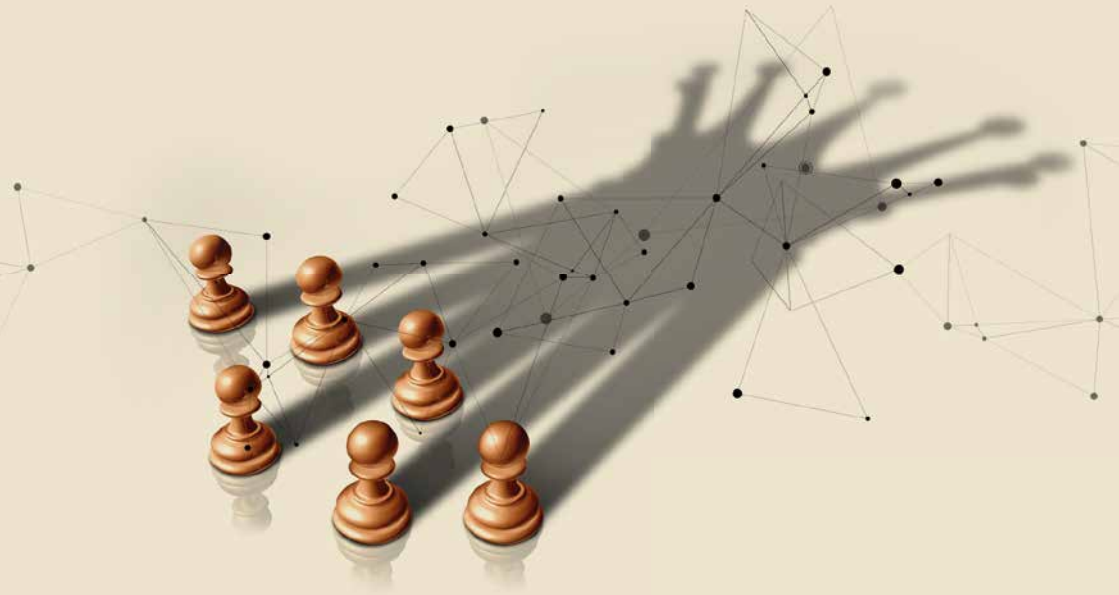
Laurent Scaringella



STRATEGIC ALLIANCES, ABSORPTIVE CAPACITY, AND AMBIDEXTERITY TOWARD INNOVATION AND KNOWLEDGE SPILLOVERS

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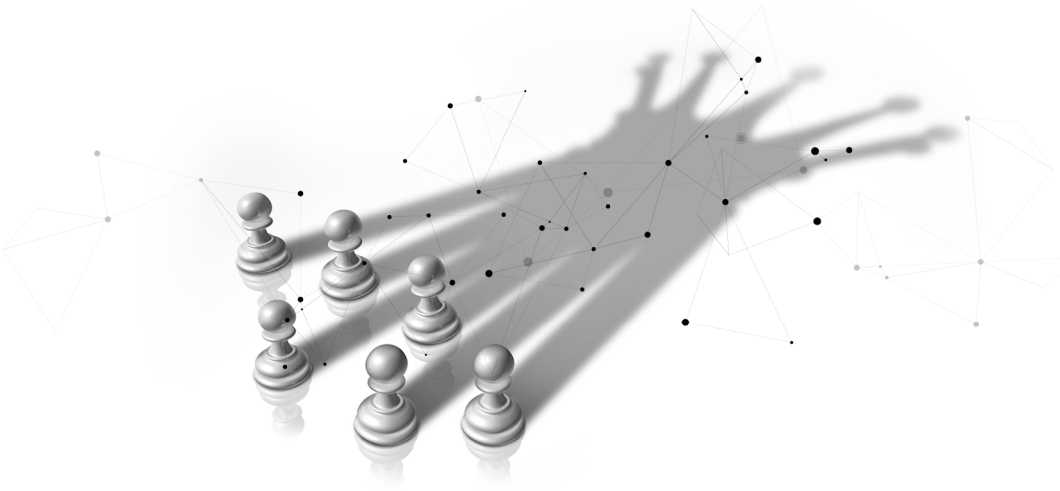

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Summary

This monograph investigates the involvement of firms in strategic alliances and the interplay with organizational absorptive capacity and organizational ambidexterity. The theoretical work highlights the positive aspects, as well as the negative aspects, for firms engaging in strategic alliances. The main contribution relates to the evaluation of both positive and negative outcomes of various types of strategic alliances. This monograph presents different avenues for firms regarding how to benefit from strategic alliances in terms of innovation, while avoiding threats such as unintended knowledge spillovers.

Introduction

Strategic alliances have been widely studied in the literature (Gulati & Singh, 1998; Heimeriks & Duysters, 2007; Werner, 2002), from different perspectives, such as knowledge transfer (Khazam & Mowery, 1996), innovation (Stuart, 2000), and firms' performance (Singh & Mitchell, 2005). Mom et al. (2019) argued that strategic alliances are very difficult to analyze, as each one is unique and complex. Consequently, many studies have attempted to adjust this difficulty by narrowing the scope of research, for instance by restricting the empirical studies to a specific type of alliance.

The performance of firms engaged in strategic alliances strongly relates to their absorptive capacities (ACAP) (Cohen & Levinthal, 1990). Past studies investigating the relation between open innovation and ACAP presented mixed results, proposing positive, curvilinear, and even negative relationships between openness and innovation performance (Cheng & Huizingh, 2014; Du et al., 2014; Knudsen & Mortensen, 2011; Laursen & Salter, 2006). For instance, using firm-level as the unit of analysis, Zobel (2017) proposes a positive but indirect link between external technological knowledge access and competitive advantage in product innovation. More recent studies on this field focus on the antecedents, processes, and outcomes of open innovation suggesting the need for specific ACAP (de Jong & Marsili, 2006; Fabrizio, 2009; Noseleit & De Faria, 2013) and culture (Burcharth

et al., 2015; Dodgson et al., 2006; Herzog & Leker, 2010). Therefore, in the context of open innovation, West & Bogers (2014) focused on ACAP to integrate externally sourced knowledge. Nevertheless, Bogers et al. (2017) argued that only few studies provide a theoretical grounded explanation demonstrating the connection between open innovation and ACAP, and how they relate.

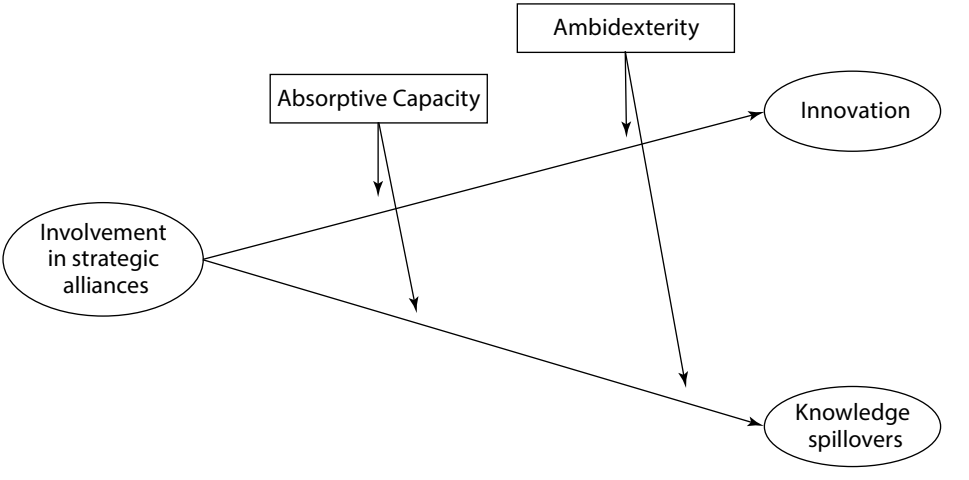
In addition, Omidvar et al. (2017) argued that, "extant research remains inadequate in explaining and understanding several AC[AP] aspects. First, most AC[AP] research has focused on single organizations or dyadic relations. At the same time, there is a dearth of research on how AC[AP] develops when multiple organizations are involved, and various types of expertise prevail" (p. 665). Consequently, there is a need for further research investigating multiple organizations. Multiple organizations may have different capabilities to conduct exploratory and exploitative activities and consequently have a different level of organizational ambidexterity (March, 1991). Existing studies on ambidexterity related studies are based on a macro-level perspective and have provided solid bases for understanding the procedures, structures, and methods to enhance the firm-level capacity to simultaneously explore and exploit knowledge (see Raisch & Birkinshaw (2008) for a review). Past research has also focused on the trends, determinants, and effects of ambidexterity in organizations (O'Reilly & Tushman, 2013), which is critical for maintaining a competitive advantage over time (He & Wong, 2004; O'Reilly & Tushman, 2013). Consequently, both ACAP and ambidexterity matter in the success of strategic alliances.

