

Main Challenges Of Knowledge Management: Telecommunications Sector As An Example

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Abstract

This paper deals with the issues of profiting from mutual interfirm and partnership formation between large incumbent firms and small specialized suppliers. We emphasize the nature of knowledge relevant for partnerships decisions. A dynamized transaction cost economics model is launched in order to grasp the issue of profiting from partnership. In order to be able to analyze also the value-creating aspects the basic model is extended by introducing the main determinants of transaction/network benefits as well. Finally, the implications of our model are scrutinized in the field of telecommunications in Finland.

Keywords : knowledge management, transaction costs, dynamic capabilities, partnerships

Introduction

Knowledge management has received plenty of scholar and managerial attention in the 1990s. Competitiveness of the modern knowledge-based firms is more and more based on their intellectual assets. Various consulting activities as well as research and product development demand careful management of knowledge (e.g. Sarvary 1999). There are hundreds of managerial books, articles and even devoted journals on the topic. There is no doubt that the creation and transfer of knowledge is a key competitive asset of today's knowledge-based businesses. However, the concept of knowledge management is used vaguely and without strict scientific base. Because of its peculiar commodity properties knowledge is hard to capture theoretically and manage in real life businesses (Nonaka and Konno 1998).

In the following we clarify the multi-faceted knowledge management concept and set it into the context of a dynamized transaction cost theory. The knowledge-related transaction costs and benefits are illustrated in the asymmetric R&D partnerships common in the telecommunications industry. Our focal point is the issue of how to profit from cooperation and partnerships between large incumbent firms and small specialized suppliers.

Following the tradition of evolutionary economics (e.g. Nelson and Winter 1982;

Kyläheiko 1998), we emphasize such knowledge related processes as *replication* of existing knowledge base, learning induced *partial replication*, *knowledge creating*, *knowledge integrating* and *knowledge transferring* mechanisms. In order to be able to analyze these mechanisms we combine evolutionary economics-related ideas with the so-called dynamic capability view.

The pioneers of this tradition, Teece and Pisano (1994, 537), interpret firms as generators of *dynamic capabilities*, which help “in appropriately adapting, integrating, and re-configuring internal and external organizational skills, resources and functional competencies toward changing environment.” According to this view the competitive advantage of firms lies in dynamic capabilities “rooted in high performance routines operating inside the firm, embedded in the firm’s processes, and conditioned by its history”.

On the nature of knowledge

We start from the main knowledge related mechanisms. Fig. 1 below consists of three basic knowledge categories. *Tacit knowledge* (“know-how”) is assumed to be embedded either in the firm organization as a whole (which makes it easy to protect against the imitation attempts of rivals) or in teams or sometimes even in single persons (which can fairly easily to be “bought” by rivals). Tacit knowledge gives rise to cumulative *learning based internalities* which enable a firm to exploit the economies of scale and utilize better outsourcing opportunities. There are two types of basic mechanisms which make internalities possible; *replication and partial replication*. These learning effects make path-dependent firm-specific trajectories possible and enable the crucial differences between firms even within the same industry.

Generic knowledge and *codified information* in turn make it possible to exploit the *externalities* generated through other (external) knowledge bases. They are sources of network externalities and the most important mechanisms related to them are *knowledge transferring* and *knowledge creation* through *integrating* tacit know-how with generic knowledge.

