

Chapter 10

The inter-organizational context of open innovation

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1. Introduction

Open innovation is almost by definition related to the establishment of ties of innovating firms with other organizations. Companies are increasingly forced to team up with other companies to develop or absorb new technologies, commercialize new products or simply to stay in touch with the latest technological developments.

Firms are working more and more as part of broader networks to create customer value. Those networks are based on the collaborative efforts of specialist companies each providing complementary intermediate goods and services. As Information and Communication Technology (ICT) becomes a powerful technology, it allows those companies to be linked by sophisticated business-to-business information systems. But networking can also imply collaboration with other partners. The set of partners can be quite different depending on the goal an innovating company wants to realize: companies develop relations with universities and research labs to explore the technical and commercial potential of new technologies, they establish alliances with or acquire technology based start ups or set up networks with selected suppliers and customers to launch radically new products or services based on new technologies or a new business model. Learning how to create and capture value when companies are highly dependent on each other is still an under-explored area in the network literature. Most firms are used to make decisions within their boundaries taking the external environment as an exogenous variable or as an arena where firms compete with one another. But in networks value is co-produced: the total value created in the network depends directly on how well partners' objectives are aligned to each other and on the commitment of the partners to invest in complementary assets (Teece, 1986; Moore 1991). Similarly, in developing systemic technologies, the innovating company depends on the technological skills and commitment of other companies. Most firms do not feel comfortable in these 'open' scenarios where the return essentially depends on the partnering actors.

The three chapters in this section analyze in greater detail how companies have to team up with other actors in the business system and build inter-organizational networks to support open innovation. But firms are not only embedded in their environment by inter-organizational networks: they can be part of regionally bounded clusters of competitive firms which, in turn,

can be considered as a subsystem of a regional (or national) innovation system. Chapter 12 and 13 apply open innovation to inter-organizational networks but in two different settings: Maula et al. show in chapter 12 that, in the context of systemic innovations, innovating companies are highly dependent on complementary innovators forcing them to take an external perspective to resource allocation processes. Vanhaverbeke and Cloudt (chapter 13) describe how the commercialization of radically new products based on technological developments in the agro-food biotechnology requires the establishment of a value network where central players establish a network of firms with complementary skills and assets to create value for the targeted customer group. Chapter 11 takes a broader perspective starting with an inter-organizational knowledge flow and a description of the geography of open innovation to derive taxonomy of different inter-organizational networks that enable open innovation.

2. Open innovation and different levels of analysis

Chesbrough (2003a) conceives open innovation from the point of view of large, incumbent companies. Although open innovation entails by definition the close collaboration with a broad set of potential partners to insource or outsource technologies, the open innovation framework has been analyzed so far at the (focal) company level and not at the value network level where the targets of the focal firm are jointly analyzed with those of the collaborating organizations. There are of course good reasons to emphasize the firm level perspective as open innovation is always expected to have an impact on a company's bottom line and is based on a business model which is by definition centered on a single firm (Amit and Zott, 2001).

Analyzing open innovation on other levels of analysis can however broaden the scope and enrich our understanding of open innovation. Following Figure 2 in chapter 13, there are a number of levels at which open innovation can be analyzed.

The first level is that of the intra-organizational networks. There exists a considerable literature about intra-organizational networks to stimulate innovation (Foss and Pedersen, 2002; Hansen, 1999; Lagerstrom and Andersson 2003; Nonaka and Takeuchi, 1995; Szulanski, 1996; Tsai and Ghoshal, 1998). However, these networks have not been analyzed explicitly within the context of open innovation. Since many companies struggle leveraging the commercial potential of innovations that have been developed externally, it is interesting to analyze how firms' internal organization plays a role in improving the assessment and integration of externally acquired

knowledge. Internal networks play a crucial role in the way companies get organized to increase the effectiveness of acquiring external knowledge (Hansen, 1999; 2002; and Hansen and Nohria, 2004). None of the chapters in this volume are focusing on intra-firm level networking, leaving open an interesting avenue for future research.

