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**Knowledge Management in Knowledge Intensive Service
Networks: A Strategic Management Perspective**

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Abstract

Knowledge is the key to gaining and sustaining competitive advantage. Driven by a change in consumer needs towards “comprehensive service solutions”, more and more services are offered through networks. By so doing, individual firms can concentrate on their distinctive competencies and by combining these with those of partner firms such a network is able to offer complex, knowledge-intensive services at high quality and at reasonable prices. It is clear that the success of such knowledge intensive service networks depends strongly on the effective and efficient combination and use of the distinctive competencies of the network partners. That ability to combine and use distinctive competencies represents the core competency of the network as a whole. Understanding knowledge as a key resource for those distinctive competencies the combination problem can be seen as a knowledge management problem.

The main contribution of this paper is to analyze knowledge management in service networks. We use a strategic management approach instead of a more technology-oriented approach since we believe that managerial problems still remain after technological problems have been solved.

Therefore the question arises how to guarantee an effective and efficient combination and utilization of the distributed knowledge in knowledge-intensive service networks. The objective of this paper is to analyze the problems concerning the management of knowledge in service networks. It outlines possible solutions for these knowledge management problems in order to provide sustaining competitive advantage for the network as a whole.

1 Introduction

Markets nowadays are characterized by high complexity caused by decreasing market entry barriers, increasing competition, shorter (product-) life cycles and increasing risk. That is particularly true for the service sector. Even though it constitutes the fastest growing industry worldwide, accounting for roughly 70% of gross value-added and employment, the transformation of “producers” from the secondary sector to “service providers” just as the changing demand from customers to ever more complex services, continues to make this particular market more competitive.

That calls for identifying the roots of corporate success, a key issue of strategic management. Nonaka (1991: 96) noted with respect to that observation: “In an economy where the only certainty is uncertainty, the one sure source of lasting competitive advantage is knowledge.” Obviously, the knowledge of a firm is the key resource that can lead to sustained competitive advantage (Dierickx/ Cool, 1989; Grant, 1996; Teece, 1998; Schultze 1999: 156; Gupta/ Govindarajan, 2000: 473; Cavusgil/ Calantone/ Zhao, 2003: 6).

Beneath labor, land and capital, knowledge becomes more and more important in order to make use of or exploit these classical resources. Especially for complex (knowledge-intensive) services knowledge can be seen as the building block. Since not all knowledge, necessary to provide complex services, can be accumulated in a single firm, the perceived uncertainty concerning future knowledge requirements is relevant for the evolution of inter-organizational networks. (See the example of pharmaceutical product development: Tenkasi/ Boland, 1996.) “The greater the uncertainty which firms perceive as to the future knowledge requirements of their present product range, the greater the benefits of inter-firm collaboration compared with internalization as a means of accessing and integrating additional knowledge” (Grant/Baden-Fuller, 1995: 20). Powell supports this: “When uncertainty is high, organizations interact more, not less, with external parties in order to access both knowledge and resources (Powell, 1998: 229). Empirical evidence shows, that nearly 70% of German companies in the service sector are dependent on partners to provide their services (Kenning/ Schütte/ Blauch, 2003).

Therefore the management of knowledge becomes a key task for network management. From a strategic management perspective it seems to be necessary, that knowledge as a key resource of complex (knowledge-intensive) services gets the unrestricted attention of the management (Maier, 2001). Knowledge management in networks is not only a task of transferring and using existing explicit knowledge but to gain and sustain competitive advantages built on the evolution of new “network-internal-tacit” knowledge. This evolution has to be fostered by implementing a network periphery which provides opportunities to combine the distributed specialized knowledge (“distinctive competencies”) already existent in the network, in order to create new and innovative services that ultimately guarantee sustained success for knowledge-intensive service networks.

The paper consists of five chapters. Based on a definition of knowledge and knowledge management and a systematization of networks and services in the second chapter, knowledge management problems in knowledge-intensive service networks are analyzed in the third chapter. The fourth chapter presents theoretical and empirical solutions to these problems. The concluding fifth chapter summarizes the main findings and points out the need for future research.

2 Knowledge-intensive service networks as the object of analysis

2.1 Knowledge as a basis of core competencies

2.1.1 Definition of knowledge

The concept of knowledge has been investigated in many different disciplines, such as philosophy, psychology, sociology or business sciences (Berger/Luckmann, 1966; Polanyi, 1966; Curtis/Pedras, 1970; Popper, 1972; Payne, 1982; Gardner, 1985; Squire 1987; Mandl/Spada, 1988; Nonaka/Takeuchi, 1995; Hayek, 1996; Blosch, 2001; Ayer, 2001). Two major views on the nature of knowledge have emerged: a cognitivist and a constructionist perspective (von Krogh, 1998: 134; von Krogh/ Roos, 1995).

The cognitivist perspective understands knowledge as a representation of the world that consists of a number of objects or events, which are represented in the human brain. In this perspective knowledge is explicit and objective and can therefore be stored or transferred between persons or organizations with relative ease.

The constructionist perspective, based on new insights from neurobiology, cognitive science and philosophy, views knowledge not as an act of representation, but as an act of subjective creation of reality by an individual person (von Krogh, 1998: 134). Much research about knowledge and knowledge management is based on the work of Michael Polanyi, who is using a constructionist perspective of knowledge. Polanyi describes knowledge as something manifestly personal (Polanyi, 1959: 27), consisting of two complementary parts: „What is usually described as knowledge, as set out in written words or maps, or mathematical formulae, is only one kind of knowledge; while unformulated knowledge, such as we have of something we are in the act of doing, is another form of knowledge” (Polanyi, 1959: 12). Polanyi later clarified this distinction between explicit and tacit knowledge with his famous, often cited statement “We know more, than we can tell”, describing the tacit part of knowledge (Polanyi, 1966: 14). This distinction between different kinds of knowledge is comparable to the distinction between “knowing how” and “knowing

that” (Ryle, 1949) or the distinction between declarative and procedural knowledge introduced by Anderson (Anderson, 1976). It is important to note that knowledge exists on a continuum between explicit and tacit, and is never completely tacit or completely explicit (Leonard/Sensiper, 1998: 113).

In an economic context this constructionist view of knowledge is often complemented with the differentiation between knowledge, information and data, inspired by information theory (Kerr, 1991: 64ff.; Schultze, 1999: 161; McDermott, 1999: 110; Kaipa, 2000; Bollinger/Smith, 2001; Kakabadse/ Kakabadse/ Kouzmin, 2003). This differentiation is shown in Fig. 1.