NATURE OF KNOWLEDGE

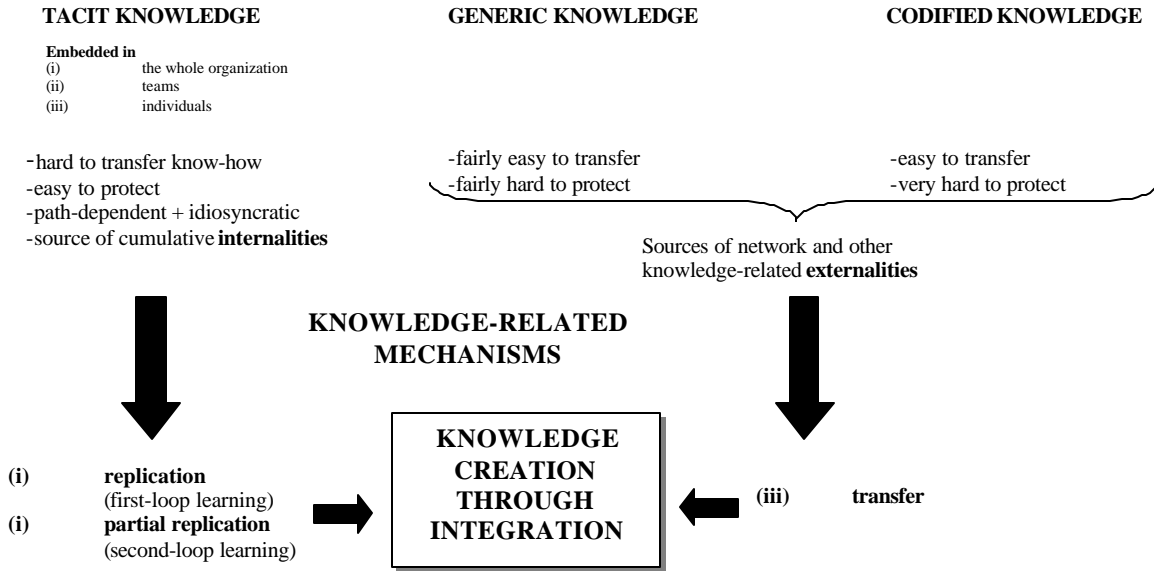


Figure 1: Knowledge categories and knowledge-related mechanisms

Next we combine these categories with the issue of knowledge management. Sarvary (1999, 95-96) has defined knowledge management as a "business process through which firms create and use their institutional or collective knowledge". He continues that knowledge management can be seen "as a technology that transforms information into knowledge". According to the dynamic capability view the firms can be seen as responses to knowledge related problems i.e. *repositories of knowledge*. Firms that are able to create and manage knowledge, which is valuable to others, are able increase their value. Knowledge becomes a source of competitiveness. Figure 2 below illustrates this idea.

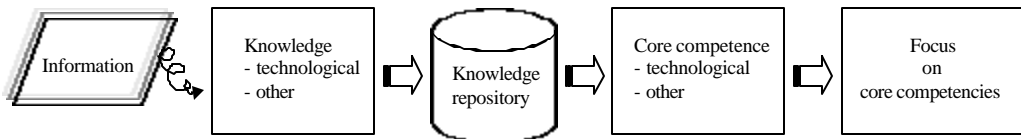


Figure 2: Core competence-based strategy as a result of firm as a knowledge repository

Evolutionary knowledge management view

Next we explain how the firms function as *knowledge repositories*. Evolution of knowledge is analyzed in terms of *knowledge creating, transferring and integrating processes* using the "Blind Variation-Selection-Retention" scheme. The main role of *alert entrepreneurs* is to trigger off *variation-generating* new combinations (technical artifacts, new routines, etc.) on which selection works. However, *selection* always needs time to operate and to pick up fitter new combinations. This, in turn, depends upon the *organizational inertia*. In the evolutionary theory of the firm organizations have a double role: (i) the sources of "new combinations" (*variation*) and (ii) providers of a stable hierarchy of path-dependent routines and capabilities which are continuously replicated (*retention or*

replication).

The former means that there are replication mechanisms that guarantee the necessary stability and continuity. According to Nelson and Winter routines function as an *organizational memory*. The role of tacit knowledge is important and new information will always be conceptualized in the framework of old established organizational routines (capabilities).

In order to analyze replication mechanisms, Nelson and Winter introduced such important concepts as *static* and *dynamic routines*. Static routines replicate existing organizational and technological competencies. Through only *partial replication* there is room for adaptational changes. Dynamic routines are routines through which the firm can "learn by learning" and diffuse generic scientific and engineering knowledge. The *dynamic capability* concept rests on dynamic routines and can be defined as "the capacity of a firm to renew, augment, and adapt its core competencies over time." (Teece, Pisano and Shue 1992: 18). Dynamic capabilities generate new organizational and technological competencies by combining (i) joint contributions of tacit internal learning, (ii) R&D search routines, (iii) complementary assets, and (iv) generic knowledge. Consequently, *dynamic routines* and *dynamic capabilities* reflect and actualize the firm's latent competencies, which opens new business opportunities.

