EVALUATING KNOWLEDGE MANAGEMENT IN NETWORK CONTEXTS – APPLYING THE STRATEGIC KNOWLEDGE MANAGEMENT FRAMEWORK

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ABSTRACT

Gaining and sustaining competitive advantage through knowledge sharing and network-based knowledge processes is a process involving the tasks of formulating a strategic vision, formulating a knowledge vision, identifying relevant knowledge, designing the knowledge process, catering for knowledge protection, implementing the process, and using the system. The focus of this paper is twofold. Firstly, we apply a strategic knowledge management framework, aimed at evaluating the effect of such processes, on an empirical case. Secondly, we discuss the results of our appliance of the framework and propose some further issues to be resolved.

1. INTRODUCTION

The KM activities traditionally carried out within organizations have now started to appear in organizational networks, aimed at supplying the participating organizations with knowledge that previously was difficult to acquire. However, performing knowledge management in network contexts is not a trivial task, due to the increased complexity inherited when organizations are to cooperate. In addition, add the requirement of a need for the organizations to cooperate on equal bases and you may end up with an almost uncontrollable situation. Since the initiation of the network is rather resource demanding, it is not acceptable to invest those resources and end up with an uncontrollable situation that is not contributing to the assumed gaining and sustaining of competitive advantage. Therefore, different approaches are suggested in order to be able to control networks and to cater for support in achieving competitive advantages. One approach suggested by Carlsson (2001) is the strategic knowledge management (SKM) framework, aimed at evaluating the efforts taken and supporting the initialization of a network.

The purpose of this paper is twofold. Firstly the evaluation framework for strategic knowledge management given by Carlsson (2001) is applied to an empirical case. The case is focused on the cooperation between organizations in the electronic circuit industry. Secondly, the paper discusses the appliance of the framework with respect to its advantages and disadvantages.

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2. KNOWLEDGE MANAGEMENT

Knowledge management is difficult to describe, since there exist many different descriptions and definitions thereof (e.g. Nonaka and Takeushi, 1995; Davenport and Prusak, 1998; Wiig, 1993). The fluid mix of concepts, technologies and approaches in knowledge management also contribute to make the whole area almost indefinable. Therefore, we will instead describe the different elements constituting KM. The description will be based on the work conducted by Binney (2001) and we consider his separation of knowledge management spectrum into different elements as a necessity for being able to comprehend the area and all the activities involved. Binney (2001) claims that the concept of KM includes six distinct elements, each of which has a particular aim to fulfil, in order to allow organisations to cover the whole KM-spectrum. Along with the distinct elements, Binney (2001) also exemplifies on different applications that may be included to support the activities of each element (Figure 1).

	Transactional	Analytical	Asset Management	Process	Developmental	Innovation and Creation
Knowledge Management Applications	* Case Base Reasoning * Help Desk Applications * Customer Service Applications * Order Entry Applications * Service Agent Support Applications	* Data Warehousing * Data Mining * Business Intelligence * Management Information Systems * Decision Support Systems * Customer Relationship Management (CRM) * Competitive Intelligence	* Intellectual Property * Document Management * Knowledge Valuation * Knowledge Repositories * Content Management	* TQM * Benchmarking * Best practices * Quality Management * Business Process (Re)Engineering * Process Improvement * Process Automation * Lessons Learned * Methodology	* Skills Development * Staff Competencies * Learning * Teaching * Training	* Communities * Collaboration * Discussion Forums * Networking * Virtual Teams * Research and Development * Multi-disciplined Teams

Figure 1. KM applications mapped to the elements of the KM spectrum (From Binney, 2001, p. 35)

However, since Figure 1 only exemplifies on which applications that are suitable for a particular element and provides no description of the elements are included, the following sections will be dedicated to a brief description of the aim and role of the six distinct elements.

Transactional KM is focused on supporting the user in day-to-day tasks, such as completing a transaction or handling a customer query, by reusing already existing knowledge. The application typically supports the user by supplying her/him, who is confronted with a problem, with the solution to a similar problem.

