Reengineering the Structure of Knowledge Sharing Network

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Contents

Key Words: Knowledge Management, Network, Hub, Knowledge Probing

Abstract

지식경영은 기업의 지속적 경쟁력을 제공하는 중요한 경영기법으로 인식되고 있다. 그러나 많은 기업에서 know-how 지식이나 know-where 지식을 축적하여 놓고 관련 평가체계를 잘 정립하면 향후 사용될 것이라는 전제하에 지식관리를 하고 있는 실정이다. 이러한 관점에서 본 논문은 지식관리를 조직업무형태에 따른 체인, 허브, 웹 유형으로 구분, 관리함이 효과적일 것이라는 가설을 기존 논문을 근거로 도출하였다. 이 중에서 가장 관리하기가 어렵다고 판단된 웹 혹은 네트워크 유형의 지식관리를 체계적으로 하기 위해서는 네트워크의 구조 자체에 대한 분석이 클러스터링 계수와 네트워크를 확장하는 역할을 담당할 수 있는 구성원에 대하여 이루어져야함을 e-Business 모델을 이용하여 제시하였다. 이러한 네트워크의 선행분석은 기존의 지식관리방법론을 보다 적극적인 관점에서 계획 및 통제할 수 있는 수단을 제공할 수 있을 것으로 판단된다.

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Ⅰ. Introduction

Knowledge management has been widely accepted as a sustained source of competitive advantage of organizations while BPR considered effective for improving business efficiency improvement. However, the goals of the two initiatives are different; creativity and rigidity, as recognized by Brown et al. (2000). A business can improve its bottom line through rigid process. Then from where the right process comes? We need creativity and research. That is, know-how centered process knowledge should be augmented by know-why and know-what type of intrinsic knowledge. Then the natural question might be "is there any integrative way by combining the two approaches so that the structure of knowledge management is studied in rigid ways and the resulting knowledge management facilitates organizational effectiveness". I believe this question might not be answered in rigorous way but it conveys relevant and practical implications.

To answer the question I will borrow theories both from telecommunication and socal network related areas and propositions addressed by Mintzberg (1999) regarding organigraphs.

The structure of this paper is as follows: Section 2 describes background information including previous research. Section 3 provides related theories and adapt them to my research question. Section 4 propose ways of reengineering knowledge management. In Section 5 limitations of the research and conclusions are described.

Ⅱ. Related Research

Since 1980's organizations have invested huge amounts in information technologies (IT) to gain competitive advantages. But many scholars (for example, Devaraji et al., 2000, Davern et al., 2000) said that they could not find direct relationship between the IT investment and the productivity and performance of the organizations. They called this phenomena IT paradox. Regarding the paradox, Davenport (1998) argued that the investment in Enterprise Resources Planning (ERP) may hurt organizational performance since the package-based standard process could not support individual firm's specificity. Davenport's point of view implies that competitive advantage comes from the core competency, not from general process reengineering.

Knowledge management was believed to be the solution to improve organizational capabilities. There are many literatures about knowledge management. Here are brief summary:

Nonaka's contribution (1991) to the evolutionary and circular process of

knowledge emphasizes the transformation process from tacit to objective and explicit knowledge. Influenced by Nonaka, many researchers follow two paths; the first one pursues explicit knowledge management track, and the other places importance on tacit knowledge sharing. Hansen et al. (1999) studied knowledge intensive consulting companies to see any difference on knowledge management practice. They claimed to find out knowledge management should be aligned to corporate strategy, business domain, and economic models. Accordingly they coined two different types of knowledge management strategies such as codification and personalization. Codification coincides with "publishing model" stated by Gilmour (2003). The model implies that if someone posts knowledge in knowledge repository, other persons who need the knowledge will use it. Personalization strategy which only digitizes know-where knowledge is the similar as the codification. The only difference is the content; the first one is knowledge itself; the second is appropriate reference point where the real knowledge resides.

I believe most of the current knowledge management initiatives are variants of the publishing model. But the utilization of knowledge management in real business settings is not desirable. In Gilmore (2003) one survey showed the reality: about two thirds of the respondents says that they think someone in the company can help them for better performance, but they do not know how to find the right persons in the company.

