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Theories of the Firm and Open Innovation

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14.1 INTRODUCTION

The concept of open innovation primarily stems from observing changing innovation management practices in companies (Chesbrough, 2003a, 2006a). This practice-based approach explains to some extent why open innovation research has not been grounded systematically in prior management research. The failure to connect the phenomenon of open innovation to existing theories of the firm represents a weakness in the open innovation literature and, therefore, there is an urgent need to overcome this theoretical deficit as: "... a better theoretical foundation of open innovation research is needed. [...] In particular, open innovation studies need to be sufficiently grounded in prior research into both open innovation and related fields. [...] A cumulative development of open innovation research that integrates earlier findings is essential to arrive at a coherent body of knowledge about open innovation" (Lichtenthaler, 2011: 87).

The growing interest for open innovation management in companies provides several opportunities to shed new light on existing theoretical frameworks on innovation. To develop a consistent body of knowledge about open innovation, we argue that existing management theories should be combined as none of them can fully explain how companies benefit from open innovation. We will shed light on open innovation from multiple perspectives and bring theories together in an attempt to develop a better theoretical grounding of open innovation. In particular, we explore the need to link open innovation to the strategy literature and to different theories of the firm, such as transaction cost economics, the resource-based view, the resource dependence theory, the relational view, and real options theory. We also relate open innovation to theoretical concepts such as absorptive capacity and dynamic capabilities. Thus far, only a few open innovation

researchers have attempted to connect open innovation concepts to the existing innovation management literature and its underlying theories of the firm.¹

To connect open innovation to existing theories, we choose the open innovation funnel as a starting point. Chesbrough (2003a) explains open innovation using the innovation funnel as a central visualization tool in his first book to discuss differences between closed and open innovation. We use the open innovation funnel (Grönlund et al., 2010) as a starting point for this chapter because a quick examination of its constituent dimensions already highlights the need to delve into strategy, business modeling, transactions or collaborations with external partners, internal and external resources, etc.²

In the following we first describe the open innovation funnel and its most important dimensions in detail. In this part, we will explain which literature streams and theoretical concepts underlie the open funnel concept. We will then proceed with a discussion of these literature streams in an effort to enhance our understanding of the different dimensions of the funnel. Interestingly, although open innovation requires connecting different theories with each other, it also implies that particular interpretations of these theories are compatible with open innovation and others are not. In a final discussion we will shed light on the lessons learned through our venture to build the contours of a theory that has the potential to frame the open innovation phenomenon.

14.2 THE OPEN INNOVATION FUNNEL AS A STARTING POINT

The innovation funnel has a long history in the innovation management literature. It has been used within the Chandlerian, “closed innovation” framework where firms organize research, development, and commercialization processes within the corporate boundaries. Chesbrough (2003b, 2006a) uses the (open) innovation funnel as a central concept to develop several key insights about open innovation. The funnel is an interesting concept, not only summarizing and visualizing key lessons of open innovation, but it has also the potential to connect open innovation to existing management and theories. In this chapter, we use particular constituent parts of the open innovation funnel (Grönlund et al., 2010) as a starting point to connect open innovation to existing management theories and theoretical concepts. We explain these potential links referring to the open innovation funnel represented below in Figure 14.1.

Firstly, “new market” and “current market” at the right side of the innovation funnel refer to the business model of a company. Business model thinking is at

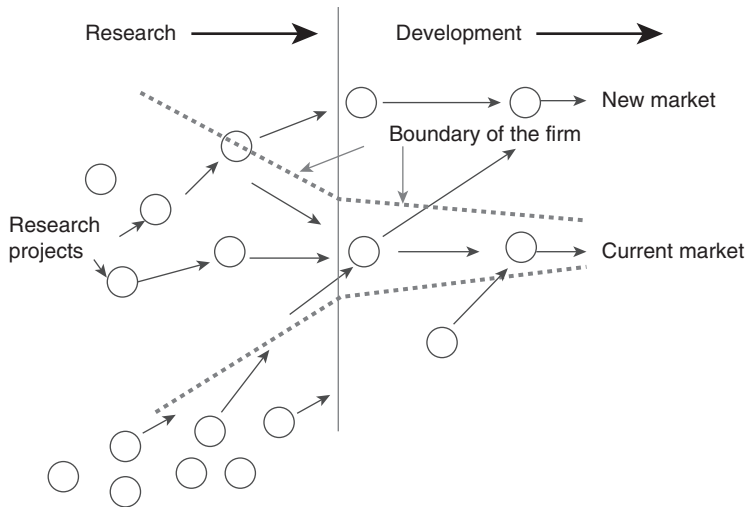


Figure 14.1 The open innovation funnel

Source: Chesbrough (2003b, p.37)

the heart of open innovation: internal knowledge not supporting the firm's business model will be out-licensed or sold and external knowledge complementing its business model will be insourced to develop new products or businesses. Accordingly, open innovation can be only correctly understood when it is integrated into firms' strategy. Yet, few publications have examined how the overall strategy, the innovation strategy, and open innovation in companies interconnect with each other (a notable exception is Chesbrough & Appleyard, 2007).

Secondly, arrows crossing the organizational boundary in the figure represent different types of inter-organizational agreements to pull ideas and technologies into the funnel or to monetize on unused technologies. Insourcing knowledge takes place through research agreements, co-development deals, corporate venturing, in-licensing agreements or outright-acquisitions. In other cases, companies tap into communities of users or experts, or they rely on the services of specialized innomediaries.³ Firms outsource their own knowledge via alliances, licensing agreements, and spin-offs. Firms practicing open innovation are continuously making decisions about which knowledge they have to develop internally, which to buy or to co-develop, and which to sell or license. The choice between internal and external technology developments within the open innovation framework is closely related to the make-buy-ally decision-making process (Geykens et al., 2006; Jacobides & Billinger, 2006; Gulati & Nickerson, 2008; Mudambi & Tallman, 2010). Consequently, future research should examine how the make-buy-ally and the open innovation literature streams relate to each other and how they can enrich each other.

In this respect, open innovation research has certainly to pay more attention to the question how collaboration with external innovation partners redraws the boundaries (and the organization) of (the innovation activities in) the firm.

