

KNOWLEDGE MANAGEMENT IN NETWORK CONTEXTS

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ABSTRACT

The basic economic resource in the post-industrial information economy is knowledge, but there is a lack in our knowledge on how to manage knowledge and knowledge processes for competitive advantage. We present a new conceptualization of knowledge management: knowledge management in network contexts. We also present a strategic knowledge management (SKM) framework. SKM is a process involving: 1) strategic vision, 2) knowledge vision and key knowledge identification, 3) design, 4) knowledge protection, 5) implementation, and 6) usage. The conceptualization and the framework are based on extensions of the resource- and knowledge-based view of the firm. The framework can support organizations in strategically managing knowledge and knowledge processes to gain and sustain competitive advantage. The conceptualization and the framework open up new knowledge management research areas and issues.

1. INTRODUCTION

It is widely stressed that a firm's competitive advantage flows from its unique knowledge and how it manages knowledge (Nonaka & Takeuchi 1995; Boisot 1998; von Krogh *et al.* 2000a, b; Wikström & Normann 1994; Nonaka & Teece 2001). It is argued that knowledge is displacing natural resources, capital, and labor as the basic economic resource in the post-industrial information economy (Drucker 1995). Organizations have always, more or less intentionally and consciously, "managed" knowledge. Although the concept of coding, storing, and transmitting knowledge in organizations is not new organizational and managerial practice has recently become more knowledge-focused. We find reports of knowledge management (KM) initiatives and use of KM systems (KMS). Though we have many answers to the question: "Why do firms invest in KM and implement KMS?" we have fewer answers to the question: "How can firms strategically manage knowledge to improve firm performance?" While we have some theories, frameworks, and models related to KM, there are large gaps in the body of knowledge in the area of how to gain and sustain competitive advantage through strategic knowledge management.

The purpose of the paper is twofold. First, to conceptualize KM in a new way. The conceptualization is based on extensions of the resource-based and the knowledge-based view of the firm. We also place KM in network contexts—we will argue that a main focus in strategic knowledge management should be different forms of networks. Second, based on the conceptualization we develop a framework for strategic knowledge management (SKM). SKM is a process involving: 1) strategic vision, 2) knowledge vision and key knowledge identification, 3) design, 4) knowledge protection, 5) implementation, and 6) usage. The

framework can support an organization in strategically managing knowledge and knowledge processes to gain and sustain competitive advantage. The conceptualization and the framework also point out new research areas and issues in KM. Our approach is primarily conceptual-analytic (Järvinen 2000), which means that we use previous empirical studies, theories, models, and constructs to develop our conceptualization and the SKM framework.

The remainder of the paper is organized as follows: Next section sets the scene by briefly discussing knowledge, KM, and KMS. A presentation and discussion of a new conceptualization of knowledge management follows. Based on the conceptualization we present a framework for strategic knowledge management and note the roles ICT (information and communication technology) can play

2. KNOWLEDGE, KM, AND KMS

Although the concept of coding, storing, and transmitting knowledge in organizations is not new, organizational and managerial practice has recently become more knowledge-focused (California Management Review 1998; Truch *et al.* 2000). This section very briefly presents some of the numerous views of knowledge as discussed in the IS/IT, strategy, and organizational theory literature. This enables us to uncover some (unstated) assumptions about knowledge and knowledge management. We also present the views on knowledge, knowledge management, and knowledge management systems that will form our starting point—in later sections we will extend our views. (We will not enter the debate about whether knowledge management is a novel idea or just a recycled concept. Arguments in favor of that KM is a new concept and requires the development of new theories, concepts, etc. can be found in, for example, Nonaka & Takeuchi (1995), Alavi & Leidner (2001), Alavi (2000), Spiegler (2000), Nonaka & Teece (2001), and von Krogh *et al.* (2000a, b) — on this issue we adhere to the view of these authors.)

We can at least identify the following views of knowledge (Alavi & Leidner 2001):

- Knowledge vis-à-vis data and information. Some authors, most notably in the IS/IT community, address the question of defining knowledge by distinguishing among knowledge, information, and data (Fahey & Prusak 1998; Tuomi 2000; Spiegler 2000).
- Knowledge as state of mind, where knowledge is described as “a state or fact of knowing” with knowing being a condition of “understanding gained through experience or study; the sum or range of what has been perceived, discovered, or learned” (Schubert *et al.* 1998).
- Knowledge as objects (a thing) that can be stored in knowledge repositories (organizational memories) and manipulated (Stein & Zwass 1995; Wijnhoven 2000).
- Knowledge as a process of simultaneously knowing and acting (Brown & Duguid 2000).
- Knowledge as capability or resource, where knowledge is viewed as a capability or resource with the potential for improving organizational performance (Carlsson *et al.* 1996; Meso & Smith 2000).