Existing research has shown a positive link between firms' alliance counts and performance (Baum, Calabrese, et al., 2000; Powell et al., 1996; Rowley et al., 2000). However, strategic alliances that focus too much on performance – as the main objective of the development of a collaboration – can lead to disappointments (Harrigan, 1986; Kogut & Singh, 1988; Porter, 1987). On that point, Bakker (2016) stated that "cooperation in and of itself does not ensure alliance success" (p. 1921). Despite the increase in the use of strategic alliances, empirical studies pointed out the high failure rates – around 50% of unsuccessful alliances – according to Koza & Lewin (2000), Kale et al. (2002), as well as Argyres et al. (2007). Some issues have been reported, such as conflicting resources between firms, lack of trust, low individual attachment, bargaining power conflicts, and lack of previous bonds (Greve et al., 2010; Gulati, 1995; Puranam & Vanneste, 2009; Rowley et al., 2005). Additionally, the firms' resources may not be compatible with partners (Greve et al., 2010); individuals may have a reduced attachment (Broschak, 2004); new alternatives outside the alliance may appear (Greve et al., 2013); power relations between firms may cause an imbalance (Rowley et al., 2005), and so forth. Due to these difficulties, a gap is created between expected outcomes and the realized outcomes from engaging in strategic alliances (Das & Teng, 2000; Inkpen & Beamish, 1997). In addition, some other negative outcomes may be caused by ex-

ternal knowledge dynamics developed through strategic alliances, such as unintended knowledge spillovers, that are considered to be a deterrent to R&D activity (Nelson, 1959; Arrow, 1962; Spence, 1984), which occurs through borrowing or stealing (Jaffe, 1985). Therefore, there is a need to better understand the positive (Singh & Mitchell, 2005; Huang et al., 2016), as well as the negative consequences of strategic alliances (Greve et al., 2010; Puranam & Vanneste; 2009; Rowley et al., 2005).

The tradeoff between the positive and the negative aspects of strategic alliances constitute an important paradox. The firms have to make a choice between innovating while taking some risks with external partners or having a much limited innovation by relying on internal resources and capabilities, therefore limiting the risk of unintended knowledge spillovers. Zahra & George (2002) introduced another paradox by distinguishing potential absorptive capacities (PACAP) and realized absorptive capacity (RACAP). PACAP is composed of acquisition and application, while RACAP is composed of transformation and application. Finally, many studies have recognized the paradoxical relationship between exploration and exploitation (Andriopoulos & Lewis, 2009; Smith & Lewis, 2011; Zimmermann, Raisch & Cardinal, 2017). This happens because the processes of exploration and exploitation require different structures, processes, strategies, and capabilities (McGrath, 2001; Benner & Tushman, 2003; Siggelkow & Levinthal, 2003; Chang, Chen & Huang, 2009). The paradox suggests that the tensions that arise from the contradictory nature of the ambidexterity components are difficult to resolve. Therefore, the main motivation of this monograph is to better understand the paradoxes around the outcomes of strategic alliances, ACAP, and ambidexterity.

Figure 1. Main research objects



In summary, we contend that we are missing studies on the positive and the negative outcomes firms may expect when engaging in strategic alliances, considering their level of ACAP and ambidexterity. To respond to the multiple gaps in the literature on strategic alliances and ambidexterity, this monograph investigates the following research question: *"What are the positive and negative outcomes of strategic alliances in organizations considering the role played by ACAP and ambidexterity?"*

This monograph will further investigate the following model (figure 1).

The aim of this monograph is to determine strategic alliances effects, including the mediating effect of absorptive capacity and ambidexterity, and propose a model on the relationships.

This monograph holds several contributions. First, it uncovers the relation between strategic alliances and its positive as well as negative outcomes to complement past mixed results. Indeed, while some scholars argued that strategic alliances are beneficial to firm's performance, another line of research pointed out how strategic alliances may hinder firm's performance. In contrast to past research which was restricted to a specific type of alliance, the monograph investigates a larger range of strategic alliances, including (1) R&D alliances, (2) backward vertical alliances, (3) forward vertical alliances, (4) equity alliances, and (5) licensing agreements. In this monograph, a solid theoretical anchoring on the link between strategic alliances, absorptive capacity, ambidexterity, innovation, and unintended knowledge spillovers that had been missing until now, is provided.

In the following parts, the following five research objects will be presented: strategic alliances as an antecedent (chapter 1), absorptive capacity (chapter 2) and ambidexterity (chapter 3) as moderators, as well as both positive and negative outcomes, such as innovation (chapter 4) and unintended knowledge spillovers (chapter 5). Finally, an empirical study will be presented on the relations between all those concepts (chapter 6).

Chapter 1

Strategic Alliances

1.1. Introduction on strategic alliances

Alliance is described as the pursuit of an activity or goal via a partnership of two or more independent organizations (Hennart, 1988; Williamson, 1985). Strategic alliances are important for industry giants but also for ambitious start-ups (Doz & Hamel, 1998). However, it is essential to highlight the differences between alliances and mergers. Although there are various kinds of alliances, which typically take the form of arm's-length agreements, mergers and acquisitions are instead much more engaging for the stakeholders (Spekman et al., 2000). Dussauge & Garrette (2000) defined a strategic alliance as "an arrangement between two or more independent companies that choose to carry out a project or operate in a specific business area by coordinating the necessary skills and resources jointly rather than operating alone or merging their operations" (Dussauge & Garrette, 2000, p. 99).

Strategic alliances enable collaborative relationships between firms, with the aim to generate value which was not generated independently by the companies (Zajac & Olsen, 1993). Such interfirm connections involve exchange, sharing, or co-development (Gulati, 1995b), which is generated through arrangements between two or more independent companies that opt to carry out a project or operate in a particular business area by coordinating necessary skills and resources instead of operating independently or merging their operations (Dussauge et al., 2000) or which was generated by any voluntarily instigated cooperative agreement between firms involving exchange, sharing or co-development, which may include contributions by partners of capital, technology, or firm-specific assets (Pollock & Gulati, 2007).

Strategic alliances has been very popular in the literature (Gulati & Singh, 1998; Heimeriks & Duysters, 2007; Werner, 2002). Strategic alliances have previously been investigated from different perspectives, such as knowledge transfer (Khazam & Mowery, 1996) innovation (Stuart, 2000), and firm's performance (Singh & Mitchell, 2005). The existing literature, for instance, has investigated strategic alliances, knowledge sharing of partners, and performance and development through collaboration during development (Inkpen, 2002; Mowery & Shane, 2002). Gulati & Singh (1998) delved further, observing five major areas in their research for studying alliances, which are: (a) alliance formation, (b) choosing governance structure, (c) evolution in dynamics, (d) alliance performance, and (e) consequences of performance.

Recent studies call for the use of more inclusive frameworks of analysis in order to capture the variety of reasons why firms involve themselves in alliances more thoroughly and to offer better forecasts in the presence of competing explanations (Duysters et al., 2007; Krammer, 2016; Lin et al., 2009; Wang & Zajac, 2007). Also, the literature of alliances is moving in new directions such as partner selection processes (Dickson & Weaver, 2005; Eisenhardt & Schoonhoven, 1996; Hitt et al., 2000) and the resourced-based view (Das & Teng, 2000; Eisenhardt & Schoonhoven, 1996), towards a more diverse perspective focusing on reputation (Zhelyazkov & Gulati, 2013), alternatives that can be found outside the alliances (Greve et al., 2013), how flexible an alliance is (Bakker & Knoben, 2015), signaling (Reuer & Ragozzino, 2014), experience spillovers (Zollo & Reuer, 2010) and contractual change (Argyres et al., 2007).

The Resource Based View (RBV) theory investigates the competitive advantage of the firm, focusing especially on how their capabilities and resources are difficult to mimic (Barney, 1991; Dierickx & Cool, 1989). Following RBV (Barney, 1991; Peteraf, 1993) and theories of dynamic capabilities (Teece et al., 2009), literature shows that knowledge acquisition aids in creating capabilities through alliances (Anand & Khanna, 2000; Dussauge et al., 2004; Khanna et al., 1998; Mowery et al., 1996; Mowery et al., 1998; Simonin, 1999b, 2004; Spender, 1996; von Hippel, 1998). This relational perspective actually asserts that unlike RBV, competitiveness arises not from the firm, but from the interfirm sources (Dyer & Singh, 1998; Gomes-Casseres, 1984; Lavie & Rosenkopf, 2006; Smith et al., 1995).

From a RBV perspective, knowledge has been essentially considered to be internally generated following the research of Barney (1991) and Penrose (1959). However, a differentiation has been made between the concepts of "knowledge generation" (Spender, 1996) and "knowledge acquisition" (Grant & Baden-Fuller, 2004). Moreover, the activities that use knowledge assets to create value have been classified as "knowledge application" (Spender, 1996) or as "knowledge accessing" (Grant & Baden-Fuller, 2004). As a result, strategic alliances have come to be progressively regarded as vital sources of knowledge (Ahuja, 2000a; Gomes-Casseres et al., 2006; Grant & Baden-Fuller, 2004; Mowery et al., 1996a; Mowery et al., 1998; Powell et al., 1996).