If successful, dynamic routines and capabilities make it possible to earn *entrepreneurial rents* through superior core capabilities (competencies). Consequently, the evolutionary *dynamic capabilities* view stresses *differences* between firms even within the same industry and, consequently, *strategies* based on intended efforts to renew and adapt the firm's core competencies through partial replication mechanisms. Differences in the ability to generate entrepreneurial rents reflect differences in *efficiencies*.

Now we are ready to outline the basic message of the *evolutionary theory of the firm* in the context of *knowledge management*. The emphasis is not on resources per se, but on evolving routines and capabilities and mechanisms through which a web of coordinating relationships connecting firm-specific resources are replicated. The resource base of the firm determines its routines and is subject to learning and variety through the path-dependent *search and learning mechanisms* that the firm uses. The emphasis is "on the challenge of leveraging the existing resource position into a more favorable future position" (Winter 1995: 151). Figure 3 summarizes our basic evolutionary knowledge management view.

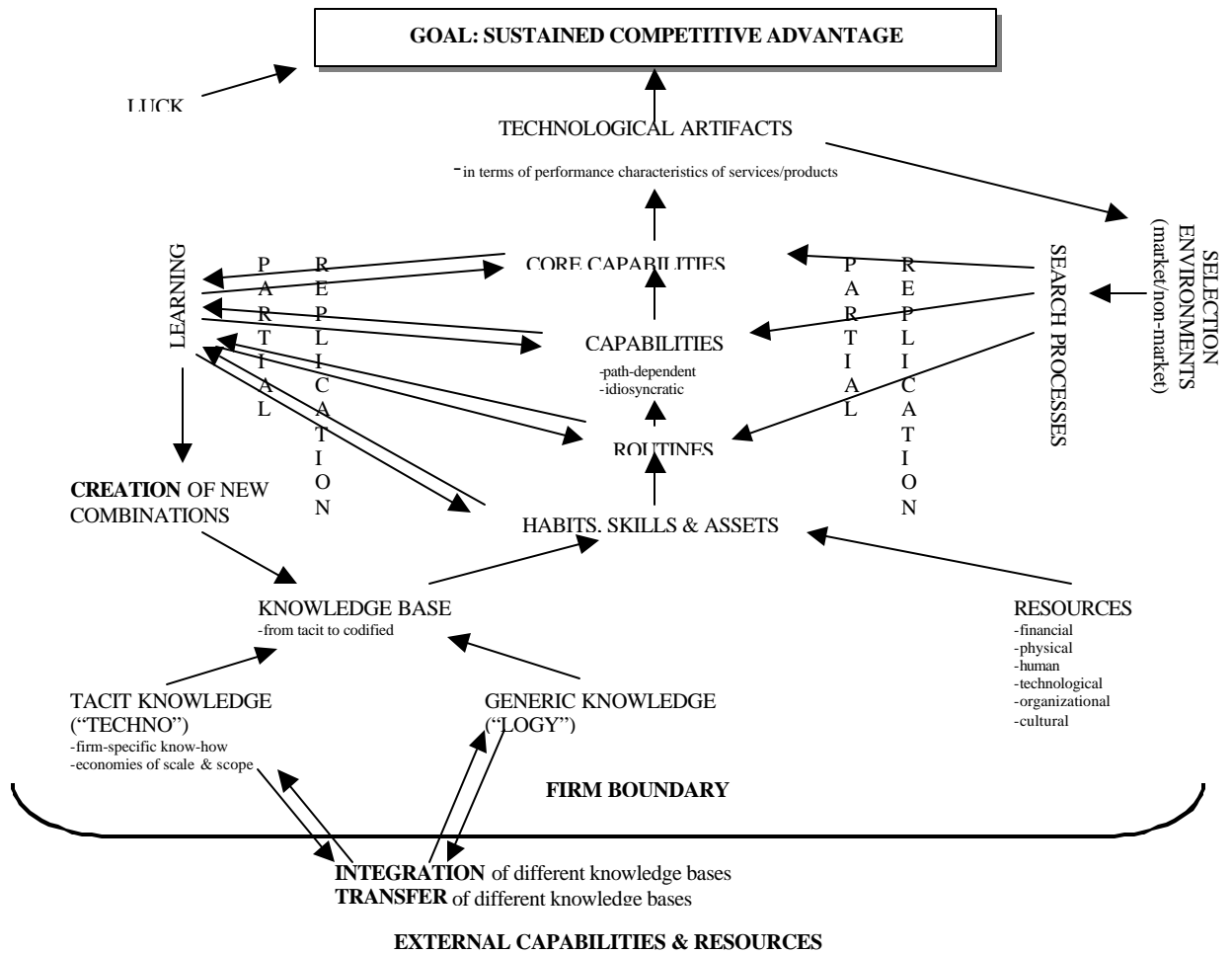


Figure 3: The basic framework of an evolutionary theory of the firm in the knowledge context (cf. Kyläheiko 1995, 223).

On transaction and management costs and benefits

Introduction

Our evolutionary knowledge management view regards the firm as an organization, which combines partly tacit and cumulative know-how (“techno”) with generic information (“logy”). Heterogeneity of capabilities implies that the *boundaries* of the firm have to be interpreted as strategic devices when outlining a firm’s knowledge management strategy. It is a question of how to generate more value and how to strengthen the competitive position by using internally produced/ externally acquired capabilities and resources in the most efficient way.

Fig. 4 below assumes that the firm as a value chain consists of different activities or transactions. All the activities are based upon routines/capabilities which are partly tacit and partly generic. Some internal and external capabilities already exist (static), whereas some have to be developed from the old ones through partial replication or created through knowledge integration (dynamic). Some of the activities can be bought from other firms (i.e. *outsourced* capabilities), whereas some of the activities

are based upon internal capabilities. Outsourcing costs i.e. the costs of using the market are called *transaction costs* (relating to search, planning, negotiating, monitoring, and enforcement) and the insourcing costs i.e. the costs of running the firm are called *management costs* (relating to administration, control and monitoring as well as the costs of using low-powered bureaucratic incentives).