The different views of knowledge lead to different perceptions of knowledge management and on the roles of KMS (Carlsson *et al.* 1996; Alavi & Leidner 2001). In accordance with the resource-based view (RBV), our starting point will be knowledge as capability. The main reason for this choice is that of the different views this is the only one that actually addresses the link between knowledge, knowledge management and firm performance.

The recent interest in organizational knowledge has prompted the issue of managing knowledge to an organization’s benefit. Knowledge management refers to identifying and leveraging the individual and collective knowledge in an organization to support the organization in becoming more competitive; problems with maintaining, locating, and applying knowledge have led to systematic attempts to manage knowledge (Davenport & Prusak 1998; O’Dell & Grayson 1998; Cross & Baird 2000; Liebowitz 1999).

Frameworks and models of organizations as knowledge systems suggest that knowledge management consists of four sets of socially enacted knowledge processes, namely: 1) knowledge creation, 2) knowledge organization and storage/retrieval, 3) knowledge transfer, and 4) knowledge application (Pentland 1995; Davenport & Prusak 1998; Boisot 1998). The frameworks and models represent both the cognitive and

social nature of organizational knowledge and its embodiment in the individuals' cognition and practices as well as the collective (i.e., organizational) practices and culture. The four processes do not represent a monolithic set of activities, but an interconnected and intertwined set of activities.

According to Davenport & Prusak (1998), most knowledge management projects have one of three aims: 1) to make knowledge visible and show the role of knowledge in an organization, mainly through maps, yellow pages, and hypertext tools, 2) to develop a knowledge-intensive culture by encouraging and aggregating behaviors such as knowledge sharing and proactively seeking and offering knowledge, 3) to build a knowledge infrastructure—not only a technical system, but a web of connections among people given space, time, tools, and encouragement to collaborate. Teece (2001) says that there are three broad aims frequently advanced by the “KM movement”: 1) the creation of knowledge repositories (data warehouses), 2) improvement of ‘knowledge’ access, and 3) enhancement of knowledge environment.

Knowledge management systems (KMS) refer to a class of information systems applied to managing organizational knowledge. That is, they are ICT systems developed to support and enhance the organizational processes of knowledge creation, storage/retrieval, transfer, and application. While not all KM initiatives involve ICT, and warnings against an emphasis on IS/IT at the expense of the social and cultural facets of KM are not uncommon (Davenport and Prusak 1998; O'Dell and Grayson 1998; McDermott 1999), many KM initiatives rely on ICT as an important enabler. The literature on applications of ICT to organizational knowledge management initiatives suggests four common applications: 1) the coding and sharing of best practices, 2) the creation of corporate knowledge directories, 3) the creation of knowledge networks, and 4) knowledge-based support of decision making and action taking. KMS is not a particular ICT in a restricted sense, but primarily a perspective (vision) on KM, the role of ICT as support for managing knowledge and how to realize this vision in practice. There is room for different perspectives on KM and obviously also room for different perspective on KMS. After presenting the SKM framework, we will briefly address the roles that ICT may play.

Summarizing, the literature points out several reasons for KM initiatives, presents different views on knowledge, describes KM and KMS in action, and describes the different activities in knowledge management. The literature is sparse on how firms actually can manage knowledge to gain and sustain competitive advantage. We will in the rest of the paper address this and will take off from the resource-based view (RBV) of the firm.

3. A NEW CONCEPTUALIZATION OF KNOWLEDGE MANAGEMENT

The conceptualization of knowledge management we present takes its epistemological starting point in business strategy theory. It is based on extensions of the resource-based view (RBV) and the knowledge-based view (KBV) of the firm. The main proposition of RBV is that competitive advantage is based on valuable and unique internal resources that are costly to imitate for competitors. In the case of KBV, the resources are knowledge-related resources. RBV and KBV are aimed at explaining and in part predicting a firm's market performance by addressing the role of the resources on which product/service features are based. The RBV has been criticized. For example, Teece *et al.* (1997) point out that the RBV recognizes but does not attempt to explain the mechanisms—dynamic capabilities—that enable a firm to sustain its competitive advantage. Also, recent research suggests that an important source for competitive advantage lies in a firm's network of external relationships (Gulati *et al.* 2000; Nohria & Ghoshal 1997).