The survey does not negate the utility of the publishing model. However, the model is not effective to ad-hoc knowledge seeking situation, at least. Rather than the publishing model, Gilmour proposes the "brokering model" whose role is just to provide information between persons who are eager to get knowledge.

The prevalent assumption that once knowledge is published, the knowledge will be utilized for organizational performance places knowledge management independently from others. For knowledge management to be effective, knowledge management should be embedded into business processes seamlessly. One good example is described in Sawy et al. (1997), where the process of knowledge creation, distribution, and application to real problems is closely tied to customer relationship management. One implication of the case by Sawy et al. is that the success of knowledge management depends on the capability of knowledge exploration when it is needed and close link to other business process. This will increase visibility of knowledge management in the organizations, which in turn increase the utility of knowledge management. Combining these will form a reinforcing cycle. In this context we need kind of reengineering in the knowledge management structure and processes to shorten the distance from the knowledge itself to

business bottom line and to satisfy the eagerness of employee to tap knowledge management.

Ⅲ. Structure of Knowledge Sharing Process

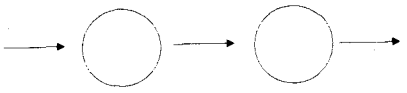
In this section we introduce two models from existing literature. The first one is from organizational form and the second is from e-Business and telecommunication area.

1. Organigraph and Its Implication to Knowledge Management

Mintzberg et al. (1999) argued that the current organizational chart does not convey information about product, process, and interrelationship of people in an organization. To view the real working of an organization, they proposed a new organizational graph or "organigraph" which consists of sets, chains, hubs, and webs. These entities are logical description of a set of objects and activities which are important to organizational operation and decision making. These entities can be nested each other when we change the depth of analysis of an organization. They claimed that "each organizational form suggests a different philosophy of managing". Managing knowledge should not be exception here. These organization characteristics give us valuable insights in knowledge management too. In the following I will describe each type of organization activities and its implication to knowledge management area.

The first entity in the organigraph is set. Set is independent objects. They are not connected so that no communication or dependency exists. Partners of a consulting company are an example of set.

The second organizational form is the chain. The main objective of chain is to support linearly connected activities (See Figure 1. As a reference I revised the figures in Mintzberg (1999) in this paper. In the figure a circle represents an entity which can be employee, organizational unit, information system, or machine. An arrow denotes the flow of job or information. These notation is the same for the organizational form of hub or web.)

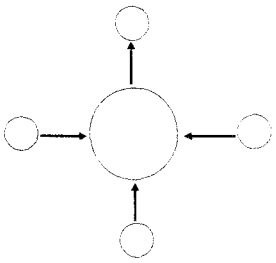


〈Figure 1: Chain form〉

Business process under the chain form is usually applied to pre-defined ordered jobs. The main objective of chain is to impose standards for entities and linkages. Performance is measured by quantitative measures such as productivity, time, or cost incurred. Since the boundary of the job is not

broad, most required knowledge is procedural know-how type. Also the knowledge needs to be provided in timely manner and high level of accuracy is a must. Manual and guidelines are good example of procedural knowledge.

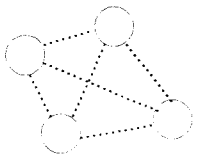
Figure 2 represents hub form. Entities along the peripheral are set form. But each of them do its work by independently interacting with a central entity. The most important obligation of the central entity is to coordinate the peripherals by allocating resources. Since the organization of this type fails if the central entity breaks down, high reliability of the central entity should be provided. The central entity interacts with diverse types of peripheral entities, which implies the central entity needs to possess knowledge repository to respond to the peripherals requests. For efficient handling by the central entity it is easy to see that the information processing capability of the central entity should be high.



〈Figure 2: Hub form〉

In many organization the central entity can be represented as core competency of the entire organization. For example, at Canon the jobs related to optics technology at Canon and bonding and coating at 3M can be considered as hubs. When the central entity is heavily loaded to provide services to the peripherals, some of the peripherals can be outsourced.

The last organization archtype is web or network. As in Figure 3 the linkage between entities is denoted in dotted lines, meaning that the existence of linkage is not predefined and haphazard. Moreover the direction of the linkage can be changed from time to time and the entities in the network can be added or deleted. Unlike the chain or hub organization, there is no controller or owner of the web organizations. The entities participate in the process on the ad-hoc basis.



