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Innovation across tech-firms' boundaries

A knowledge-based view

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Introduction

Nowadays, the business environment is becoming more and more dynamic and uncertain requiring firms to continuously innovate within short periods of time. Further, technological products are requiring more and more distinct and numerous bodies of knowledge which increases the complexity of the production process. In order to gain competitive advantage, firms tend to outsource the innovation process strategically, as a whole or in part, to external players. Traditionally, the knowledge creation process was considered a firm's core capability to be kept internally, within its boundaries. However, due to the new rules of competition, firms have started to cooperate with external players in order to create new value and develop novel products. These emergent business tendencies have restructured different technology-oriented industries and reshaped the core capabilities of the firm. Indeed, the knowledge representing a critical input to the value creation process is becoming more dispersed over a network of interconnected organizations. Accordingly, a new governance structure has emerged to overcome the shortcomings raised by the wide-ranging multi-technological base of high-tech products. As a matter of fact, the extended enterprise (EE) is the result of an outsourcing strategy adopted by firms aiming mainly at reducing the complexity, increasing the creativeness, and lowering the cost of the innovation process. Thus, new core capabilities have emerged within the context of the EE, making the traditional core capabilities of a firm obsolete.

Drawing on the technology management literature and the resource-based theory, and more specifically the knowledge-based view, this chapter seeks to find reasons why companies outsource their core functions that constituted, in the past, their competitive advantage. Throughout the chapter, the authors will analyze the outsourcing decision of innovation of the modern firm, referring interchangeably to the technology-based firm. Reviewing the different perspectives on outsourcing, mainly from the resource-based theory, the authors extend the traditional definition of outsourcing to reveal emergent features of a firm's strategic orientation and its reaction to the environment. Moreover, the chapter puts in perspective a new business model that has emerged as a result of the newly adopted strategy. A theoretical conceptualization of the EE from the knowledge-based view is introduced, and the implications underlying the outsourcing decision of the innovation activities within a technology-based firm are highlighted.

Thereafter, the chapter is organized into five main sections. The first section presents the assumptions lying behind the emergence of a new innovation process framework within the context of a technology-based firm. The second section introduces the new conceptualization of outsourcing according to the previously developed innovation framework. The third section describes the extended enterprise, defines its strategic search processes, and details the main capabilities that the EE needs to master in order to effectively and efficiently manage innovation. The fourth section ends up illustrating the features of the EE and its management capabilities through analyzing the Toyota case study. Finally, the chapter concludes with presenting the implications of the theoretical framework mentioned and suggests directions for future research.

Towards a new innovation paradigm for sustainable competitive advantage

The new competitive realm

Several transformations in the socio-economic context of the modern firm have changed the competitive environment to be more dynamic and unstable. These environmental features are continuously expanding due to the increasing number of factors influencing the daily operations of the firm, their interdependency, and their dynamicity.

Accordingly, the modern firm has to cope with and adapt to environmental needs in order to gain competitive advantage, or even to survive. A study of the life expectancy of firms has shown a drastic drop in average life from thirty to fifteen years over the period 1975–2005 (Foster and Kaplan, 2001). Additionally, another research study that examined 6,772 firms from different industries over a period lasting twenty-five years, demonstrated that only a small percentage of these firms has recorded high economic performance (Wiggins and Ruefli, 2002). Firms are exposed to environmental threats and ultimately to market failure, and only a few succeed in adapting and then prospering. Thus, technology plays an important role in creating firms' sustainable competitive advantage and guaranteeing their success in the market through developing new products, discovering new processes, altering competitive rules, or readjusting the boundaries of their industries (Utterback, 1994).

Organizational adaptation and growth is a critical issue heavily researched in different fields of study such as management, strategy, organizational sociology, psychology, and economics (Christensen, 1997; Hannan and Freeman, 1984; Nelson and Winter, 1982; Porter, 1980). Among the organizational theories that emanated from such research, the competitive advantage model (Porter, 1980) and the resource-based theory of the firm (Barney, 1991; Grant, 1991; Penrose, 1959) have been used extensively to explain the adaptation and growth of a firm within its competitive environment. The assumptions made by the Porter model (1980) claimed that sustainable competitive advantage of a firm relies on both its market position and the positioning of its products within that specific market. The resource-based theory, on the other hand, argued that organizational competitiveness is mainly derived from the resources and capabilities of a firm and the way in which they are deployed for matching the emerging needs of the market (Barney, 1991; Penrose, 1959). Consistent with Penrose's work claiming that "a firm is both an administrative organization and a pool of productive resources" (Penrose, 1959: 2), Wernerfelt (1984) and Barney (1986) fostered a theoretical departure from the neo-classical tradition which perceived the firm as a mere profit function, to viewing the firm as an organization able to manage potentially valuable resources. Therefore, viewing the firm as a bundle of resources, the resource-based theory extends Porter's model by concentrating on the internal idiosyncratic resources of a firm and its

capability to create and develop its competitiveness within the marketplace (Grant, 1991).