KM can be addressed from a strategic perspective—managing knowledge as a strategic resource. Strategy is about the direction and scope of an organization over the long term and strategy theory includes configuration of resources of primary concern to senior management, or to anyone seeking reasons for success or failure among organizations (Rumelt *et al.* 1994; Johnson & Scholes 1997). Given this, a strategic perspective on KM means addressing: 1) vision and direction, and 2) how to organize and manage knowledge-related resources for competitive advantage. If we believe that knowledge and knowledge processes are critical, theory and practice on strategic knowledge management should address how important factors in the management of knowledge and knowledge processes can lead to competitive advantage.

The next sections will be devoted to the above issues, that is: 1) dynamic capabilities, i.e. an extension of the RBV, 2) an extension of the RBV to also include external relationships as a source of competitive advantage, 3) networks as a context for knowledge management, and 4) a strategic knowledge management framework.

3.1. Extending the Resource-Based and Knowledge-Based View of the Firm

In the “new economy”, the sustainable competitive advantage of business organizations flows from the creation, ownership, protection and use of commercial and industrial knowledge assets that are difficult to imitate (Teece 2001). A knowledge-based view (KBV) of the firm has emerged in the strategy literature (Grant 1996a,b, 1997; Spender 1996a; Cole 1998). This perspective builds upon and extends the resource-based view (RBV) of the firm initially promoted by Penrose (1959) and expanded by Wernerfelt (1984), Barney (1991, 1995), and Conner (1991).

The RBV and the KBV postulate that the services rendered by tangible resources depend on how they are combined and applied, which is in turn a function of the firm’s know-how (i.e., knowledge). This knowledge is embedded in and carried through multiple entities including organization culture and identity, routines, policies, computer-based information systems, and documents, as well as individual employees (Grant 1996b; Nelson & Winter 1982; Spender 1996b; Boisot 1998). Because knowledge-related resources are usually difficult to imitate and socially complex, KBV posits that these knowledge assets may produce long-term sustainable competitive advantage. However, it is less the knowledge existing at any given time per se, than the firm’s ability to effectively create new knowledge and to employ the existing knowledge to solve problems, make decisions, and take actions, that forms the basis for achieving competitive advantage from knowledge-based assets.

The RBV makes two assertions. First, resource heterogeneity, which means that resources and capabilities may be heterogeneously distributed across competing firms. Second, resource immobility, which means that these resource and capability differences can be stable over time. A firm’s resources and capabilities include all financial, human, physical, and organizational assets utilized by a firm to develop, manufacture, and deliver services and products to its customers.

Descriptions of resource attributes that render competitive advantage are plentiful. According to Kalling (2000), few attributes are frequently referred—resources should be: 1) valuable, 2) unique, 3) sprung out of factor imperfections and ex ante uncertain, 4) costly to imitate, and 5) distributed in an optimal way internally in the organizations.

1. *Value*. A resource must enable a firm to respond to environmental threats or opportunities, for example by lowering costs or rising the price for a product/service, or differentiating a product/service.
2. *Uniqueness or rareness*. In order to create a competitive advantage a resource must be unique and has an asymmetric distribution across competitors.
3. *Different fit and expectations*. Related to the issue of value are the different expectations on the future value of resources. In an SKM-perspective this is related to what value specific knowledge-related resources are expected to bring to the organization.
4. *Costly imitation*. To gain and sustain a competitive advantage of a resource it must be costly to imitate. There must be a barrier to future duplication of the resource. Hence, firms without a resource or capability face a cost disadvantage in obtaining it compared to firms that already possess it.
5. *Resource organization and leverage*. This feature is related to how well a resource is organized and to the direct management of the resource. Hence, it is related to the structuring of organization, routines etc. to make sure that the resource is used optimally.