〈Figure 3: Web or Network form〉

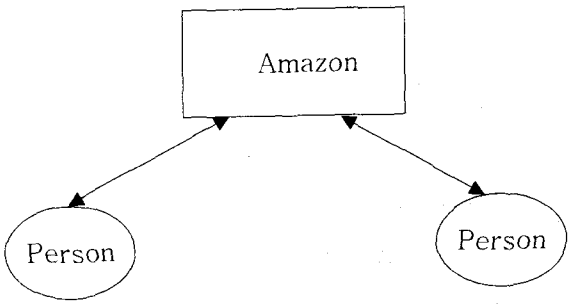
The structuredness of web form is weaker compared with that in chain or hub. Moreover it is fluid and ad-hoc. The underling jobs of the web organization are sometime ambiguous. This ambiguity makes knowledge management in this context difficult to define. Therefore satisfying knowledge requirements for all the entities is even more difficult. Mintzberg et al. (1999) pointed out the major success factor of web organization is to energize the entities so that

the cooperation among them can be enhanced. While the rigidity which is very important to chain form, flexibility in knowledge sharing should be preserved since the jobs can be changed. The required knowledge is declarative or know-what type rather than procedural one. Facilitating the communication seems to be more important than providing knowledge repository. The capacity of linkages in web form does not require large bandwidth like chain or hub. But the connectivity becomes important factor for improving system performance. Since the infrastructure of the web is consisted of information technologies and the structure of the web is social capital, the management of IT infrastructure and promotion of social network is the core areas for knowledge management in the web form.

2. Implications from Network Point of View

In Section I mentioned publishing model. In this section I will explore knowledge process network focusing on the web form described in Section III-1. I borrowed concepts from e-Business models and telecommunication network theories.

The publishing model can be considered as Amazon exchange model. The brokering model propposed by Gilmore (2003) can be interpreted as Napster P2P (peer to peer) type. In the Amazon model all the transaction management is assumed by the centralized entity, Amazon (See Figure 4).



〈Figure 4: Publishing Model: Amazon Exchange Hub Model〉

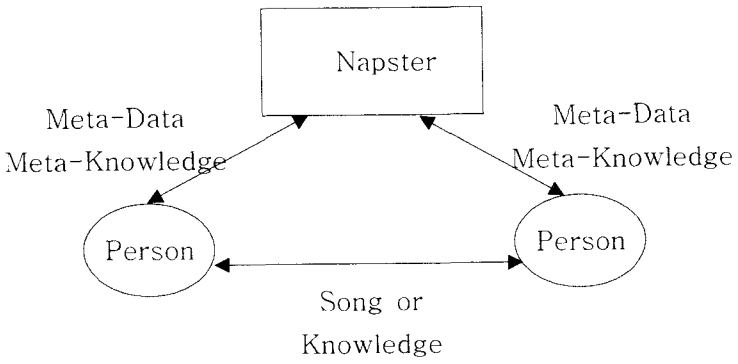
But the Napster P2P model plays a role as enabler by publishing the description of attributes for items on sale and rules of transactions. Based on the published information, individual entities participate in real transactions for themselves. In the Amazon model, structured knowledge is stored in the central entity, while the know-where type knowledge only is kept at the Napster P2P entity (Related reference can be found in "Power to the People" in Harvard Business Review, Jan 2001, pages 20-21). So far so easy for finding either knowledge itself or meta-knowledge like who owns the expertise and where.

As we noticed, the Amazon model is the analog of Barnes and Nobles in offline. It had to struggle to handle logistics problem; storage and delivery of books and other materials. Dealing with all the transaction related information, knowledge, and products at a single point is tremendous. Based on the organizational form in Section III-1, Amazon model is in the hub type whose center entity is highly overloaded.