Choosing appropriate sourcing modes is crucial to deploy open innovation successfully. The choice between them depends on the uncertainty both in the technology and market (and will thus change in different stages in the funnel) (Van de Vrande et al., 2006, 2009a) and the type of knowledge involved. The arrows in the figure can be considered as some type of inter-organizational transactions. In section 14.4 we investigate whether the arrows in Figure 14.1 should be examined through a transaction cost minimization lens or not (Williamson, 1975, 1985). In open innovation, firms can trade technology through market like transactions, but in most cases they also invest in complex, long-term agreements with their innovation partners.

Thirdly, we can focus on the R&D projects (the dots inside and outside the funnel). They start as ideas and develop over time into new business products. This process requires resources and capabilities to nurture the projects. Some of them are available internally, but others have to be sourced from other organizations. Getting access to these resources or capabilities is a major driver of open innovation. Open innovation should therefore be linked to the resource-based view (Barney, 1986, 1991; Wernerfelt, 1984). We also take the knowledge-based view into account, considering knowledge as a specific case of the resource-based view (Grant, 1996). The RBV and knowledge based view are primarily focused on the internal development of capabilities. To account for the growing use of external competencies, several authors have developed frameworks to incorporate the sourcing of capabilities and knowledge from external sources: The relation-based view of the firm has focused on how companies can tap into external resources (Dyer & Singh, 1998). Similarly, the knowledge-based view has been applied to inter-organizational relations such as strategic alliances (Grant & Baden-Fuller, 2004), external corporate venturing (Keil, 2004; Schildt et al., 2005) and acquisitions of start-ups (Wagner, 2011).

Finally, the open innovation funnel can be managed as a Stage-Gate process. Stage-Gate methodologies are widely used in managing closed innovation processes (Cooper, 1999), but they can also be used—in a different way—in open New Product development (NPD) processes (Grönlund et al., 2010). Innovation is a risk-laden activity that requires a sequence of investments, first with small reversible steps followed by investments with increasing financial commitment. The Stage-Gate process is an approach that aims to reduce technological and market uncertainties early on in the process and it disciplines companies to postpone major investments until uncertainty is low enough. In this way, the open innovation funnel can also be considered as a staged decision-making process that can be analyzed from a real options theory perspective (Vanhaverbeke et al., 2008). Collaboration with external partners in early stages of the funnel can be considered as option-creating

decisions, which offer companies an opportunity to make better-informed decisions about more costly investments in external technology during later stages of the funnel (Van de Vrande et al., 2009a).

The (open) innovation funnel provides us the different intersection points between open innovation and prior management literature. We start by exploring the relationship between open innovation and strategy.

14.3 LINKING OPEN INNOVATION TO STRATEGY

Careful observation of companies with a good track record in open innovation indicates that open innovation practices have to be embedded in firms' strategy. We touch upon three aspects of this (potential) link between open innovation and strategy.

Firstly, business model thinking as part of firms' strategy is at the heart of open innovation. Discussing Figure 14.1, we mentioned already that internal knowledge, which cannot be aligned to the firm's business model, would be licensed or sold. In contrast, external knowledge complementing a firm's business model would be insourced to develop new products or businesses. Yet, few publications have examined how strategy and open innovation interconnect with each other (some exceptions are Chesbrough & Appleyard, 2007; Dittrich & Duysters, 2007). This lack of attention is surprising as practitioners have called attention to the fact that open innovation is pointless if it is not integrated with strategy (Slowinsky & Sahal, 2010; Kirschbaum, 2005). This nexus between strategy and open innovation deserves a central place in new open innovation studies.

Secondly, there is a connection between *corporate* strategy and open innovation, which has not been explored in the open innovation literature. Most examples of open innovation illustrate how firms can benefit using external knowledge sources to develop new products in existing businesses. This overemphasis on the use of open innovation in existing businesses eclipses other strategic uses of open innovation. At DSM, a Dutch specialties chemical company, management has established the EBAs (Emerging Business Areas), developing and incubating complete new divisions at the corporate Innovation Center to drive future (in contrast with current) growth of the company by establishing new businesses that do not exist yet in the company (Vanhaverbeke & Peters, 2005; Wijen et al., 2011; Vanhaverbeke & Roijakkers, 2013). These businesses are developed in collaboration with a variety of external (technology) partners, which are different from the partners that are involved in open innovation initiatives to grow existing businesses. To generate incremental growth in current businesses requires a different form of internal organization compared to the case when the company intends to develop completely new businesses in the long run. Different strategic growth

targets lead to different ways to organize open innovation in a company, different departments in the organization will be responsible to lead the projects, and other types of partners are required to collaborate with. Consequently, open innovation should be explicitly linked to corporate (growth) strategy. Sourcing knowledge from partners is not only useful to spur growth in existing businesses, but also to incubate early stage ventures in business areas that are targeted by top management as corporate growth areas (beyond the existing divisions in the company). Likewise, a firm may use open innovation to realize corporate renewal. Organizing open innovation for reasons of corporate growth and renewal implies that a firm has to develop new (technological) competencies. How companies develop new competencies collaborating with different external knowledge partners is a topic that has not received the attention it deserves in the innovation management literature. This, in turn, can be linked to interesting new developments in our understanding of dynamic capabilities (Helfat et al., 2007; Teece et al., 1997; Teece, 2007).

Thirdly, making use of innovation communities, corporate venturing, ecosystems, licensing deals, and venture acquisitions requires new approaches in strategy. The main literature streams in strategy—growth and diversification strategy (Chandler, 1962), positioning strategy (Porter, 1980, 1985) and extensions (Brandenburger & Nalebuff, 1996), resource based strategies (Wernerfelt, 1984; Barney, 1986, 1991) and control of key complementary assets (Teece, 1986)—are all focusing on internal assets, ownership and control as key sources of strategic success. Each of these directions has proven to be fruitful for understanding business strategy when companies relied mainly on internal technological capabilities to develop new products. None, however, adequately accounts for collaborative or open innovation as an empirical phenomenon emerging in many industries. There is an imperative to find new or adapted strategic approaches that can fully account for collaboration and cooperative strategies. In this respect, one approach to take into account is the recent work on the management of innovation ecosystems (Nambisan & Shawney, 2011; Adner, 2012; Borgh van der et al. 2012; Leten et al., 2013).