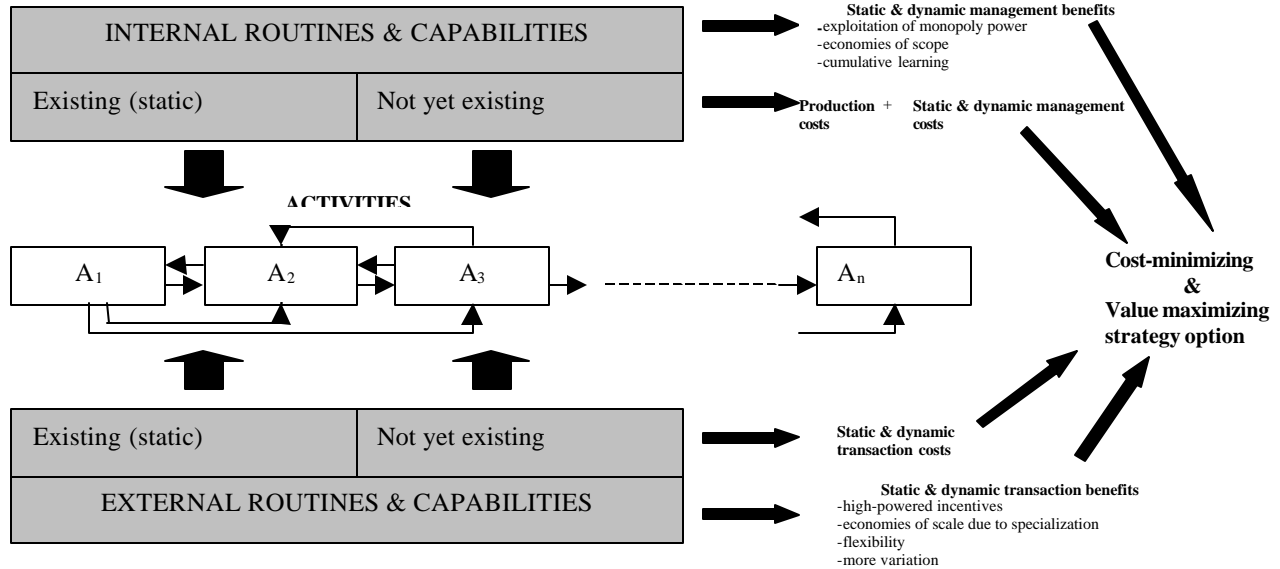


Figure 4: Dynamic transaction and management costs and benefits

When the firm utilizes its own resources and capabilities it can build on cumulative learning and exploit the economies of scope through replication. It can also utilize competence-enhancing innovations or even use monopoly power over other firms. These all are the *benefits* related to insourcing strategy. We call them *management benefits* (cf. Dietrich 1994).

On the other hand, when the firm uses the market option (i.e. outsourcing) it can exploit high-power incentives through fierce competition, economies of scale through specialization, flexibility and variation generated through many alternative partners. A firm can also cope with radical uncertainty and competence-destroying innovations. We call them *transaction benefits*.

The central knowledge management issue now is to find out such a *governance structure* i.e. a combination of outsourced, networked and insourced activities or transactions which minimizes the sum of transaction and management costs at the same time when the value obtained through transaction and management benefits is maximized

Main determinants of static transaction and management costs

The concept of transaction cost has proved to be fruitful when explaining the boundary of the activities in which the firm engages. Williamson (1975) explicated the following determinants that give rise to (static) transaction costs: (i) bounded rationality, (ii) opportunism, (iii) information impactedness,

(iv) frequency of transactions, and (v) asset (site, physical, brand name or human asset) specificity. Moreover, Teece (1986) introduced such concepts as *complementary capabilities* and the *appropriability regime*. The former consists of external routines and capabilities (cf. Fig. (3)) that are needed to complete a firm's internal capabilities. The complementary external capabilities, which have to be outsourced, affect the bargaining situation the more, the more inefficient are their markets. This implies higher transaction costs and, consequently, more insourced solutions. The *appropriability criterion* determines how easily a firm can protect its innovation from imitation. It depends upon legal protection and tacitness. The more tacit knowledge, the lower are transaction costs and vice versa. Our first *knowledge management lessons* are now:

The *insourcing solution* is the best option when (i) uncertainty and the danger of opportunism are high, (ii) there are only few providers of complementary capabilities, (iii) innovation is systemic by nature and requires large specific investment, (iv) appropriability (protectability) of new knowledge is weak, thus implying the danger of a free rider imitator, (v) the markets of complementary assets are inefficient, and (vi) trust between partners is lacking.

The arm's length *outsourcing solution* is preferred when (i) the degrees of uncertainty and complexity are minor and the danger of opportunistic behavior is small, (ii) there are many providers available, (iii) innovation is autonomous and no high specific investment are needed, (iv) protection is tight, and (v) the markets for the complementary capabilities are competitive. The hybrid form between market and integration options is the network solution which will be discussed more carefully in chapter 5.

Main determinants of dynamic transaction and management costs

In the longer run, different sources of governance costs can no longer be held constant but have to be endogenized. For example, in the turbulent emerging phase of a new technological trajectory (e.g. telecommunications) the role of tacit knowledge is high and it is easier to obtain a strong appropriability position than in the case of well-established mature trajectory (e.g. automobile industry). One can anticipate a tendency towards vertically more integrated solutions as the technological trajectory becomes more stabilized due to decreased technological uncertainty and increased standardization. The automobile industry offers a good example.

On the other hand, when the firm faces a new not yet fully developed technology trajectory it is very risky to bet only on one horse. It would be better to let the variation-generating forces of open markets do their job and exploit the fruits through a networking strategy. On the other hand, also the use of markets may be hazardous due to risk of opportunism. This situation is typical for telecommunications with radically new technologies.

The question is, whether it is more efficient (i) to generate new and develop old internal capabilities through continuous internal second-loop learning and large R&D inputs ("an integrated conglomerate strategy") or (ii) to acquire external capabilities from the open market ("a hollow firm strategy a'la IBM's PC's") or (iii) to exploit economies of scale and scope through networking ("a networking firm strategy").