The next level is the firm level: open innovation has been explored at this level of analysis in Chesbrough (2003a) and in different chapters of this volume.

Next, one can consider open innovation at the dyad level; i.e. considering the interest of two (or more) companies that are tied to each other through equity or non-equity alliances, corporate venturing investments, etc. This level of analysis has been explored in depth in the academic literature (e.g. Gulati, 1995b) as well as in the business press (e.g. Doz and Hamel, 1998; Kanter, 1994). A rich literature exists on how to select partners, how to assess the return and risks of an alliance, how to evaluate the fit between potential partners and how to structure the cooperative agreement and manage it over time. As open innovation is basically about non arm's-length relations between companies it can take advantage from a dyad level perspective and from the management lessons about alliance management (Bamford and Ernst, 2002 ; Lynch, 1993) and external corporate venturing (Keil, 2002a).

The last level of analysis refers to inter-organizational networks. Within this approach open innovation is no longer studied at the level of a single company or the dyad level. Individual alliances or other non arm's-length transactions between organizations usually do not account for a company's success, but it is determined by the way the firm integrates its external relations into a coherent strategy and manages them over time. Interorganizational networks provide a durable structure for inter-firm relations, which both enables and constrains dyadic interactions. The fact that individual relations between companies are “embedded” in broader networks also leads to the formation of more complex topologies.

The last level of analysis consists of the national or regional innovation systems. Innovating companies are embedded in a broader institutional setting that can enhance or hinder the innovativeness of the local companies. Academics have debated whether the impact of innovation systems is on the national, regional or supranational level (Lundvall, 1992, Cooke, 1992, 1998), but it is beyond doubt that the external, geographically bounded innovation systems play a crucial role for companies' innovativeness. Cooke (2005) explains that open innovation is

one of the key concepts to explain how regional innovation systems, and clusters within them, have to be organized to be globally competitive.

The three chapters in this section focus on the two last levels of analysis. First, I will explore the inter-organizational networks. Next, I will have a closer look at regional systems of innovation and their link to open innovation. Inter-organizational networks and regional systems of innovation are two levels of analysis that are complementary with the traditional, firm-oriented approach of open innovation. In this way, they have the potential to enrich our understanding of open innovation.

3. Inter-organizational networks

During the post war period, innovations were managed in what Chesbrough (2003a) calls the "closed innovation" paradigm. Within this view successful innovation requires that firms generate and develop ideas internally, nurture and market them until they are launched as a new product or business. It is an internally focused logic where the innovating company trusts on internal capabilities to successfully innovate. Inter-organizational ties like technology alliances have been around for decades but did not challenge the "closed innovation" paradigm as long as companies relied mainly on their internal (technological) capabilities to develop new products or services. However, recently this paradigm has been challenged because of the increasing costs and complexity of R&D, the shortening of the technology life cycles, the presence of increasingly knowledgeable suppliers and clients, the growth of venture capital and the growing diffusion of leading-edge knowledge in universities and research labs around the world. If most of the new knowledge emerges outside the firm as a result of these ongoing trends, a closed innovation approach is likely to overlook the business opportunities from this large pool of external knowledge, while it cannot prevent internally built knowledge from leaking out as entrepreneurial employees leave the company and start their own business with venture capital financing. Companies embracing open innovation actively tap into these external technology sources to strengthen their businesses. Similarly, internally developed technology and resulting IP are no longer only valuable for internal use, but the company can also profit from the selective use of its IP by other companies with different business models. Open innovation thus implies an extensive use of inter-organizational ties to insource external ideas and to market internal ideas

through external market channels outside a firm's current businesses (Chesbrough, 2004; West and Gallagher, chapter 6).