Analytical KM is focused on creating new knowledge. The core of analytical KM is the integration of large amounts of data and information, from both internal and external sources, which is then used to derive trends and patterns. Those trends and patterns are previously not known, due to the complexity of the sources and the diversity of the data and information.

Asset management KM concerns the processes associated with the management of knowledge assets. The asset management involves one of the following:

1. The management of codified explicit knowledge.
2. The management of intellectual property.

When these assets have been captured, they are made available to the users in the organization. Binney (2001) uses the analogy of a library, since the knowledge assets, similar to books in a library, are catalogued and made available to the user. These knowledge assets are often by-products to the ordinary business.

Process-based KM covers, as the name implies, processes. More specific, this element is focused on the codification and improvement of processes, procedures, and methodology. The process-based KM activities often have their origin in total quality management (TQM) and process reengineering activities.

Developmental KM focuses on increasing the competencies and capabilities of organizations knowledge workers. The KM element concerns both the transfer of explicit knowledge and the development of tacit knowledge. Explicit knowledge is transferred via training interventions whereas tacit knowledge is developed through developmental interventions such as experimental assignments or membership in a certain community of interest. This KM element is becoming more and more important, especially since the investments spent on developing the knowledge and capabilities of a company's personnel, is a measure of the value of the organization. Further, according to Binney (2001), such investments also help to attract personnel in a highly competitive market. Examples of developmental KM applications include: skills development, training and learning.

Innovation/Creation KM applications focus on the creation of a "learning" environment, in which the personnel of an organization or from different organizations can come together and exchange knowledge or create new knowledge. This KM element is the most popular in the whole KM spectrum and much literature is devoted to how to create this learning environment.

3. THE STRATEGIC KNOWLEDGE MANAGEMENT FRAMEWORK

In the framework proposed by Carlsson (2001), it is suggested that gaining and sustaining a competitive advantage through knowledge and knowledge processes is a process involving the tasks given in Figure 2. Figure 2 also describes the relationships between these tasks.

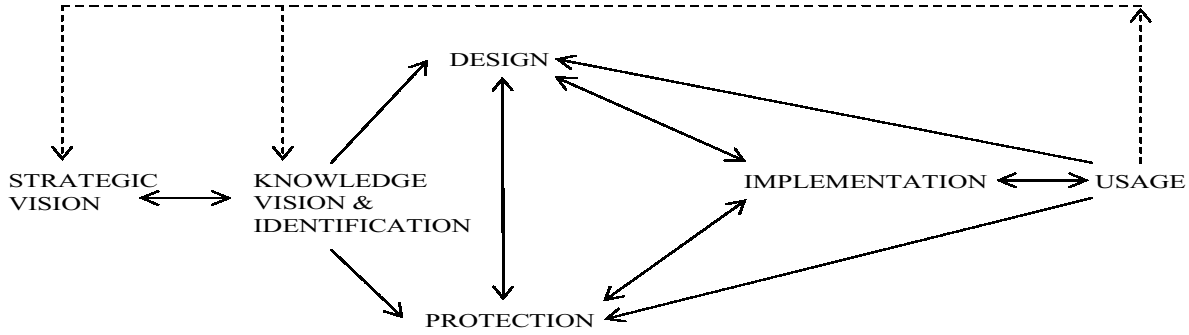

Figure 2. A model of the strategic knowledge management process (From Carlsson, 2001)

In the following sections, the tasks will be briefly described. However, before describing the different tasks and their specific evaluation focuses, the authors would like to make clear that the evaluation of each task is based on the following general questions, formulated by Carlsson (2001):

- *The question of value*. Do a firm's knowledge and network-based 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 limitability*. Do firms without particular valuable knowledge or 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?