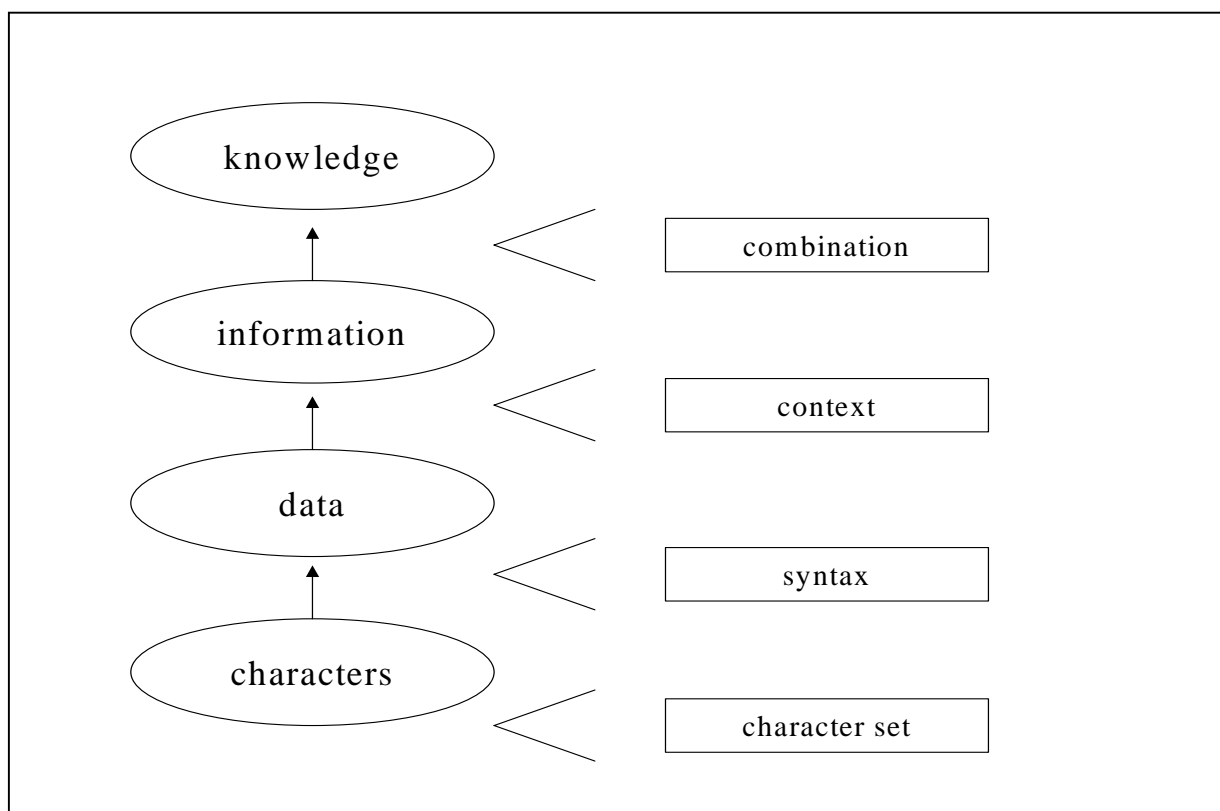


Fig. 1: Distinction between data, information and knowledge

Characters are the smallest entity of knowledge. The digit “1” or the letter “a” are examples for characters. The combination of characters according to specific syntax-rules in turn leads to data. Information comes into existence through observation and transliteration of the results. Therefore information is always connected with a specific personal context. The “raw material” information is transformed to knowledge by embedding the “new” information in a different and individual, personal context. This context comprises existing experiences, education, social and cultural

background etc., of a person. It is important to understand that both information and knowledge are entirely subjective attributes (Kerr, 1991: 65). Knowledge becomes observable and economically interesting if applied and used to build the specific competencies of an individual.

In conclusion knowledge as used in this article is an individual subjective construction based on information and experience in order to solve problems.

As the basis for core competencies, organizational knowledge arises from the integration of the individual specialized knowledge of members within the firm (Grant, 1996). Through this combination of individuals, through shared goals, cause-and-effect beliefs or general shared beliefs, knowledge structures at the organizational level emerge (Hedberg, 1981; Daft/ Weick, 1984; Brunsson, 1985; Lyles/ Schwenk, 1992) Organizational knowledge appears in procedures, rules, norms, strategies and technologies and is a result of interrelations between individuals acting on behalf of the organization (Nelson/ Winter, 1982; Weick/ Roberts, 1993; Myers, 1996). To avoid misunderstanding: it is not implied, that organizations have minds in the same sense that human beings do (Lyles/ Schwenk, 1992: 156). Only through the individuals acting on behalf the organization, organizational knowledge can evolve (Inkpen/ Dinur, 1998: 456). No individual on the other hand has the abilities to provide the services, an organization can provide. Assigning the tacit-explicit continuum used to analyze individual knowledge, organizational knowledge can be described as “tacit” (Inkpen/ Dinur, 1998). No individual can grasp and explain organizational knowledge as a whole and it can not be transferred from one organization to another.

In this paper both the individual and the organizational perspective are relevant for analyzing problems of knowledge combination, knowledge transfer and knowledge application. Problems of transferring knowledge and making use of knowledge are analyzed on the individual level. The organizational perspective is necessary in order to analyze the combination of distinct competencies of the network partners.

2.1.2 Knowledge as a resource

The resource-based view (RBV) (Penrose, 1959; Wernerfeld, 1984; Barney, 1991, Grant, 1991; Mahoney/ Pandian, 1992; Peteraf, 1993, Barney, 2001; Mahoney, 2001) treats enterprises as a bundle of productive resources. The RBV works on the

assumption that resources influence the success of an enterprise. That is an essentially “inside-out” perspective. However, not all resources are equally suitable for the development of competitive advantage. Only when resources reveal certain attributes, the necessary condition for developing competitive advantage is fulfilled. Of the numerous catalogs of attributes developed in the literature, that of Barney (1991, similar: Barney, 2002) has the widest acceptance. According to this criteria catalog, resources must reveal the following four criteria (VRIS criteria), if they are to contribute towards generating a competitive advantage. *Value* is the first relevant criterion. Resources are valuable when they contribute towards the achievement of corporate objectives. Secondly, the resources of the enterprise must be *rare* (to third parties), that is, they cannot be available to every current or potential competitor. Thirdly, the resources of an enterprise must only be *imitable* to a limited extent. Fourthly, corporate resources must also be *substitutable* only to a limited extent, that is, the utility or benefit must not be easily achieved with other resources.

Particularly the last two criteria are important for the development of sustainable competitive advantages. Limited (or uncertain) imitability (Lippman/ Rumelt, 1982) in turn depends on four additional attributes (Barney, 2002: 165). Resources which are created through historically unique contextual conditions can only be imitated to a limited extent or not at all. This leads to time-compression diseconomies (Dierickx/ Cool, 1989). Some resources can also only be developed over many years in experience-based learning processes. If this learning process cannot be matched by competitors within a considerably shorter time frame, one talks of path-dependent resources (Dierickx/ Cool, 1989). Secondly, resources can be causally ambiguous, that is, it is not clear what measures must be undertaken in order to develop them. Resources which are socially complex – the third attribute – are also excluded from a straightforward imitation. A particular corporate culture cannot be unraveled through mere observation from outside. Interpersonal relationships in the development of resources (particularly human resources) play a substantial role. Fourthly, many resources are subject to legal barriers which preclude imitation. These use legal mechanisms to prevent the copying of valuable resources.

Individual knowledge as well as organizational knowledge is valuable and rare since it enables the network to perform a service. It is not easy to imitate or substitute, since it is intangible and idiosyncratic (Attewell, 1992; Kogut/ Zander, 1992). Moreover, knowledge is created in a historic, path-dependent process, mainly

through human interaction, and the result of the knowledge application is ambiguous. Especially that ambiguity makes the transfer of knowledge difficult (Simonin, 1999a and 1999b) Hence, knowledge is a resource that functions as a viable base for competitive advantage (e.g. Calantone/ Cavusgil/ Zhao 2002).