We shall call the costs of transferring capabilities over the firm's boundaries *dynamic*

governance costs (Langlois 1992). They can further be divided into *dynamic transaction costs* (i.e. persuading, negotiating and teaching with the providers of external capabilities) and *dynamic management costs* (persuading, negotiating and teaching within the firm of own when trying to create/develop a capability internally or persuading, negotiating and teaching external partners when a firm-made activity is tried to sell).

Main determinants of governance benefits

Traditional TCE literature does not deal with the issue of *transaction or network benefits* at all, which means that they implicitly assume that these benefits are in a way independent of governance structures. This is, of course, not true. There are different benefits which arise from different governance structures. These benefit categories are of great importance, since they are closely connected with the knowledge-based value adding processes and key mechanisms, such as replication, partial replication, creating of new knowledge, value creating through integration, and transferring.

In order to clarify these categories we extend and modify Dietrich's (1994, 38-48) approach which is based on two distinctions. On the one hand, he differentiates between *static transaction costs* (C_m) and *static management costs* (C_f), where C denotes "costs" and **m,f** denote **market** and **firm's internal organization** respectively and, on the other hand, between *dynamic transaction benefits* (B_m) and *dynamic management benefits* (B_f). Our extensions *dynamic transaction and management costs* can be differentiated by using *'s. Internal benefits (B_f) introduce explanatory items which are important in the knowledge management context, namely (i) *internal path-dependent capabilities* and (ii) advantages of *monopoly* and *other strategic power* achieved through idiosyncratic capabilities. Dynamic benefits (B_m) of using the market include such explainers as *economies of scale* and *increased variation*. Now we can introduce our more extensive and dynamized governance cost formulations as follows:

- (i) *Outsource* iff $B_m - C_m - C_m^* > B_f - C_f - C_m^*$ or $B_m - B_f > C_m - C_m^* - C_f - C_f^*$
- (ii) *Insource or network* iff $B_m - C_m - C_m^* < B_f - C_f - C_f^*$ or $B_m - B_f < C_m - C_m^* - C_f - C_f^*$,
 B_m^* = *Dynamic transaction benefits* (ability to exploit economies of scale, high-powered incentives, flexibility, increased variation through many potential partners, ability to utilize competence-destroying innovations).

C_m = *Static transaction costs* (depending upon opportunism, few partners available, asset or capability specificity, inability to cope with parametric uncertainty, complexity, strong dependence on complementary assets holders, systemic nature of innovation, low appropriability, organizational inertia against newcomers)

C_m^* = *Dynamic transaction costs* (persuasion and learning costs with the providers of outsourced external capabilities).

B_f^* = *Dynamic management benefits* (ability to use monopoly and other strategic power, ability to use asymmetric knowledge, ability to exploit economies of scope and utilize cumulative tacit know-how and competence-enhancing innovations, increased absorptive capacity)

C_f = *Static management costs* (monitoring and management costs of a large bureaucracy, high sunken R&D costs, low-powered incentives, lack of variation of ideas).

C_f^* = *Dynamic management costs* (persuading, negotiating and teaching costs within the firm when a new capability has to be generated, inability to cope with radical uncertainty).

Toward the explanation of the rise of partnerships and other network solutions

The rapidly increasing networks as organizational governance structures can be regarded as hybrid forms between market and vertically integrated solutions. Partnerships are preferable when there are determinants, which simultaneously speak for both *insourcing* (e.g. uncertainty, danger of opportunism, asset specificity, low appropriability of new knowledge) and for *outsourcing* (e.g. the need for high-powered incentives and greater variation of new ideas). A typical precondition for the emergence of networks is also the pursuit of *economies of scale and scope* at the same time. These two important concepts belong to the domain of dynamic transaction/management cost determinants. In addition, *trust* and *reciprocity* among partners are badly needed to impede opportunism.

A brief sketch of the usage of our dynamized TCE-based knowledge management analysis in the field of telecommunications can now be introduced in terms of our former equations (i) and (ii). Let us think about the situation which is fairly typical in the telecommunications sector where partners are asymmetric. When a small innovative service-producing firm tries to contact a large partner it faces a problem of lacking reputation/references. However, if it manages to effectively utilize *trust-generating* mechanisms it may result in successful *network* solution.