Most RBV-writings focus on stable rents that are costly, or impossible, to imitate. Recently, some writers have addressed the dynamic nature of resources (Grant 1996a, b, 1997; Teece *et al.* 1997; ; Kogut & Zander 1992; Eisenhardt & Martin 2000). This can be viewed as an extension of the RBV and the KBV. From an SKM-perspective this extension is critical in that it will force us to focus on the dynamic aspects of knowledge and knowledge processes. Also, we increasingly see that competition in the market gets displaced by the competition for the market (Teece 2001). Said Teece (2001), “The pay-off from market insight—

figuring out where the market is heading and investing heavily to get there first—is high. ... The ability to sense and then seize such opportunities is in part an organizational capability.” This capability is often referred to as dynamic capability, and means a shift in focus—a shift in analysis units and design units (Teece & Pisano 1994; Teece *et al.* 1997; Teece 2001; Eisenhardt & Martin 2000). The focus in RBV is on resources, but in the dynamic capabilities perspective it is on processes, positions, and paths. Teece *et al.* (1997) define dynamic capabilities as “... the firm’s ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments. Dynamic capabilities thus reflect an organization’s ability to achieve new and innovative forms of competitive advantage given path dependencies and market positions (Leonard-Barton, 1992).” Hence, profits not just flow from the assets structure of the firm and the degree of imitability, but also by the firm’s ability to reconfigure and transform.

Our conceptualization is primarily based on the RBV and the KVB, but crucially extended by the dynamic capability perspective. To gain and sustain a competitive advantage through KM include:

- The design of knowledge processes—knowledge creation, knowledge organization and storage/retrieval, knowledge transfer, knowledge application.
- The “design” of means to redesign, reconfigure, and transform knowledge processes.

3.2 Knowledge Management in Network Contexts

The second and third extensions are related to: 1) from a firm-perspective to a firm- and inter-firm perspective, and 2) a focus on networks as the context of knowledge management.

Fifteen years ago, Thorelli (1986) wrote an article stressing the importance of networks and the need for research on networks. Thorelli used the term network to refer to relationships between two or more organizations. Other writers have used the term to refer to networks in an organization as well as between organizations. Following Laumann *et al.* (1978) a social network can be defined as “a set of nodes (e.g., persons, organizations) linked by a set of social relationships (e.g., friendship, transfer of funds, overlapping membership) of a specified type.” In knowledge management the social network will primarily be for enabling and supporting the different knowledge processes. A network can be enabled and enhanced by the use of ICT.

Although, the construct ‘network’ can be used to describe an observed pattern, we advocate that it is used in strategic knowledge management. We suggest that knowledge management has to become network-focused if knowledge intensive firms’ are to gain and sustain competitive advantage from knowledge management. Support for this suggestion can be found in a number of empirical studies. von Hippel (1988) found that an organization’s suppliers and customers were its primary sources of ideas for innovations. According to von Hippel, a network with excellent knowledge transfer among users, manufacturers, and suppliers will out-innovate networks with less effective knowledge sharing activities. In a study in the biotechnology industry it was found that the network of firms was the locus of innovation, not the individual firm (Powell *et al.* 1996). Dyer and Nobeoka (2000) showed that Toyota’s ability to effectively create and manage knowledge sharing networks at least in part explains the relative productivity advantages enjoyed by Toyota and its suppliers. Liu and Brookfield (2000) found that Taiwan’s successful machine tool industry has a number of network structures. They also found that the networks in part explain the tool industry’s success. These, as well as other (e.g., Miles *et al.* 2000; Boisot 1998), studies demonstrate the importance of networks and that the networks can be effective in all of the knowledge processes (from knowledge creation to knowledge application and use).

New organizational forms have been proposed and several of these stress the importance of using networks in knowledge and innovation processes—see, for example, Nonaka and Takeuchi (1995), Quinn (1992), Quinn *et al.* (1997), as well as several of the contributions in Nohria and Eccles (1992).

We define three different types of networks for knowledge management: 1) intra-networks, 2) extra-networks, and 3) inter-networks. Intra-networks are firm-specific networks, that is, they do not transcend firms’ boundaries. It could be a Lotus Notes-based intranet for disseminating best practices in the firm.

Extra-networks are networks that transcend firms' boundaries. Participation in the network is restricted, meaning that only individuals and groups from specific organizations are allowed to participate. To exemplify, an extranet for R&D personnel in certain telecommunication equipment firms engaged in the development of Bluetooth applications. Inter-networks are also networks that transcend firms' boundaries, but participation is not restricted. They are more or less open to anyone who wants to join and participate. An example, is how Fiat used the Internet to test some new design ideas for its Punto. Fiat invited potential customers to, for example, select features for the car on its Web site. More than 3000 persons took the change and gave Fiat valuable design information—this is a good example of co-design using an inter-network. (Although, we have used ICT-based examples not all networks will use ICT and in most networks ICT will only be one of several components and aspects).