14.4 TRANSACTIONS WITH SINGLE AND MULTIPLE ACTORS

Open innovation is about setting up relations with external innovation partners. Those inter-firm relations are shaped into transactions between different legal entities. Companies can collaborate in different ways with their innovation partners and the choice between these different types of collaboration lies at the core of the *transaction costs theory* (Williamson, 1975, 1985). As inter-organizational transactions are essential in open innovation, we have to

examine the potential of the transaction costs theory as a theoretical framework for open innovation. The productivity of the collaboration between innovation partners increases through cooperative specialization (Alchian & Demsetz, 1972). However, when innovation partners make transaction-specific investments, transaction costs arise because of fear of opportunism (Williamson, 1985). Although co-specialization increases productivity, firms' incentive to make transaction specific investments is alleviated because specialized resources have lower value in alternative uses (Dyer, 1997). Owners of specialized resources are exposed to greater risks compared to owners of general resources (Klein et al., 1978). The transaction cost theory argues that companies will choose a specific governance mode (arm's length transactions, hierarchical control or intermediate forms of governance) to *minimize transactions costs* given the threat of opportunism in a competitive setting. Market transactions are highly efficient as a transaction governance mode, but when opportunistic behavior is likely to occur, companies can mitigate the threat of opportunism by choosing for an intermediate (e.g. strategic alliances; joint ventures) or hierarchical governance mode (e.g. acquiring the economic exchange partner) (Oxley, 1997; Van de Vrande et al., 2006).

The central question remains whether minimizing the transaction costs is a useful approach for open innovation? One assumption underlying the transaction cost theory is that transaction costs increase as asset specificity increases. However, Dyer (1997: 539) shows that "while transaction costs may increase with asset specificity, they will also vary independently of asset specificity" due to the use of appropriate ways to govern the relationship. Consequently, partners can simultaneously achieve the twin benefits of asset specialization and lower transaction costs (through optimal governance choice). In this way, inter-organizational transactions should not be structured only to economize on transaction costs but also to maximize the transaction value (Dyer, 1997). Careful observation of open innovation deals reveals that companies choose a particular type of collaboration governance to jointly maximize the value of a transaction rather than to minimize transaction costs.⁴ As such, transaction value optimization offers a more interesting theoretical framework for open innovation deals. First, open innovation takes shape through different types of long-term relationships between a set of partners to execute complex tasks related to the development and commercialization of innovations. This requires a high level of understanding and confidence among the partners to learn from each other and to realize the full strategic potential of the cooperation. Within such a context, the value of cooperation among firms is not only based on transaction costs objectives but also *on strategic value and learning opportunities* (Kogut, 1988). Accordingly, partners are not interested in transaction cost minimization, but in the pursuit of transactional value. They may choose cooperative modes with higher transaction costs, as long as "[...] the expected joint gains outweigh transaction cost considerations" (Zajac & Olson, 1993, p. 138).

Secondly, although the threat of opportunistic behavior is obviously present within an open innovation context, companies are often involved in a long-term relationship to develop and/or commercialize a new product offering. In such a context, the transaction or relationship between the partners becomes a value-bearing asset in its own right. Transaction specific expenditures are no longer considered as costs but as an investment in future value (Madhok & Tallman, 1998). Consequently, the inclination to act opportunistically is dominated “[...] by the firm’s estimate of the negative impact that the opportunistic behavior will have on the value of the future exchange with its partner” (Zajac & Olson, 1993: 137).

Thirdly, transaction costs theory focuses explicitly on transaction specific uncertainty—or uncertainty *within* the relationship (endogenous uncertainty). However, research examining the choice between different government modes in an open innovation context has shown that this choice depends on both exogenous and endogenous uncertainty. Both types of uncertainty will differ depending on the stage in the innovation funnel, and as such have an effect on the preference for a specific governance mode. For example, Van de Vrande et al. (2006) argue that under conditions of high exogenous uncertainty (front-end stages of the funnel) companies prefer to undertake flexible governance modes that are highly reversible and involve a low level of commitment. When external uncertainty decreases (back-end stages of the funnel) firms prefer to undertake more hierarchical governance modes, which involve a larger amount of investment and commitment.

Based on the above-mentioned argumentation we conclude that open innovation seems to be more in line with the *transaction value theory*. As transactions among partners in an open innovation context can be considered primarily in terms of maximizing transactional value, it is useful to further analyze open innovation activities from a transaction value theoretical perspective.⁵

Another topic related to the inter-organizational transactions (arrows in Figure 14.1) that we like to address is the fact that reaching out to external innovation partners can be done in a direct or indirect way. Companies can set up relationships indirectly with partners through innovation intermediaries—or innomediaries. Over the last decade, companies made increasingly use of services offered by innovation intermediaries such as Innocentive, Ninesigma, Yet2com, Ocean Tomo, and many others (Chesbrough, 2006a; Huston & Sakkab, 2006; Lopez & Vanhaverbeke, 2009). An innovation intermediary can be defined as a platform provider in two-sided innovation markets created to coordinate the flow of innovation requests and solutions across distinct, distant and previously unknown innovation actors.^{6, 7} The mechanics and dynamics of two-sided markets have been analyzed in detail by industrial economists (Rochet & Tirole, 2003, 2006; Parker & van Alstyne, 2005), and these theoretical insights may help open innovation scholars to better

understand the drivers of success of innomediaries. Embedding innovation intermediaries into the two-sided (innovation) markets framework will provide a double benefit: First, open innovation has been focusing traditionally on direct transactions while a two-sided market approach brings in the role of indirect transactions and describes the conditions under which a platform creates value. Second, transactions become *more efficient* as *technology intermediaries* develop and shape the technology market. The platforms that innomediaries create increase the value of external searching of technology (as the reach is much broader than in direct searches) and the transparency and neutrality of innomediaries decreases transaction costs related to external knowledge and IP acquisition. This, in turn, makes open innovation an even more interesting strategy to follow.