Our example can be illustrated as follows. Because of lacking trust, high-powered incentives, and economies of scale both the partner candidates prefer dynamic market benefits ($B_m > B_f$) at the same time when they, however, face a situation where market uncertainties are very high as well as the threat for opportunistic behavior of potential market partners ($C_m > C_f$). In such a frustrating situation there is no co-operation or market activities to be expected, since the governance cost implication appears to be the following one: $B_m - C_m - C_m^* < 0$ & $B_f - C_f - C_m^* < 0$ i.e. *no activities* take place.

Fortunately, this is not the whole story. If a small partner can signalize that its innovative ideas, *cooperative learning* and *trust* are possible and worth of trying. C_m may *decrease* enough when the non-cooperative prisoners' dilemma game changes into the cooperative coordination game through trust-enforcing mechanisms so that we obtain a new management cost condition: $B_m - C_m - C_m^* > 0$. Together with the old transaction condition $B_f - C_f - C_m^* < 0$ this new situation implies that a *network solution* arises!

The next step could be to take into account *cumulative path-dependent internal learning processes* which increase the dynamic management benefits (B_f) within the firm. Interestingly, it may now happen that a *vertical integration* between the partners becomes more profitable than a network solution and so the governance structure changes again. As a matter of fact something alike seems to be happening within such high-tech industries as telecommunications where there are signs about more integrated organizational solutions after the rapid networking phase. This tendency is fostered through stabilization of technological trajectories which means that the appropriability regime will become weaker i.e. static transaction costs (C_m) increase.

Challenges for Knowledge Management in the Telecommunications Sector

In the turbulent telecommunications sector the convergence of information technology, telecommunications and the content industry has created potential business areas, where *knowledge of different actors is needed*. The technological discontinuities e.g. the Internet and the E-Commerce are creating possibilities for specialized suppliers. The emerging E-Commerce requires special telecommunication software for actor identification and authentication. Large scale customer care and billing as well as various data base services need further development for the E-Commerce to flourish. In the New Economy the competitive players must be able to focus on dynamic core capabilities.

The partnering large firm in the telecommunications is motivated by the possibility to gain dynamic capabilities by external linkages. According to our TCE framework the situation belongs to *network structures* since it contains *both the determinants for insourcing* (market and technological uncertainty, opportunism and low appropriability) *and outsourcing* (need for variation, flexibility and high-powered incentives). The asymmetric partnerships also offer transaction and management benefits to be gained. However, because of the partnering firms' asymmetry (Fig. 5) the transaction and management costs are remarkable.

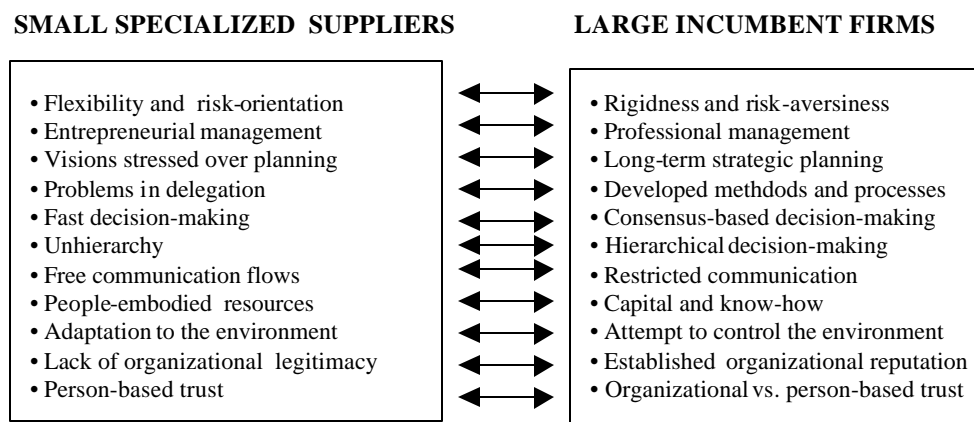


Figure 5: Characteristics of small and large technology firms

Costs for large incumbent firms: Management costs are mainly caused by internal inertia. The NIH-phenomenon, not-invented-here resistance is common. Partnerships may also be seen as a critique towards in-house competencies. Existing partners or in-house development may be favored, since the new partnership may be seen as risky causing difficulties to present operations.