Theses questions are focused on the core of each task, in order to create a baseline for the evaluation process. In other words, the tasks and their relationships described, along with the specialization of the questions given above, constitute the core of the evaluation framework. Below we present a brief description of each task. We have deliberately chosen only to present the general idea behind each task, allowing the reader to grasp the core of the tasks, since the focus of this paper is to describe the

appliance of the framework to a case rather than describe the framework in detail. Readers willing to extend their knowledge of the framework and its tasks are referred to Carlsson (2001).

Strategic vision. As the name implies, this task is focused on identifying the purposes for incorporating knowledge management into the business, as a means for gaining and sustaining competitive advantage. The purposes must be made available in the strategic vision of the organizations, but the form in which it is made available is of secondary importance.

Knowledge vision and identification of key knowledge-related resources. This task is focused on identifying the KM resources in which the organization must invest, in order to gain competitive advantage. The importance of aligning the knowledge vision to the strategic vision is also pinpointed. Furthermore, the knowledge vision is also to consider as guidance to the types of KM resources needed, but it does not specifically describe how these resources are to be acquires, designed, implemented, and used.

Design. This task addresses how the requirements stated in the knowledge vision can be accomplished. The core of this task is to develop strategic knowledge architectures, i.e. combining the knowledge resources, in order to put the knowledge vision into effect.

Knowledge protection. This task can be divided into two broad categories. Firstly, protecting the knowledge and the (network-based) processes from being imitated by competitors and secondly, protecting the knowledge from value erosion. Carlsson (2001) also exemplifies on so called isolation mechanisms to protect the knowledge and its sources. The mechanisms are, besides legal and contractual measures: 1) Ambiguity, 2) Complexity, and 3) Time advantage.

Implementation. This task concerns how to promote the knowledge management activities and support to the organization. This task concerns different tactics to implement the knowledge-related resources. Focus is laid on their competitive implications and economic performance.

Usage. This task concerns the organizational usage of the knowledge-related resources. For this task, the general questions may be directly applied to evaluate the usage of the knowledge-related resources. The outcome of such evaluation may in turn affect the strategic vision and knowledge vision.

4. THE CASE

The case study includes the establishment of routines for knowledge sharing as well as the creation of a knowledge management system (KMS), aimed at integrating knowledge of design and manufacturability within the electronic circuit industry. The partners in the network represent designers and manufacturers in the electronic circuit industry. The motive for their cooperation is the need to implement new manufacturing techniques in short time spans. The implementation of a new manufacturing technique complicates the product development process. This process covers stages from initial product development to large volume manufacturing. The different stages in the process are typically performed by different companies. We chose to describe this as horizontal cooperation and vertical competition (Figure 3).

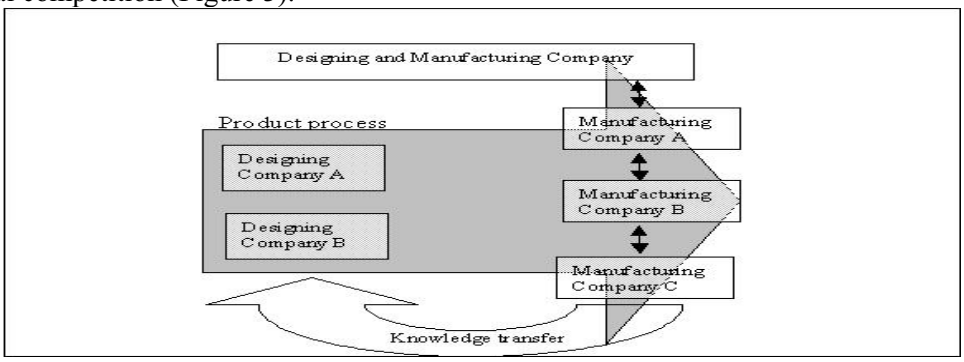

Figure 3. The network-based knowledge process, concerning the knowledge transfer from manufacturing organizations back to the designing organizations.

