledge Management

Knowledge management is a process of knowledge producing, distributing, and utilizing. Hansen et al. find that consulting business employs two different strategies for managing knowledge: the codification strategy and personalization strategy. In some company, the strategy centers on the computer. Knowledge is carefully codified and stored in databases, where it can be accessed and used easily by anyone in the company. This is the codification strategy. In other company, knowledge is closely tied to the person who developed it and is shared mainly through direct person-to-person contacts. The purpose of computers is to help people communicate knowledge. This is the personalization strategy. [9]

Company will choice their fitness strategy depend on the way the company serves its clients, the economics of its business, and the people it hires. Some large consulting company, such Andersen Consultant and Ernst & Young, have pursued a codification strategy. They have developed ways to codify, store, and disseminate, and reuse knowledge. People can use the searching tools to access the explicit knowledge. Company gains its benefits from the economics of reusable knowledge.

By contrast, Strategy consulting firms such as McKinsey and Boston Consultant Group emphasize a personalization strategy. They focus on dialogue between individuals. The implicit knowledge is transferred in brainstorming and one-to-one conversation. They build expert network to facilitate knowledge sharing via face-to-face communications, e-mail, and videoconferences. These firms have also developed electronic document systems, but its purpose is facilitated experts scanning in specific domain and to find out who has done work on the topic. Then they approach those people directly. However, Hansen et al. found that effective firms excellent by focusing on one of the strategies and using the other in supporting role.

3. Lotus Enterprise Knowledge Management Architecture

As largest management consulting firm in the world, Andersen Consulting had a unique opportunity to leverages its knowledge base, but the integration of such a large and disparate organization also presents a challenge. They develop computer-based knowledge management systems. Lotus Notes became the firm standard for e-mail and knowledge management. The Knowledge Xchange system was first released in 1993, and gaining top-down support was quickly recognized as crucial long-term success. By 1996 all associate partners, managers, and consultants had been enabled. Lotus Notes was the primary platform for the Knowledge Xchange system. [10]

As the above mentioned of enabling capability of information technology, Lotus has introduced enterprise knowledge management solutions architecture recently. These solutions present in five application domains including collaboration, expertise, business intelligent, content management and knowledge transfer. Except the business intelligent is provided by IBM. The others are originally supported by Lotus.

In this five layers architecture focus on two level of performance: Organizational performance and personal productivity. Some heterogeneous databases as repositories are important components of the information infrastructure in the base of architecture. The 2nd layer of this architecture is collaboration technology. With the knowledge portal, it's integrated the 3^d layer of core knowledge management functionality and the 4th layer of knowledge management products of Lotus. Including the Domino Doc, Domino Workflow, SameTime, TeamRoom, Expert Network, and Learning Space etc. The 5th layer is Enterprise knowledge management solutions. The ultimate goals are organizational innovation, productivity, responsiveness, and competence.

4. Virtual Organization and Dynamic Work Team

Conventional organizations have organized workers together for purposes of communications and coordination. In contract to physical presence, information technology design variable allow for virtual organization structure, and it's also creates new management and coordination challenges.

In organization theory perspective, virtual organization is an ad hoc network organization. It's generated for the purpose of one-time problem, a self-management of infra-organization team or inter-organization business network. As the development of organization theory, virtual organization is becoming new organization structure—dynamic network organization. Information technology is the enable role of virtual organization. [11]

We emphasize the infra-organization dynamic team working. The participants take short term and dynamic cooperation. There isn't a formal structure, but react for specific task, all participants can play in various roles. At once a new task force establish, they will communicate closely and intensively. In a specific period, they will integrate and exchange the core resources of requirement. Once terminate the task, they turn back independent operation. The fundamental of dynamic network organization is trust in each other and the resources sharing system in an ad hoc structure. Dynamic team working is different from traditional design of integrating operation. It's a market mechanism rather hierarchy in intra-organization.

According to the research suggestions, it's better to introduce the market mechanism into enterprise knowledge management. Market mechanism will reinforce intra-organization knowledge sharing and exchanging environment. It will facilitate organization to find out the demand and supply of knowledge. [12] If the organization can develop an electronic market base on computer network that will form an intra-organization dynamic network.

In the research model of Nonaka & Takeuchi present four mechanisms of knowledge creation and transfer processes: socialization, externalization, internalization, and combination. They found the hyper-structure is suitable structure in

management of knowledge creation. [2] The hyper-structure is focus on team working which will interconnect the individual learning and organizational learning. In fact, combining virtual organization theory and organizational learning theory might be the one alternative approaches of studying the knowledge management.