The Naspter P2P model has been banned

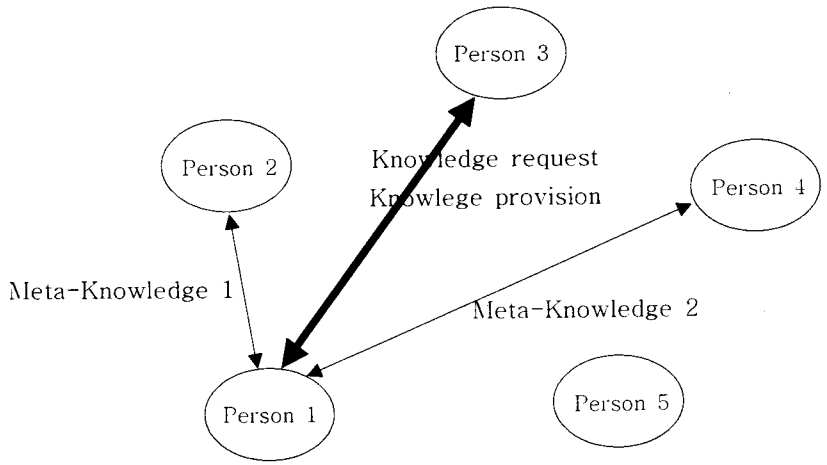
from the sharing music files due to the control of central entity. As in the Amazon model, the Napster center performs the hub role with light load in the center (See Figure 5).

Kazaa model requires a web or network type form (See Figure 6). Figure 6 represents each entity serves as a local hub which contains meta-knowledge of neighboring entities. Entity 1 first probes entity 2 for the meta-



〈Figure 5: Brokering Model: Napster Hub Model〉

It is easy to see that the distance required from a knowledge requester to knowledge possesser is just 1 because of the hub. But if the central entity does not keep the meta-knowledge which is requested by a customer? With the Napster model there is no way to provide the meta-knowledge. Fortunately we have Gnutella or Kazaa type of P2P model (McAfee, 2000). Unlike Napster model, Kazaa model does not have a centralized hub, but the meta-data or meta-knowledge is stored across distributed entities. Thus, there is no unified way of searching the needed knowledge, making the distance from the knowledge requester to the possesser is variable. This implies that the knowledge. But entity 2 does not have the meta-knowledge, but instead entity provides possible location where the entity may have the meta-knowledge, returning entity 4. Entity 1 establishes linkage to entity 4, which possess the meta-knowledge of location 3. Finally entity 1 asks the knowledge to entity 3, which returns the knowledge back to entity 1. Note that the distance from the entity 1 to entity 3 is 3 links away. The Kazaa model is very flexible in terms of knowledge searching. There is no searching limit. Search process can be expanded to the farther in another network of different organization, different country, and so on.



〈Figure 6: Probing Network Model: Kazaa Model〉

In Figure 6, if an entity do have meta-knowledge on many neighboring, the distance from search requester to provider can be shortened. The degree of possessing meta-knowledge of neighbors can be measured by the clustering coefficient (Barabasi, 2002) which is defined as the ratio of the number of actual links to the number of total links when the network is fully connected. If the clustering coefficient is high, the entities of the underlying network can be judged as strongly tied. So if a network is strongly tied, knowledge probing process can be easier than in a weakly tied network.

On the other hand, if all the entities in a network do not have any clue for the requested knowledge, the requester can not get back the knowledge. In this case if an entity has a weak tie to an entity of another network, then the knowledge probing can continue. It means that a high clustering coefficient is not sufficient for effective knowledge process. A network needs to have a "boundary spanner" (This terminology comes from Cross and Prusak, 2002) whose role is to expand the boundary of a network into another network. 3M utilized the knowledge of lead user groups of a technology to innovate its products (Hippel et al., 1999). In that case 3M needs to call for a boundary spanner to probe knowledge residing in totally different network.

Ⅳ. Reengineering the Structure of Knowledge Sharing Network

Reengineering focuses on the structured coordination of people and information, while knowledge management emphasizes more on effectiveness than on efficiency. In order for a firm to respond to unpredictable environments it needs to have creative and improvisational ways of doing business. Since the assumption of the two approaches are different, it is difficult to make them go along together (Brown, 2000).

I strongly believe that in knowledge management, especially in web form organization, the two approaches can be harmonized: network structure for effective and efficient knowledge sharing needs to be designed from top down and then fostering the probing and sharing of knowledge needs to be supported from bottom up.

To support my argument we can use analogy from telecommunication network performance issues. Major network performance issues cover response time, reliability, and availability. Response time is the required duration from resource request to obtaining it. Reliability measures the variance of response times so that requester can measure the expected response times in sufficiently accurate manner. Availability deals with the degree entities in the network is available. In conjunction with knowledge management we can think of the entities which have the requested knowledge.