Furthermore, we have adopted the ideas of (Binney, 2001) concerning the KM spectrum. The project concerns the KM elements: 1) *asset management (e.g. knowledge repositories)* and 2) *innovation and creation (e.g. networking and virtual teams)*. The reason for adopting the asset management element for this work is that the project was focused on the creation of a web-based database aimed at storing explicit manufacturability data shared amongst the participants. The reason for adopting the innovation and creation KM element was that the project focused on allowing personnel of different organizations to come together and exchange knowledge and create new knowledge. Furthermore, Binney (2001) states that networking is a possible KM application for the innovation and creation KM element. However, since there are different types of networks described in literature, we will be more precise in that point. Since this work is based upon the work conducted by Carlsson (2001) we find it natural to apply his categorization of networks. Carlsson (2001) defines three different types of networks for knowledge management: intra-networks, extra-networks, and inter-networks. Since the project involved six organizations and the participation in the network was restricted to these, the network is considered as an extra-network. However, concerning extra-networks there are different typologies described in literature. Franke (1999) describes three types of networks (Figure 4) between organizations: 1) Internal network, 2) Stable network, and 3) Dynamic network.

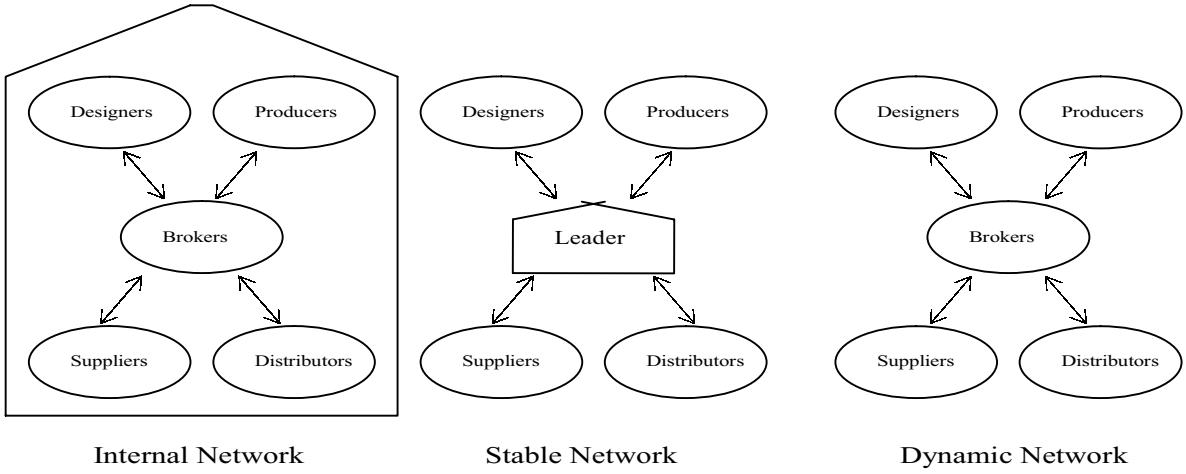

Figure 4. Common network types (From Franke, 1999, p. 205)

The network is arranged with a broker responsible for the network-based knowledge processes and the knowledge shared. The broker is a stand-alone organization and therefore we classify the network in this case as a dynamic (extra-) network.

5. APPLYING THE SKM FRAMEWORK TO THE CASE

In this chapter, we will apply the SKM framework (Carlsson 2001) on the case described in chapter 4. The aim of applying the framework is to evaluate the case described. In order to structure the evaluation, each task described in the framework will be handled separately. However, we would like to give some comments on the appliance. Firstly, in this particular case, we consider the knowledge transfer described in Figure 3. as the network-based knowledge process. Secondly, since Carlsson (2001) focuses on the strategic knowledge management in organizations, we have chosen to consider the extra-network as the organization and the strategic- and knowledge visions are described from that point of view. As a matter of fact, one may consider the network as a virtual organization built up by virtual links through the used of ICT (Shao et al., 1998). The reason for not considering the strategic vision of each participating organization was that it was considered as misaiming the evaluation, since the focus of the framework is on the strategic level of different types of networks. Finally, we have chosen not to answer each task related question one by one. Instead, the results of the evaluation were aggregated to a task level. This approach was chosen since it was considered to increase the readability

of the paper and give a better overview of the results. In the following sections, each task will be evaluated respectively.