The resource-based theory, and later on the knowledge-based view, described the intangible resources that can be sources of sustainable competitive advantage as rare, imperfectly imitable, valuable, and non-substitutable (Barney, 1991; Penrose, 1959). A stream of research then emerged recognizing the centrality of knowledge and capabilities as the most valuable intangible asset of a firm as well as the key element of a firm's strategy (Drucker, 1993; Grant, 1996; Leonard-Barton, 1995; Nelson, 1995; Nonaka, 1994; Prahalad and Hamel, 1990; Quinn, 1992; Teece *et al.*, 1997; Toffler, 1990; Zack, 1999). This literature additionally emphasizes the importance of strategic activities to integrate knowledge (Grant, 1996; Huber, 1991) and to convert dispersed, tacit, and explicit competencies into an aggregated body of organizational knowledge (Nonaka, 1994), giving rise to the knowledge-based view of the firm (Grant, 1996; Nonaka and Takeuchi, 1995). Knowledge is, then, the most valuable intangible asset and is considered the core element of innovation (Clark and Fujimoto, 1990).

Towards a new framework of innovation

Firms are increasingly innovative in order to cope with continuous changes and the uncertainty of the environment. Innovation processes are the basis of more complex and multidimensional dynamics due to the need for considering more factors (e.g., environment, manufacturability, etc.), cooperating with various actors outside the firm (e.g., research centers, alliances, etc.), as well as effectively and efficiently managing the commercialization of new technologies (e.g., timely and efficient introduction of new products to the market) (Nobelius, 2004). The complexity of the innovation dynamic is higher when dealing with a technology-based firm (TBF).

Granstrand (1998) has modeled a theoretical framework for the technology-based firm and defined its technology diversification strategy. He argued that the TBF is an organization encompassing various interconnected elements. Each involves or is influenced by, technology or technical artifacts (Granstrand, 1998). Conceiving technology as a "dynamic body of knowledge" with special features over other knowledge resources (e.g., protection through patent system), technological diversification plays a key role in the evolution of a TBF

and its adaptation by performing strategic economies of scale, scope, speed, and space (Granstrand, 1998). This author further suggested that cross-fertilization between different technologies may bring to light new inventions, new functionalities, and higher product and/or process performance (Granstrand, 1998).

In the same vein, the quality of technology management and the capability to combine effectively heterogeneous technologies and their idiosyncrasies with the aim of reaping the potential benefits of the technological diversification, are considered to be critical issues. While technology diversification is a primary factor for the growth of a TBF, R&D expenditures increase as a result of the diversification strategy (Granstrand *et al.*, 1997). The growth of R&D expenditures is mainly derived from the cost of acquiring the new technology and overcoming the troubles faced in combining various technologies (Granstrand *et al.*, 1997). Nevertheless, Quinn (2000: 13) claimed that “leading companies have lowered innovation costs and risks by 60% to 90% while similarly decreasing cycle times and leveraging the impact of their internal investments by tens to hundreds of times.”

Additionally, given the growing complexity of multitechnology products and their production system, major innovations of technological products cannot be pursued by a single firm. This is essentially explained by the systemic interdependency among their sub-components (Brusoni and Prencipe, 2001) and the multiple technological fields of knowledge and resources that go into their production. In order to gain competitive advantage and overcome the shortcomings of technological diversification strategy, a TBF needs to source its technological needs from external partners. Accordingly, firms are involved in new knowledge co-creation and knowledge transfer through vertical and horizontal networking (Möller and Svahn, 2003; Powell, 1996).

A new paradigm for innovation has emerged and is characterized by the joint efforts of loosely tied networks of organizations, driven more by pure and mutual interest and having different capabilities in new product development (NPD) management. A new era of partnering needs to be established based on crossing borders and functions instead of technology. Coalitions of autonomous but interdependent firms that are willing to coordinate some of their actions, and sometimes even to abdicate part of their activities and decisions to the focal firm in the network, hope to achieve greater benefits than any single member of the network can independently. Quinn (2000) claimed that strategically

outsourcing innovation can place a firm in a sustainable leadership position within its industry.

The new innovation framework for outsourcing

Resource-based approach to outsourcing

Over the past twenty-five years, the outsourcing literature has been predominantly concerned with transaction cost theory. Coase (1937) argued that a firm needs to perform its activities in-house rather than to turn to the market in situations of uncertainty. Numerous researchers have provided empirical support (e.g., Murray *et al.*, 1995; Walker and Weber, 1984, 1987). However, this approach has ignored other features of organizational behavior that turn out to be of major importance. Recently, the outsourcing literature has incorporated other theories to analyze the phenomenon from other perspectives such as the resource-based theory to explain the decision of a firm to outsource.

The resource-based approach views the firm as a set of resources and capabilities that needs to be nurtured and that guides the firm's strategy (Grant, 1991). Such resources have been classified into two major typologies: tangible and intangible ones (Grant, 1996). The first, which includes financial and physical assets, are easy to identify and evaluate (Grant, 1996). The second type of resource, which includes human, technological, and reputation assets, is deemed to be difficult to measure; however, it represents the main competitive advantage (Grant, 1996). Resource-based theory relates the internal features of a firm to its market positioning, arguing that the difference in organizational resources and capabilities may explain the difference in a firm's performance over time and thus become a key determinant of the firm's long-term competitive advantage. Within this context, outsourcing is considered a strategic decision affecting the resources allocated to business units within a firm and the firm's extent of vertical specialization (Quélin and Duhamel, 2003).