Next, we should connect innomediaries to the ubiquity of knowledge and markets for technology. Innovation intermediaries become more interesting when knowledge is both plentiful and widely distributed across the globe (Chesbrough et al., 2006). The growing globalization of R&D and the increasing diversity of knowledge sources increase the value of working via innomediaries. Innomediaries can also be linked to the market for technology literature (Arora et al., 2001a; Arora & Gambardella, 2010). The market for technology denotes trade in technology disembodied from physical goods. The focus is mainly on the efficiency of market transactions in technology and the resulting division of innovative labor between technology specialists licensing their technology to firms that integrate that externally developed technology to create new products and businesses. This literature has, however, a strong focus on bilateral technology transactions such as R&D contracting and licensing between a technology specialist and a technology buyer. The role of innovation intermediaries, which ties together technology suppliers and technology buyers in a triangular set of relations, is to our knowledge not yet discussed within this framework.

Finally, the choice between firms' use of innomediaries or own portals is an interesting but unexplored topic. Large companies like Procter & Gamble, Unilever, Starbucks, Kraft, Pfizer, Lego, and Dell make use of the services of innomediaries but they also have their own portal connecting them directly with thousands of external solution providers. Future research should determine when it is advantageous to work with innomediaries and when it pays to have one's own portal.

14.5 RESOURCES

A core feature of the *resource-based view* of the firm is that a firm requires a unique collection of difficult-to-imitate resources, competencies and

capabilities to be competitive (Barney, 1986, 1991; Grant, 1996; Wernerfelt, 1984). To create a competitive advantage and capture above-normal rates of returns (i.e. rents) these resources must, by definition be scarce, valuable, and reasonably durable (Barney, 1991). The resource-based view argues that firms can create and capture value according to the unique bundle of resources they possess and the differences between these resources are held responsible for the differences in performance between firms (Bierly & Chakrabarti, 1996). In other words, proponents of the resources-based view emphasize the fact that a sustainable competitive advantage is based on those resources and capabilities that are owned and controlled within the boundaries of a single firm (Dyer & Singh, 1998). This view about how companies develop and sustain a competitive advantage is typically in line with the closed innovation framework.

In open innovation, firms rely for their new products on both internal and external resources, and internal resources can be deployed using inside as well as outside paths to market (Chesbrough, 2003b). Companies get access to external knowledge and integrate it into the development of their new offerings. Resources and capabilities of different organizations are brought together in an effort to offer value to the targeted customers. Firms—even the largest ones—cannot develop the required resources internally and have to team up with innovation partners enabling resource flows between firms. Such an increase in permeability of firms' boundaries will enhance the match between market opportunities and capabilities as well as a more efficient use of resources (Elmquist et al., 2009; Arora et al. 2001a, 2010). Subsequently, whereas the resource-based view stresses such issues as *independence* and the crucial role of *competition* between autonomous companies based on the unique set of resources and capabilities they possess, open innovation emphasizes the *interdependence* of *complementary* resources of firms to develop and launch the innovation in the marketplace (Vanhaverbeke et al., 2008). However, given this difference both the resource-based view of the firm and open innovation underline the importance of resources and competencies to generate a sustainable competitive advantage.

Given the similarities and differences, there is a need to align the resource-based view with the theoretical premise underlying open innovation. One option is *the relational view* of the firm. The relational view emphasizes that critical resources can and should also be found outside the firm's boundaries (Dyer & Singh, 1998). Collaborating firms that combine resources in unique ways may realize a competitive advantage over others that compete on the basis of a stand-alone strategy. To do so, firms have to combine resources with partners in unique ways and be willing to make relationship-specific investments. These relationship-specific investments generate relational rents that are a property of the dyad or network and cannot be enjoyed by a firm in isolation (Dyer & Singh, 1998). The relational view identifies complementary resources or capabilities of firms as a potential source of inter-organizational

competitive advantage: this is in line with a major premise of open innovation to consider the sourcing of knowledge from external partners a source of competitive advantage. In particular, the relational view of the firm considers the dyad/network as the unit of analysis and, as a consequence, the complementary resources that create the relational rents are essentially beyond the control of the individual firm (Dyer & Singh, 1998).

The latter also implies that organizations become dependent on their environment (i.e. other organizations) for the provision of vital resources, which they need to survive and prosper.⁸ Consequently, there is a risk that organizations lose their freedom of action as they are constrained by external interdependencies with other organizations (Pfeffer, 1987). However, they can try to reduce their environmental dependence based on the concept of power (Hillman et al., 2009), which is defined as the control over vital resources (Ulrich & Barney, 1984). According to the *resource dependence theory* the ambition of an organization is to minimize the dependence on other organizations and to find ways to influence these organizations to secure the resources that are needed (Pfeffer & Salancik, 1978). To manage this resource dependency, organizations engage in different inter-organizational arrangements, such as co-optation, contractual alliances, equity alliances (e.g. minority participations or joint ventures), and mergers and acquisitions (Pfeffer & Salancik, 1978; Drees & Heugens, 2013). The open innovation literature has not paid attention to the power structure and the interdependence between partners. On the one hand, it would be interesting to investigate when power structure and interdependence becomes important in innovation networks. On the other hand, the resource dependency theory is static in nature. Most industries nowadays experience strong dynamics and face the challenges of new technologies and business models. Power ebbs and flows in networks and ecosystems over time. Look at IBM with Intel and Microsoft in the 1980s, or Nokia and any of its ecosystem partners in the past few years. We know Philips as a consumer electronics company, but it currently redefines itself as a lighting, healthcare, and lifestyle company. Although we do not exclude power and interdependence issues in some industries, coping with the rapidly changing dynamics in an industry is a more important topic to understand open innovation. This is the subject of the following section.

14.6 DYNAMIC CAPABILITIES

A large number of companies currently operate in an environment in which the knowledge landscape is much more diverse and globally distributed than in the past (Chesbrough, 2003a). In such an environment, core competences based on scarce, unique, and difficult-to-imitate resources can turn into

competence traps as companies get stuck with resources that become increasingly irrelevant when technologies and the competitive environment change. As a result, obtaining a sustainable competitive advantage goes beyond the ownership of difficult-to-imitate resources and requires difficult-to-replicate dynamic capabilities (Teece, 2007).

Teece (2007: 3019) classifies dynamic capabilities into the following three categories (1) the capacity to sense and shape opportunities and threats, (2) the capacity to seize opportunities and (3) the capacity to maintain competitiveness through enhancing, combining, protecting, and, when necessary, reconfiguring the business enterprise's intangibles. We argue that the three classes of dynamic capabilities are closely related to several important elements of open innovation.⁹ In addition, we argue that the underlying micro foundations of these dynamic capabilities offer interesting insights into *organizational* and managerial processes, procedures, systems, and structures to implement open innovation in the firm.