5. Case Study in Mckinsey Taiwan

McKinsey & Company is the famous consulting firm in strategy management, which established at U.S. in 1925. There are 50 branches in global McKinsey, and more than 2,500 consultants discrete in 15 countries. McKinsey & Company in Taiwan has one partner and 18 consultants.

5.1 Operation of Team building

McKinsey & Company view itself as a pool of human resources. When it receives a request from customer, during the period in survey and before making a contract with customer, the staff coordinator will announce a request for organizing team members of the task force. All of consultants in global McKinsey are candidates who may interest in this case. According to the competency and schedule of consultant, dynamic team will be organized after received submission from customer. Project leader will respond to the schedule, one or more MIS Consultants are company with the task. When the task dismissed, staff coordinator will keep searching for next service request and help to reorganize a new dynamic team to match new request from their customers.

5.2 Role of Information Technology

Computer-based information system in McKinsey & Company is distributed computing environment. They implement some databases system in some selected branches. Consultants in global McKinsey are enabled information sharing and knowledge sharing via intranet. There is different functionality of each database system. For example, the PDNet stored the knowledge of task experiences more than 18,000 documents, which is written by consultants. Another one system, FPIS stored the detail record about task events and schedules, which will be facilitated tracing and controlling the project schedule.

5.3 Knowledge Management Process

In case of different task and team members, the ways they are doing was shown the knowledge management process in firm. By describing the different roles of the members, we can find out some pieces of information about management of knowledge in dynamic work team as follows:

- (1) Staff Coordinator: is focus on knowledge retrieval, disseminating, and verifying. They have to understand the complete requirement from customers, searching for competent team members, and keep tracing the status of each consultant.
- (2) Project Leader: is focus on knowledge explanation, and make policy decision. They have to coordinate team working, and control the schedule.
- (3) Consultant: as a team member. He has to face the problem and acquire the knowledge applying in problem solving. These implicate the knowledge transfer from individual implicit knowledge to explicit working knowledge. Then they will codify their experiences in knowledge system and share it with others. Those contributions will accumulate in credit when they are promoted to the partnership in firms.
- (4) MIS Consultant: provides tools and methodologies for consultants in knowledge processing, and build networking environment in order to facilitate team working and leverage its knowledge base.

In this study, we had interviewed two consultants in order to get a brief understanding of the nature of dynamic work team in consulting firm. It may not enough information to explore the truth of knowledge management in virtual organization. But we have generated some ideas that help to depict the skeleton of the following conceptual design. There are more detail discussions in next section. The concept of knowledge capital portfolio and the information infrastructure that presents in figure 2 may also provide some directions in the future researches.

6. Strategic Knowledge Management

Management is the processes of planning, organizing, executing, and control to achieve the objects of the organization. Most topics of knowledge management now focus on organizing and utilizing knowledge resources of the firm. Planning and control process involve setting the organization's objects and checking the results of the works. For

the lack of planning and control processes in knowledge management, it's effectiveness and performance is hard to evaluate now.

As knowledge is going to be the most important resources for organizations, knowledge management should be aligned with strategic management process. In other words, the strategic decisions of what the we are going to do should based on what we know and what we will know, and we should know what we are going to do in order to understand what's the unknown for the future needs so we can plan for acquiring new knowledge to meet the needs. [13]

6.1 Conceptual Design of Knowledge Management for Virtual Organization

This process is especially important for virtual organizations to deal with the dynamic task environment and accumulate knowledge for future. Ciborra presented a normative typology of organizational knowledge modes He suggested there are four kinds of rationality and knowledge in organizations: unbounded rationality and mechanistic knowledge, limited rationality and tacit knowledge, strategic rationality and opportunistic information, and adaptive rationality and knowledge for change. For firms in a dynamic environment, importance of adaptive rationality and knowledge for change should be emphasized and the roles of knowledge management is not only to maintain and utilize the knowledge of the firm, but also to coordinate knowledge management function with current and future business needs. We propose a framework of knowledge management roles for virtual organizations to describe the needs of knowledge management in organizations. [14]