Our conceptualization opens up new research issues in knowledge management, for example:

- Under what circumstances are different networks effective in knowledge management. Liu and Brookfield (2000) identified three basic types of networks: concentrated, dispersed, and multi-centered networks. Within each basic type, they identified a number of different forms of networks. This classification can be used in addition to the above distinction (intra-networks, etc.)
- Strong tie versus weak tie networks. Some studies suggest that a highly interconnected, strong tie network is effective for the diffusion of knowledge rather than creating new knowledge, which is the strength of weak tie network (Rowley *et al.* 2000; Dyer & Nobeoka 2000). Research on when strong tie networks and weak tie networks are effective in knowledge processes is needed.
- A problem with extra-networks and especially inter-networks is that in many cases there is no higher authority to orchestrate a “top-down” design. Research on how these types of networks can be designed and put to effective use is also needed.
- From a management and design perspective we can distinguish between: 1) artificial (designed) networks, 2) and natural and emerging networks. Examples of designed networks include the design of an electronic communication network, using for example Lotus Notes, or the design of a knowledge repository where best practices from lab tests are registered. But design can also include the design of reward systems and education packages as well as the design of physical meeting places. In and between organizations some networks develop and emerge naturally or they are causally formed, i.e. they are not designed. As stressed by von Krogh *et al.* (2000) a firm can and should take actions to enable knowledge creation and knowledge sharing. Gupta & Govindarajan (2000) point out that a crucial requirement for effective knowledge management is the development and support of an effective social ecology—the social ecology is the social environment within which people operate. Liu & Brookfield (2000) point out that relationship-building and trust-building are critical in effective networks. Research on how a firm can and should involve it self in fertilizing both designed and natural networks is another critical research issue.

To summarize, we suggest that the contexts of knowledge management should be networks. This will have implications for research on knowledge management as well as on KM practice. Although, theory and empirical studies support this suggestion, we, as noted, still need much more research on the above areas and issues.

4. A FRAMEWORK FOR STRATEGIC KNOWLEDGE MANAGEMENT

Above, based on the RBV, five resource attributes, which when fulfilled render a firm a competitive advantage, were presented. Hence, a framework for the strategic management of knowledge-related resources should support an organization in creating these attributes. This means that the framework should guide an organization in: 1) identifying the right knowledge and knowledge processes, 2) developing and refining the knowledge and knowledge processes to enhance the value, 3) implementing and distributing the knowledge and knowledge processes in an optimal sense, 4) making sure that the knowledge and knowledge processes are used in an optimal way, and 5) protecting the knowledge and knowledge processes from imitation.

Our framework is in part based on a framework for IT resource management processes developed by Kalling (2000). Based on the RBV of the firm he developed the framework. We have adapted and extended Kalling's framework by: 1) focusing on knowledge and knowledge processes, 2) also using dynamic capabilities as a foundation, 3) focusing on networks (intra-, extra-, and inter-networks), 4) renaming some of the tasks, 5) developing the content of the tasks to be specific for knowledge-related resources and processes, and 6) adding one task (strategic vision).

The proposed SKM-framework suggests that gaining and sustaining a competitive advantage through knowledge and knowledge processes is a process involving (Figure 1): 1) strategic vision, 2) knowledge vision and key knowledge identification, 3) design, 4) knowledge protection, 5) implementation, and 6) usage. These are six distinct tasks that a firm has to manage in order to gain competitive advantage through knowledge and knowledge processes. Each task has certain purposes and certain problems; certain evaluation issues are related to each of the tasks.

Barney (1997), based on the RBV, generated four questions that can be asked about any resource or capability to assess whether or not it is or can be a source of competitive advantage. Adapting the question to our conceptualization, the following questions emerge:

- *The question of value.* Do a firm's knowledge and network-based knowledge processes enable the firm to sense and then seize environmental opportunities as well as respond to environmental threats?
- *The question of rareness.* How many competing firms already possess particular valuable knowledge and network-based knowledge processes?
- *The question of imitability.* Do firms without particular valuable knowledge and network-based knowledge processes face a cost disadvantage in obtaining them compared to firms that already possess them?
- *The question of organization.* Is the firm organized to exploit the full competitive potential of its knowledge and network-based knowledge processes?