The first class (sensing and shaping opportunities and threats) deals with the sensing of both technological and commercialization opportunities. To identify and shape these opportunities Teece (2007) argues that companies must overcome a narrow search horizon by combining internal and external knowledge that originates in the core as well as the periphery of their business ecosystem. This is closely related to the outside-in approach of open innovation. To start, firms can develop strong knowledge bases internally by investing heavily in R&D activities (Park, 2002). These R&D activities will enable the firm to develop its own core capabilities in new technological fields that form the basis of possible "first mover advantages" (Chesbrough & Teece, 1996). However, building up an internal knowledge base is a long and costly process and it is also very difficult to change the profile of technological foundations over time (Breschi et al., 1998; Giuri, Hagedoorn & Mariani, 2004; Granstrand et al., 1997). Therefore, relying on internal capabilities only is likely to lead to "core rigidities" (Leonard-Barton, 1992, 1995) or the so-called familiarity trap (Ahuja & Lampert, 2001) reducing the chance that companies can benefit from new technological opportunities (Jaffe, 1986; Lunn & Martin, 1986; Levin, Cohen & Mowery, 1985). By tapping into external knowledge a firm can overcome the limits of internal learning (Capron & Mitchell, 2000; Karim & Mitchell, 2000).

This reliance on external knowledge is closely related to the imperative of open innovation, where external knowledge is equally important to internal knowledge. The same balance between internal and external knowledge sources is advocated by Teece (2007). To establish this balance, microfoundations consisting of processes to direct internal R&D, processes to learn about changing customer needs as well as processes to tap into exogenous science and technology, supplier, complementor, and customer innovation, need to be established within the firm (Teece, 2007). The open innovation literature has

not paid sufficient attention to these microfoundations and clearly can benefit from integrating them into the open innovation research.

The second class of capability (seizing opportunities) deals with the choices one has to make after the opportunity is sensed. This is particularly related to making the right decisions regarding the investments in development and commercialization activities, as multiple investment paths are possible. The selection or creation of the proper business model is fundamental as it defines a firm's commercialization strategy and investment priorities (Teece, 2007). Consequently, the creation, adjustment, or replacement of business models is a very important microfoundation of the second class of dynamic capabilities (Teece, 2007). However, business models can create strong inertial forces, once they have become well established (Chesbrough & Rosenbloom, 2002), making it difficult to adjust or replace them. As we have been arguing before, the business model also plays a central role in open innovation (Chesbrough, 2006a). However, Teece is focusing on internal paths to market while open innovation is also emphasizing external paths to market.

The third dynamic capability class is focused on the reconfiguration of assets and organizational structures as a result of changing technologies and customer needs. This change is needed to escape from unfavorable path dependencies (as discussed earlier) and to maintain evolutionary fitness (Teece, 2007; Helfat et al., 2007). One of the important microfoundations underlying this dynamic capability class is the achievement of decentralization and near decomposability. On the one hand, growing enterprises must decentralize to remain flexible and be able to respond to changing technological and customer needs. On the other hand, organizations should be able to achieve integration as well to benefit from potential economies of scale and scope. Obtaining this subtle balance is called "near decomposability" (Simon, 2002; Teece, 2007). Teece (2007) explicitly links the concepts of decentralization and near decomposability to open innovation as they rely on a distributed model of innovation to access and integrate external knowledge.

In sum, dynamic capabilities explicitly address some of the important elements of open innovation. Especially, the balance between internal and external knowledge, the important role of the business model and embracing open innovation as a way to access and integrate external technology, play a role in Teece's in-depth analysis of dynamic capabilities. However, we can also observe some differences between the dynamic capabilities theory and open innovation. Most importantly, the inside-out approach of the open innovation model is not addressed in the former. According to Teece (2007: 1343), the sensing and seizing of opportunities as well as reconfiguration are all closely related to an outside-in approach of the open innovation model, where the company integrates internal and external knowledge to create new products or services that are commercialized via internal paths to markets. However, the inside-out approach of the open innovation model clearly diverts from the above

mentioned definition of dynamic capabilities as a firm can also make money by leveraging external paths to market. Companies can only go for external paths to market when they have the right dynamic capabilities in place. Selling or spinning off technology requires the development of particular practices in the company. Philips' IP ventures are an example in case: when the company decides not to use a technology internally, the related IP might not be interesting enough to sell to other firms. In this case, Philips will develop the technology till there is a proof of concept or a prototype in which case it is much easier to sell or license the technology.

14.7 ABSORPTIVE CAPACITY AND BEYOND

Absorptive capacity was first defined by Cohen and Levinthal (1989, 1990) as a firm's ability to recognize the value of new information, assimilate it, and apply it to commercial ends. Both the literature about open innovation (Chesbrough, 2003a, 2006a; Chesbrough et al., 2006; Christensen et al., 2005) and the one about absorptive capacity (Lenox & King, 2004, Arora & Gambardella, 1990; Ireland, Hitt & Vaidyanath, 2002) focus on how innovating companies can benefit from these external sources of technology. More in particular, since absorptive capacity focuses on acquiring and utilizing external knowledge inside the firm (Lichtenthaler & Lichtenthaler, 2009) it is a concept at the heart of the outside-in side of open innovation. To gain a better understanding of the relationship between absorptive capacity and open innovation we will first explain how the two concepts are linked to each other. Thereafter we will also explain the differences between them.