In order to establish a new partnership the key employees must *invest time to learn of and commit* themselves to the new venture. In addition to partner company culture and people there is *the new technological knowledge, which must be learned* in order to be able to absorb it. *The dynamic costs of negotiation and teaching* result from *additional negotiations, meetings and memos* since there are no socialization through physical proximity (Nonaka and Konno 1998) and *learning* by just being around and receiving bits and pieces of information to adapt to the large firm culture and mode of operation. The potential *scale economies* may be lost. A new partnership changes the large firm's position in a network of firms. It may *lessen options to partner with competing firms or even harm the existing relationships*.

Costs for small specialized suppliers: Small telecommunications firms have *the management costs* of developing the organization investing e.g. in quality system to satisfy the large firm partner selection and auditing. Small firms may need to *adapt* their systems e.g. project management or electronic data communications to the large firm's needs. Small firms may need to *recruit* new staff or *teach* the present employment to meet the large partner's demands.

Establishment of a partnership with an incumbent firm may create major *negotiation costs*. Finding the right people and establishing the partnership *agreement* is time-consuming. *Administration and control costs* may become quite large. The small firms need to *learn* the large party's organizational culture, *adapt* itself, and build a *wide interface* in order to safeguard themselves against potential change of the contact persons due to organizational changes. *Loss of small firm key personnel* is a potential cost. If the large firm personnel would behave opportunistically, there would be a *great risk of losing valuable proprietary information*. There is also the potential *cost of creating a competitor*. The small firm *flexibility and decision-making* may slow down. The small firm may *lose its R&D focus* because of the changing needs of the large partner. A *cost of losing an alternative partner* is also relevant. In the telecommunications the firms cooperate and compete within networks. If a small firm works closely with e.g. one telecom operator, it is unlikely that it is able establish similar relationship to a competing telecom operator. Also the tight partnership agreement may practically *block the small firm future* activities in the field, thus generating high hold-up risks and transaction costs.

Benefits for large incumbent firms: The partnering large firm could benefit by increasing the variety for different customer segments and markets. It may focus on its core competencies and enjoy the *economies of scale and scope* at the same time. Local supplier offering may suit better the local customer needs. It would not be necessary to build all the competencies internally, but encourage small software suppliers to develop their niche applications. Small firms may be highly motivated to create innovative and cost-efficient solutions. Partnerships may increase the flexibility and lower the risk inherent in new technologies and new projects by offering a technology window to new technologies. They may also postpone or replace the need to hire *new employees*. Partnerships with small firms extend the large firm employees personal network and may generate some innovative practices and processes. As the new partnership extends the existing network of relationships, it may bring new potential contacts and partners e.g. a university start-up brings the potential relationships with other university graduates or researchers known by the start-up. If the small firm or start-up is in "an exiting and new field" it may even bring positive visibility to the large firm, who may want to refresh its image towards state-of-the-art technology firm. A partnership with a small and specialized supplier may act as a pre-competitive move.

Benefits for specialized small suppliers: The small firm may benefit from large firm's complementary and rich resources e.g. finances for R & D or an existing marketing channel. It may be able to target several markets simultaneously. A very important benefit from a partnership with an incumbent firm is the legitimization of the small firm and its products (reputation effect). Through the partnerships the small firm may also be able to push its products towards standardization. Large firms

also have better skills to handle regulating agencies and lobby, if necessary. A demanding large customer may also force the small firm to continuously increase its competitiveness in producing high quality and state-of-the-art service. Partnership with a large firm enables the small firm also to learn of the processes and practices of the professional firms e.g. quality system and project management. Potential competition may be changed towards cooperation. A partnership announcement may also act as a pre-emptive competitive move towards small firms' competitors.

Conclusions

In this paper we have developed an evolutionary knowledge management model which makes it possible to derive the basic determinants that give rise to static and dynamic transaction and management costs and benefits. This model is applied to the partnership problems between asymmetric firms both analytically and then empirically using the Finnish telecommunication sector as an example. The results are straightforward and show that our model really captures some of the most crucial aspects concerning these dyad relationships.

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