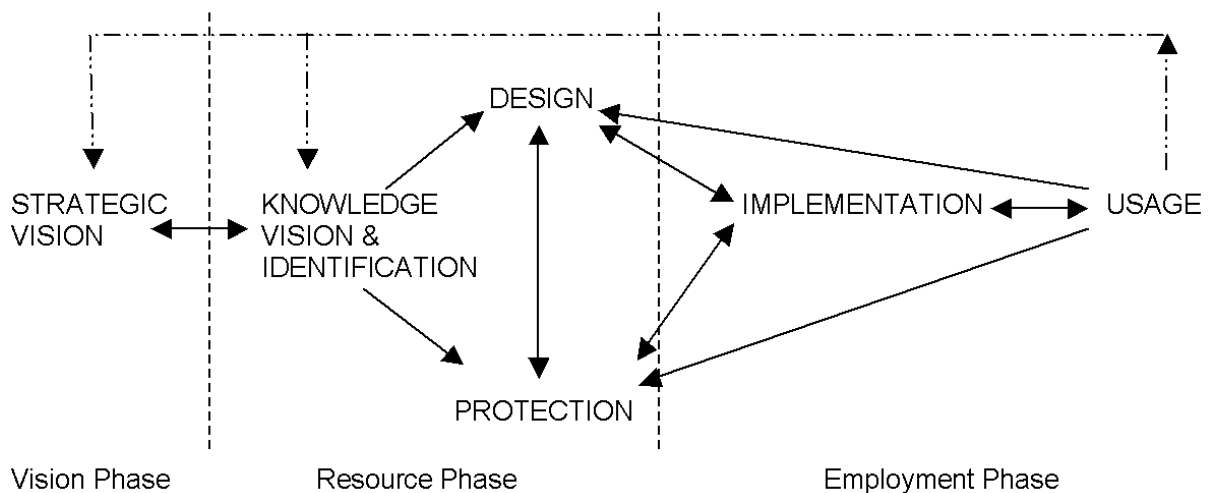


Figure 1: A model of the strategic knowledge management process

Strategic vision. This is like “traditional” strategic planning. The strategic vision can include: a) mission of the firm, the overriding purpose in line with different stakeholders' values and expectations, b) vision or intent, the desired future state which can include the aspiration of the firm, c) goal, general statement of purpose or aim, and d) objectives, quantification and operationalization or more precise statements of the goal(s). Whatever the strategic vision encompasses, it should from an SKM-perspective identify strategic knowledge management as a critical means for the company to gain and sustain competitive advantage. The strategic vision will identify the ultimate purpose of strategic knowledge management. If strategic

knowledge management is not consider a critical means the organizations might be better off focusing on other resources. The output of this activity is the input to the knowledge vision activity.

Knowledge vision and identification of key knowledge-related resources. To be able to manage knowledge-related resources dynamically and continuously, a firm needs a knowledge vision. The knowledge vision should be aligned with the strategic vision of the firm. It should identify how the firm by strategically managing knowledge and (network-based) knowledge processes can fulfill the strategic vision of the firm. Since the knowledge vision is related to the strategic vision it can transcends the boundaries of existing knowledge, products/services, organizational design, and markets.

Using the above questions we can ask:

- Can a specific type of knowledge and networked-based knowledge processes be valuable to the firm? The value should be assessed in relation to the strategic vision.
- Do competing firms possess the specific type of knowledge and networked-based knowledge processes?
- Will firms without the specific type of knowledge and networked-based knowledge processes face a disadvantage in obtaining it compared to firms that already possess it?
- Will it be possible to design and implement different artifacts, artificial systems, physical and virtual spaces, etc. to exploit the full competitive potential of the specific type of knowledge and networked-based knowledge processes?

Using the questions will support an organization in assessing likely competitive implications of the specific type of knowledge and networked-based knowledge processes (competitive disadvantage <-> sustained competitive advantage). It will also suggest likely economic performance (below normal <-> above normal).

Hence, the knowledge vision defines what knowledge-related resources the firm should develop in order to gain competitive advantage through KM, but the knowledge vision does not specifically define how the knowledge-related resources should be designed, acquired, implemented, and used.