Strategic vision. The network has two strategic visions. To create:

1. a knowledge management system, which allows for knowledge sharing between organizations, for the electronic industry.
2. an organization that will further develop and maintain the system.

The broker initially identified the above goals. The first goal may be considered controversial, and was so, by some of the participating companies. We conclude that this due to what we describe as the vertical competition within the network. However, during the project, the difficulties associated with this item were overbuilt. The second vision was less controversial since the general agreement was that a branch of trade organization for the electronic business could play this role in the future.

We conclude that the strategic vision should recognize that the knowledge contained in the repository should be hard for each participating companies to obtain and maintain on their own and of such dignity and interest that other companies will find it worthwhile to pay a broker for obtaining it. This vision was not anchored through out the entire network and there was no common understanding on what type of knowledge would gain and sustain competitive advantage for the network.

Knowledge vision and identification of key knowledge-related resources. The network has identified the following short-term goals:

- Create knowledge about the production processes;
- Verify the production process;
- Implement new production processes;
- Verify the reliability of the production processes.

And the following long-term goals:

- Access to a knowledge management system;
- Shorter development cycles for new products;
- Rules to ensure the quality of products.

The knowledge vision of the network was focused on sharing manufacturing knowledge between designing and manufacturing companies. Without participating in the network, the designing companies would only have access to raw component knowledge, such as the size or shape of a particular component. However, by integrating the knowledge of the manufacturing companies in the design process, knowledge concerning constraints on the relation between components and knowledge concerning constraints on combinations of certain components on a particular printed circuit board, were introduced. By allowing for such knowledge the number of design loops may be reduced and hence the resources associated with redesign. In extension, this also reduces the amount of resources required from the manufacturing companies, since every design loop is associated with testing activities of the physical design. By reducing the number of design loops, the number of tests of the physical design may be decreased as well. Hence, the value of the network was identified and made clear to all network participants.

Another value-adding fact that was identified during the evaluation was that the knowledge vision was aimed at reducing the pressure of key personnel in the participating organizations. By sharing knowledge via a web-based system, the key personnel's knowledge may be distributed without direct contact with them. This was valuable, since the key personnel also had a heavy workload in each participating organization. During the evaluation, we were not able to clarify if competing organizations outside the network possessed the same type of knowledge or network-based knowledge process. However, within the network, it was more or less made clear that the manufacturing companies, which were both competitors and cooperators, were managing valuable knowledge, which they were not so keen on sharing. When evaluating the question on imitability, it was made clear that the network-based knowledge process in itself was generic and not hard to imitate. However, since the participating organizations had invested resources in the establishment of the network as well as in the

knowledge process, it was decided that when up a running the system should only be accessible to members of a certain branch of trade organization. This may be interpreted in different ways, but a reasonable interpretation is that it would be rather costly for others to join the network.