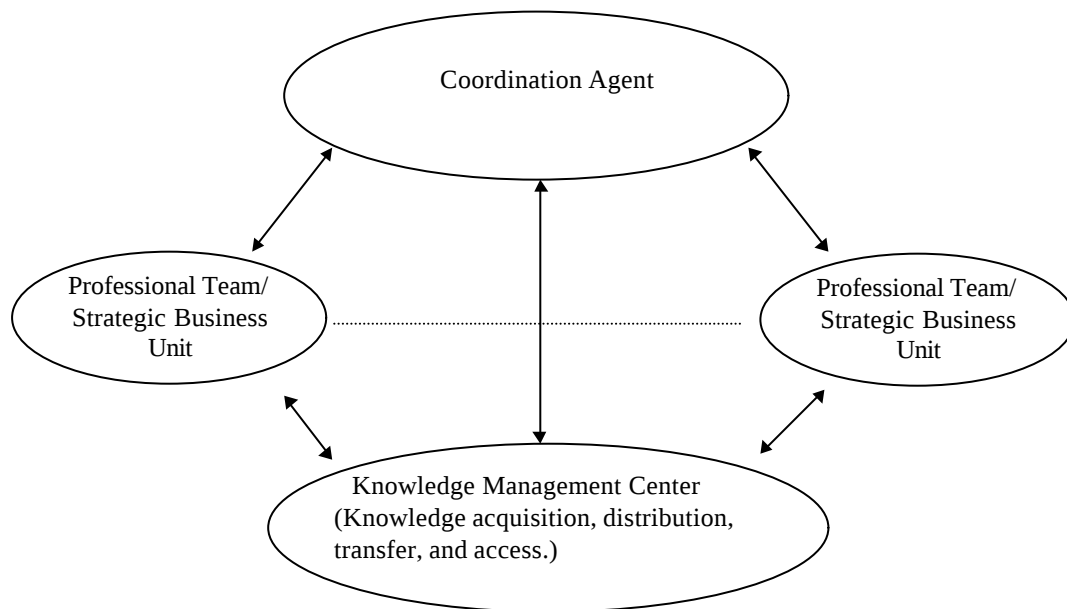


Fig. 1 Knowledge Management Roles for Virtual Organization

As in figure 1, there are three major knowledge management roles for virtual organizations: (1) Coordination Agent: is centric of dynamic network organization. It responds to coordinating and communicating with intra- and inter-organizations; (2) Professional Team: corresponding to the task of knowledge creation and knowledge transfer of virtual organization. It is groups of professional knowledge workers; (3) Knowledge Management Center: is knowledge resources processing, disseminating, and extracting service interface. All of these components of Coordination Agent, Professional Team, and Knowledge Management Center are alternatives of virtual organization. It includes the major variables of information infrastructure design. Those are organizational design, human resource, data resource, and management procedure.

The mechanism of such virtual organization is dynamic. For example, application of Coordination Agent, it could be inference engine of dynamic team. By using the knowledge base of groupware, there are various profiles of expertise, and resolution of customer requirement. For any service request of customer, inference engine of Coordination Agent will extracted the suggestion list of task force from the organizational repositories.

6.2 Knowledge Capital Portfolio

As knowledge capital becomes a resource for organizations, it's important to leverage the capital optimization. In competency-based approach of human resource management, building the competency dictionary of knowledge workers is kind of knowledge capital portfolio. [15] The intelligent agent then can easily find out best team for a specific task.

Another way to build organizational knowledge capital portfolio is established the Knowledge Review System. This system will generate organizational knowledge profile; predict the most significant knowledge capital that reinforces the growth of business. By tracing the knowledge seeking behavior, knowledge retrieval strategy, and browsing behavior of managers. We can also extract the meta-knowledge of knowledge needs of user profile. Knowledge Management Center can easily identify knowledge needs of managers, then provide customize and personalized knowledge service with knowledge routing agent.

7. Information Infrastructure for Knowledge Management

The review and feedback process is necessary for double loop organizational learning to affect to the level of the theory-in-use and be able to change it, overcoming those defensive routines that keep behavior within the boundaries of a limited adaptation. [16] Organizational learning occurs when (1) the problem-solution exchanges and consequences are communicated and known by other organizational members, (2) there is some form of organizational memory that stores problem-solution exchanges and consequences, and (3) there is a mechanism for organizations to share their interpretations about the problem-solution exchanges and to update the organizational memory about their experiences. [17]

Wijnhoven argued that organizational memory contents should satisfy certain organizational knowledge and information need, which require a definition of the memory contents that should be retained. [8] He proposed three methods to find out what is needed based on Earl's framework for information strategy formulation. [18] These methods are defined as followed:

- (1) *Top-down*: By analyzing the strategic position of the company, one can derive organizational memory needs.
- (2) *Bottom-up*: By evaluating current knowledge and information against the company's needs and use by individuals in their business environment.
- (3) *Inside-out*: By describing gaps in the memory contents, the difference between available memory and memory needed, and by defining a memory contents acquisition strategy.