Design. The design activity addresses how the requirements (from previous activity) can be fulfilled. Design is both about content and process. Design can include the design of knowledge repositories, knowledge-intensive business and management processes, reward systems, etc., but also the design of physical places (Earl & Scott 1999; Brown & Duguid 2000; Hansen *et al.* 1999; Nonaka *et al.* 2001; von Krogh *et al.* 2000a; Gupta & Govindarajan 2000). This can also include the design of environments for simulation (Schrage 2000). Design is not only about the development of structural capital but also about the development of human capital. It also includes the design of how knowledge can be used to enhance or amplify other existing (strategic) resources that might be sources of competitive advantage, for example, the design of how knowledge can enhance NPD processes.

The core of design is the development of a strategic knowledge architecture, which is a combination of knowledge-related resources to put a knowledge vision into effect.

We can use the questions to evaluate design:

- To what extent and degree can specific design alternatives of (network-based) knowledge processes be valuable—valuable in relation to the knowledge vision and the strategic vision?
- Do competing firms possess the specific design alternatives of (network-based) knowledge processes?
- Will firms without the specific design of (network-based) knowledge processes face a disadvantage in obtaining them compared to firms that already possess them?
- To what degree and extent will it be possible to implement the different artifacts, artificial systems, physical places and virtual spaces, etc. to exploit the full competitive potential?

Knowledge protection. The fourth activity is sparsely addressed in the KM-literature. There are two purposes of knowledge protection: 1) protecting for imitation, and 2) protecting for value erosion. A firm can in some cases use contractual and legal protection measures, but for many knowledge-related resources it can only use isolation mechanisms to protect its key knowledge-related resources. Isolation mechanisms can be, for example:

- *Ambiguity.* This is a question of “blurring” the relation between a knowledge-related resource, for example, an ICT supported network-based knowledge process, and its effects.

- *Complexity*. This is a question of “embedding” a knowledge-related resource in such a way that it becomes a socially complex phenomenon—for example, a network-based knowledge process.
- *Time advantage*. This is a question of time advantage, trying to be first and continuously develop the knowledge-related resources (a moving target for the competitors)—this is related to dynamic capabilities of a firm.

These mechanisms can complicate imitations and reduce value erosion. Again, it is possible to use the questions to assess: 1) to what degree certain steps taking for protecting knowledge and knowledge processes are likely to lead to a competitive advantage, and 2) different design alternatives from a protection perspective.

Implementation. After the resource phase follows the employment phase. It is not enough to cleverly identify and design knowledge-related resources. In most cases there is a need for different interventions so that the knowledge and networked-based knowledge processes will be fully exploited. Implementation can include, for example, the development and implementation of a new reward system, unlearning and learning programs, etc. The questions can be used to assess different implementation tactics in terms of their likely competitive implications and economic performance.

Usage. This is the actual use of the knowledge and the network-based knowledge processes. The questions can be used to evaluate the effects of the actual usage of the knowledge-related resources. The result of an evaluation can affect the strategic vision and the knowledge vision.

4.1 Implications for the Use ICT in Knowledge Management

As we pointed out, KMS is not a particular ICT in a restricted sense, but primarily a perspective (vision) on knowledge and knowledge processes, the role of ICT as support for managing knowledge and how to realize this vision in practice. ICT useful in KM in network contexts include, for example, Internet, intranet, groupware and computer-mediated collaboration, data warehouses, knowledge discovery in data bases (incl. data mining), computer-based yellow pages, simulation tools, intelligent agents, video conferencing—this is not an exhaustive list. (Different aspects of the use of ICT in KM can be found in, for example, in Liebowitz (1999), Alavi & Leidner (2001), and Carlsson *et al.* (2000).) Above, we have presented one conceptualization of knowledge management as well as the SKM framework. These can be used to identify and assess what roles ICT can play and how ICT can be used in intra, extra-, and inter-networks to gain and sustain competitive advantage. The use of ICT in network-based knowledge processes deserves considerable research attention.

5. CONCLUSIONS AND FURTHER RESEARCH

Using a conceptual-analytic approach we have developed a new conceptualization of knowledge. We built our conceptualization on the RBV and KBV of the firm, but these were extended to also include: 1) the dynamic capability perspective, and 2) the firm and inter-firm perspective. We also introduced networks as the context for knowledge management and presented a strategic knowledge management framework. The framework can guide an organization in designing and developing critically strategic knowledge processes. Further theoretical work is needed to tighten the conceptualization and the framework. Empirical research will also be critical in helping us understand how firms get to be good at knowledge management in network contexts, how they sometimes stay that way, why and how they improve their knowledge management, and why sometimes knowledge management decline.

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