Resource-based theory goes further to claim that firms can exploit resources that lie outside their boundaries by means of contracts (Barney, 1999; Grant, 1991). Thus, those resources that are difficult or costly to specify or include within contracts are kept in-house, while other resources can be outsourced and performed by a third party. Extending this perspective gave rise to the core competence

approach (Gilley and Rasheed, 2000; Prahalad and Hamel, 1990; Teng *et al.*, 1995) presenting a distinction between activities that need to be performed within the boundaries of a firm, called “core competences” versus others that could be externalized (Peteraf, 1993). Further, Prahalad and Hamel (1990) claimed that while the long-term competitiveness of a firm relies on its core competences derived from its learning mechanisms, the short-term achievements of a firm are based on the attributes of its products (Prahalad and Hamel, 1990). Accordingly, Quinn and Hilmer (1994) identified the most effective core competence strategy as the one focusing on performing only a few activities that constitute its best capabilities and innovative value. Thus outsourcing core competences was held to be detrimental and would endanger the firm’s key value-added resources. Argyres (1996) also suggested that firms keep in-house those operations they perform better than their suppliers, while they may outsource those activities that they do not master. Additionally, Barney (1999) pointed out that firms need to consider the cost needed to develop their own capabilities versus the cost to acquire them from other organizations such as the threat of opportunism by the third party.

The new perspective on outsourcing

Despite the fact that innovation is considered a core capability, firms are today increasingly externalizing their innovation activities, relying partially or totally on external partners (Quinn, 2000). Outsourcing is no longer restricted to the firm’s complementary and non-core capabilities *per se*; instead, the outsourcing decisions have been extended to include also what used to be considered core capabilities. In fact, Granstrand *et al.* (1997: 18) stated that “rather than simply calling them ‘core’ competencies, a more accurate description of large multi-technology firms’ competencies is that they are ‘distributed.’” Accordingly, these firms are focusing more on enhancing their capacity by dispersing and coordinating complex activities along their value chains as well as exploring and exploiting new emerging technologies (Granstrand *et al.*, 1997; Patel and Pavitt, 1997).

The new view of outsourcing and strategy defines a firm’s core capabilities as the ability to coordinate and integrate its distributed activities. For instance, two decades ago, Dell outsourced all design and innovation for its different sub-systems, software, and non-assembly production, to concentrate on its newly recognized core capabilities,

namely understanding customer needs, logistics, and component integration. This strategy made Dell the leader in introducing new products with the shortest innovation cycles.

Technology-based firms are increasingly involved in different collaborations, partnering activities, or inter-organizational networks (Gulati and Zajac, 2000; Hagedoorn, 1995). While contractual arrangements represent an important tool to govern the relationship among firms and manage outsourced activities (Barney, 1999; Grant, 1991), innovative activities are considered uncertain processes and the knowledge created through such processes cannot be defined *a priori*. Contracts are ineffective mechanisms for managing innovation activities subcontracted to external players. Instead, autocatalytic or self-sustaining motivations such as trust, mutual interest, and the network identification provide the glue for cooperation and ongoing joint work (Dyer and Nobeoka, 2000). We propose the following definition:

Outsourcing is a strategic decision that encompasses the subcontracting of some business activities to an external party by means of relational rather than contractual arrangements, while redefining the firm's core capabilities and preserving the knowledge base of subcontracted activities for the purpose of enhancing long-term competitive advantage.

This definition entails three main features that extend the existing literature. The first suggests that outsourcing is a strategic decision for building sustainable competitive advantage. The second extends the scope of outsourcing to include traditional core capabilities. The last aspect illustrates the importance of relying on relational mechanisms (such as social norms, trust, etc.) to govern the outsourced activities rather than the traditional contractual arrangement under which it is difficult to manage tacit knowledge. Further, the firm needs to retain access to knowledge or processes that have been subcontracted to an external firm to effectively coordinate and integrate the distributed business processes.

The extended enterprise (EE) as an emergent governance structure

The new framework for the "extended enterprise" (EE) argues that the traditional way of networking cannot effectively deliver the capabilities for new value creation within the framework of multitechnology products; instead, a new way of coordination and collaboration is required