These performance measures depend on the following: network topology of distributing entities in certain locations and providing linkage among entities in selective ways; communication capacity or bandwidth allocation on the linkages; and network protocols which control the communication processes.

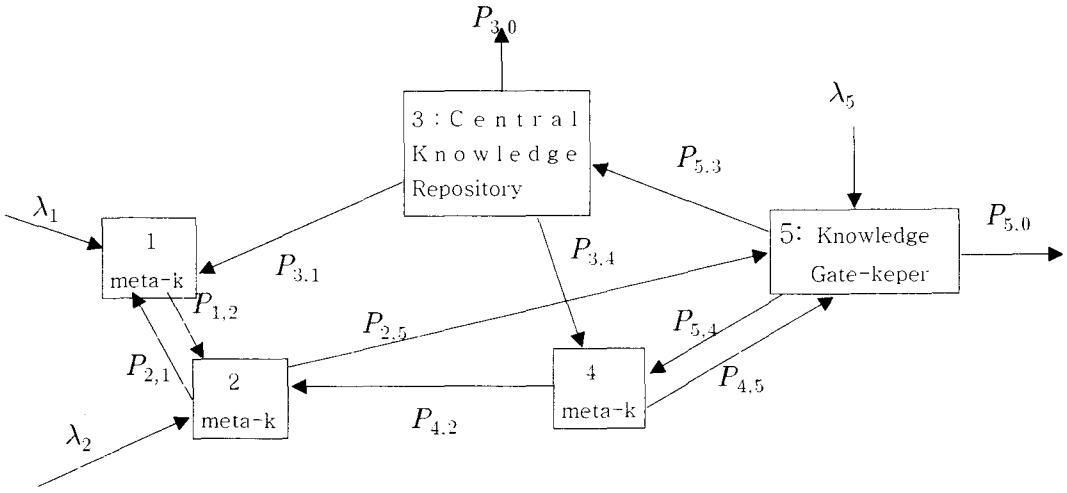
We can use the same logic for knowledge sharing network to upgrade its performance. First the network structure can be examined. If the network is not configured correctly to fit the business process, it needs to be changed. For example, if an R&D organization operates a chain oriented publishing knowledge management model, it needs to be changed. Second, the network topology in terms of bottleneck, boundary spanner, and local meta-knowledge repository has to be checked. If an entity handles too many requests, the entity may be overloaded and the response time might be significantly increased. Since the boundary spanner makes the knowledge search space much wider, existence of spanners and characteristics of spanned domain needs to be monitored. In ideal case, the local knowledge repository is distributed in a balanced way. In reality some entities may have much larger repository than the others. To prevent Meta-knowledge hoarding diverse cultural activities can be implemented.

Periodic check based on survey or interview, system log data can help to see the status of the whole network in terms of soundness of topology, communication bandwidth, existence of bottlenecks and the

role of boundary spanners. Figure 7 shows an hypothetical network. From the network, we can derive a set of valuable information to reengineer the structure of knowledge sharing network. Some ideas of using Figure 7 is as follows: Based on the survey list, quantitative measures such as arrival rate at a particular entity from probability matrix of knowledge requests. From the arrival rate, we can identify whether the entity is a bottleneck or not. Since represents magnitude of knowledge obtained from outside the network, we can figure out the boundary of spanning.

management method can be performed. In the past most organizations adopted publishing model. But now we can apply specific knowledge management philosophy to pertinent organizational form. The organizational unit of knowledge management can be business division or functional area.

We also proposed some guideline of how to reengineer the structure of knowledge sharing network; quantitative analysis on network of knowledge process can be used to identify structural problems such as bottlenecks or bandwidth problems;



〈Figure 7: General Knowledge Sharing Network Configuration〉

V. Conclusions

We showed that based on the orgagraph proposition, a simple check for fitting organizational from and knowledge characteristics of network connectivity such as strongly connected; boundary spanners who weakly tie the network to outside networks to expand knowledge probing space.

The motivation of this research is to see knowledge sharing network from the top

down perspective. This research is based on the assumption that if the structure is not designed in an appropriate way, the performance of knowledge management practice can not satisfy our expectation. I believe we need quantitative measures to see the soundness of network structure. I expect this exploratory study brings forth much research in this area.

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