The strategic, top-down approach generates insights into business areas and knowledge classes and generates a stable competence pattern definition. The bottom-up approach generates insights into business activities and what they imply in relation to knowledge elements. The inside-out analysis matches the strategic memory architecture with the available memory contents and matches memory needs in operations with the architecture; resulting in insights about memory gaps. The inside-out analysis further searches for opportunities to fill the knowledge gaps by developing a memory contents acquiring, development, and maintenance strategy.

We propose an information infrastructure framework based on the inside-out approach. This framework as shown in figure 2 illustrates the information flows between different knowledge management roles mentioned above. The duties of professional team are to understand and develop their changing task environment, and to find out what's the knowledge they need for them to accomplish their tasks. After that, they have to know how to look at the knowledge they need in firms' knowledge base through a knowledge seeking process.

Knowledge management center has to develop the knowledge base of the firm. The knowledge base includes both the knowledge contents, which is usually centrally stored by computer systems or information library, and a competence dictionary of the expertise in the firm. Knowledge base is part of the organizational memory of the firm and consists of all four kinds of content: know-how, know-why, meta-memory, and memory-information. The knowledge management center must serve the organizational memory process function too, which consists of four operations: acquisition (input), retention (storage), search (retrieval), and maintenance (update). [8]

The last one is coordination agent, which serves the review function for knowledge management and has to check if

the knowledge requirements of professional teams match with the capabilities of knowledge base. Coordination agent must review the results of knowledge seeking, not only the questions and answered by knowledge base, but also the questions but answered. So managers can understand not only what we know, how important it is, but also what we don't know.

The outputs of review system support two succeed works: First, knowledge strategic planning is aligned with strategic planning process to determine what the firm is going to do based on knowing what valuable knowledge in the firm. Second, knowledge capital portfolio analysis can learn what's needed in the knowledge base from current knowledge seeking results to maintain to know-how, know-why, meta-memory, and memory-information knowledge in the knowledge base.

All three roles overlap in knowledge seeking process, where problem-solution exchanges and consequences are communicated. Problem-solution exchanges and consequences are stored as part of knowledge base through the feedback loop then. The three organizational learning requirements mentioned by Goodman & Darr can be satisfied in this framework. [17] The challenge here is to build common cognitive maps and share interpretations about the problems and solutions. Three kinds of social strategies for promoting the spread of knowledge between communities can be used here [19] :

- (1) *Translators*: Organizational translators are individuals who can frame the interests of one community in terms of another community's perspective.
- (2) *Knowledge brokers*: People loosely link to several communities who facilitated the flow of knowledge among them. In contrast to that of translators, brokers involve participation rather than mediation.
- (3) *Boundary objects*: Boundary objects are objects of interest to each community involved but viewed or used differently by each of them. They can forge coordinating links among communities, bringing them, intentionally or unintentionally, into negotiation. Contracts and business processes are examples of boundary objects.