Design. As mentioned in the above section , the knowledge vision was focused on sharing manufacturing knowledge between designing and manufacturing organizations. In order to allow such knowledge sharing, the network-based knowledge process should be supported by ICT. The knowledge resources that were to be integrated were widely dispersed and included e.g. the personnel's knowledge, raw manufacturing data, and information acquired from different test cycles. Different design and implementation alternatives for this network have been considered. However, since the organizations participating in the network are geographically distributed, ICT support was a necessity. A vast amount of different artifacts and systems are suggested in literature describing ICT systems, but we have chosen a well-established ICT solution, based on a three-layer data base architecture, with web-technology support (Connolly et al., 1999). The underlying motivations are platform independence, availability, use of a common GUI, low costs, and relatively easy maintenance. The platform independence and the low cost have also been used as motivations for using the same type of technology in other work (Tiwana and Bush, 2001). Furthermore, the utilization of web-technology for distributing and sharing knowledge is widely accepted and some also consider web-technology as a base knowledge management application for most types of KM activities (Meso and Smith, 2000; Binney, 2001). These capabilities of the strategic knowledge architecture developed cater for efficient knowledge sharing, which in turn exploits most of the potential of the network. In addition, the capabilities also allow for further development of the underlying services. Finally, the possibilities to implement different artifacts and systems, to fully exploit the potential of the knowledge and the network-based knowledge processes were difficult to evaluate. To implement the artifacts and systems chosen was not a problem, but to evaluate if the architecture fully exploits the potential of the knowledge shared and of the network-based knowledge process is much more difficult. Primarily since the utilization of the knowledge process and the related data is still in an initial stage and no obvious advantages or disadvantages have been brought into light, but also due to the fact that such evaluation in one form or another requires metrics to compare with. Such metrics should preferably come from another, similar case, in which the advantages and disadvantages have been fully exploited. We consider it hard to evaluate how rare the design is or how hard it is to imitate. The process in itself, with the feedback loop from manufacturers to designers is not rare. On the contrary, this type of knowledge sharing is frequently described in literature concerning value chains and business-to-business cooperation and it is already conducted to some extent between some of the companies. However there are some problems concerning this issue in the cooperation between small designing firms and manufacturers.

Knowledge protection. The network-based knowledge process applied in the case is, as mentioned before, not difficult to imitate. As a matter of fact, the design is based on ideas from other projects and from literature. However, the knowledge shared within the network is more difficult to imitate, since it is a mixture of experiences and know-how, primarily from key personnel in the participating firms. In addition, the knowledge acquired from these key persons and the knowledge resources are combined with more in-house knowledge within each organization, making it even more difficult to imitate. Furthermore, the blurriness of the utilization hides the competitive advantage gained. Other precautions taken to avoid imitation is the delimitation of number of organizations participating in a project. A smaller number of participants should imply that the underlying strategic vision and the strategic knowledge architecture are kept secret. However, the task of knowledge protection also concerns how to avoid value erosion. In the case described value erosion was mainly handled in two ways. Firstly, by combining the shared knowledge from the network-based knowledge process with in-house knowledge, imitation is made complicated and this in turn implies that the value of the process is preserved. Secondly, by assigning responsibility for maintenance of shared knowledge to the broker, knowledge is centrally maintained. It was considered that central maintenance should be beneficial, compared to letting each participating company maintain their "own" knowledge. In addition, by assigning the responsibility of maintenance to the broker, there was one single function

with an overview of the contributions from each organization. This is important since the combination of knowledge from different organizations was the main reason for cooperation. Furthermore, by assigning responsibility for the network to the broker, political issues, e.g. equal contributions of knowledge from all participants, could be regulated.

Implementation. The evaluation gave at hand that this task was the task in which the most problems aroused. First of all, general routines for implementing the network-based knowledge process in the participating organizations were not established. Instead, the responsibility for the implementation was laid on the organizations' members in the project. Furthermore, Carlsson (2001) suggests that the task may be accompanied with the development of e.g. reward systems and learning programs. We have not been able to identify if such activities have been carried out, but the impression is that the strategic vision was considered sufficient enough to sell in the idea. In addition, no metrics to measure the value of the network were established and that affected the activity among the members in the project group. A partial explanation of this phenomenon may be found in the relation between the knowledge vision and the actual support offered by the KMS. As mentioned above, the knowledge vision was to transfer manufacturing knowledge between the different stakeholders in the network. However, the support offered by the KMS mostly created gains for the designers and the gains for the manufacturing organizations were postponed until the designers actually started using the KMS. Mostly based on how well the designing companies were able to improve the initial design of the electronic circuit boards. Our interpretation of this is that metrics to measure the benefits of the knowledge process, for both the designing- and manufacturing organizations, should have been established and regularly followed up.