2.1.3 Knowledge as a basis of core competencies

The resource “knowledge” of a knowledge-intensive service network is a key to all competencies. Distinctive competencies, a term first used by Selznick (1957), describe a firm’s ability to reach a unique competitive position by deploying the firm’s resources (Selznick, 1957; Hofer/ Schendel, 1978).

From a network perspective, distinct competencies of the network partners need to be combined to produce a complex service. That ability can be called the “core competency of the network”. Core competencies can therefore be defined as the network’s ability to coordinate and combine the network partners’ distinctive competencies in order to achieve a desired result (e.g. a complex service) (Prahalad/ Hamel, 1990). If the services offered are knowledge intensive, a network’s core competency is the ability to manage and develop its knowledge base.

The management of knowledge is often seen as a process. This process of knowledge management comprises the phases of knowledge generation/ construction, knowledge dissemination, knowledge use and knowledge embodiment/ knowledge storage (Hedlund, 1994; Schultze, 1999; McAdam/ McCreedy, 1999; see also Hlupic/Pouloudi/Rzevski 2002 for an overview of knowledge management definitions and tasks).

Applied to a network setting, this means that the knowledge of all network partners must be identified in order to combine it to a desired result. Missing parts have to be developed internally or generated from outside the network. Besides combining the distinctive competencies, transfer of knowledge is another task for the network knowledge management. Knowledge held by individuals or by small groups of individuals within the network could be transferred, while organizational knowledge of the network partners could not be transferred (Inkpen/ Dinur, 1998: 457). Organizational knowledge does not seem to be transferable, because it cannot be grasped as a whole by an individual.

The transfer of knowledge also bears the risk for the individual network partner to lose distinctive competencies to other network partners. That ultimately endangers the existence of that network partner (Argote/ Ingram, 2000; Loebecke/ Fenema/ Powell, 1999; Larsson et al., 1998; Kogut/ Zander, 1993).

After applying the combined competencies to provide a service for customers, the final task for the network knowledge management is to support the embodiment of the experiences in the “network knowledge”, in order to improve the network competency. In sum, the use of knowledge and its management function as the core competency of a knowledge intensive service network. They built the basis of sustained competitive advantage.

Before developing a knowledge management concept for service networks, the object of analysis is systematized and defined subsequently.

2.2 Systematization of services

There are many approaches toward systematizing services (Copeland, 1923; Judd, 1964; Rathmal, 1974; Hill, 1977; Chase, 1978; Kotler, 1980; Lovelock, 1983; Schmenner, 1986; Wemmerlov, 1990; Kellog/Nie, 1995; Roth/Chase/Voss, 1997; Verma, 2000; Krishnan/Hartline, 2001; Ahlert/Evanschitzky, 2002). Schmenner (1986), as a well established and widely accepted source, divides services according to the two criteria of individualization and labor intensity.

Here, the systematization is extended through the use of service complexity, rather than individualization, because the first includes the second and is of particular interest for knowledge intensive services. The complexity of a service should not be understood in the sense of the “normal” complexity of problems or structures. Complexity refers far more “purely” to that quality of systems in which a large number of different circumstances can be assumed within a given time span, which renders more difficult, their understanding and management. A large number of possible circumstances leads to manifold and relatively unpredictable, uncertain behavioral possibilities. A system for investigating complexity should be understood here as referring to the network of relationships between service sellers and the potential offered by the seller (e.g. the knowledge of the personnel), the external factors of customers and the nature of the service offered.

The degree of complexity can be determined on the basis of the following criteria: coordination of internal factor capacity, the nature of the available factors, the number or heterogeneity of service components, interaction intensity, individuality of the service, contractual relationship, and nature of use (temporal utility creation).

Apart from the complexity of services, the costing relationship of the factors “machinery & equipment” and “labor”, play an important role in determining the type of service offered. Labor intensity (or capital intensity), refers to the relationship of personnel costs to those of machinery and equipment (Schmenner, 1986: 22, Table 1). Services with high labor intensity lead to relatively low costs for machinery and equipment (and thus low investment in this area), but require relatively high numbers of workers and large outlays for their development.

Both criteria relate to the knowledge-intensity of the services offered. There is a continuum ranging from very simple, mainly machine-made and standardized services to highly complex, man-made and individualized services. Fig. 2 depicts this relationship.

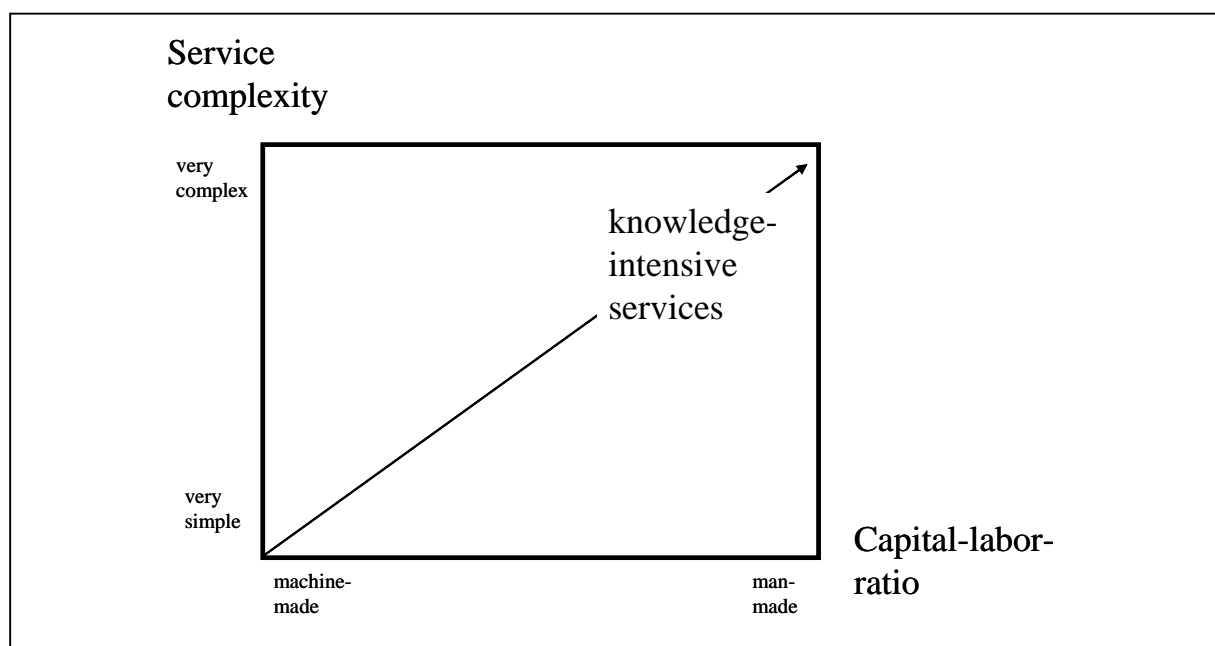


Fig 2: Knowledge intensive services

Dry-cleaning or car-washing would be in the lower left-hand quadrant and consulting services and the like in the upper right-hand quadrant.