According to Berchicci (2013) and Kavusan et al. (2016), in the last two decades, knowledge-based alliances (KBAs) have observed a notable increase in popularity. Independent organizations experience mutual gain in either transferring or absorbing the partner's knowledge, either for negotiating unique domains (Anand & Khanna, 2000a; Russo et al., 2019) or for enhancing the combined utilization of supportive assets (Lavie et al., 2011). These alliances are usually described as agreements among the organizations. Solid establishment of alliances enhances the possible advantages that firms can get from KBAs (Almeida et al., 2003; Rosenkopf & Nerkar, 2001). In KBA formation, Meier (2011) has studied

how knowledge-based determinants and identity-based drivers undertake individual paths. Moreover, according to Franco & Haase (2015), these studies raise some largely-unresolved questions regarding circumstantial factors and their impact on KBA formation.

On that aspect, Yayavaram & Ahuja (2008) suggest the depth and scope of an alliance, and the knowledge base structure (which also includes other dimensions such as decomposability, malleability, and size). Based on panel data of 1051 firms' complete attention on 197 patent companies in the universal fuel business from 1999 to 2009, Russo et al. (2019) puts forth the notion that the propensity of a firm to develop KBAs is affected by the misalignment among its knowledge depth and scope, and the part it plays in the industry.

Compagnies frequently create partnerships with other companies which can provide knowledge (Inkpen & Dinur, 1998; Yayavaram et al., 2018). This search for external knowledge is especially vital for knowledge intensive industries; for example, resource-constrained biotechnology companies seek to form alliances with external organizations to gain access to a larger amount of knowledge, resources and skills that can provide them with the bases for firm innovation (George et al., 2002; Maurer & Ebers, 2006; Oliver, 2001). KBAs have been accepted as being especially analytical in dynamic and emerging industries, where very few firms would own the required internal knowledge to manage improbabilities with regards to the high rates of technology development (Rosenkopf & Nerkar, 2001; Subramanian et al., 2018). Existing studies also investigated the importance of formally cooperating with developing technological sectors, as previous studies had assumed the knowledge base of firms for the development of KBAs (Preacher et al., 2010; Subramanian et al., 2018). Furthermore, the knowledge scope transfers to a higher capability which helps in forecasting and identifying combinatorial opportunities that are ground-breaking as well as innovative.

1.2. Typologies of strategic alliances

With regards to external sources of knowledge, various types of strategic alliances exist (Gulati & Singh, 1998b; Santoro & McGill, 2005) and can be considered in a continuum between arm's-length transactions and fully integrated solutions (Gulati, 1998; Hagedoorn & Sadowski, 1999; Nielsen, 2002; Santoro & McGill, 2005; Villalonga & Mcgahan, 2005). Based on this, the acquisition of external knowledge may take the form of strategic alliances, such as acquisition (Chaudhuri & Tabrizi, 1999), licensing and contractual agreements (Granstrand & Sjölander, 1990), R&D consortia, and joint ventures (Vermeulen & Barkema, 2001). From a different perspective and depending on the degree of control and commitment, four categories of strategic alliances have been identified, such as contrac-

tual agreement: a) without shared risk, b) with shared risks, c) minority equity positions, or d) joint ventures (Spekman et al., 2000).

The definition of Dussauge & Garrette (2000) covered both equity join ventures and partnerships that do not include the creation of a separate legal entity. This research was then taken forward by van de Vrande et al. (2009). He analyzed the distinction between: corporate venture capital investments, non-equity technology alliances, joint ventures, minority holdings and mergers and acquisitions, offering different governance modes from which firms can choose when confronted with exogenous and endogenous uncertainties (Folta, 1998; Mahoney, 1992; Sutcliffe & Zaheer, 1998). From a different perspective, Culpan (2009) was considering strategic alliances, cooperative ventures, interfirm cooperation, collaborative ventures, interfirm partnerships, networks, coalition, and joint ventures as inter-organizational alliances. Alliances are organized and managed in various ways, Child & Faulkner (1998); Garrette & Dussauge (1995); and Yoshino & Rangan (1995) observed significant different between entirely informal relationships (Kreiner & Schultz, 1993), formal contractual agreements (Reuer & Ariño, 2007), deals involving (sometimes mutual) minority equity investments in partner organizations (Gulati, 1998), or partnerships involving the formation of an equity joint venture (Das & Teng, 2000; Harrigan, 1986; Lyons, 1991).

Franco & Haase (2015) develop an empirically based taxonomy of interfirm alliances, based on a survey of 106 Portuguese manufacturing SMEs. Those SMEs categorized interfirm alliances as "Strategic", "Improvised", "Exploratory" and "Deliberate". This enabled them to monitor the involvement and work culture of their alliance (Franco & Haase, 2015).

1.3. Vertical and horizontal alliances

According to Gulati & Singh (1998), voluntary arrangements between firms typically involves sharing, exchanging or co-developing technologies, products or services. This implication is shown within competitive alliances that can be either in terms of "horizontal" or "vertical" with consumers, suppliers, and other partners. This is also backed by Mitsuhashi & Greve (2009), who proposed that "An alliance is established when two or more organizations mutually see collaboration as beneficial, so organizational goals and external opportunities jointly determine alliance formation" (Mitsuhashi & Greve, 2009, p. 977).

Innovation management literature has remarked multiple times on the importance of networking and collaboration (Chesbrough, 2003; Powell et al., 1996). For example, knowledge transfer and innovativeness are enhanced through collaboration between different types of actors, namely: suppliers (Bidault et al., 1998), customers (Bogers et al., 2010; von Hippel, 1986b), competitors (Gnyawali & Park,

2011; Hamel, 1991), universities (Perkmann & Walsh, 2007; Ponds et al., 2010), and consultants or research centers (Tether & Tajar, 2008).

Jensen et al. (2011) argued that market identity consists of upstream raw-material suppliers, with research labs and universities. Both upstream as well as downstream companies are likely to possess very divergent modes of value creation, knowledge bases, and managerial processes (Isaksson et al., 2016; Robinson & Stuart, 2007). This was explained by Gambardella & McGahan (2010) arguing that the processes of the upstream firms typically possess expertise in narrow, modular technologies, resulting in customer satisfaction following integration by downstream firms. Such a distinction was also made by Hashai (2018) suggesting a "separation of the value chain into three main activities: R&D, operations (including production, assembly, and logistics), and customer-facing activities (including marketing, sales, and customer support)" (p. 1737). Some alliances could include a wider vertical scope, as they include downstream activities like manufacturing or marketing. Therefore, R&D plus manufacturing and/or marketing) will have a wider scope than alliances only including R&D activities.

Firms with a modular pool of knowledge are expected to look for partners with sufficient expertise in different technological fields, which could can be joined with those that their firms already possess (Yayavaram et al., 2018). Additionally, it is mentioned that when the focus of the firm is allotted accurately, the ability to inspect new technological knowledge improves. Investigating 147 Israeli high-technology firms over a 7-year period, Hashai (2018) argued that firms have been outsourcing production, assembly, and logistics activities, which were among the reasons behind their R&D's technological knowledge exploration. Hashai (2018) argued the following "I further find that the outsourcing of production, assembly, and logistics activities is positively associated with the number of R&D partners and with the proportion of integrated marketing, sales, and customer-support activities." (p. 1737).

Cui et al. (2018) have focused their research on horizontal alliances. The composition of the alliance dual-relationship has an impact on the firm's competition against its partner (Cui et al., 2018). However, their results were limited to horizontal alliances in the pharmaceutical industry. For this reason, further research is necessary to acquire more knowledge about the "emerging paradigm of competition by considering the roles of alliance- and industry-specific conditions in the relationship between collaboration and competition" (Cui et al., 2018, p. 3135). More studies are called to thoroughly investigate the dynamics between collaborating partners in strategic alliances.

1.4. Non-equity and equity alliances

At present, there is a rise in collaborative R&D through non-equity alliances as demonstrated by Frankort & Hagedoorn (2019). This trend showed that non-equi-

ty alliances are vital which called for further research on those contracts as the main mechanism for formal governance of the non-equity alliances (Anderson & Dekker, 2005). Several alliances have been formed between the firms, especially between high-tech industries and the biopharmaceutical sector (Devarakonda & Reuer, 2018). The research of Devarakonda & Reuer (2018) also delved into alliance governance by investigating non-equity alliances in its addressal of the challenges linked with knowledge transfers in alliances.