There are many types of inter-organizational ties. Spin-ins and spin-offs, corporate venture investments, joint ventures and several types of non-equity alliances are only a few examples. Simard and West (chapter 11) develop a taxonomy of network ties that enable open innovation. They make a distinction between deep vs. wide ties and formal vs. informal ties. Both authors argue that companies have to build ties that are both wide and deep. Deep ties enable a company to capitalize on its existing knowledge and resources. They are the result of a company's strong network position that allows it to tap into key resources for innovation. Deep ties are enhanced by the geographical proximity of the partners and by building trust in networks. They are appropriate to deepen the strength of companies in their existing businesses. Wide ties on the contrary enable a company to find yet untapped technologies and markets. In contrast to deep ties that are associated with the exploitation of existing technologies, wide ties offer a firm opportunities to explore new technologies. Explorative search is enhanced by ties that span structural holes and link the innovating firm with diverse technological environments by means of different types of ties. Because of this diversity geographical proximity is very valuable. Wide and deep ties, or explorative and exploitative ties, have to be balanced (March, 1991). In this way, companies have to combine both deep and wide ties to profit optimally from their external relations (Uzzi and Gillespie, 1999a).

Simard and West (chapter 11) make another distinction between formal and informal ties. The former are agreements based on a formal contract. They are planned channels for knowledge exchange between organizations. However, formal contracts bring people from different firms together who, in turn, establish informal networks. Similarly, existing informal networks lead to more formal arrangements to cooperate.

Simard and West (chapter 11) combine deep vs. wide ties and formal vs. informal ties to get a better understanding of the role of inter-organizational ties in open innovation. The combination of both dimensions (deep-wide and formal-informal) leads to different types of networks; e.g. deep ties are characterized by redundant information overlapping with the existing knowledge base of the companies involved. This suggests that deep networks tend to lead to incremental innovations. Wide networks give a company access to non-redundant information and have as such greater potential for innovation. Informal networks are harder to manage and

make it more difficult to control the knowledge flows in and out of the firm. Simard and West developed this framework to understand the role of different networks in innovation management. It is a guideline to identify opportunities for further research about the relationship between knowledge flows, inter-organizational networks and the practice of open innovation¹.

Formal ties have been studied extensively, but the role of informal inter-organizational ties is less well understood. How is commercially viable knowledge accessed through informal networks? Different case studies give scattered evidence that informal ties of employees with employees in other organizations or institutions are crucial to understand how new ideas are generated and turned into commercial successes. Hamel (2000) recalls the story of Ken Kutaragi, a Sony Corp. engineer who had been "outsourced" as engineer to one of the leading game console producers and which ultimately led to Sony's successful PlayStation. However, informal networks might also be too "closed" to generate the desired information from other organizations. Porter et al. (2005) remark that in biotechnology informal social networks are too tightly centered on star scientists that act as a bottleneck for information sharing. Hence, both formal and informal ties have their advantages and disadvantages and an innovating firm has to balance the mix to optimize the return on open innovation.

Simard and West (chapter 11) also point at the management challenges related to the network portfolio. The role of network portfolio management (Ashkenas et al., 1995; Bamford et al., 2003; Heimeriks, 2005; Hoffmann, 2005; Ozcan and Eisenhardt 2005; Parise and Casher, 2003; Reuer and Ragozzino, forthcoming; Sarkar et al. 2004) has not been linked so far to the promises of open innovation strategies of innovating companies. We don't know what aspects of the network portfolio significantly can raise (or lower) the effectiveness of open innovation. What is the optimal mix of different types of ties in the portfolio? Are portfolios dependent on the industry setting or the business model that the innovating company is pursuing? These are just a selection of yet unanswered questions opening a new avenue for future research.