2.3 Systematization of networks

Just as for services, there are many different approaches towards the systematization of networks (Child, 1987; Powell, 1987 and 1990; Jarillo, 1988 and 1993; Lorenzoni/ Grandi/ Boari, 1989; Hakansson/ Snehota, 1989 and 1995; Oliver, 1990; Reve, 1990; Miles/ Snow/ Coleman, 1992; Alter/ Hage, 1993; Wassermann/ Faust, 1993; Ahlert/ Evanschitzky, 2002 and the articles in the book “Networks in Marketing”, edited by Iacobucci, 1996, and the Special Issue of the International Journal of Research in Marketing, Vol. 13, 1996, and the Special Issue of the Strategic Management Journal, Vol. 21, 2000). All systematizations are driven by specific research objectives. For the purpose of this paper, three criteria are of particular interest, since networks strive to minimize costs, maximize utility and coordinate activities leading to that end. Those factors are:

1. the type of agents doing transactions,
2. the resource dependency of network partners and
3. the type of network coordination.

The rationale behind engaging in a network-like form is the search for the exchange mechanism that minimizes the sum of “production” costs, transaction cost and cooperation costs deriving mainly from negotiating the contract and controlling agreed-upon rules. It is crucial to determine the type of actors interacting in the network. There are:

- social networks (e.g. Wassermann/ Faust, 1993) modeling relationships between persons,
- internal networks (e.g. Miles/ Snow/ Coleman, 1992) modeling personnel relationships in a firm and
- inter-organizational networks (e.g. Jarillo, 1988) modeling relationships between firms.

Since knowledge is created mainly by informal means (Bleicher, 2002; Kenning/ Schütte/ Blaich, 2003), the importance of personnel and especially internal networks becomes apparent. For the purpose of this study, we first consider the inter-organizational network which consists of several firms. These players are tied together more or less tightly: from contracts to licensing agreements to profit-center

organizations. In such an inter-organizational network, several internal networks exist as well as “networks within the network”, that is internal networks from the perspective of the network as a whole. With respect to knowledge creation, the agents interacting are persons: one is a knowledge-seeker and one is a knowledge-provider. In consideration of the fact, that a knowledge transfer is rarely a singular event, but more often an iterative exchange process, the roles of knowledge-seeker and knowledge-provider will be switched regularly (Szulanski, 2003: 31).

Adding to that (essentially) transaction-cost-based approach towards networks, a more managerial approach poses the following question: “Which type of configuration best fits the relative, resource-induced power between the service-central (“back-office”) and the service-provider (“front-office”)?” The rationale behind this resource-based approach towards networks is not to minimize costs, but to maximize value through gaining access to other firm’s or other persons’ valuable resources, especially their knowledge (Das/ Teng, 2000: 35; Teece, 1998: 76). Resource-Dependency-Theory (RDT) proposes three factors that determine the degree of dependency between two units, (Pfeffer/ Salancik, 1978; Hickson et al., 1981): resource importance, availability of alternatives and degree of discretion. Maximum dependency occurs when one unit has unfettered discretion over an important resource to which no alternatives exist.

The RDT can be connected theoretically to the Resource-based view (RBV) (e.g. Penrose, 1959; Wernerfeld, 1984; Barney, 1991; Grant, 1991; Mahoney/ Pandian, 1992; Peteraf, 1993; Foss/ Knudsen, 2000; Mahoney, 2001), since the fundamental concepts are nearly identical in meaning. In order to be a source of competitive advantage, resources must be of value, rare, imperfectly imitable, and imperfectly substitutable. Therefore “resource importance” in RDT is close in meaning to the value-concept of the RBV. The concept of “alternatives” is close to the concept of uniqueness. In sum, the relative, resource-induced power of two units or two persons is directly proportional to the strategic importance of the resources that a particular unit embodies (Medcof, 2001).

It is obvious that there is reciprocal dependency in networks. The actors try to promote the form of organization that best reflects their perception of dependency, meaning the relationship between resources given and resources received (Pfeffer/ Salancik, 1978: 69). For that purpose, Vroom and Yetton introduced a model arguing

that managers should choose a decision model that solves the given problem, e.g. degree of dependency (Vroom/ Yetton, 1973). They give three basic decision making models, “autocracy”, “consultancy” and “inclusive” and five criteria for deciding on one of these models. Since services can best be offered through network-like arrangements, where there is a back office and a front-office, both units have numerous unique and valuable resources. In addition, the knowledge possessed by personnel is highly valuable for knowledge-intensive networks. In such a constellation, the Vroom-Yetton model calls for a “consultancy” or even “inclusive” approach toward management, depending on the front-office’s tendency to implement effectively the decision made.

That brings us to the third systematization criterion: the coordination intensity of the network. Coordination methods are shown within a domain which is based on two main criteria, the level of autonomy on the one hand and the level of commitment on the other. The level of commitment refers to the degree to which parties participating in the network coordinate and fix their behavioral patterns. A high level of commitment means that most areas of activity are constrained. The level of autonomy then specifies how much freedom the actors have at their disposal. These two factors determine the level of coordinating intensity of the network.

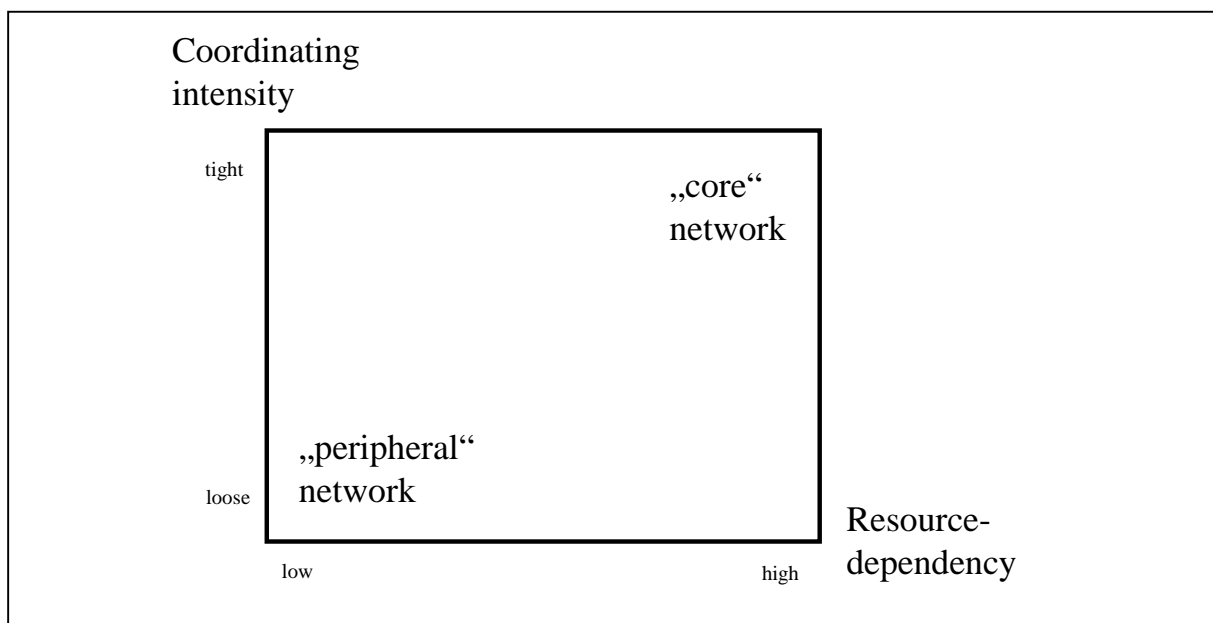


Fig. 3: The “core” and the “peripheral” network

Fig. 3 outlines the positioning of service networks in a two-dimensional space and differentiates between a core network in which the partners are highly dependent

upon each other and coordinate their activities rigidly and a peripheral network where dependency and coordinating intensity are low.