R&D alliances can encounter problems monitoring each other's performance, since knowledge is an intangible asset. As a solution to this issue, the alliance literature has often put forth equity arrangements, which are helpful for aligning the incentives of allies (Williamson, 1991), defining their rights (Grossman & Hart, 1986) and providing hierarchical controls (Gulati & Singh, 1998; Pisano, 1989). Prior research compared equity arrangements to non-equity ones, arguing that the former typically permits a better management of knowledge flows in alliances (Gomes-Casseres et al., 2006; Mowery et al., 1996; Tallman & Phene, 2007).

More trusting partners make the firms less protective of knowledge and tend to obtain more knowledge, lose less knowledge, and be more satisfied. This is also backed by Norman (2004), who asserts that equity alliances are linked with lower levels of knowledge loss and higher levels of satisfaction. Thus, equity arrangements in R&D alliances could take up various other forms, like a minority investment of one firm in its partner or creating a joint venture. In both cases, Ryu et al. (2018) argued that including equity in R&D alliances increase the ability of the firm to decrease knowledge spillovers to rivals located in the same cluster through enhanced monitoring and incentive arrangements. Ryu et al. (2018) supported the following hypothesis by which firms engage in equity-based R&D alliance to limit the risk of partner–rival co-location.

1.5. Types of strategic alliances

1.5.1. R&D alliance

R&D alliances are agreements between partners who opt to exchange, share and co-develop R&D activities, aiming for a cooperative R&D objective (Hagedoorn, 2002; Reuer & Lahiri, 2014). There are multiple sub categories of R&D alliance, for instance, horizontal R&D collaboration with competitors (Ahuja, 2000), vertical collaboration among customers and suppliers (Gulati & Sytch, 2007), and university collaborations (Bercovitz & Feldman, 2007; Gittelman & Kogut, 2003). Temporal alignment is required to be fairly close in order to gain coordination advantages when vertical R&D collaboration takes place. Moreover, existing research conducted by Lavie & Rosenkopf (2006) mentioned R&D alliances as being important knowledge-generating inter-organizational agreements, development ap-

provals, R&D contracts, and joint ventures and research corporations that were cited in their final sample.

Rothaermel & Deeds (2004) argued that institutional alliances are playing a crucial role in the process of how collaborations are created with other partner types. Moreover, in the case of unexpected and fast changes, which often occur – particularly in the technological field – firms attempt to leverage these difficulties by building new competencies while engaging in R&D alliances, as explained by Mitchell & Singh (1996).

1.5.2. Joint venture

According to the literature, there are several advantages when an alliance or joint venture is established (Glaister & Buckley, 1996; Oliver, 1990). Among these, scholars often refer to knowledge creation and flow as a crucial advantage (Dyer & Singh, 1998; Inkpen, 2000; Inkpen & Dinur, 1998; Inkpen & Tsang, 2008; Lane & Lubatkin, 1998; Simonin, 1999a, 2004). According to different authors, learning is perennially a part of the alliances and joint ventures (Kale et al., 2000; Yoshino & Rangan, 1995), which has become progressively more crucial (Grant & Baden-Fuller, 1995; Hamel, 1991; Huber, 1991). Hence, joint-ventures are alliances that can efficiently absorb the technology, tacit knowledge and know-how embedded within organizations (Kandemir & Hult, 2004). Within joint-ventures, firms pursue complementarity among capabilities. According to Hennart (1988), Kogut (1988), and Rothaermel & Deeds (2006), the form of governance of the partnership has a powerful impact on the effectiveness of equity joint ventures (EJVs) or non-equity joint ventures (non-EJVs).

According to Glaister et al. (2003), there is an increasing interest in international joint ventures, as firms are expanding their markets. Companies are increasingly developing international joint ventures, by acquiring new market knowledge and by improving new product development performance (Inkpen & Dinur, 1998; Kwon, 2008; Lambe et al., 2002; Narula & Hagedoorn, 1999; Si & Bruton, 1999; Sinha & Cusumano, 1991). Existing literature indicates that when partner companies in joint ventures have complementary knowledge, they could develop synergies (Berdrow & Lane, 2003; Stafford, 1994). These could translate into new market opportunities for both partners, yielding new propositions regarding product design and development (Yao et al., 2013). Consequently, there is a direct relationship between complementary knowledge resources and new product development performance. Additionally, Yao et al. (2013) suggested that knowledge absorption effectiveness is a crucial mediating factor for connecting knowledge complementarity and new product development performance. Yao et al. (2013) performed empirical research on this topic within the context of 119 international joint ventures in China. This study indicates that knowledge complementarity improves interna-

tional joint ventures' new product performance, and that knowledge absorption effectiveness performs a complete moderating role in this relationship.

1.5.3. OEM

We only acknowledge a few studies on Original Equipment Manufacturers as a very specific case of strategic alliances. For instance, Bernstein & Kök (2009) inspected the OEM investment of dealers in the reduction of costs by evaluating the learning model and acknowledged that "the cost of a component in a given period is a decreasing convex function of the cumulative investment in process improvement achieved by its supplier" (Bernstein & Kök, 2009, p. 552). Moreover, "cost reductions were largely the result of small technical changes in production" (Sinclair et al., 2000, p. 43). This point was discussed by Rust et al. (2002), agreeing that a reduction in costs could be achieved as part of the linearity of innovation. Thus, discontinuous, and incremental innovation simultaneously result in the reduction of costs. Furthermore, Großmann et al. (2016) investigated two equipment manufacturers (OEMs) and one supplier in the automobile industry. It was put forth that patenting and standardizing within this sector could be considered highly important (Großmann et al., 2016). Both the strategies – patenting as well as standardization – have strong potential for knowledge management and knowledge transfer. Thus, the findings demonstrated that OEM A focused mainly on setting up standards and quality and was considered a better application of patents than OEM B, who applied the modular strategy with a variety of brands and devoted more resources to company standardization (Großmann et al., 2016).

1.5.4. Licensing

While licensing has been studied in the field of marketing, it has been much less studied in the field of innovation management. Hermosillaa & Wu (2018) argued that "larger markets also increase the extent of licensing-based cooperation between upstream innovators and downstream commercializes. This cooperation is valuable because it pools firms' complementary capabilities. Thus, downstream market expansions could positively impact innovative outcomes even holding R&D expenditures constant" (p. 980).

1.5.5. University alliances

Dess et al. (2003) and Zahra & Bogner (1999) have discussed the acquisition of learning of external knowledge. For instance, cooperation with research labs and universities in the pursuit of technology exploration is advocated by George et al.

(2002). Mowery & Shane (2002) studied strategic alliances between universities and firms to develop a critical flow of technical knowledge.

According to Belderbos et al. (2016); Bercovitz & Feldman (2007); Cassiman et al. (2009); Cockburn & Henderson (1998); and Zucker et al. (2002), universities and research institutes form a primary source of the latest knowledge. Indeed, the access to new ideas and concepts involving basic fundamental knowledge is often offered by universities and research institutes (Baum, Li. et al., 2000; George et al., 2001). Collaborations with different partners bring new ideas and knowledge to the firm, and innovation is improved through the different types of knowledge, including scientific collaboration (Faems et al., 2005). However, the over-search of knowledge could bring risks, in term of complementarity between the internal knowledge creation and the knowledge created by the scientific collaboration (Laursen & Salter, 2006).

When universities provide scientific knowledge, they enable firms to develop their R&D plans but do not intervene with commercial matters. Additionally, Cohen et al. (2003) state that in manufacturing processes, universities are essential in helping to finish R&D projects which already exist as well as assisting in technical problem solving. Furthermore, Sherwood & Covin (2008) analyzed knowledge acquisition within university-industry alliances, and stated that new products concurrently use internal learning alongside generating external sources of knowledge. Moreover, according to Di Gregorio & Shane (2003), R&D collaboration with reputable universities improves a firm's image and appeal. However, Cassiman et al. (2009) and Zucker et al. (2002) encourage conducting research on the impact of individual faculty members and researchers in knowledge dynamics with other partners, such as firms.

Usually, R&D alliances are created with other companies instead of universities and research institutes (Almeida et al., 2011; Stuart et al., 2007). Furthermore, Almeida et al. (2011) conducted interviews that point that R&D alliances might not draw the attention of scientists because of their formal nature, which decreases the efficiency of the alliance (Almeida et al., 2011). Despite this, R&D alliances with scientists may allow firms to access external knowledge and enhance their innovation processes as well as their capability to successfully take innovations to the market.