Defining new metrics for managing open innovation is a final topic that Simard and West analyze. They argue that managers have to use new metrics to measure open innovation. Measuring inter-organizational knowledge flows is an important challenge in realizing that objective. Citing patents of partners give us a first indication of these flows, but patent citations are known to be imperfect measures of interdependence between firms. They do not indicate

¹ I exclude the geographical dimension of this topic, which will be discussed below.

how much value a company creates from its externally acquired technology. Licensing agreements and royalty payments measure some forms of knowledge used in formal ties, but it is harder to measure knowledge that flows through informal ties. Hence, we need new measures to accurately manage open innovation.

4. Network management and open innovation

Inter-organizational relations and networking are a crucial dimension of open innovation. They are implicitly present in the open innovation framework when external ideas are insourced to create value in a firm's current business or when internal ideas are taken to the market through external channels, outside a firm's current businesses (Chesbrough, 2004). When companies are highly dependent on other organizations for their supply of new technologies or when they need the support of others to bring a new technology to the market, it seems logical that open innovation has to put an emphasis on the management of external networks to be successful. However, Chesbrough's work (2003a, 2004) on open innovation is analyzed at the level of the innovating firms and network management is not treated explicitly. This does not mean that network management is not present in the existing literature about open innovation. On the contrary, Chesbrough and Rosenbloom (2002) consider the value network as a function of the business model. The latter describes "the position of the firm within the *value network* linking suppliers and customers, including the identification of potential complementors and competitors" (p. 534). "The value network created around a given business shapes the role that suppliers, customers and third parties play in influencing the value captured from commercialization of an innovation. The value network increases the supply of complementary goods on the supply side, and can increase the network effects among customers on the demand side" (pp. 534-535). However, it is not explicitly mentioned whether the innovating company should manage the entire value network, and if so, how it should do this. Chapters 12 and 13 analyze how innovating companies manage the external network to create and capture value. The context is however rather different in the two chapters: chapter 12 focuses on systemic innovations within the ICT sector, and chapter 13 applies network management to the commercialization of innovations in the agro-food biotech where companies want to commercialize genetically modified crops that create value for a targeted customer group in completely new ways.

A. Network management and systemic innovations

Maula, Keil and Salmenkaita (chapter 12) describe how companies face new challenges when creating systemic innovations that require significant adjustments to be made in other parts of the business system. The benefits of a systemic innovation can only be realized in conjunction with complementary innovations or components. But companies usually cannot wait until new technologies emerge. How can they coordinate the activities of the relevant players so that the development of components and subsystems is mutually aligned assuring the success of the value creating, systemic innovation?

The classic answer to this problem is provided by Chesbrough and Teece (1996). In systemic innovations, innovating companies are exposed to strategic hazards because of their reliance on suppliers or partners. As a consequence Chesbrough and Teece (1996) recommend that companies develop the technology in house when the required capabilities still have to be developed, and that they ally with caution (because of the strategic hazards) in case these capabilities exist in other organizations. Maula et al. (chapter 12) remark that companies face problems to develop systemic innovations in-house because of the growing complexity of technologies and the shortening of the technology life cycles. Since vertical integration is rarely an option, innovating companies have to take a broader, network level perspective to resource allocation. "Ally with caution" is now translated into the management of an inter-organizational network to successfully create a systemic innovation. In that regard, the innovating companies need tools to manage this network; examples are external venturing, research collaboration and industry consortia. The difference with autonomous innovations is that there must be a collective governance in the case of systemic innovations giving each partner incentives to stick to the network. In autonomous innovations, a firm can team up bilaterally with another company irrespective of its existing network portfolio.

The systemic nature of innovations thus forces innovating companies to manage other actors in the network in a proactive way. Maula et al. (chapter 12) argue in this respect that companies can manage these mutual dependencies by creating *foresight* and *shaping* the development of these industries over different time horizons. The foresight process is necessary because the systemic innovation requires that the company monitors the development of multiple innovations simultaneously. Multiple external contacts provide rich information about the development of

different technologies which ultimately allows the company to translate technological developments into new business opportunities. The foresight process keeps companies alert to create new offerings that offer the highest potential value for the targeted customers.