Both open innovation and absorptive capacity stress that there should be a proper balance between internal and external knowledge. In order to access and assimilate external knowledge firms need prior related knowledge to understand the knowledge that is absorbed (Cohen & Levinthal, 1990; Jansen et al., 2005). Firms thus require internal R&D capabilities to recognize and monitor interesting technologies that are developed elsewhere. On the other hand, internal research capabilities are indispensable to effectively exploit external know-how (Arora & Gambardella, 1994; Rosenberg, 1990; Cohen & Levinthal, 1989). In-house R&D activities remain crucial to develop technological know-how, to increase the firm's learning capacity and to improve its absorptive capacity. This is also echoed in the open innovation literature; internal R&D improves the effectiveness in monitoring and using external knowledge resources (Rigby & Zook, 2002; Chesbrough, 2003b; 2006a). In line with Cohen and Levinthal (1990), open innovation scholars stress the need to balance the ability to profit from external knowledge sources and the ability to develop and exploit internal knowledge (Chesbrough, 2003a, 2006a;

Gassmann & Enkel, 2004). Accordingly, the growing focus on external knowledge sources does not diminish the need to understand how companies can generate and manage internal knowledge (Gambardella & Giarratana, 2004). Therefore, to understand the relationship between a firm's absorptive capacity and open innovation, one should focus on the internal organization of the innovation process, which determines the diffusion and exploitation of technological knowledge within the organization (Nooteboom et al., 2007; Levinthal & March, 1993; Argyres & Silverman, 2004). The presence of valuable external sources of knowledge does not imply that the inflow of new ideas into the organization is an automatic or easy process. External knowledge can only be recognized, accessed, and assimilated when firms develop routines and change their organizational structure and culture to facilitate open innovation processes (Dahlander & Gann, 2007). Consequently, open innovation scholars have to take advantage of the development in the absorptive capacity literature to understand how firms develop new organizational routines to tap more effectively into external knowledge.

There are, however, also noteworthy differences between absorptive capacity and open innovation. Absorptive capacity is related to the assimilation and integration of external knowledge and is therefore limited to the outside-in perspective of open innovation. This also implies that other aspects of the open innovation process are neglected. For example, the purposive outbound flows of knowledge and technology through licensing and spin-offs, has been accorded no recognition in the absorptive capacity literature. Absorptive capacity cannot explain all dimensions of open innovation in terms of capabilities. Therefore, we need to complement the concept of absorptive capacity with new theoretical developments. The study of Lichtenthaler and Lichtenthaler (2009) provides an important first step in this direction. They built a capability-based framework for open innovation by distinguishing internal and external knowledge exploration, retention and exploitation. We restrict our attention here solely to the external dimension. Firstly, external knowledge exploration describes the assimilation of knowledge from external sources (Lane et al., 2006) which matches with the absorptive capacity concept. Secondly, external knowledge retention refers to the knowledge that is embedded in firms' interorganizational relations such as research agreements, technology alliances, corporate venturing investments, technology acquisitions, etc. They identify a firm's *connective capacity* as its ability to maintain and subsequently reactivate knowledge in interorganizational relationships (Lichtenthaler & Lichtenthaler, 2009: 1320). Contrary to absorptive capacity, here the focus lies on maintaining and managing knowledge externally instead of inward knowledge transfer. Gaining access to external knowledge without immediate transfer of the partner's knowledge is an important but often neglected aspect of the first stage(s) of the open innovation funnel. We hope that this concept will be applied more in the future partially

as a consequence of the growing popularity of innovation ecosystems. Thirdly, they introduce external knowledge exploitation as the monetization of knowledge through external paths to market (Chesbrough, 2003b). It is not straightforward to monetize effectively on unused technology. A firm's *desorptive capacity* is its capability to generate revenues through external knowledge exploitation (Lichtenthaler & Lichtenthaler, 2009: 1321), which is complementary to internal knowledge application in a firm's own product-markets (Lichtenthaler, 2007). It consists of identifying external knowledge exploitation opportunities based on strategic and monetary motives and the subsequent transfer of the knowledge to the partner firm(s) (Lichtenthaler & Lichtenthaler, 2009). Given that external knowledge exploitation refers to outward knowledge transfer and external paths to market, it is a capability related to the inside-out dimension of the open innovation model.

The extension to three capabilities to explain open innovation practices is a remarkable extension of the absorptive capacity framework. Future contributions should identify how companies build these capabilities and to which extent they are different from each other. In any case, it is obvious that an extension is needed and that the distinction between different types of external knowledge capabilities is a fruitful step to understand the complex reality of open innovation.

14.8 REAL OPTIONS

The alleged benefits of open innovation can be partly explained by the real option approach. The creation of new products and businesses involves a high level of uncertainty. One way for firms to cope with the technological and market uncertainty associated with new business development is by making small investments in multiple options on technology. These small, initial investments can be regarded as a real option, that is “the right, but not the obligation, to take an action in the future” (Amram & Kulatilaka, 1999, p. 5). Real options reasoning is a tool for uncertainty reduction—making a small, initial investment under high levels of uncertainty to create an option while waiting until the uncertainty about the opportunity has decreased. When the uncertainty has decreased, the investing firm can decide whether to make a follow-on investment or whether to terminate the project (Adner & Levinthal, 2004; McGrath & Nerkar, 2004). Vanhaverbeke et al. (2008) show how real options reasoning can be applied to open innovation. The open innovation funnel is composed of different stages where uncertainty decreases, going from the idea generation stage till market launch. Compared to closed innovation, open innovation practices have four advantages in terms of real options; 1. Firms benefit from early involvement in new technologies

or business opportunities; 2. They may benefit from delayed entry or delayed financial commitment to a particular technology; 3. Open innovation offers firms the advantage of an early exit, and the ability to realize some value from projects that do not go forward internally; 4. Finally, open innovation allows firms to benefit from delaying an exit.

Firstly, firms may benefit from open innovation through early involvement in new technologies or business opportunities. External partners help the firm to get access to a broad range of externally developed technologies and market opportunities. Partners can trace new technologies or market developments earlier and more accurately than a single company. The latter can take advantage from partners' knowledge through early stage investments such as minority stakes in start-ups, participation in VCFs, educational investments or crowdsourcing. These are minor investments for the company enabling them to scout technologies (through its partners) in a more effective way. Secondly, companies can also benefit from a delayed internalization of new technologies or ideas. Internalizing research and development projects implies that the company is paying all the related costs. Delaying these expenditures is beneficial when technologies are in an early stage and when therefore investments are still very risky. With open innovation firms have more flexibility in deciding when to start the internal portion of the innovation process: Firms start exploring the commercial possibilities of a technology outside initially, via relationships with universities, start-ups, research-labs, suppliers, and other innovation sources. Delaying investments in internal innovation enables the firm to take fewer risks in starting the innovation inside the company. Thirdly, open innovation offers firms the advantage of an early exit for R&D projects that do not live up to expectations. In a closed innovation setting, an R&D project can only turn a success (a new product or service) or a failure (abandoning the project). Because of this dichotomy, firms tend to invest too long in unpromising projects. In contrast, firms have additional options with open innovation: they can license out technologies or spin-off ventures that are not promising enough or do not fit with their business model. Finally, open innovation allows firms to benefit from extended control until a full exit of a project. Licensing out technologies or spinning out ventures frees cash for other, more interesting projects. Yet, the firm may still want to monitor "externalized" knowledge for strategic reasons while delaying the (full)exit decision. While the licensed technology or the spin-off matures and the value for the company becomes apparent over time, it can delay the decision whether to spin-in the venture or sell its remaining interests to the other capital providers.