Over the last three decades, there has been a global increase in university patenting and licensing (Geuna & Nesta, 2006; Lissoni et al., 2008; Mowery et al., 2004; Siegel & Wright, 2015). Despite many statistics estimating the number of spin-offs or start-ups created and the number of jobs created (e.g. Powers & McDougall (2005) and Van Looy et al. (2011)), there is still a need for further research on the content of licensing agreements and its impact on transfers. Bessy et al. (2002) stated that licensing contracts are heterogeneous, and that their features can have a notable impact on technology transfer performance. Öcalan-Özel & Pénin

(2019) intended to contribute to fill this gap by developing the first empirical research on licensed technology. Two French research universities (University of Strasbourg and University of Grenoble Alpes) were taken into consideration and a dataset of 91 inventions contained in 62 licensing agreements during 2005 and 2014 was gathered. Öcalan-Özel & Pénin (2019) aim to study the determinants of universities' non-exclusive as well as exclusive licenses. A license's degree of exclusivity and the technology transfer performance can be impacted by the characteristics of the licensed invention. In this paper, the authors considered three characteristics of the invention: embryonic versus mature; generic versus specific; appropriable versus easily imitable (Öcalan-Özel & Pénin, 2019). The authors did not support the link between the degree of exclusivity and the characteristics of invention. Furthermore, embryonic inventions are not significantly related to exclusive licenses (Öcalan-Özel & Pénin, 2019).

1.6. Processes

1.6.1. Alliance formation

Various scholars have investigated the reasons behind cooperation in R&D efforts, among others Gulati (1999) and Hagedoorn et al. (2000). They have discovered different motivations for engaging in R&D cooperation, such as getting access to technological resources and capabilities (Teece, 1986, 1992), increasing the speed to market (Powell et al., 1996), reducing the risk and costs sharing (Eisenhardt & Schoonhoven, 1996), and exploring new technological capabilities (Rosenkopf & Almeida, 2003), reducing transaction costs, increasing market power, and acquiring new resources and capabilities (Gulati, 1998). According to the behavioral theory of the firm, sales, financial, innovation and production performance are some explicit, measurable variables that decision makers were found to typically use to establish goals or aspirations (Cyert & March, 1963; Greve, 2008).

Thanks to previous research carried out by Chung et al. (2000); Ranjay Gulati (1995); Powell et al. (2005); Rowley et al. (2005); and Stuart (1998), it has been argued that firms with higher complementarity resources are more likely to engage in strategic alliances. For instance, Mitsuhashi & Greve (2009) supported the following hypothesis: "Organizations are more likely to establish alliances with partners that have complementary mark" (p. 985). They also argue that companies are less likely to ally when the average compatibility of their resources is different (Mitsuhashi & Greve, 2009).

Results of previous studies suggest that companies with similar technologies are more likely to form R&D alliances. Moreover, companies could be required to form alliances to access resources which they do not have; this enables them to satisfy their customer's demands. Mitsuhashi & Greve (2009) supported the fol-

lowing hypothesis: "Organizations are more likely to establish alliances with partners that have compatible resources" (Mitsuhashi & Greve, 2009, p. 979). However, the results found by Mitsuhashi & Greve (2009) cannot be generalized to alliances created for the delivery of a product or service that require the exchange of tangible resources. In addition to this, companies can only be involved in a particular amount of R&D alliances (Almeida et al., 2011; Rothaermel & Hess, 2007; Stuart et al., 2007) which is significantly less than the number of individual level collaborations in a company (Almeida et al., 2011).

Previous studies led by Yayavaram & Ahuja (2008) suggest that partners that possess highly modular knowledge bases or highly integrated knowledge bases are more likely to have a lower innovation performance compared to partners with an intermediate level of knowledge decomposability.

Existing research on strategic alliances has primarily scrutinized how firms with similar knowledge have a tendency to partner up (Mowery et al., 1998; Rothaermel & Boeker, 2008) and how knowledge transfer is accomplished within such partnerships (Lane & Lubatkin, 1998). Yayavaram et al. (2018) argued that "The literature on technological alliances emphasizes that search for knowledge drives alliance formation. It was argued that firms seek partners that are similar in domain knowledge to deepen their knowledge, and partners that are dissimilar in architectural knowledge to broaden their knowledge. Our results indicate that the likelihood of alliance formation increases when two firms are similar in domain knowledge and dissimilar in architectural knowledge." (p. 2277). Additionally, Mindruta et al. (2016) studied the reasons why firms with various research capabilities could end up in strategic alliances.

Between 1990 and 2004, Yayavaram et al. (2018) conducted a study based on 192 semiconductor companies and their partners in technology alliances. The authors argued that "the likelihood of alliance formation between two firms increases with an increase in the degree of similarity in domain knowledge as well as an increase in the degree of dissimilarity in architectural knowledge between them" (Yayavaram et al., 2018, p. 279).

Krammer (2016) argued that the corporate and technological diversification of firms and their degree of relatedness in terms of products and technologies will have strong consequences on their capacity to form technological alliances. Therefore, higher levels of diversification and higher degrees of relatedness signal superior capabilities and available resources to prospective partners, which will make the exploration and exploitation of technological assets in an alliance easier to process. The previous investigation found that complementarity leads to exploitative interactions and that similarities between partners leads to explorative interactions.

Speaking of rapid technological advancements, technological discontinuities produce first and second order consequences on alliance termination and formation (Asgari et al., 2017). Their findings support the effect of exogenous techno-

logical discontinuities on the formation and termination of alliance portfolios (Asgari et al., 2017).

Additionally, most of the studies in alliance literature agree on the importance of firm specifics in the creation of strategic alliances. For instance, according to Powell et al. (2005), organizational features have a direct impact on the possibility of alliance creation and the particular unions they may create. For instance, firm size affects the degree of technology production and sharing (Bayona et al., 2001; Gambardella et al., 2007; Miotti & Sachwald, 2003), and may, as such, also impact innovation. Big companies are able to attract highly skilled employees, and they also possess more financial and R&D resources than small companies. However, small companies are highly flexible and creative, which allows them to adapt to changing environments easier than big organizations (Damanpour, 1992). Stuart et al. (2007) and Mindruta et al. (2016) suggest the use of the natural logarithm of the number of employees to normalize the distribution of this variable.

There is a need to study how and why firms with different resources and capabilities decide to form a strategic alliance. Moreover, previous research has focused on the biopharmaceutical industry, tested via using matching games as an estimator, the best partner selection criteria for firms. Mindruta et al. (2016) considers two variables: The firm size and the number of prior alliances, obtained by measuring the number of times each firm had an alliance in the previous 10 years.

Tyler & Caner (2016) affirm that the firm size (number of employees in the firm), the firms' patent stock & partner patent stock (Arora & Gambardella, 1990; Patel & Pavitt, 1997; Reuer & Lahiri, 2014), and technology breadth (Deeds & Rothaermel, 2003) have a great impact on the number of R&D alliances. Studying data gathered based on firms with SICs 2833 through 2836 from the U.S biopharmaceutical industry using patent and alliance data from 201 small biotechnology firms during the period 1996–2010, Tyler & Caner (2016) investigated the effect of new product introduction (NPI) – below aspiration levels – in R&D alliance formation, and identified the positive impact of slack as a moderator that enhances the relationship between NPI below aspiration levels and R&D alliances creation (Tyler & Caner, 2016).

1.6.2. Partner matching

A good partner selection is essential for increasing the value created through synergies between the alliance (Ahuja et al., 2009; Alcacer et al., 2009; Hitoshi Mitsuhashi & Greve, 2009). Mindruta et al. (2016) raised the following "whom to ally with" (Mindruta et al., 2016, p. 206). Furthermore, several studies have consistently demonstrated how alliances are a crucial mechanism to enhance the performance of a firm. So far, there is no research that affect the impact of matching in alliances on the results of a company.

Matching theory has been customarily used in the fields of economy and sociology with the objective of analyzing the relationships between the employer and employee (Fujiwara-Greve & Greve, 2000; Hannan, 1988; Logan, 1996; Simon & Warner, 1992). For instance, Sarkar et al. (2001) demonstrated that resource complementarity has a positive impact on managers' evaluations of cooperative project performance. This has been followed by a study by Mitsuhashi & Greve (2009) scrutinizing a matching model of alliance creation, by which companies perform alliances to benefit from heterogeneous resources being acquired from other companies.

Mindruta et al. (2016) discuss the concept of "pair-specific" attribute and argued that "complementarity in partner attributes is a necessary condition for alliance formation, but not sufficient for how partners are selected." (Mindruta et al., 2016, p. 207). Mitsuhashi & Greve (2009) raised the following issue: "Because of the complexity of predicting alliance consequences and constraints that managers face in finding appropriate partners with high levels of match on multiple criteria, managers may use incorrect matching criteria, leading them to form alliances that reduce firm performance" (Mitsuhashi & Greve, 2009, p. 980). Mitsuhashi & Greve (2009) analyzed 559 new alliances between 137 shipping line operators distributed among 37 different countries. Mitsuhashi & Greve (2009) argued that the resource complementarity and the market complexity both represent crucial matching criteria. However, differing from their expectations, networked firms have better match quality compared to isolated firms. Finally, the authors showed that survival chances and performances are greater when allying with matching partners.