Note that this scheme applies to inter-organizational and internal networks alike. The coordinating intensity in an internal network is determined largely by the employment contract whereas autonomy and commitment determine the level of coordinating intensity in inter-organizational networks and network internal networks.

2.4 Knowledge intensive service networks

In short, knowledge intensive service networks can be defined as

Cooperative arrangements of a certain coordinating intensity of more than two legally independent partners on the inter-organizational level (firms) and more than two actors on the internal level (persons), which, nonetheless, are not (entirely) independent in terms of economic cooperation. They produce a mainly man-made, highly complex service. The relationship between the participating actors goes beyond pure market aspects ("spot contracts"). That is, they continue for a particular time frame and are not "once off", but ongoing (at least several times) in the market. Likewise, there is an exchange of resources between the participating network partners which in turn results in (mutual) resource dependency.

3 Knowledge management concept for knowledge-intensive service-networks

3.1 The service production process from a knowledge perspective

In general markets are currently characterized by high complexity caused by decreasing market entry barriers, increasing competition, shorter (product-) life cycles and increasing risk. The underlying effects responsible for these developments are digitalization, globalization and innovations in information and communication technology (Augier/ Shariq/ Vendelo, 2001). In addition to the effects mentioned above, these developments force firms to participate in networks in order to be successful. The partners in these networks focus on their distinctive competencies.

The result is that complex, knowledge intensive services, requiring the integration of different types of specialized knowledge, can no longer be produced by a solitary

firm (Grant/ Baden-Fuller, 1995). It can be assumed that one major success factor for these knowledge intensive service networks is the effective and efficient management of knowledge.

Fig. 4 shows the “production process” for “normal” services produced by an individual firm and the “production process” for complex, knowledge-intensive services. At the level of an individual firm, services are produced through combining the individual knowledge backgrounds of the firm’s personnel with information provided by the external factor. The integration of the external factor is the constituent element of services (Chase, 1978). On an abstract level and especially in the context of knowledge intensive services, it is information provided by the external factor that must be integrated in the process of service provision (Bettencourt et al., 2002: 100f.).

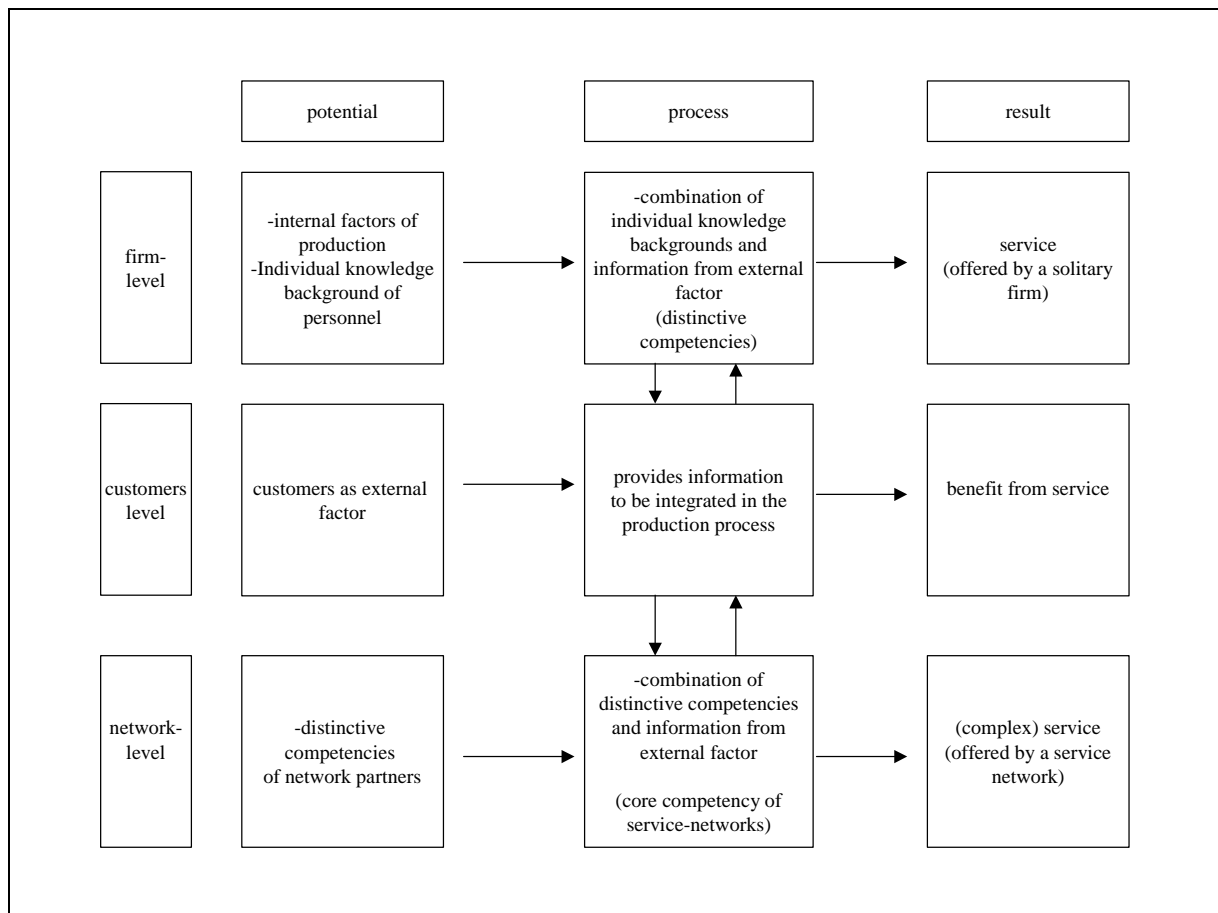


Fig. 4: Knowledge intensive service production process

The ability to combine internal potential (based on the individual knowledge backgrounds of personnel) with information from the external factor to produce a service can be described as the distinctive competency of the individual firm.

The core competency of the knowledge intensive service network can be seen in the ability to combine the distinctive competencies of the network partners with the external factor in order to produce unique services for the customer. That can be a simultaneous combination of (asymmetric) competencies of the network partners at the time the service is produced or a transfer of knowledge that enables the network partners to permanently execute certain tasks.

Examples for knowledge intensive services provided by networks can be found in different service sectors. Management consultancy concerning Mergers and Post Merger Integration is an example for a highly knowledge intensive service, often provided by a network through the combination of distinct capabilities. The ability of the network to combine the distinctive competencies of the network partners with the external factor in order to produce unique services for the customer can be seen as the core competency of such a knowledge intensive service network. For instance imagine a typical Merger and Post Merger Integration project: In the process of a merger, experts in management, post-merger integration, law, and finance are required to work together by pooling their asymmetric resources in order to successfully merge two firms. Specialized knowledge (e.g. knowledge about strategy and markets of the merging companies, knowledge about contract-law, about finance and so on) is necessary for successfully finishing the process. This knowledge is often provided by management consultants, investment banks and law firms. These firms sometimes work together on contract basis, but sometimes these specialized firms form a network, continually working together with each other.