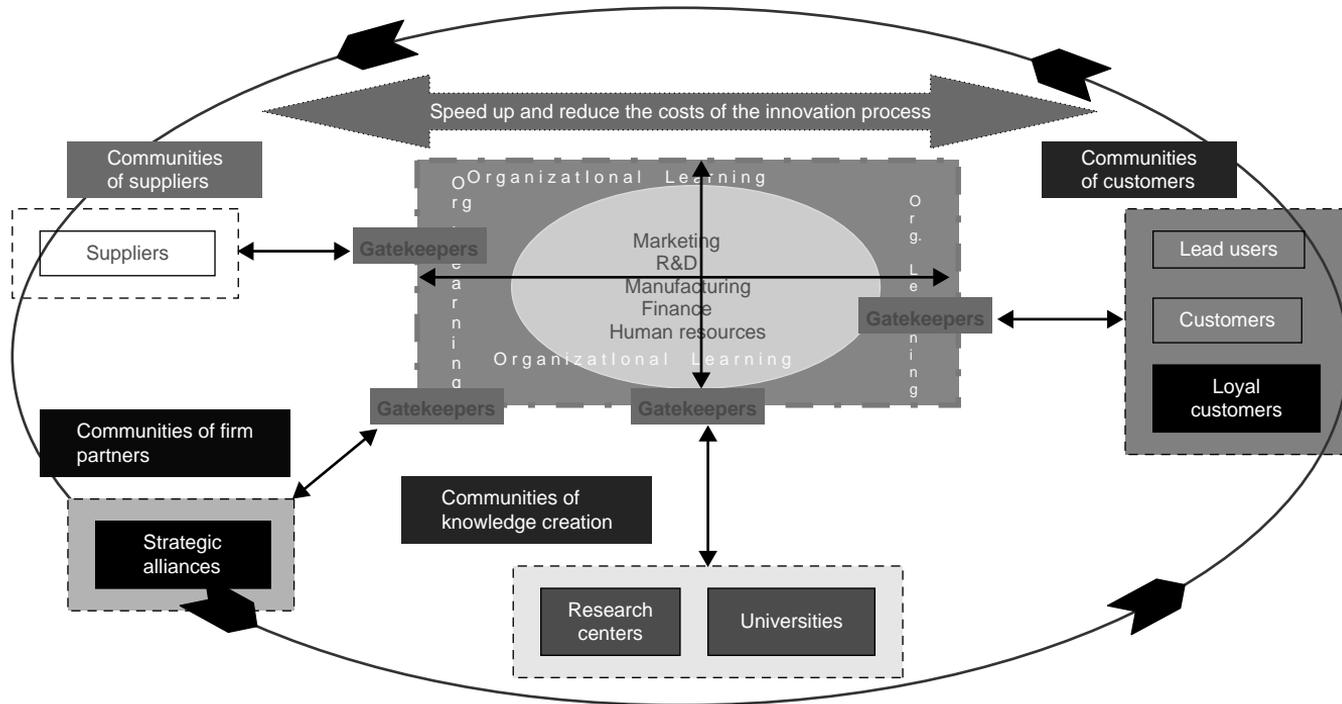


Figure 8.1. The extended enterprise framework (adapted from Filieri and Alguezaui, 2008).

for a more efficient and effective management of an interdependent and dispersed knowledge.

Accordingly, the EE is defined as a firm whose activities are based on the interaction among diverse and numerous players (manufacturers, customers, suppliers), within and across organizational and industrial boundaries (Moore, 1997), through formal or informal linkages (Brown and Duguid, 1991; Wenger, McDermott, and Snyder, 2002) for jointly leveraging and exploiting resources, capabilities, and relationships (Filieri and Alguezaui, 2008). Figure 8.1 illustrates the extended enterprise framework and its relationship to different external communities. These cross-domain connections aim mainly at creating, sharing, recovering, and deploying new knowledge and capabilities derived from the network system in order to create value and provide continuous innovation. The EE is a new model, which is composed of a focal firm outsourcing its value-added activities to interconnected firms performing different product sub-systems (Chesbrough, 2007).

Distributed innovation process

The extended enterprise (EE) framework aims at handling the increasing costs of technology development and decreasing revenues from innovations (Chesbrough, 2007). An open innovation framework can mitigate environmental threats and accelerate innovation by effectively exploring and exploiting novel ideas, knowledge, and capabilities outside the firm. Innovation can be derived from different players such as lead users and customers, suppliers (Clark and Fujimoto, 1991; Kristensson *et al.*, 2004; Prahalad and Ramaswamy, 2004; Thomke and Von Hippel, 2002; Von Hippel, 1986, 1988), research communities (Henderson and Cockburn, 1994), and even competitors (Gomes-Casseres, 1996).

Innovation is often the outcome of exploiting ideas and knowledge and fitting them into novel combinations rather than inventing new ones (Kogut and Zander, 1992). Indeed, Schumpeter assumed that innovation “consists to a substantial extent of a recombination of conceptual and physical materials that were previously in existence” (Nelson and Winter, 1982: 30). Kogut and Zander (1992) argued that the “combinatory capability” to generate new applications from existing knowledge may be a critical asset for sustaining competitive advantage. Within this context, the EE’s role is to gather and provide

the right knowledge to the right entity at the right time in the right format anywhere across the EE, as well as to combine these elements into novel products and/or processes (Filieri and Alguezaui, 2008). The innovation process of the EE is not sequential but carried out in parallel working groups with different expertise (Schilling and Hill, 1998). The boundaries between disciplines, firms' units, products, and industries are then blurred and new capabilities (e.g., multi-layered integrative capability) become the strategic assets. Through this complex collaborative learning process, firms access a wide-ranging and extended array of new ideas and knowledge, thereby reducing development costs from idea generation to the commercialization phase. The strategy depicted in this chapter enables the firm to avoid redundancies of technologies and competencies throughout its network, reduce costs, and accelerate product development cycle time. Resources, once acquired and shared across the network, become a driver for continuous innovation and for the efficiency of the whole system.