1.6.3. Alliance portfolio diversity

Past studies indicate that developing a diverse alliance portfolio is a crucial strategic concern (Faems et al., 2003; Hoffmann, 2007; Jiang et al., 2010; Lee et al., 2017). Furthermore, the fast-changing innovation environment is becoming more complex, time-consuming and needs more financial resources. Therefore, this context creates the need for firms to create a diverse and coordinated portfolio of inter-organizational alliances to improve innovation (Lahiri & Narayanan, 2013; Zheng & Yang, 2015).

The three major topics recognized in alliance portfolios literature are: The emergence, configuration, and management of alliance portfolios (Wassmer, 2010). However, the development of alliances after their formation requires some further studies (Ariño & Ring, 2010; Gulati et al., 2012; Marion et al., 2015).

Technological discontinuities can result in new alliances, changes, and even the ending of existing alliances. As a result, new alliances provide access to new resources that are needed when such discontinuities take place. Exploring this,

Mindruta et al. (2016) discussed the complementarity and substitution effect. Firstly, complementarity strengthens the values and resources of firms through the combination of co-specialized assets because of the alliance formation. Mindruta et al. (2016) further argued that "Complementarities in partner attributes represent an important question in the strategic alliances literature, since value creation in alliances is contingent on them" (Mindruta et al., 2016, p. 226).

The coordination of the entire alliance portfolio of a company enables it to identify interdependences between individual alliances. According to Bamford & Ernst (2002) and Hoffmann (2005), this prevents repetitive activities and also generates synergies between the individual alliances. Thus, an alliance portfolio will have a significant, positive effect within the company, provided managers can identify and generate these synergies among individual alliances (Bamford & Ernst, 2002; Dyer & Nobeoka, 2000). Also, coordinating alliances will allow the allotment of valuable and limited resources to strategic alliance projects that provide high benefits at low risk levels. Furthermore, Hoffmann (2005) analyzes the huge variety of synergies possible among several alliances.

In addition to this, the researchers found that instead of directly affecting alliance performance, the manager could enhance the alliance portfolio by having good codification processes. "Through the creation of guidelines and manuals the alliance department codifies important alliance know-how that is then spread throughout the company. The alliance department can serve as a collector of lessons learnt over various alliances and units" (Sluyts et al., 2011, p. 882). "Creating a knowledge base within the firm on how alliances can be managed most effectively significantly helps to improve the alliance outcomes of the firm" (Sluyts et al., 2011, p. 883). At the beginning, the authors analyzed the alliance capability of a company and ignored its alliance partners. According to them, studying partner matching in dyadic research will lead to noteworthy research. They argued that a centric alliance can be aided by the "fit" between partners when considering their alliance management capability. Therefore, the scenario presented is that either both the companies need to have top level alliance capability to succeed in the alliance, or that one company with all capabilities can support the other. For some other "fit" measures which are usually used for alliance research (cultural fit), it can be substantially proven that alliance management can explain the alliance performance (Sluyts et al., 2011).

Alliance portfolio diversity is currently attracting the attention of scholars. Few authors studied the portfolio diversity as well as the outcomes of its execution (Faems et al., 2005; Hagedoorn et al., 2018a; Hashai et al., 2015; Jacob et al., 2013; Jiang et al., 2010; Lahiri & Narayanan, 2013; Parmigiani & Rivera-Santos, 2011; Rothaermel & Deeds, 2004; Wuyts et al., 2012). For instance, Belderbos et al. (2018) conducted an in-depth exploration highlighting that the continuation and discontinuation of collaboration should be further investigated. They revealed that due

to the wide contrasts across different partner types, temporal alignment is crucial to achieve complementarity.

From the knowledge distribution scope, alliances with different firms with a high scope of knowledge distribution could enhance the problem-solving stock of a firm, thereby increasing the likelihood of recognizing new combinations that enhance innovation performance as demonstrated by Grant & Baden-Fuller (2004) and Lakhani et al. (2013). Thus, Hagedoorn et al. (2018) propose that a higher scope of external knowledge distribution inside an industry improves the benefits of partner type diversity on a company's innovation performance. Hagedoorn et al. (2018) supported the following hypothesis: "The scope of knowledge distribution in the external knowledge environment positively moderates the inverted U-shaped association between partner type variety in a firm's alliance portfolio and firm innovation performance" (p. 819).

Innovation performance can be impacted by partner type diversity and the way the resources and capabilities complement the firm's existing ones (Belderbos et al., 2004; Duysters & Lokshin, 2011; Faems et al., 2005; Nieto & Santamaría, 2007). As temporal alignment among R&D alliances is required for acquiring the benefits of complementarity, Lavie et al. (2011) describe how merging R&D alliances with the different partner types is advantageous, as it scrutinizes already-existing collaboration portfolios to become vital precursors. Furthermore, the impact of alliance portfolio diversity on innovation has been a focus of study within high-tech companies (Stuart, 2000), wherein a group of different partners helps companies to balance their own lack of resources and to keep them updated regarding technological developments (Degener et al., 2018). Indeed, Degener et al. (2018) performed research within the context of German biotechnological firms. The information they used from surveys and databases indicated that all of the alliance management capabilities which were studied had a positive relationship with portfolio diversity in order to promote innovation.

Furthermore, Lee et al. (2017) argue that to enhance their competitive advantage, companies typically develop a diverse portfolio of inter-organizational partnerships. From existing literature which investigated many performance results, it was argued that the performance results were associated with alliance portfolio diversity. This is backed up by Jiang et al. (2010), who defined alliance portfolio diversity as the variety level of the resources, skills and knowledge of the alliance partners.

Even though the literature suggests that partner type diversity in alliance portfolios has an effect on firm performance, a research gap remains regarding the characterization of partner type diversity. For instance, previous research has studied different types of diversity (Jiang et al., 2010; van de Vrande, 2013). A few years later, Hagedoorn et al. (2018) contributed to the existing literature by arguing that several dimensions exist within the same type of diversity, for instance the dimen-

sion of partner type relevance, which was analyzed in their paper and its effects on innovation performance.

1.6.4. Alliance experience

According to previous research conducted by Gulati (1995), Heimeriks & Duysters (2007), and Kale et al. (2002), alliance experience strongly matter in the creation of new alliances. Based on the work of Reuer, Park, et al. (2002), Draulans et al. (2003), Heimeriks & Duysters (2007), and Sampson (2005), we define alliance experience by the amount of times a firm has previously participated in strategic alliances.

Shan et al. (1994) was already arguing that most studies propose mixed results with regards to alliance experience having a direct impact on alliance outcome. As a result, some studies have stressed the positive relationships, while others show that there are no fixed returns to alliance experience (Rothaermel & Deeds, 2006).

Some studies showed that the relationship between alliance experience and performance was positive and significant (Anand & Khanna, 2000b; Rothaermel & Deeds, 2006; Sampson, 2005). In their empirical study, Rothaermel & Deeds (2004) suggest the existence of a relationship between alliance experience and innovation from their empirical study of bio-tech firms. Additionally, there is a relationship between the alliances these bio-tech firms have formed and the performance of alliances. Additionally, the direct impact of alliance experience was tested on performance, which showed a positive relationship (MacKenzie et al., 2005).

However, Sluyts et al. (2011) only report a limited effect. In some other studies, the effect of alliance experience on alliance outcome appeared to be non-significant. For instance, according to Draulans et al. (2003), an increase in alliance experience does not necessarily entail improved alliance performance. Draulans et al. (2003) conducted their research via seven different individuals from an inter-organizational technology consortium, who occupied key roles within this consortium and had considerable knowledge regarding the development and activities of the organizations involved. In this research, data was collected through exploratory, open-ended interviews. Through this method of data gathering, along with the information from the interviews, proceedings and newsletters from the consortium, the authors were able to implement phone interviews of about 60 minutes from a semi-structured questionnaire. The authors also measured the construct "perceived alliance effectiveness" of every actor's perception of consortiums as the difference in ratings between the potential and the realized performance of the consortium. In addition, the study of Rothaermel & Deeds (2004) failed to support the relationship between experience and alliance capability. Consequently, the relationships between alliance capability, performance and experience remain unclear.

1.6.5. Alliance management capability

Schilke & Goerzen (2010) consider alliance management capability as a second-order construct, used to investigate the extent to which organizations process relevant management routines that enable them to manage their strategic alliance portfolio. Furthermore, the authors opine that this knowledge has an effect on performance through five underlying routines: Interorganizational learning, interorganizational coordination, alliance portfolio coordination, alliance transformation, and alliance proactiveness. The result of this study is that alliance management capability generates positive outcomes on alliance portfolio performance and moderates the performance effects of dedicated alliance structures and alliance experience. According to Sluyts et al. (2011), alliance performance is affected by alliance management capability. Furthermore, it was argued that the top manager's commitment was the most vital factor while explaining the success of the alliance (Sluyts et al., 2011). There is also a positive effect of alliance function on performance (Dyer et al., 2001; Hoffmann, 2005; Kale et al., 2002; Spekman, 1988).