The shaping process is in its turn necessary to avoid the strategic hazards related to systemic innovation as mentioned by Chesbrough and Teece (1996). The shaping process intends to influence the resource allocation decision of other companies. With this process a company tries to keep all the partners in the boat offering them a sufficiently large share of the pie.

Both foresight and shaping mechanisms can be analyzed within different time horizons. Timing and differentiation of management tools over time is important to succeed with systemic innovations. Industry leaders can, in an early phase, long before the commercialization takes place, collaborate on research to speed up the technological progress defeating in that way other (groups of) competitors. They also agree on the standardization of technologies, which, in turn, allows them to partition the complexity of the system, enabling other companies to provide pieces that can be easily integrated in the system. During the early commercialization phase, companies get involved with corporate venturing to keep their options for a successful commercialization open. In the full commercialization phase, boundary spanning activities are changing again as customer and supplier alliances, joint ventures and M&As dominate the scene. Furthermore, leading incumbents are usually involved in different product generations and they have to cannibalize sales of their existing products when introducing a new generation. The fact that a company has to manage over different time horizons requires that they signal their commitment to a new technology in a credible way to their (potential) partners.

B. Network management and the commercialization of novel product offerings

Vanhaverbeke and Cloudt (chapter 13) apply network level management to the case where radical technologies are commercialized by internal paths to the market (Chesbrough, 2003a). The difference with Maula et al. (chapter 12) is that the latter focus on the supply of technologies to develop a new technology, while Vanhaverbeke and Cloudt (chapter 13) focus on the commercialization process of innovations that have already been developed successfully in the lab. They take the use of biotechnology in agricultural products (or agbiotech) as a particular setting to illustrate how network level management actually works during the commercialization of new technologies.

Taking a firm level perspective on the commercialization of new technologies that radically change the business model of the targeted customers does not reveal all management issues related to the commercialization process. New, genetically modified (GM) food products do not sell automatically, and sales will not take off by establishing loose, arm's-length transactions with other players in the value system². Take for instance the case of a GM tomato that has a better flavor and targets the fresh tomato market³. First, commercialization requires that different partners in the value system that own complementary assets make investments that are transaction specific (Teece, 1986). These firms will only join the innovating firm when they get some guarantee that these investments will be profitable. Next, new product offerings typically suffer from thin market problems. The innovating company has to develop a "take off" strategy pulling all relevant actors together in order to get the new product on the market. As a result, radical innovations require a value network perspective where the innovating company (or a small clique of central players) manages the external network with all the actors that are necessary to launch the new product offering. This is in sharp contrast with incremental innovations where a company can rely on existing relations with suppliers, channels and end-consumers. The fact that the innovating company has to team up with different partners in the value system and has to organize this external network indicates that open innovation also applies to the commercialization of radical innovations. Managers of the innovating firm have a difficult task to manage the interface between the different links in the value network⁴.

Value creation and value appropriation are central to the commercialization of new technologies. The value network is created in order to create value for a particular customer group. Three examples: The Flavr Savr tomato was targeting the end-consumer who was willing to pay a premium-price for a better tasting tomato. Herbicide resistant corn allows the farmer to save on spraying costs and time. GM improved cotton reduces the need to blend it with polyester or other materials to strengthen the natural cotton fibers. The targeted customers – the end

² I use Porter's (1985, 1990) terminology: "A value chain disaggregates the firm into its strategically different activities in order to understand the behavior of costs and the potential sources of differentiation" (1985, p. 33) A firm's value chain is embedded in a larger system stream of activities that I term the value system". (p. 34) The value system links suppliers to buyer firms, channels and the final customer.

³ This example is based on the Flavr Savr tomato described in Goldberg and Gourville (2002).