These four advantages are just a simple exercise in reinventing open innovation in terms of real options. We are convinced that real options reasoning can be applied in different open innovation contexts. Collaborating with external partners

should not only be considered in terms of competencies that a firm requires but also in terms of strategies to reduce uncertainty during research projects.

14.9 CONCLUSION: BRINGING THE PIECES TOGETHER

Ten years after Henry Chesbrough (2003a) coined the term open innovation we see a continuing increase in open innovation practices. This growing openness of firms is illustrated in a recent survey among large companies, where 78% of responding firms reported using open innovation processes (Chesbrough & Brunswicker, 2013). Van de Vrande (2009b) observed a similar trend among SMEs. Yet, despite the popularity of open innovation, few scholars have tried to link and integrate it into existing theories. This research deficit shows a strong need for further theoretical and empirical work. While the open innovation framework includes interesting conceptual insights and some theoretical extensions to theories of economic spillovers from R&D (Chesbrough & Bogers, Chapter 1 in this volume), its connections to existing theories of strategy are not yet well developed (Van de Ven, 1989). Therefore, we started in this chapter with a simple exercise linking the open innovation framework with existing theories and theoretical concepts. We limited our attention to the constituent parts of the open innovation funnel to narrow the focus and to keep the analysis tractable.

In our attempt to connect open innovation to existing theories and theoretical concepts, we found that: (1) open innovation largely neglected the link with firms' business and corporate strategy; (2) some theories are more in line with the phenomenon of open innovation than others; (3) most theories that can be aligned with open innovation still have to be adapted to grasp a particular dimension of open innovation; (4) open innovation is a complex, multi-dimensional phenomenon which compels us to combine different perspectives into a broader, dynamic (or stepwise) framework. We will discuss these findings in the following paragraphs.

Firstly, decisions to engage in open innovation should always be related to a firm's strategy. In particular the link between open innovation and corporate strategy needs to be highlighted in future research. Nowadays, benefits of reaching out to innovation partners are considered independently from a firm's business and corporate strategy. Embedding open innovation decisions in firms' strategies will offer us a more accurate picture of the diversity of goals companies envision with the opening of their innovation activities. Nowadays, open innovation activities are lumped together in "inside-out" and "outside-in" modes of open innovation. In this way, the diversity of strategic goals and

the multitude of outcomes that can be achieved through open innovation are hidden by these encompassing concepts.

Secondly, some theories are difficult to align with the underlying assumptions of the open innovation framework. Minimization of transaction costs (TCE) is not reflecting the rationale of transactions between organizations that are practicing open innovation. Maximizing the joint value between innovation partners represents this rationale much better as it explains why companies engage in relationships with high transaction specific costs (Zajac & Olsen, 1993; Dyer, 1998). Similarly, we discussed the possibilities to consider open innovation through the lenses of the relational view (Dyer & Singh, 1998) and the resource dependency theory (Pfeffer & Salancik, 1978). In the latter, attention is paid to the power structure and the dependence between partners through inter-organizational agreements. In the relational view, the focus is on the complementarity of the resources of the partners and how partners can achieve strategic targets that they cannot achieve on their own. The open innovation literature has been focusing mainly on the benefits of inter-firm collaboration—that is, how partners can create jointly value. Therefore, open innovation can benefit from a closer examination through the lens of the relational view of the firm. The resource dependency theory seems to be less promising as a theoretical framework to understand the open innovation phenomenon. However, although the relational view is very useful to theoretically back open innovation, the theory is focused mainly on dyadic collaboration (Dyer & Singh, 1998). More attention should be paid to innovation networks, where the role of a network orchestrator or systems architect in the ecosystem becomes crucial to understand the benefits and dynamics of open innovation (Adner, 2012; Nambisan & Sawhney, 2011).

Theories that can be aligned with open innovation still have to be modified to grasp open innovation. The resources-based view—and knowledge-based view (KBV) as a special case—is a valuable theoretical background for open innovation in which firms try to have the right (external and internal) resources in place to create new products and services. Yet, the RBV (and KBV) are focusing on internal resources only—in line with closed innovation—not on a balance between internal and external resources. Similarly, “theories such as transaction cost economics, resource-based view and resource dependence theory are *static* or nearly so” (Eisenhardt & Tabrizi, 1995, p.108). Open innovation is an answer given by innovating companies to cope with increasing technological complexity and competitive dynamics. Moving quickly, fast product innovation and seizing new market opportunities are core capabilities. Therefore, in order to explain open innovation, we are in need of *dynamic theories*. Dynamic capabilities and absorptive capacity are *dynamic theories* and thus appropriate for understanding open innovation in fast changing settings. However, both

are only linked to the outside-in perspective of OI and they neglect the inside-out perspective. It would be interesting to see more research explicitly linking dynamic capabilities to open innovation (Teece, 2007 was a seminal work in that respect). Similarly, we need a more detailed investigation of new capabilities—such as the connective and desorptive capacities to understand which internal capabilities firms have to develop to engage successfully in open innovation.

There is definitively a need to integrate different theories. The different theoretical perspectives can only explain a particular dimension of open innovation. Therefore, we have to bring the pieces together to draw the contours of what could become a theory of open innovation.