According to research on dynamic capabilities carried out by Eisenhardt & Martin (2000) and Zollo & Winter (2002), alliance management could be regarded as a unique dynamic capability, referring to a group of organizational routines which constitute dynamic capabilities (Helfat et al., 2007; Teece, 2007b; Zahra et al., 2006). This is backed up by existing research, which argued that alliance performance massively varies among firms (Anand & Khanna, 2000). Firms' specific dynamic capabilities explain the success of their alliance management (Kale et al., 2002; Reuer & Ragozzino, 2006). Despite learning processes varying among different firms and industries, companies will enhance their learning effectiveness to the extent that they gain experience.

Similarly, Sampson (2005) displayed that alliance management results could change when firms participated in mixed organizational forms. When a firm gains a wide range of experiences with allies, it will be able to better assess the effectiveness of its alliances. Furthermore, with every different alliance managed by a firm, it can evaluate the effectiveness of its methods of exchanging knowledge with industry partners. This could result in new organizational processes that aid the coordination between allies (Hoang & Rothaermel, 2005).

1.6.6. Learning

Alliances are considered to be strong sources of new knowledge, in which partners may learn from each other's knowledge by implementing alliance activities (Inkpen, 1998; Inkpen & Tsang, 2008; Kale et al., 2002). Additionally, there are diverse streams of literature growing within the field of learning, such as the following question: How partners manage knowledge within the alliance (Inkpen, 2002;

Khanna et al., 1998; Martin & Salomon, 2002; Tiemessen et al., 1997; Zeng & Hennart, 2002).

Another stream of strategic alliances can be derived from the works of Frankort (2013); Frankort et al. (2012); Gomes-Casseres et al. (2006); Mowery et al. (1996); Oxley & Wada (2009); and Rosenkopf & Almeida (2003), who stated that as a consequence of R&D strategic alliances, intended technological knowledge spillovers and learning are improved. Empirical findings suggest that learning and knowledge spillovers vary subject to the type of alliance (Hagedoorn, 1993; Hamel, 1991; Inkpen, 2000; Inkpen & Dinur, 1998; Yang et al., 2015).

Mutual learning is the primary purpose of strategic alliances (Grunwald & Kieser, 2007). Additionally, reciprocal learning alliances have been investigated by Lubatkin et al. (2001). Learning can be defined as the acquisition of external knowledge that can be used for future actions, similar to what some call "double-loop learning" (Argyris & Schön, 1978) or "higher-level learning" (Fiol & Lyles, 1985). Indeed, collaborations between firms helps firms to not only acquire but also absorb external knowledge (Hamel, 1991; Kale et al., 2000). As a result, there is a difference between alliances as a means of learning (knowledge generation/acquisition), and alliances to generate value (knowledge application/accessing).

Being involved in an alliance can be an effective learning method. It permits partner firms to share knowledge that is not easily accessible through market transactions (Liebeskind et al., 1996; Muthusamy & White, 2005). Furthermore, Howard et al. (2016) argue that being part of an alliance offers firms the opportunity to expand their experience in managing external collaborations and to learn from the processes and technologies of the other part. The literature on alliance learning has primarily emphasized antecedents that either increase or reduce knowledge learning.

Based on their empirical studies on the cross-citation rate, Schildt et al. (2012) supported the following hypothesis: "The rate of learning in alliances follows an inverted U-shaped relationship over time" (p. 1158). Subramanian et al. (2018) analyzed strategic alliances and inter-firm learning for small firms with limited resources, and they argued that there is an inverted u-shaped relationship between technological distance and inter-firm learning. They also argued that the knowledge base homogeneity between partners moderates such relationships.

Inkpen (2002), evaluating the ways in which knowledge transfer is feasible between strategic alliances, emphasized the analysis and learning of knowledge, characteristics, relationship, and alliance form based on an empirical analysis that scrutinized 227 alliances in the manufacturing industry in three continents (Europe, North America and Asia) from 1952–1996.

Turning the topic to internal collaborations, they can also improve through external alliances. Howard et al. (2016) concluded after their study that after small biotechnology firms formed close R&D alliances with large pharmaceutical com-

panies, the degree of internal collaboration among scientists in the small companies would substantially go up. In addition, the results found by the authors extends the scope of the possible benefits that alliances might have for firms. New firms that have a close social relationship with expert firms during R&D alliances are able to develop considerably greater collaborations between their own researchers (Howard et al., 2016).

Strategic management literature has mainly studied the inter-organizational learning generated in alliances (Hamel, 1991; Inkpen, 2002; Powell et al., 1996). Several papers have demonstrated that alliances are a method to obtain diverse knowledge, and that they can have a vital impact on a firm's innovation (Bercovitz & Feldman, 2007; Colombo et al., 2006; Hohberger, 2014; Inkpen, 2002; Rosenkopf & Almeida, 2003; Stuart & Podolny, 1996).

Few studies, however, have emphasized the effect of learning on innovation; an exception to this could be Yli-Renko et al. (2001). A second exception could be Simonin (1999), who draws a connection between knowledge outcomes, learning and innovation, thereby widening the scope of the existing literature which has typically only measured the degree of knowledge transfer. Despite that, it is noted that the literature on alliances has not systematically focused on the connection between learning and innovation (Easterby-Smith et al., 2008; Van Wijk et al., 2008).

To best benefit from strategic alliances and to learn, firms should develop a sufficient degree of absorptive capacity, prior to the development of strategic alliances. As a moderator, absorptive capacity therefore affects the relation between the engagement in strategic alliances, and the outcomes.

Chapter 2

Absorptive Capacity

2.1. Introduction to Absorptive Capacity

The work of Cohen & Levinthal (1990) is based on industrial organization theory and they define absorptive capacity as "the ability to recognize the value of new external information, assimilate it and apply it to commercial ends" (Cohen & Levinthal, 1990, p. 128). Cohen & Levinthal (1990) were inspired by Tilton (1971) arguing that "an R&D effort provided an in-house technical capability that could keep these firms abreast of the latest developments in semiconductor developments and facilitate the assimilation of new technology developed elsewhere" (Tilton, 1971, p. 71).

A decade after the seminal paper by Cohen & Levinthal (1990), Zahra & George (2002) came up with a new definition of absorptive capacity as "a set of organizational routines and processes by which firms acquire, assimilate, transform, and exploit knowledge to produce a dynamic organizational capability" (Zahra & George, 2002, p. 186) that strongly shaped the field of absorptive capacity, along with three other papers. Indeed, Lane et al. (2006) identified four papers that extend or refine the construct of absorptive capacity: Dyer & Singh (1998), Lane & Lubatkin (1998), Van den Bosch et al. (1999) and Zahra & George (2002).

In line with the seminal work of Cohen & Levinthal (1990), Lane et al. (2006), considered absorptive capacity as a process defined as "a firm's ability to utilize externally held knowledge through three sequential processes: (1) recognizing and understanding potentially valuable new knowledge outside the firm through exploratory learning, (2) assimilating valuable new knowledge through transformative learning, and (3) using the assimilated knowledge to create new knowledge and commercial outputs trough exploitative learning" (Lane et al., 2006, p. 856). Lane et al. (2006) conducted a systematic literature review of 289 articles from 14 journals (1991–2002) to re-examine absorptive capacity studies' contribution. Lane et al. (2006) argued that 78% of reviews use the idea of absorptive capacity from Cohen and Levinthal with hardly any discussion.

2.2. Existing studies and research gaps

Based on the seminal work of Cohen & Levinthal (1990), many theoretical studies (Grunfeld, 2003; Lane et al., 2006; Todorova & Durisin, 2007) and empirical studies (Jansen et al., 2005; Stock et al., 2001; Tu et al., 2006; Vinding, 2006) were

conducted. Studies have been conducted in different fields, such as strategic management (Lane & Lubatkin (1998) and Nahapiet & Ghoshal (1998)), technology management (Schilling, 1998), international business (Kedia & Bhagat, 1988), and organizational economics (Glass & Saggi, 1998).

Lane et al. (2006) stated that there is a requirement for further research to merge absorptive capacity into a broader process-oriented perspective through the efficient deployment of business knowledge, managerial techniques, and marketing and manufacturing know-how. Furthermore, Omidvar et al. (2017) argued that, "extant research remains inadequate in explaining and understanding several AC aspects. First, most AC research has focused on single organizations or dyadic relations. At the same time, there is a dearth of research on how AC develops when multiple organizations are involved, and various types of expertise prevail" (p. 665). Consequently, there is a need for further research investigating multiple organizations.

Existing studies suffer from the cross-sectional research design and from the study of a single organization or dyadic relations. Schildt et al. (2012) argue that the cross-sectional study design is not ideal for determining the short- and long-term results of the three components of absorptive capacity. Hence, causality cannot be concluded because all constructs were measured at one specific moment in time (Schildt et al., 2012). Consequently, and following Schildt et al. (2012), there is a need for longitudinal research design. Lyles & Salk (1996) and Park (2011) have reported that academic learning could be constrained by the lack of ACAP by companies in non-developed economies. Consequently, studying absorptive capacity in developing countries is an important avenue for further research (Lyles & Salk, 1996; Park, 2011).