However, knowledge codification processes are considered a prerequisite to the collaborative innovation process, enabling different players located at different levels and belonging to different domains or industries to meet and effectively share knowledge and information. It is also important to separate multi-player interactions in new product development (NPD) into two distinct stages: "divergent" and "convergent thinking." The first stage is an exploratory and open-ended phase and is used for gaining fresh consumer insights and generating ideas at the ambiguous "fuzzy front end." During the second phase, these ideas are discussed and validated and the new product is co-developed in the firm's network of alliances, partners, suppliers, and so on. The different phases of NPD are often partially outsourced to partnering firms that continuously learn from each other, and that are ready to realize what the central firm asks of them, while reducing time-to-market and costs. Figure 8.2 shows the NPD process of the extended enterprise and its different stages. Toyota highlighted the superior performance achieved by firms which rely on tiers of external suppliers, and mobilize them in order to reduce development risks, time-to-market, and defect rates, while at the same time enhancing their capacity for innovation and flexibility (Clark and Fujimoto, 1991; Dyer and Nobeoka, 2000; Helper, 1991). To involve all these players in the NPD process, firms have created ad hoc technological platforms and communities of practice. For instance, Chrysler created a community of

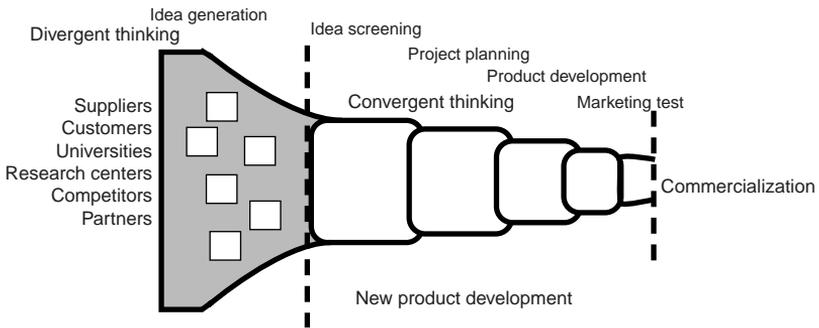


Figure 8.2. The new product development of the EE (adapted from Koen *et al.*, 2001).

innovators connecting 240 world experts from different knowledge areas, encouraged engineers to be innovative, and provided a channel for their ideas to be realized in new or improved products (Wenger and Snyder, 2000).

According to the new EE framework, competitive advantage in the future will be dependent on creativity and trust in the network, on the ability to search for ideas externally, and on the capability to communicate, learn, and anticipate changes. Moreover, the ability to maintain loyalty in this network and avoid free-riding or opportunism is important. The NPD process of the EE can be seen as a flexible and open process in which a huge and diverse number of players, linked to the focal firm in different ways, participate and collaborate, more or less directly, to develop new product concepts (Filieri and Alguezaui, 2008).

Strategic search crossing a firm's boundaries

The strategic focus of the modern firm is mainly on the NPD process as the key source for sustainable competitive advantage. To this end, the modern firm extends its boundaries and works closely with leading companies, uncovers new market opportunities, undertakes market experiments to discover future needs, or cannibalizes existing products (Jaworski, Kohli, and Sahay, 2000; Narver, Slater, and MacLachlan, 2000; Slater and Narver, 1998). Such a strategy forms the basis of the framework of the EE, where the reduction of time-to-market and

the speed of the innovation process are the main issues. This strategy takes into consideration the centrality of knowledge, and the value-added activities of sharing, deploying, and integrating the different knowledge bases into the firm.

In the traditional conception of the value-creation process, consumers, suppliers, and competitors were “outside the firm” and considered as opponents (Sawhney, Verona and Prandelli, 2005). Nowadays, it is exactly the opposite. Potential innovative ideas can come from lead users, customers, manufacturers, suppliers, research communities, and competitors through formal or informal linkages. Then, NPD is a process of co-creation (Prahalad and Ramaswamy, 2004), not merely a function of R&D departments. Within this context, a firm’s competitive advantage is a function of its ability to source knowledge crossing its organizational and technological boundaries, and its capability to identify and retain the most creative, connected, and acknowledged players in the business environment, as well as maintaining knowledge in-house.

A central emphasis of the EE strategy is to set up search processes or scanning of the external environment in order to identify the most innovative players as well as to grasp novel ideas and knowledge that have potential commercial value. Traditionally, past research focused on analyzing the impact of the search process within firms’ internal boundaries and along a single technological trajectory (Katila, 2002; Katila and Ahuja, 2002). Recently, authors have shifted their focus to include other actors in the search process, extending the search landscape of a firm within and outside the firm through its network crossing different technological trajectories (Laursen and Salter, 2006; Rosenkopf and Nerkar, 2001). There are two dimensions to measure a firm’s external search process: (i) breadth and (ii) depth. The first is defined as “the number of external sources or search channels that firms rely upon in their innovative activities” (Laursen and Salter, 2006: 134). The second dimension refers to “*the extent to which firms draw deeply from the different external sources or search channels*” (ibid.).

According to Levinthal and March (1993), the search strategy of a firm is affected by its past experience and the future expectation of its managers. Consequently, it is difficult for firms to determine the optimal search strategy in terms of depth and breadth, especially when the knowledge base of the firm is dynamic and changes over time

(Levinthal and March, 1993). Nevertheless, Laursen and Salter (2006) argued that organizations investing in broader and deeper search tend to have greater ability to adapt to environmental changes and innovate. The path-dependency nature of the search relying on past experiences may lead to *myopic* attitudes toward the potential exploitation of external knowledge sources (Levinthal and March, 1993). This results in over-embeddedness of the firm along the same technological trajectory, thereby obsolescing the current product portfolio. But adopting a broader search process may lead to other difficulties such as insufficient and inefficient convergence of these different external knowledge bases into a knowledge base with potential value (Koput, 1997). Additionally, the firm may incur higher costs in terms of resources and time for maintaining deep relationships with external partners (Laursen and Salter, 2006).