Step 1: We argued that open innovation is inextricably related to strategy. Strategy has always been present in the background of the open innovation literature through the continuous emphasis on business models and their role in determining what external knowledge need to be in-sourced and which internal knowledge can be validated through external paths to market. Yet, in many cases practitioners and researchers start focusing on the benefits of open innovation projects without framing the projects within the broader strategic objectives the company has in mind. Framing open innovation within both business strategies and corporate strategies is crucial to understand with whom a firm needs to collaborate, when and how it will collaborate and what type of governance mode is needed to reach the targeted objectives. More importantly, strategic objectives also determine which capabilities have to be developed internally, which in many cases requires external partners to source or to co-create the requisite capabilities. Combining for example, the resource-based view of the firm with the resource dependence theory and the relational view provides us with a better insight in the combination of an internal perspective (specification of resource needs for a firm's strategy) and an external perspective (outside-in and inside-out innovation opportunities leading to the strategic renewal of an existing business) within the broader strategic context of the firm.

Step 2: Once the strategic objectives are fixed, managers have to determine where the interesting sources of the required external technologies are located. It is important to realize that this is a stage before a firm actually develops relationships. This stage is strongly related to the sensing (dynamic) capability developed by Teece (2007). When open innovation projects are following existing routines, firms can rely on existing networks of partners. However, if they engage in new technologies or markets, existing networks are of little help and firms have to search for new external sources of knowledge. This capability has been underemphasized in the open innovation literature. Similarly, looking for new ways of valorization of external paths to market for internal knowledge is an elusive capability that most companies find difficult to master. In this stage, firms should already focus on several determinants that might

affect the final outcome. Examples are the fit of the competencies of the partner with the new product or service (KBV, RBV, and relation-based view); the risk profile of the project, the appropriability of IP, the irreversibility of the investments (real options theory), the potential value of the transactions, and the power structure between the firm and particular partners (resource dependency theory), etc.

Step 3: Once a firm has determined who are the best partners to team up with, it still has to start and execute the partnership. In contrast with step 1 and 2, this step has received a lot of attention in the prior literature, although there were few attempts to clarify this stage using existing theories. In this step, reaching out to external innovation partners can be done in a direct way or indirectly via innovation intermediaries—or innomediaries. Furthermore, success is determined by designing and crafting the right relation with the partner. In this stage it is important to determine how to choose for the most appropriate governance for the collaboration and how to guarantee that each partner captures enough value from their joint activities. The choice for a particular governance mode is a function of the joint value partners can realize net of the transaction specific costs they incur (transaction value theory), the risks of a power game and strategic interdependence (resource dependence theory), the absorptive capacity in the firm, the learning potential of the partnership, and the irreversibility of the investment (real option theory). For example, when an innovating firm intends to source emerging technologies, uncertainty about the future business potential of the technology is very high. Hence, under conditions of high uncertainty (environmental turbulence or technological newness), firms will prefer to maximize their flexibility and make small investments, which facilitate the reversibility of actions (Van de Vrande et al., 2009a). In that case, for example, a minority investment in an alliance can be used to achieve more certainty before executing the option of a merger or acquisition (Hillman et al., 2009). However, we have to keep in mind that we described so far only the outside-in mode of open innovation. Choosing the right governance modes when a company wants to exploit internally developed technologies through external paths to market also has to be considered.

Step 4: Open innovation is a competence companies have to learn over time. Open innovation is not only about insourcing and outsourcing of resources. Companies learn over time to work effectively with open innovation. Managing internal innovation is not trivial, but managing open innovation is even more challenging. Recently, scholars have been focusing on the need to organize and manage open innovation internally. Only firms that have the right structures and processes in place can work effectively with external partners. Examples are Enkel, Bell and Hogenkamp (2011) and Chiaroni et al. (2010, 2011). These publications indicate that open innovation is essentially an exercise in becoming a *learning organization*, which brings

us back to the need to link up open innovation with another broad literature stream (Argyris, 1999; Senge, 1990). In addition, Teece (2007) discusses several important underlying micro foundations of *dynamic capabilities* that offer interesting insights into the *organizational* and *managerial* processes, procedures, systems, and structures needed to implement open innovation in the firm.

NOTES

1. To the best of our knowledge, Laursen & Salter (2006), Christensen et al. (2005), Gassmann & Enkel (2004), Lichtenthaler & Lichtenthaler (2009), Dahlander & Gann (2010), and Vanhaverbeke et al. (2008) are a few notable exceptions.
2. Focusing on the different dimensions of the open innovation funnel is a deliberate choice and there are certainly other potential inroads to link open innovation practices to the existing management literature.
3. An innomediary or innovation intermediary can be defined as “an organization or body that acts as an agent or broker on any aspect of the innovation process between two or more parties” Howells (2006). They have been described in detail in Chesbrough (2006, chapter 6).
4. Several authors (Madhok, 1997; Ring & van de Ven, 1992; Zajac & Olson, 1993; Dyer, 1997) have argued that firms choose to optimize the *net transaction value*.
5. Given the critics with respect to the transaction cost theory, one could also argue that the transaction is not the proper unit of analysis, but rather the relationship between innovation partners. Pierre Azoulay has some nice work on this topic (see for instance Azoulay et al. 2010; Azoulay, 2004).
6. We could also define an innovation intermediary in a broader way as “an organization or body that acts as an agent or broker on any aspect of the innovation process between two or more parties. Such intermediary activities include: helping to provide information about potential collaborators, brokering transactions between two or more parties; acting as mediator, or go-between, bodies or organizations that are already collaborating; and helping find advice, funding and support for the innovation outcomes of such collaborations” (Howells, 2006, p.720). However, we prefer to stick with a narrow definition more in line with the innomediaries that have been described extensively in the open innovation literature.
7. Boudreau and Lakhani (2009) discuss the choice between competitively structured innomediary approaches versus cooperatively structured approaches. This topic is important in determining the efficiency of the intermediation process and the incentive structure of the different actors.
8. Dyer and Singh (1998) argue that there is an important relationship between the relational view and the resource dependence theory (Dyer & Singh, 1998: 675, footnote 7: “This is based on their expectation that the distribution of the relational rents is consistent with a resource-dependence perspective as partners that

bring the more critical (i.e. scarce) resources to the relationship will be able to appropriate a higher percentage of the rents.”

9. Chesbrough et al. (2006) mention several points of differentiation for open innovation relative to prior theories of innovation (see Table 1.1). Several of the micro foundations of the dynamic capabilities confirm the new insights of open innovation.