An example for a knowledge-intensive service network, where the transfer and multiplication is of importance can be found among franchise networks. The franchisor and the franchisees are working on a long term contractual basis, providing services. An example for a knowledge intensive service provided by a franchise network is a German franchise company in the building industry. This franchise-network sells houses and provides all services necessary from financing the house, to house-insurance or applying for financial government aid. The knowledge of the franchisor is multiplied, with the franchisees providing the same service in different regions. Thus the transfer of knowledge relevant to provide these services is the major task in order to enable the large-scale replication of such a service business model (Winter/Szulanski, 2001).

3.2 Knowledge management problems in knowledge intensive service networks

Knowledge management in knowledge intensive service networks is confronted with several problems in attempting to combine the distinctive competencies. Building on the aforementioned service production process and the process of knowledge management applied to a network context, these problems will be discussed in the following chapters. The analysis is structured using the knowledge management process with the four phases knowledge generation/ identification, the combination/ transfer of knowledge, the application of knowledge and finally the storage and embodiment of the experiences. The differentiation between the phases follows mainly analytical purposes, while in practice the phases often overlap. For example generated knowledge is normally applied immediately.

3.2.1 Problems concerning Knowledge generation and identification

Knowledge is seen as a critical resource that enables individuals and, on a higher level, organizations to solve problems and to be competitive. A knowledge intensive service network has to solve complex problems in order to provide services of outstanding quality to the customers. The quality of the service offering depends on the transparency concerning existing knowledge resources within the service network. In the *potential dimension* the optimal combination of individual knowledge and external information from the customer can only be achieved if every network partner (if possible every individual in the network, depending on the size of the network) reveals his capabilities. This revelation does not imply that knowledge has to be codified completely. But parts of the existing knowledge should be explicated, in order to get a grasp of the abilities an individual or a network partner has. The mere revelation is only the necessary condition. The creation of transparency is the sufficient condition for effective combination and likewise transfer and application of knowledge. The importance of the identification of knowledge resources even within a single company has been shown by Szulanski (1996 and 2003; O'Dell/ Grayson, 1998 for details). Ignorance was identified as a main barrier for not transferring knowledge within the firm. The knowledge holder did not know, that his knowledge is needed. On the other hand the knowledge seeker did not know, that somebody else

in the firm had the particular knowledge he was looking for (O'Dell/ Grayson, 1998: 155).

Therefore it is an essential task for a network knowledge management to identify existing knowledge resources in the network. As a result all individuals taking part in the service production process must have a general idea of the knowledge-base of the network. In order to achieve this task, network knowledge management has to overcome several barriers. One problem could be "knowledge-hiding", meaning that individuals or organizations do not reveal their capabilities, trying only to profit from the knowledge of other network partners. The other extreme is an overestimation of one's capabilities. Organizations may pretend to be capable of doing something or having some kind of knowledge resource in ord

er to be a member of the network.

If not all necessary (in order to fulfill the service) knowledge resources are existent within the network, knowledge must be generated either by transferring knowledge from outside the network or by developing new knowledge internally. Generating knowledge comprises some additional barriers for network-knowledge-management. Typical transfer problems could occur (von Hippel 1994; Szulanski 1996; 2003; Becker/Knudsen 2003) including motivational problems concerning the motivation of the source to make knowledge available and the motivation of the recipient to utilize this knowledge. In addition the nature of the knowledge could bear problems, especially for the recipient, who must be able to learn, and to use the transferred knowledge. Another problem becomes apparent when discussing the nature of knowledge resulting to some degree from causal ambiguity of knowledge (Dierickx/ Cool, 1989; Reed/ DeFillippi, 1990). Network knowledge management has to determine what kind of knowledge should be created in order to fill the "resource-gaps". If knowledge is tacit in nature, this determination is problematic. Additionally it will often be unpredictable to anticipate what knowledge could be the basis for the required capabilities.

3.2.2 Problems during the combination and transfer of knowledge

The combination and transfer phase of knowledge could be attached to the *potential* and to the *process dimension* of the service production process. A network knowledge management problem lies in finding the most effective and efficient mix

between combining distinctive know-how versus transferring know-how in order to make it usable for some or all network partners. Knowledge transfer seems to be appropriate to avoid redundancy or the recurrence of time-consuming and costly mistakes (McAdam/ McCreedy, 1999). Successfully transferring and reconstructing knowledge can multiply capabilities within the network, because the knowledge provider does not lose the knowledge transferred, while the recipient can build up a useful new capability for the network. Franchise networks for example rely heavily on the transfer and replication of knowledge (Langenhan, 2003). On the other hand the transfer of specialist knowledge is expensive and time consuming or sometimes impossible because of the tacitness of individual knowledge and organizational knowledge in particular (Jensen/ Meckling, 1992; Jensen, 1998: 106). Additionally the explication and transfer of specialist individual or organizational knowledge could endanger the competitive advantage of organizations because the core competency becomes imitable (Kogut/ Zander, 1993: 639; Spender, 1994: 363; Loebecke/ Fenema/ Powell, 1999; Argote/ Ingram, 2000). As mentioned before, a fundamental condition of knowledge transfer is the knowledge holder's (an individual) willingness and motivation to share his knowledge. Secondly, the individuals must be able to explicate knowledge (knowledge holder) on the one hand and to integrate and reconstruct knowledge (knowledge seeker) on the other hand. Apart from the general difficulties to explicate and transfer tacit knowledge, a common educational background is helpful in order to understand the context in which the knowledge is embedded. Based on the insight that transfer of individual knowledge is an extremely difficult task and not the most efficient approach to integrating knowledge (Grant, 1996), the coordination of knowledge holders must be considered in the process dimension.

If the transfer of knowledge seems to be inappropriate the combination of individual knowledge holders or organizations could be achieved through initiating the collaboration between them (Inkpen, 1996). Through combination of the distinct competencies of the network partners the network can provide superior services based on a unique combination of capabilities and resources within the network.

Network knowledge management therefore has to find the right mix between combination and transfer of knowledge within the network, bearing either knowledge transfer problems or problems concerning the combination of capabilities and knowledge. The latter will be discussed in the following part.

3.2.3 Problems during the Knowledge application phase

The application of knowledge becomes relevant during the *process phase*. The transferred and combined knowledge pieces must be integrated with the external factor in order to provide the knowledge intensive service. Only if knowledge is put into practice, core competencies can evolve (Brown/ Duguid, 1998).

In the context of services it is important to consider that production and consumption of the service are taking place “*uno actu*”. The customer benefits from the knowledge as part of the problem solving capacity of the service delivered. At the same time, this service is produced by combination of individual knowledge components. Therefore the phases of knowledge generation and especially of knowledge combination and knowledge application can only be separated for analytical purposes.

Network knowledge management has to ensure, that the transferred knowledge is applied and if the combination of knowledge holders is preferred, that the collaboration is working smoothly. Problems concerning the application can result from the Not-Invented-Here syndrome (Katz/ Kahn, 1982; Hayes/ Clark, 1985). The Not-Invented-Here syndrome describes the situation, that the knowledge recipient does not award the capability of knowing and doing something to the source, believing that one’s own capabilities are superior. Understanding knowledge as an individual construction of reality, this phenomenon will occur frequently because no objective method of measurement could be applied in order to provide arguments to convince the recipient of the superiority of the knowledge provided.