The firm needs to evaluate the costs and benefits of its external search process and try to fit the search strategy to the exigencies of the environment, at the lowest cost and within the shortest cycle times. The firm plays the role of integrator and coordinator of the dispersed specialized knowledge bases over its network. This cannot be realized without keeping in-house considerable knowledge underlying the various outsourced components, as well as building deep relationships with the other members of the network. The extended enterprise's main core capability is the coordination and integration of the activities distributed over a network of firms.

Managing the distributed innovation process

Innovative firms are increasingly embedded in a dense network of relationships with various partners such as universities, suppliers, customers, etc. Two capabilities are required to generate value within the network: knowledge management capability and integrative capability.

Knowledge management capability

To achieve rapid and effective innovation, firms today have to enable and facilitate the activities related to knowledge acquisition, integration, sharing, storage, and exploitation (Grant, 1996). Firms then need to formulate a knowledge strategy (Zack, 1999). This phenomenon is more evident in complex NPD processes, where the increasing need

of different and cross-functional/industrial knowledge and capabilities has further decreased the benefits of innovations. Thus, a firm's competitive advantage is related to its capacity to favor organizational learning and to manage knowledge within as well as outside its boundaries. Accordingly, knowledge management mechanisms and collaborative practices are the bases for knowledge creation and transfer (Dyer and Nobeoka, 2000; Nonaka, 1994) in order to improve a firm's innovative performance.

Knowledge refers to a fluid mix of framed experience, values, contextual information, and expert insights providing a framework for evaluating and incorporating new experiences and information (Davenport and Prusak, 1998). Knowledge management comprises methods, procedures, and tools which support the core activities of generating, transferring, storing, and applying both tacit and explicit knowledge (Mertins *et al.*, 2000). Most organizational knowledge is tacit, difficult to codify and embedded in complex tasks. By contrast, explicit knowledge or information includes "facts, axiomatic propositions, and symbols such as information on size and growth of a market, production schedules, and so forth" (Dyer and Nobeoka, 2000: 63), which is easy to codify and to communicate. Explicit knowledge is easy to manage and share, while tacit knowledge, being derived from particular circumstances and events, is unique and hard to replicate (Zack, 1999). Both tacit and explicit knowledge reside at four levels: individual, group, organization, and inter-organization (Hedlund, 1994). Therefore, knowledge-sharing, conversion, and learning not only occur at the individual level, but also at the inter-organizational level (Nonaka and Takeuchi, 1995). Recent studies of inter-organizational cooperation identified several obstacles to transferring knowledge crossing the borders of a firm (Simonin, 1999). Among these barriers, authors include the degree to which knowledge is tacit, specialized, and complex (Simonin, 1999; Zander and Kogut, 1995), as well as whether it is system-embedded or autonomous (Mosakowski, 1997; Simonin, 1999).

Previous researchers have identified two main mechanisms of knowledge transfer: people-to-people and people-to-document. In the first case, people interact with other people through face-to-face meetings or computer-mediated communication tools. Face-to-face meetings are much more expensive and more frequent at project kick-off, and later, in the form of milestone meetings (Carmel, 1999). Face-to-face

meetings are aimed at establishing trust, a factor that strongly influences knowledge transfer. In the second case, people learn from impersonal learning tools, such as documents, books, tutorials, and so on. People-to-document interfaces are supported by information and communication technologies (ICTs) and knowledge management systems. Kogut and Zander (1992) pointed out that knowledge codification is a key element in the facilitation at knowledge transfer among the members of a network by translating the tacit knowledge into documents which are then easily shared. The extended enterprise needs to be engaged heavily in codification practices in order to facilitate the management of knowledge and capabilities and to enhance the value co-creation among the members of the network.

Integrative capability

Granstrand (1998) distinguished between outsourcing the production of components and outsourcing its underlying knowledge. Recent literature claimed that large firms are expanding their technological knowledge repositories beyond the core/distinctive competences to involve background, marginal, and niche ones; recognizing the importance of background competencies (Granstrand, 1998; Granstrand *et al.*, 1997; Patel and Pavitt, 1997). The latter refers to the technological competencies enabling the firm to effectively manage and coordinate changes in complex production processes or value chains, as well as to learn about new technologies and benefit from emerging opportunities (Granstrand *et al.*, 1997). Brusoni and Prencipe (2001) argued that the knowledge possessed by a network led by a system integrator firm often extends beyond what it actually does. They empirically found that though firms outsource their high-value activities (e.g., detailed design and manufacturing) to specialized suppliers, they keep the underlying knowledge in-house, namely “integrative capability.” This latter refers to the firm’s ability “to set the requirements, specify source equipment, materials, and components, which can be designed and manufactured either internally or externally, and integrate them into the architectures of existing products” (Prencipe, 1997: 1275).

The EE plays a critical role in integrating knowledge distributed over the network into a product architecture, coordinating the co-creation activities among the members of the network during the value creation process. This may entail the risk of opportunism. Because of the tacit nature of knowledge, contractual arrangements cannot specify all

contingencies. Control is maintained, and opportunistic behaviors are moderated not so much by the formal structure managing dyadic relationships, but by social norms, reputation, and trust. Several authors emphasize the importance of trust-based, informal networks for innovation (Kreiner and Schultz, 1993; Liebeskind *et al.*, 1996). Trust governing the relationship between two firms within the value creation process is more relation-specific than institution-oriented. This relation-specific trust is derived from previous experiences with the firm, its reputation, potential long-term collaboration, or the like. Consequently, to enhance and better perform its innovation activities, the EE needs to cultivate a culture of trust and long-term commitment between its network's members through developing various social mechanisms. Toyota represents a leading company that succeeded in building a devoted network of collaborators and partners through social tools for enhancing innovation, reducing costs, and increasing flexibility and adaptation.