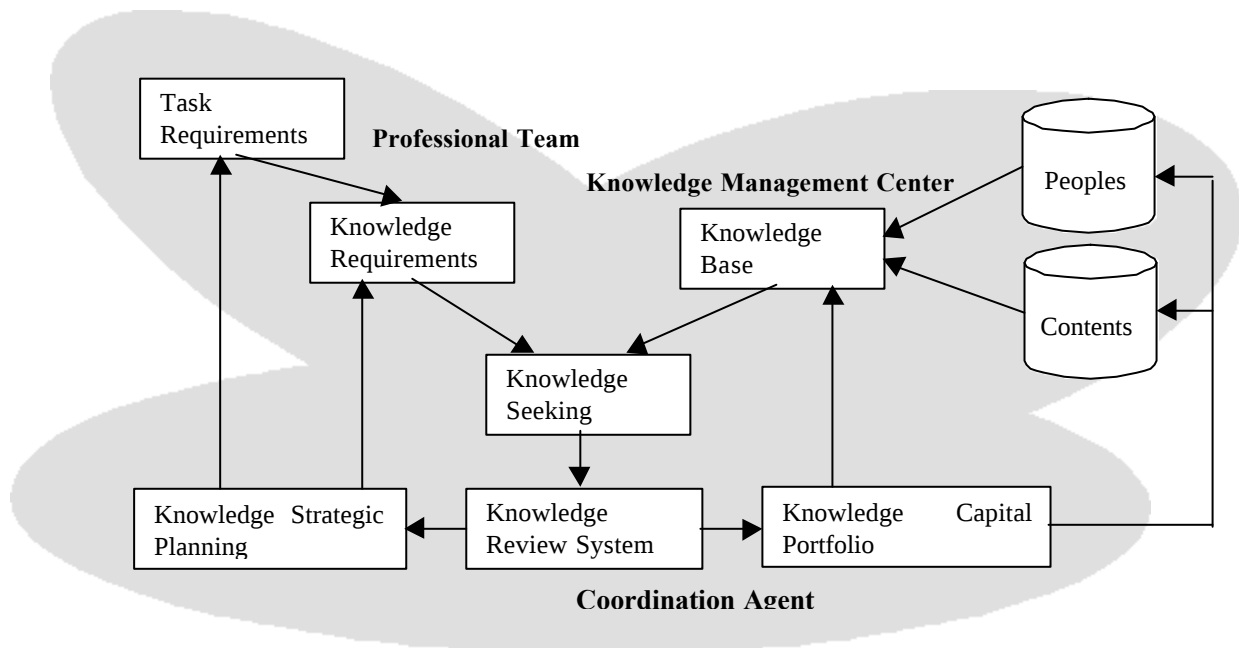


Fig. 2 Information Infrastructure for knowledge management

References

- [1] Laudon, K. C., & Laudon, J. P., Essentials of Management Information Systems, 3rd edition, p.9, 1999.
- [2] Nonaka, I. & Takeuchi, H., The Knowledge-Creating Company, New York, Oxford. 1995.
- [3] Huang, Y. L., "Research Approaches of Knowledge Management in Virtual Organization : Perspective of Organizational Learning and Cultural Knowledge in Organizations," Proceeding of International Conference of Information Management, June 1998, Taiwan.
- [4] Harris, D. B., "Creating a Knowledge Centric Information Technology Environment", <<http://www.bus.utexas.edu/kman/index.htm>>, (Accessed Feb. 22, 1998)
- [5] Polanyi, M., The Study of Man. (1959) Science, Faith, and Society (1964), The Tacit Dimension (1966).
- [6] Hedlund, G., "A Model of Knowledge Management and the N-Form Corporation," Strategic Management Journal, Vol. 15, 1994.
- [7] Walsh, J. P. & Ungson, g. R., "Organizational Memory," Academy of Management Review, Vol. 16, No. 1, 1991, pp. 57-91.
- [8] Wijnhoven, F., "Designing Organizational Memories: Concept and Method," Journal of Organizational Computing and Electronic Commerce, Vol. 8, No. 1, 1998, pp. 29-55.
- [9] Hansen, M. T., Nohria, N. & Tierney, T., "What's your Strategy for Managing Knowledge", Harvard Business Review, March/April 1999, pp12-24.
- [10] Davenport, T. H. & Hansen, M. T. "Knowledge Management at Andersen Consulting," case study 9-499-032 July 7, 1999
- [11] Jarvenpaa, S. L. and Ives, B., "The Global Network Organization of the Future: Information Management Opportunities and Challenges", Journal of Management Information Systems, spring 1994.
- [12] Davenport, T. H. & Prusak, L., Working Knowledge: How Organization Manage What They Know. Boston, MA: Harvard Business School Press, 1997.
- [13] Drucker, P., Past Capitalist Society. Oxford: Butterworth-Heinemann Pub. 1993.
- [14] Ciborra, C. U., "Knowledge and Systems in Organizations: A Typology and A Proposal," in R. M. Lee, A. M. McCosh, & P. Migliarese edition, Organizational Decision Support Systems, Elsevier Science Publishers, 1988.
- [15] Tseng, E. & Huang, Y. L., " A Case Study on Training Needs Survey Using Competency-Based Approach", 1999 Asia Pacific Decision Sciences Institute Conference, June 9-12, 1999, Shanghai.
- [16] Argyris, C., & Schon, D. A., Organizational Learning: A Theory of Action Perspective. MA: Addison-Wesley Reading, 1978.
- [17] Goodman, P. S. & Darr, E. D., "Computer-Aided Systems and Communities: Mechanisms for Organizational Learning in Distributed environments," MIS Quarterly, December 1998, pp. 417-440.
- [18] Earl, M. J., Management Strategies for Information Technology, New York, NY: Prentice Hall, 1989.
- [19] Brown, J. S. & Duguid, P, "Organizing Knowledge," California Management Review, Vol. 40, No. 3, Spring 1998, pp. 90-111.