Further problems can occur because of misunderstandings and problems concerning the collaboration between the network partners. As described in the second chapter collective knowledge evolves from individuals working together. Through collective practice, shared sense making and distributed understanding, the network, or a group within the network, is capable of solving problems an individual alone would not have been able to solve (Brown/ Duguid, 1998: 95f.; Inkpen, 1996). Network knowledge management therefore has to support a smooth and frictionless collaboration in order to facilitate the evolution of collective knowledge.

As far as frictions regarding the collaboration between network partners arise on the organizational level, these problems seem to be general problems concerning

network management and coordination within the network and will therefore not be further analyzed.

3.2.4 Problems concerning Knowledge storage and embodiment

The main challenge for knowledge management during the *result dimension* is to reduce or eliminate the threat of losing core competencies. This is a task on the network partner level as well as on the network level.

On the level of the network partners, every network partner tends to capture as much knowledge as possible from the collective knowledge and the partners capabilities, while giving away as little knowledge as possible from the own organization. Because of the collaboration during the service provision process, it is possible that network partners imitate or copy the distinctive competencies of one another. A successful imitation would lead to the loss of competitive advantage of that particular network partner. This phenomenon of simultaneous co-operation and competition between firms is called “co-opetition” (Loebecke/ van Fenema/ Powell, 1999).

Apart from developing solutions to overcome the co-opetition problem regarding knowledge sharing the network knowledge management has to deal with the knowledge “storage” problem, to make possible the permanent availability of the knowledge created during the service production. The network is not stable over time; single network partners may leave the network, making their knowledge inaccessible for the network. Another danger evolves from the fact that knowledge is not everlasting. Individuals as the “holders” of knowledge tend to forget. Forgetting of knowledge on the individual level can lead to decomposition of organizational and network capabilities.

Therefore the network knowledge management has to facilitate the evolution of “network-knowledge”, that guarantees that experiences and capabilities once developed can be continuously used, independent from single individuals or single network partners.

4 Possible solutions for managing knowledge processes in knowledge-intensive service networks

Resolving the problems mentioned above, is one of the key issues for knowledge-intensive service networks which seeking sustained competitive advantage.

4.1 Solutions for knowledge identification and generation

One task of a network knowledge management is to provide an overview of the knowledge and the capabilities existent within the network. This creation of transparency enables the actors in the network to get in contact and transfer or combine their knowledge. As Borgatti and Cross have analyzed, a baseline condition for the transfer of knowledge is the “awareness of that individual as a possible source in light of a current problem...” (Borgatti/ Cross, 2003: 434). Research also indicates that once expertise of a person is made public, the exchange of information between members of a group increases (Thomas-Hunt/ Ogden/ Neale, 2003; Kim, 1997; Stasser et al., 2000). The positive impact of knowledge management system in the service sector is further described by Sarvary (1999), who argues that consultants can concentrate on problem solving rather than on number crunching and data collection.

These positive effects of knowledge transparency could generally be achieved by two different approaches. One is “signaling”. That means each network partner is responsible for explicating his knowledge. Positive effects of signaling are low administrative costs. On the other hand it is doubtful that the method of signaling alone is capable of initiating the explication of all relevant and valuable knowledge (Sarvary, 1999). Signaling approaches will lead to failure, when people do not provide valuable knowledge to the system. Searching for specific knowledge in such a system will be of little value for knowledge seekers. As a result those knowledge seekers will likewise not spent time to provide their valuable knowledge to the knowledge management system.

The other way to address the knowledge identification issue is “screening”. That means that the network knowledge officer or another “authority” within the network is in charge of constantly screening the network’s knowledge base. Knowledge screening has proven to be more efficient than knowledge signaling (Baligh/ Richartz,

1967) and is therefore the preferable solution for the identification problem. Although the benefits of knowledge screening systems are hard to measure, while the costs, which could not be neglected, are very present, the possible benefits are outstanding (Sarvary, 1999). Only a screening process can provide the complete revelation of knowledge from the actors in the network and can therefore provoke the innovative combination of resources.

Therefore it is task of the network management to establish routines, to build and regularly refresh some meta-knowledge about the competencies and abilities existent within the network.

Besides creating transparency the network, knowledge management has to create an environment that facilitates the sharing of knowledge between the network partners. Knowledge seekers must be able to get in contact with knowledge holders. The exchange of knowledge could be fostered by technology, but cultural and leadership aspects as well as aspects of measurement have to be considered as well (O'Dell/ Grayson, 1998: 163). Analyzing aspects of bringing people together, technological solutions, like e-mail, groupware solutions, intranets and elaborated search and retrieval software, have to be mentioned as facilitators of knowledge sharing. These technological solutions can help people to get in touch with each other and to exchange information. O'Dell and Grayson (1998) describe some solutions for these problems using databases enhancing and supporting the direct personal exchange of knowledge. For the transfer of highly tacit knowledge, possibilities, for example yellow pages as one application of the intranet, must exist, to arrange personal meetings. "Technology has a helpful role to play, but it will not be the driver of sharing best practices because all the important information about a process is too complex and too experiential to be captured electronically, and because the incentives for and barriers to sharing are not really technical" (O'Dell/ Grayson, 1998: 163). Therefore the following chapters will focus some of the "human" barriers of knowledge transfer and knowledge management in general.

4.2 Solutions to knowledge combination and transfer problems

Motivational problems to the combination and the transfer of knowledge are rooted in the absorptive capacity of the receiving person or organization (Cohen/ Levinthal,

1990; Simon, 1991; Levinthal/ March, 1993; Szulanski, 1996; Gupta/ Govindarajan, 2000).

Concerning motivational problems on the individual level, it is necessary to establish motivating situations, so that knowledge holders are willing to transfer their knowledge to knowledge seekers within the network (Tampoe, 1993; Osterloh/ Frey, 2000; Osterloh/ Frost/ Frey, 2002). The motivation of an individual could be differentiated as either extrinsic motivation or intrinsic motivation. "Extrinsic motivation occurs when employees are able to satisfy their needs indirectly, most importantly through monetary compensation" (Osterloh/ Frost/ Frey, 2002: 64). In contrast to that, intrinsic motivation results from an activity which is satisfying by itself. Intrinsic motivation "is valued for its own sake and appears to be self sustained" (DeCharms, 1968; Calder/ Staw, 1975: 599; Deci, 1975; Osterloh/ Frost/ Frey, 2002: 64).

In order to facilitate the transfer of knowledge within a network intrinsic motivation should be addressed predominantly. Osterloh/ Frey (2000) analyzed, that intrinsic motivation should be applied in areas where markets and prices play a minor role. As knowledge always consists of explicit and implicit parts, it could be argued, that not being able to use pricing mechanism to coordinate and measure the transfer of those tacit knowledge parts, extrinsic motivation could not be used to support knowledge transfer. Additionally the so called crowding out effect should be kept in mind (Osterloh/ Frey, 2000: 540-544 for an overview of theoretical and empirical work on this effect). This effect analyzes the trade-off between intrinsic and extrinsic motivation. It is argued that once extrinsic motivation is applied – for example in form of financial rewards for explicating and sharing knowledge – the intrinsic motivation will decrease. The result of this effect would be that knowledge is only shared, if financial rewards are obtainable, thus making knowledge transfer expensive and inefficient.