Case study: Toyota

Generally, firms zealously guard their proprietary knowledge and are reluctant to share it with external actors. In fact, Toyota relies on suppliers for more than 70 percent of the value of its vehicles (Dyer and Nobeoka, 2000) and the network collaborates more strongly than others. Toyota was able to increase its worker productivity, lower inventories, and improve product quality at a faster rate than competitors. Further, Toyota recognized the importance of establishing strong trust between it and the other members of the network, such as suppliers, component manufacturers and so on, by the creation of three key inter-firm organizations (1) the Suppliers' Association, (2) the Knowledge Transfer Consultants (OMCD), and (3) the Jishuken/PDA core groups or small-group learning teams.

These inter-firm organizations were established in order to foster common routines, defined as "pattern(s) of behaviour that (are) followed repeatedly without conscious awareness, and (are) subject to change if conditions change" (Nelson and Winter, 1982: 263). These range from well-specified technical routines for producing artifacts, to procedures for hiring and firing, ordering new inventory, R&D, and business strategies (Nelson and Winter, 1982). According to Pentland and Reuter (1994), a routine can be a varied repertoire of responses

in which individual moves are patterned as “grammars of action,” featuring the use of narrative data and methods to better explain processes (Lorenzoni and Lipparini, 1999). Five network focal points were purposefully designed by Toyota to facilitate knowledge transfers and integration across organizational boundaries:

- (1) *Supplier association (kyohokai)*. These associations are established to promote “mutual friendship” and the exchange of technical information between Toyota and its suppliers. Toyota’s *kyohokai* meet every other month (e.g., general assembly, top management meetings) to facilitate high-level communication of explicit knowledge-sharing (e.g., production plans, market trends) among members. More frequent interactions occur within the association’s topic committees (e.g., cost, quality, safety, etc.). Suppliers’ associations are also an important vehicle for creating the “identity” of the “Toyota Group.”
- (2) *Onsite consulting*. The Toyota Operations Management Consulting Division (OMCD) is the organizational unit within Toyota that is assigned the responsibility to acquire, store, and diffuse valuable production knowledge residing within Toyota’s Extended Enterprise. The division consists of six senior and highly experienced executives and about fifty consultants that Toyota sends to the suppliers’ sites for a period ranging from one day to many months, and its assistance is for free. One of the most important features of this routine is that Toyota demands that participating suppliers let other suppliers see their operations and best practices when the project is completed. By enabling supplier-to-supplier knowledge transfer, such a routine has a strong impact on process quality and productivity.
- (3) *Voluntary learning teams (Jishuken/PDA core)*. These teams are groups of 55–60 key suppliers (*jishukenkyu-kai* or *jishuken*) organized by the OMCD with the goal of assisting each other with productivity and quality improvements. These groups are composed of executives (plant managers, assistant plant managers, and/or section managers) and they are built based upon: (1) geographic proximity; (2) competition (direct competitors are not in the same group); and (3) experience with Toyota. Each year these groups meet together with the OMCD manager to determine a “theme” (project) selected by suppliers (with Toyota’s input) in strategic and

Table 8.1 *Toyota routines for suppliers' network management*

Routine	Communication process	Type of knowledge
1. Supplier association	Many-to-many interactive	Explicit knowledge
2. Onsite consulting	Many-to-one and many-to-many, interactive	Tacit knowledge
3. Voluntary learning teams	Many-to-many interactive	Tacit knowledge
4. Problem-solving teams	Many-to-one interactive	Tacit knowledge
5. Inter-firm employee transfer	One-to-one interactive	Tacit knowledge

relevant areas. When a theme is established (e.g., “Eliminating supplier design defects”), the group establishes a schedule to visit each supplier’s plant to develop jointly suggestions for improvement. In addition, a quality management conference is held once each year and offers suppliers the opportunity to learn from cases of successful supplier quality improvement.

- (4) *Problem-solving teams*. These teams are designed to bring knowledge to solve emergent problems within the network. If a supplier has a quality problem of which the root cause is not easily determined, the OMCD or the QAD (Quality Assurance Division) set up a problem-solving team (including various divisions and possibly even other Toyota suppliers) to fix it. Once the problem-solving team has identified the source of the problem as being in product design, Toyota’s Design Engineering Division is asked to work more closely with the supplier to find and implement an effective solution.
- (5) *Inter-firm employee transfer*. The transfer of employees (*Shukko*) is carried out to help large assemblers maintain control of suppliers and provide an opportunity to shed unwanted employees. Further, this mechanism is used for creating a network identity and transferring knowledge from Toyota to suppliers.

Table 8.1 summarizes the five learning routines adopted by Toyota and the nature of these processes – either bilateral or multilateral – determining the type of knowledge that can be transferred through these processes.