⁴ We will call an organized network of partners in the value system a "value network". This concept is not new and has been applied in many business settings (Amit and Zott, 2001; Normann and Ramirez, 1993; Normann, 2001) but the article of Amit and Zott (2001) is the only exception linking the concept to the market introduction of a new technology (ICT in that case)

consumer, the farmer and the textile industry in the three examples – are always better off as long as the premium price for the GM crop is smaller than the extra value they get from the product offering compared to other offerings (i.e. traditional crops). Other actors in the value network, however, are not necessarily better off: logistics can become quite complex when different GM types of cotton have to be transported and stored separately. As a result, balancing the value appropriation among the different actors in the value network requires the active management of a central firm. Besides the task to organize the network to create value from the innovation, this central firm also has to manage the potential tensions between partners about value capturing. This is a difficult task because competition is no longer based on rivalry between single firms but between groups. Different product offerings – and not firms - are competing in the market (e.g. herbicide resistant corn vs. traditional corn). It is a group-based competition (Gomes-Casseres, 1994, 1996) where the total value created depends on the quality of the relations between the partners in the value network. The profitability of the companies or the distribution of the total value created depends not only on the traditional bargaining power of each partner (Brandenburger and Stuart, 1996). Contrary to the firm based competition, value appropriation has to be considered jointly with value creating strategies in group based competition because the total value created depends on the quality of the interorganizational relations. In other words, too much fighting about the share of the pie reduces the total volume of the pie. This subtle interaction between value creation and value appropriation implies that there exists a continuous tension between maximizing joint value creation and firm level profitability. The innovating company has to manage this tension carefully.

How value is created and distributed in the commercialization process of agbiotech innovations illustrates two central ideas. First, the commercialization of an innovation is based on a business model of the innovating firm but its scope is much wider than the firm itself: its path to the market entails the establishment and management of an inter-organizational network of partners with different assets and positions in the value system. Thus, although a business model is always centered on a particular firm, it has as a unit of analysis a much wider scope than the firm since it encompasses the capabilities of multiple firms in multiple industries (Amit and Zott, 2001, p. 514). Business models are in this way no longer tied to the boundaries of the firm but can be analyzed in terms of open innovation – or is open commercialization a more appropriate term? Second, the previous analysis also suggests that the analysis of competitive

advantage can be centered on the value-creating system and not necessarily on the firm or the industry (Normann and Ramirez, 1993; Iansiti and Levien, 2004a, 2004b). The source of value creation lies in networks of firms and the configuration of their roles in these networks (Bettis, 1998; Dyer and Nobeoka, 2000; Gulati, et al., 2000).

The commercialization of new technologies also challenges the established theoretical frameworks about value creation (and distribution). In line with Amit and Zott (2001), Vanhaverbeke and Cloudt (chapter 13) argue that in order to understand the commercialization of new technologies one has to integrate various theoretical perspectives. The commercialization of GM crops as described in chapter 13 shows that the way how value is created cannot be fully captured by a single theoretical framework. The value creation in agbiotech – but also in ICT as demonstrated by Amit and Zott (2001) – can only be explained when different theoretical perspectives are brought together. First, the commercialization of new technologies is situated at the crossroad of strategic management and entrepreneurship (Hitt et al. 2002): it combines how value is created for buyers who want to pay premium prices with the exploitation of new business opportunities based on the emergence of a new technology. The commercialization of agbiotech products can also be described in terms of the Schumpeterian model of creative destruction since new products based on GM crops will replace traditional products in as well out the food industry. Next, the resource based view of the firm (RBV) is also applicable since the value network brings together different players with complementary resources and capabilities that are necessary to market the new products (Barney, 1991). The establishment of a value network is also related to dynamic capabilities (Teece et al. 1997; Eisenhardt and Martin, 2000) because it activates, coordinates and reconfigures these resources in new ways to create value. Value networks are almost by definition related to strategic networks and the relational view of the firm (Dyer and Singh, 1998). Finally, value networks cannot be analyzed without entering the question why firms internalize transactions that might otherwise be conducted in markets (Coase, 1937; Williamson, 1975, 1985). Value networks are hard to analyze from a single firm's transaction cost minimization point of view. The partnering firms are rather interested in the pursuit of joint transactional value (Dyer, 1997; Zajac and Olson, 1993). Hence, the commercialization of GM crops – or the commercialization of technologies in general – which is essentially an open innovation process, calls for an *integration* of various frameworks (Amit & Zott, 2001). The recipe of "open innovation" can only be understood when different