Usage. This task has not been thoroughly evaluated, since the project is in a phase, making the evaluation impossible.

6. DISCUSSION

This chapter is separated into two parts. Firstly, we discuss the experiences from applying the framework to a real case and how the appliance fell out. Secondly, we discuss some general thoughts on the framework, i.e. what is its main contribution and what is missing? We will start with the appliance of the framework.

The framework for strategic knowledge management was in most aspects supportive and the idea of general questions specifically applied to each task makes the result of the evaluation consistent. By using the same tasks, the outcome of the evaluation is focused on the same aspects 1) value, 2) rareness, 3) imitability, and 4) organization and therefore is it possible to relate the purposes and problems of each task to the purposes and problems of the other tasks. However, concerning the four evaluation aspects, we found that rareness was the most difficult to evaluate. Since the nature of this aspect (and the others) is to make sure that the firms are gaining and sustaining competitive advantage, it must be of vital interest to keep secret, if an organization or a network possesses certain knowledge or certain types of network-based knowledge processes. Considering this fact, it is difficult for others to now if competing firms already possess particular valuable knowledge and knowledge processes and how they have designed the underlying strategic knowledge architecture. Furthermore, the framework is giving support at a rather high level and the evaluation aspects given are broad. Our impression is that these aspects should be divided into a number of more specific questions/aspects, since it is on the operational level were the value creating labor is performed and therefore it is at this level that the real advantages may contribute.

The evaluation process also gave at hand, that there are some evaluation questions which are more difficult to find the answers to than others. Firstly, the question of evaluating whether the artifacts and systems chosen fully exploit the potential of the knowledge shared and of the network-based knowledge process raised some problems. Such evaluation calls for, in some form or another, *metrics to use for comparison*. Such metrics should preferably come from another, similar case, in which the advantages and disadvantages have been fully exploited. Otherwise it is very difficult to evaluate if the

design alternative chosen fully exploits the potential of the knowledge and of the network-based knowledge process. Therefore, we would like to suggest the establishment of such metrics as possible future work. Alavi and Leidner (1999) have, as a result of an empirical study, also pointed out the importance of establishing metrics. Such metrics should be established to allow for the comparison of the advantages and disadvantages associated with a strategic knowledge architecture chosen, with the advantages and disadvantages of other artifacts and systems utilized in other cases. One way of conducting such research may be to use this case as a base and compare the outcome of this case with future cases. Secondly, Carlsson (2001) exemplifies on how to implement the knowledge and knowledge process into an organization, in order to exploit the full potential of the knowledge and the network-based knowledge process. This is important, since one of the most important success factors, for all KM activities, is the motivation of the users (Hahn and Subramani, 2000). However, the framework would also benefit from some *guidelines, describing or exemplifying how the strategic vision is to be implemented into the participating organizations*. Since we consider this as a main problem for the success of the whole network, the framework ought to support the evaluation of this aspect.

Furthermore, we would like to point out that it is important to be aware of the *dynamics of the network*. There are a number *of influential factors within the participating companies*, which are out of the control of the network as well as of the coordinating broker. To accurately develop aspects to evaluate if such dynamics have influenced the outcome of the network is not a trivial task and it is possible that such dynamics do not belong in an evaluation framework, since they are difficult to identify and their impact may cause problems that occur within each participating organization. However, we have chosen to include a discussion on theses dynamics, since it is important to be aware of their possible existence. Otherwise, the project may fail without anyone knowing why.

Finally, Carlsson (2001) include some relevant evaluation aspects that are not dedicated to a particular task. One of them is related to the problems of orchestrating the network. Carlsson (2001) states that a problem with extra-networks is that in many cases there is no higher authority to orchestrate a "top-down" design. This aspect was very useful for us in identifying why some of the participants did not make their contribution to the network. In this case the broker handled the orchestration and was responsible for designing and implementing KMS. However, we experienced that the problem of equal contribution partly lay on the broker, since the broker lacked commercial strength to perform efficient and effective orchestration.

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