In addition to intrinsic motivation at the level of the network partners, a balanced use of incentives and sanctions is preferable. The main reason for that is that cooperation theory provides evidence that a "tit-for-tat-strategy" is optimal (Axelrod, 2001, 1984). Furthermore it might be useful to implement an evaluation system with which all network partners can evaluate each other. A favorable assessment by their peers is socially accepted and can function as a basis for financial benefits. Continuously unfavorable scores will ultimately lead to exclusion from the network.

Even if the motivation and coordination problems are solved, it is possible that the knowledge transfer process will fail. The reason for that is the inability to adapt the knowledge received. The receiver of knowledge has to reconstruct the transferred information and is able to use that knowledge (Höerem/ von Krogh/ Roos, 1996: 119; Polanyi, 1959: 22). This process of reconstruction is a learning process. The network knowledge management has to avoid frictions that could deteriorate this learning process. A common language, multiple learning possibilities and a learning friendly culture should be established and maintained by the network knowledge management in order to support the transfer of knowledge within the network.

If the transfer of knowledge is too difficult because of the tacitness of knowledge, because of learning problems, or because of motivational problems from source or recipient of knowledge, the rotation of personnel as another form of knowledge combination could be an effective way of using the knowledge within the network. "The rotation of personnel [...] can be a very effective means of mobilizing personal knowledge." (Inkpen, 1998: 130). By bringing together people with different experiences and abilities from different network partners, network knowledge management can foster a common understanding as well as new innovative knowledge combinations in order to gain and sustain competitive advantage for the network as a whole.

4.3 Supporting knowledge application

In a service network, the production and consumption of a particular service takes place "uno actu", meaning the transferred and combined knowledge has to be integrated with the external factor. The agent being in contact with the external factor does not only use his individual knowledge to perform the service but also includes knowledge from his network partners. It is in fact the main idea of a network to combine knowledge in order to avoid redundancy in the problem-solving process. To be of value to the organization, the transfer of knowledge should lead to changes in behavior, changes in practices and policies and the development of new ideas, processes, practices and policies (Bender/ Fish, 2000: 130).

Research on knowledge management indicates that individual knowledge holders have a tendency to resist towards using knowledge created elsewhere (i.e. by their network partners) since they do not trust the quality of the shared knowledge (Hayes/ Clark, 1985; Katz/ Kahn, 1982). Hence, knowledge is developed by themselves

resulting in redundancy which ultimately leads to suboptimal resource allocation. Therefore, the main problem facing network management is to find solutions for the Not-Invented-Here syndrome. Three possible approaches to solving that problem can be identified in particular (Michailova/ Husted, 2003): Influencing the environment in the network, providing the right infrastructure for knowledge sharing, and – strongly correlated to the latter – introduce appropriate incentives at the network level.

Trust in the quality of the knowledge provided by the network partners is the basis of overcoming the Not-Invented-Here syndrome. An organizational culture of trust and commitment is of supreme importance to knowledge intensive service networks in particular. Since distrust often comes from not knowing the knowledge provider, it helps to have employees get to know each other better. That can be done by organizing informal meetings or be formal job-rotation.

If trust is the basis, IT may function as the physical backbone to overcoming the Not-Invented-Here syndrome. While knowledge assets are grounded in the experience and expertise of individuals, the network must provide the physical, social, and resource allocation structure so that knowledge can be shaped into competences. How these competences and knowledge assets are configured and deployed will dramatically shape competitive outcomes and the commercial success of the enterprise (Teece, 1998: 62). Knowledge must therefore be readily available to use by the network partner. If that is the case, there is a strong incentive to use that particular knowledge instead of developing one's own.

4.4 Supporting the evolution of “tacit-network-knowledge”

After the combination of explicated knowledge has resulted in the delivery of a service, the network is faced with the problem of losing knowledge. Firstly, knowledge concerning certain service delivery process steps can be lost by failing to document properly, the process, the associated problems and the level of success. Therefore, it should be mandatory for the participating partners to make their experiences available in a documented form. This could be organized by implementing a central data warehouse functioning as a “knowledge warehouse”, or by making documentation available for automated retrieval systems. Secondly, as shown before, knowledge is a central building block for a knowledge-intensive service network's core competency. Only if the network partners contribute their distinctive competencies and prevent them from being imitated, competitive

advantages can be sustained from the network's perspective. "Knowledge-patents", an indication of who contributed a valuable resource to the process of service delivery, can be a solution to the problem of losing knowledge inside the network. The leakage of knowledge to actors outside the network is even more of a problem. This can be prevented by patenting important knowledge. Where this is not possible – and that is the case for most services – knowledge must be developed constantly. That is especially relevant for the "core network". Tighter functional cooperation is a barrier to imitation, since knowledge is embedded in a socially complex environment (Lippman/ Rumelt, 1982; Dierickx/ Cool, 1989). Therefore, the network must identify different "levels of importance": the more sensitive the knowledge, the more important it is to obtain a sufficient level of coordination between partners. More than other aspects, the creation of a cultural atmosphere based on mutual trust where no "insider" would communicate sensitive knowledge to actors outside the network, is the key to preventing a leakage that would lead to an erosion of the core competency and of the competitive advantages of the network.

5 Conclusion

It has been shown in the previous analysis that knowledge is the key to gaining and sustaining competitive advantage, especially for knowledge-intensive service networks. Knowledge is a resource that is valuable, since it helps to achieve a corporate goal, rare, since it is not available in access of demand and especially hard to imitate and substitute, since it is tacit, causally ambiguous and developed in a path-dependent, historic process. Therefore, it is the task of the strategic management to implement a knowledge management strategy in order to stay successful.

The task of knowledge management is a difficult one. It renders even more difficult when the object of implementation is a network instead of an individual firm. It is clear that networks exhibit substantial advantages compared to firms, especially for the provision of knowledge-intensive services: in uncertain environment – as the service sector nowadays clearly is – it is a necessity to cooperate between firms in what we call a "service network". Such a network is superior to firms since it (flexibly) combines the distinctive competencies of the network partners to form a network's core competency.

Engaging in a network brings certain problems with it, especially the leakage of knowledge that can ultimately erode the network's core competency. Such a thread can be faced by clearly identifying the phases of the service production process and by subsequently developing solutions to the particular problems during each phase. Solutions include personal aspects, technological aspects as well as organizational and cultural aspects. Personal aspects are relevant to guarantee efficient transfer and application of knowledge on an individual level. Organizational and cultural aspects are relevant to permit the frictionless collaboration between the network partners on an organizational as well as on an individual level. Technological aspects have to be considered to support the sharing and use of knowledge.

A problem overlapping the different phases of knowledge management is the measurement and the evaluation of knowledge, which is especially challenging for the case of tacit knowledge. Only with a "measure of importance" of the knowledge components that contribute to the service provision, the management can evaluate the contribution of the individual network partner to the network. Based on that measure, incentives and sanctions can be developed to ensure a better creation, explication, application and securing of the network's knowledge base. Much further research needed in that particular field.

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