ingredients such as transactions, capabilities, value creation and appropriation, and inter-organizational networks are linked to each other and integrated in a coherent strategy. The challenge to relate open innovation to an integrated approach of the existing theoretical perspectives has just begun. This is a most promising area for future research.

4. The geographical dimension of open innovation

Inter-organizational networks constitute one level of analysis for open innovation. These networks can be part of larger regional clusters that can be defined as "geographical concentrations of interconnected companies and institutions in a particular field" (Porter, 1998, p.78). Clusters, in turn, are part of broader regional or national innovation systems (Cooke, 2004b; Lundvall, 1992; Nelson 1993). Although there is a huge literature stream on clusters and the link between geographical proximity and economic growth, the relation between inter-organizational networks and geography is underexplored.

Clusters and regional innovation systems are important for open innovation because the knowledge flows between companies is crucial to open innovation. An optimal open innovation strategy would exploit multiple ties to multiple types of institutions. Since knowledge flows more readily to closer entities (Jaffe, Trajtenberg and Henderson, 1993), the organization and institutional embeddedness of geographically networks might be crucial in explaining the differences in effectiveness of open innovation in different regions or nations. Simard and West (chapter 11) identify universities, research labs, venture capitalists, focal firms and other industry specific actors as powerful institutional forces that shape open innovation and determine its effectiveness. The institutional changes have also been explored by Chesbrough (2003a, chapters 2 and 3). He mentions for instance different factors that erode the strength of the closed paradigm such as the increasing availability and mobility of skilled workers, the emergence of the VC market, and the increasing capabilities of external suppliers. These erosion factors are not necessarily linked to the existence of clusters and regional innovations systems, but they clearly show that open innovation is fostered within particular institutional settings.

This is an important observation because there exist huge differences in the 'regional knowledge capabilities' of regions depending on the presence and the level of global competitiveness of clusters and regional innovation systems. Since the effectiveness of open innovation strategies of companies is strongly related to the presence of regional innovation

systems, these regional differences can also explain why some regions are much more successful in attracting multinationals ensuring a steady flow of knowledge workers and entrepreneurs. Examples are Silicon Valley, Helsinki's and San Diego's telecommunications clusters, biotechnology in Boston (Owen-Smith & Powell, 2004) and ICT-clusters in Cambridge and on the Leuven-Eindhoven axis just to mention a few. Companies depend increasingly on the external supply of knowledge, which is locally embedded in regional innovation systems, and forces them to tap into these local epochs of knowledge. Hence, getting access to local knowledge is of crucial importance in the current knowledge economy. As a result, open innovation has to be connected to regional economics in the future.

There is to my knowledge only one author who has explicitly linked open innovation to clusters and regional innovation systems. Cooke (2004a and 2004b) explains in two recent papers how open innovation plays a crucial role in the explanation of regional innovation systems. Based on a Penrosian-inspired (1959/1995) theorization of 'regional knowledge capabilities' as drivers of globalization, he argues that open innovation plays a crucial role in the changing spatial structure of industries. He claims that instead of the organization of industry determining spatial structure, the economic geography of public knowledge institutions determines industry organization. "Thus firms agglomerate around universities or centers of creative knowledge like film studios. Learning was the central attraction where knowledge capital could have rapidly escalating value. Now it is clear that knowledge itself is the direct magnet. The more knowledge-based clusters thrive, the more imbalanced the economy is likely to become spatially and in distributional terms and the more important it becomes to seek ways of moderating this without killing the golden goose. This is an important challenge confronting economic policy-makers everywhere for the foreseeable future." (Cooke, 2005, p. 31). Although this conceptualization of the link between open innovation and regional development might be still in an embryonic phase, it is clear that this is an interesting topic for future research.