Unlike US automakers that tried to implement the same routines and processes, Japanese automakers have created a high level of trust that enormously facilitated the knowledge-sharing process and reduced transaction costs. In fact, Toyota spent only 21 percent of its face-to-face interaction time on negotiating contracts and prices. Trust, which characterizes the Toyota network, has a positive effect on its procurement productivity (value of goods purchased per procurement employee). Besides, the knowledge-sharing among the members of Toyota network was reciprocal. All Toyota's knowledge and capabilities are open to Toyota's suppliers on the condition that every supplier share and open its plant to other members of the network. Toyota states: 'we will help you, but in return, you must agree to help the network' fostering a win-win strategy that is focused on transparent, equity-based, and long-term collaboration with suppliers. Free assistance created a state of reciprocal obligation within the network. Suppliers that did not respect these rules of openness were sanctioned by Toyota with lower commitments.

Production processes and innovation-related activities are not viewed as proprietary and Toyota accepts that some valuable knowledge will spill over to benefit competitors. Any valuable knowledge that Toyota or a supplier possesses is viewed as accessible by virtually any member of the network (with perhaps the exception of a direct competitor).

While outsourcing its productive processes, Toyota maintains "control" over the whole network through its social system. The outsourcing of business processes is accompanied by the capacity to learn from suppliers' experiences and to share such knowledge with other suppliers, namely the capacity to locate, gather, and transfer the right knowledge to the right actor across the Toyota suppliers network at the right time in the right format. This capability increases Toyota's reputation among its network of partners and legitimizes its leadership role (power and relevance).

Toyota itself thus accesses a greater amount of knowledge and information. It learns from the network, but at the same time, monitors and coordinates its activities. The greater the knowledge asymmetry with the members of the network, the greater is Toyota's control and power over the network and the appeal of being part of this network. Face-to-face meetings are important mechanisms since tacit knowledge "is created and shared via direct person-to-person interaction, story-telling,

and shared experience” (Zack, 2000: 81). However, face-to-face frequent communication is also aimed at increasing the level of trust across the network. In fact, frequent communications have been found to be a strong predictor of trust-based relationships (Daft and Lengel, 1986; Fidler and Johnson, 1984).

Toyota shows how it is possible to outsource the main part of the production process to external partners and legitimates its position of expert in the network by accumulating suppliers’ networks knowledge and distributing it to the others. Suppliers will find additional benefits of being part of the network by learning other suppliers’ best practices, improving productivity, and getting more commitments from Toyota. Knowledge-sharing transfer through organizational routines helped Toyota to increase worker productivity, lower inventories, improve product quality, and introduce new products at a faster rate than competitors.

Conclusion

This chapter illustrates how innovation processes are becoming distributed over trust-based and long-term networks. This new way of collaborating and innovating provides various advantages such as cost reduction, helping firms to diminish their cycle time, and an increase in returns. Previously, innovation had been considered a core capability that needed to be performed within the firm’s boundaries. Recently, numerous technology-based firms have adopted a strategy consisting of outsourcing innovative activities to collaborators specialized in different technological domains. This reshapes the definition of the core capabilities of a firm that are needed to sustain its competitive advantage.

This new orientation gives rise to a new business model, namely the Extended Enterprise. The authors have conceptualized the EE as a collection of dispersed and interdependent resources, dynamic capabilities, and relationships, following a win-win strategy in their interaction with new and different players (such as customers and suppliers), organizations, and industries. Considering the increasing uncertainty of the economic environment, the main strategy of the EE is to focus on new product developments as the main source of sustainable competitive advantage. Accordingly, the EE reduces time to market and speeds up the innovation process, giving rise to a more distributed

network of specialized and interdependent knowledge bases involved in the value creation process. The focal firm then aims at boundary-spanning activities for two main reasons. On the one hand, the firm needs to sense the market in order to detect new ideas and opportunities, to establish novel technological designs. But the focal firm is also responsible for ensuring adequate resource allocation of the different innovation activities to the different members of the value chain. Thus, the EE can be seen as a “novelty seeker” and “network shaper” (Teece, Pisano, and Shuen, 1997). This strategy is aimed at accelerating the NPD process and reducing costs.

The EE's knowledge management capability aims at managing knowledge within the network and facilitating the knowledge-sharing activities that result in high performance. The codification of knowledge is considered a prerequisite for transferring knowledge among members of the network. Integrative capability refers to the ability of the firm to integrate and coordinate the activities required for an effective co-creation system. Several authors distinguish between the outsourcing of activities and the outsourcing of their underlying knowledge. They argue that while firms outsource the development of products, they maintain key knowledge in-house as well as coordinating knowledge dispersed over the network, while at the same time sensing new opportunities. Relational governance is perceived as an adequate tool for managing the distributed processes and resources within the framework of the EE. Contractual agreements, which were traditionally used for managing cooperation among firms, are seen as ineffective. This is principally due to the tacitness of knowledge that cannot be specified *a priori*. Thus, the EE, as it is illustrated through the case study of Toyota, relies on novel mechanisms to develop trust and norms of commitment to its network, as a tool to manage dispersed activities, and develop a culture driven by innovation. Future research may contribute to the literature by developing other examples of firms adopting the extended enterprise model.

The EE framework offers several insights for managers about the path their firms need to follow to gain sustained competitive advantage. In the current environment, firms have to open their boundaries, and draw on external knowledge and capabilities from an increased number of players having different roles and functions, such as lead users, suppliers, research centers, universities, manufacturers, employees, or partner firms. Even competitors may become strategic partners,

and the integration of different core competencies can lead to superior returns on investments, eliminate other competitors, and create new markets or products.

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