Open innovation has already (although implicitly) been applied to new internationalization strategies for multinational companies. Within this respect, Doz et al., (2001) have developed the notion of the metanational company. They acknowledge that globalization and the distributed presence of leading research institutes around the world reduces the knowledge pre-eminence of any single location. So, the profits from projecting home-grown advantages (the traditional drive

to internationalize) are falling. Instead, metanationals prospect the world for good ideas and technologies. Since valuable knowledge is complex and hard to move, they have to be present in these knowledge centers to sense the new technological or market developments. This is a nice example how open innovation can be applied into the context of international management. These ideas are also echoed in a recent book of Hagel and Brown (2005).

5. Conclusions

We can draw a number of conclusions from the three following chapters. First, the "open innovation"-framework is not only applicable to ICT or to industry settings where network economies play a role. Vanhaverbeke and Cloudt (chapter 13) illustrate how open innovation is also prominently present in the commercialization of agbiotech innovations. Cooke (2004b) also provides evidence that open innovation is abundant where biotech start-ups and big pharma companies in the development of pharma-based or "red" biotech applications. Developments in the innovation and commercialization strategies of companies in other industries suggest that open innovation is applicable in a growing range of industries.

Second, business models always refer to a particular firm (Chesbrough and Rosenbloom, 2002; Chesbrough, 2003a) but its impact easily spans the firm and even the industry boundaries. Inter-organizational networks play a crucial role in that respect. Companies with complementary capabilities or positions in the value system have to be fully committed to cooperate. Creating value cannot be done unilaterally based on the efforts of a single, focal firm, nor can it be done without keeping the different and divergent interests of all collaborating partners in mind. Hence, in order to understand open innovation correctly, it has to be analyzed on complementary levels of analysis. Two of these levels, the network and the firm level, play a crucial role in the understanding of open innovation.

Third, external network management is one of the new roles for the central firm. There is always one company that operates as the organizer of the value network when companies develop a new systemic innovation or commercialize a radically new product (see also Gomes-Casseres, 1996).

These focal companies – or industry shapers – establish boundary spanning activities for two purposes. On the one hand, they design the whole process starting from the idea or business model how the innovation or new product offering has to deliver value: the complexity of the

technology requires that a central firm monitors the multiple simultaneous innovations in the case of systemic innovations and the changes required in different parts of the value network in order to deliver value for the targeted customer in the case of the commercialization of GM crops. On the other hand, they have to make sure that they have an impact on the resource allocation decisions of the other actors in the network. These two processes – industry foresight and industry shaping - are dynamic concepts since a company has to manage its dependencies on other actors by shaping the industry over different time horizons.

Next, open innovation has a number of implications for the theory of the firm especially when one is focusing on the need to team up with partners to successfully commercialize new product offerings based on breakthrough technologies. I have suggested, echoing Amit and Zott (2001), that the network perspective on open innovation calls for an integration of the various theoretical frameworks such as value chain analysis, transaction costs theory, the relational view of the firm and the RBV. This is probably one of the most promising areas for future research.

Finally, open innovation also implies that innovating companies choose a particular governance mode for their ties with other actors in the network. Maula et al. (chapter 12) indicate that the appropriate modes of external technology sourcing might change depending on the time horizons a company considers to change the business environment. Simard and West (chapter 11) provide a taxonomy suggesting that different types of ties are required for different open innovation settings. However, the choice between different external sourcing modes of technology still has to be linked to the broad literature stream about the 'buy-ally-make' decisions (Dyer et al., 2004; Hoffman and Schaper-Rinkel, 2001; Roberts et al. 2001).

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