Cohen & Levinthal (1990) first introduced absorptive capacity using an organizational unit of analysis – at the firm level. ACAP is inspired by the presence of knowledge and spillovers within an industry. This is in line with Nelson & Winter (1982) who privileged technical expertise as a collective good: "the possession of technical 'knowledge' is an attribute of the firm as a whole, as an organized entity, and is not reducible to what any single individual knows, or even to any simple aggregation of diverse competencies and capabilities of all the various individuals, equipment and installations of the firm" (Nelson & Winter, 1982, p. 65). Nelson & Winter (1982) considered patterns of activity or routines entailing both individuals and groups. Collective mobilization of knowledge have been documented, using different terms such as "collective mind" by Weick & Roberts (1993), "collective memory" by Olick (1999), "collective competence" by Boreham (2004), "collective learning" by MacKinnon et al. (2002), "organizational schemas" by Labianca et al. (2000), "organizational memory" by Walsh & Ungson (1991), and "organizational cognition" by Alavi & Leidner (2001). In the specific field of ACAP, the majority of studies used an organizational unit of analysis

like Szulanski (1996) for instance studying multiple firms, followed by Ferreras-Méndez et al. (2016), Heil & Enkel (2015) and Ritala & Hurmelinna-Laukkanen (2013) among others.

2.3. Potential and realized Absorptive Capacity

Teece et al. (1997) argues argue that dynamic capability allows firms to reorganize their resources to the changes taking place in the market to earn a competitive advantage. As a result, individual firms' performance varies inside an industry based on their use of organizational resources and capabilities (Spender, 1996; Teece et al., 1997).

As a dynamic capability, Zahra & George (2002) defines absorptive capacity as follow: "a set of organizational routines and processes by which firms acquire, assimilate, transform, and exploit knowledge" (Zahra & George, 2002, p. 186). Indeed, Zahra & George (2002) examined four absorptive capacity dimensions: acquisition, assimilation, transformation, and exploitation. (1) The acquisition of external knowledge influences absorptive capacity in terms of intensity, speed, and direction. (2) Assimilation is the process of analysis, interpretation, and understanding of information, and it can be related to the variable of absorption. (3) Transformation is the capacity to handle compositeness between existing and new knowledge. (4) Exploitation refers to the application of knowledge.

Zahra & George (2002) initiated the distinction between potential absorptive capacities (PACAP) and realized absorptive capacity (RACAP). PACAP is composed of acquisition and application, while RACAP is composed of transformation and application. Thus, PACAP makes external knowledge available (Ahuja & Katila, 2001; Crescenzi & Gagliardi, 2018; Schweisfurth & Raasch, 2018), but this is not a knowledge that will bring innovation to the organization (Kotabe et al., 2011; Yi & Gong, 2013). According to Mueller et al. (2012), the transformation and exploitation components of RACAP allow firms to better the internal processes that increase the identification and commercialization of various potential innovation alternatives.

Potential absorptive capacity (PACAP) is "a path-dependent capability that is influenced by [a firm's] past experiences that are internalized as organizational memory" (Zahra & George, 2002, p. 193). It encompasses two capabilities: acquisition and assimilation (Zahra & George, 2002). Acquisition refers to the firm's ability to identify, value, and acquire relevant externally generated knowledge (Cohen & Levinthal, 1990; Lane & Lubatkin, 1998). Assimilation describes the capability to analyze, comprehend and assimilate knowledge acquired from external sources (Zahra & George, 2002).

Realized absorptive capacity (RACAP) includes two capabilities, transformation and exploitation, which determine the firm's ability to utilize external knowl-

edge that has been acquired (Zahra & George, 2002). Transformation refers to the firm's ability to combine existing and assimilated knowledge (Zahra & George, 2002). This entails a process of "bisociation" whereby an idea is perceived in "two self-consistent but incompatible frames of reference" (Koestler, 1966, p. 35). Exploitation describes the ability to incorporate knowledge which has been acquired, assimilated, and transformed into the firm's operations (Zahra & George, 2002). It is exploitation capabilities that enable firms to convert acquired knowledge into new products and processes (Kogut & Zander, 1996).

Consequently, PACAP characterizes the effort made by a firm to identify and assimilate external knowledge, whereas RACAP characterizes how knowledge is transformed into operations (Jansen et al., 2005; Zahra & George, 2002). Furthermore, Zahra & George (2002) clearly described that PACAP impacts more in long-term projects' implementation, while RACAP has a powerful effect on short-term projects' performance (innovation). According to Zahra & George (2002), the transformation process from PACAP to RACAP enables developing innovative ideas and exploiting acquired knowledge with the right time-to-market (Zander & Kogut, 1995). However, the positive causality between PACAP and RACAP did not reach a scientific consensus and requires further studies.

Jansen et al. (2005) was the first to fuel such a debate. Jansen et al. (2005) used six items to measure knowledge acquisition, three items to measure assimilation, six items to measure transformation, and six items to measure the exploitation of new external knowledge. Moreover, Jansen et al. (2005) used control variables such as unit size, branch size, and unit age to impact knowledge acquisition and exploitation. The findings from Jansen et al. (2005) suggest the existence of a negative relation between PACAP and RACAP. Indeed, Jansen et al. (2005), argued that stressing PACAP by obtaining and assimilating external knowledge could prove counterproductive due to the costs involved, preventing them from capturing all the potential of exploitation. Jansen et al. (2005) further argued that a firm focusing on RACAP by transforming and exploiting knowledge could put an emphasis on on short-term profits and may neglect the renewal of their knowledge base.

In line with Jansen et al. (2005), Cepeda-Carrion et al. (2012) analyzed the positive effect of absorptive capacity on innovativeness in the specific case of Information Systems in 286 large Spanish firms. They used the distinction between PACAP and RACAP. However, the authors argued that both concepts are very dissimilar that cannot be taken jointly and that "while potential absorptive capacity requires change, flexibility and creativity, realized absorptive capacity requires order, control and stability". Hence, Cepeda-Carrion et al. (2012) proposed that "an unlearning context and an information systems (IS) capability are required to maintain an appropriate balance between potential absorptive capacity and realized absorptive capacity" (Cepeda-Carrion et al., 2012, p. 111).

In contrast to what argued Jansen et al. (2005) and Cepeda-Carrion et al. (2012), the findings from Daspit & D'Souza (2013) indicate that there is a positive connection between the capabilities to (1) acquire and assimilate knowledge, (2) assimilate and transform knowledge, and (3) transform and exploit knowledge. Lastly, Daspit & D'Souza (2013) conclude that there is a positive relationship between absorptive capacity and a firm's performance.

Jiménez-Barrionuevo et al. (2011) operationalize the measure of both potential and realized absorptive capacity. In line with Zahra & George (2002) and Filippini et al. (2012) argued that it is essential to distinguish potential from realized absorptive capacity. Using such distinction, Ebers & Maurer (2014) studied the impact of absorptive capacity on innovation and organizational performance and based it on their empirical study on 218 inter-organizational projects in Germany. They argued that potential and realized absorptive capacity are distinct and complement each other.

Leal-Rodríguez et al. (2014) argued that both PACAP and RACAP lead to innovation. The implementation of routine is crucial to ensure the integration of new knowledge into the existing knowledge base. Furthermore, Leal-Rodríguez et al. (2014) investigated how firms recognize relevant knowledge, capture it and incorporate it to gain from innovation. From their study of 110 Spanish automotive components manufacturers, Leal-Rodríguez et al. (2014) argued that RACAP acts as a mediator between PACAP and innovation outcomes.

In some other empirical studies, these is the association of PACAP and RACAP that are studied. Sciascia et al. (2014) argued that the entrepreneurial orientation (EO) has a positive effect on firm performance. However, it occurs only when both PACAP and RACAP are associated. With regards to RACAP, the search and recombination process have effects on innovation. Moreover, Savino et al. (2017) performed a systematic literature review and stated that "the variety and diversity of knowledge elements are critical in creating breakthrough innovations" (Savino et al., 2017, p. 1). Based on these results, Savino et al. (2017) request more contribution to scrutinize how recombination and search dynamics occur in SMEs.

Distinguishing PACAP from RACAP improve the understanding of the relations, antecedents, and outcomes of both components. Literature in these two distinctions suggests the iterative process that a firm must undertake when acquiring new knowledge to create value (Camisón & Forés, 2010). However, the relation between PACAP and RACAP requires further studies as Savino et al. (2017) and Crescenzi & Gagliardi (2018) argued.

Additionally, according to Corso et al. (2001), there is a need for longitudinal studies to establish causality and to understand the temporal and sequential impacts of absorptive capacity. Hence, there is no evidence on how firms may benefit from previously spilled knowledge and take it as an opportunity to improve their performance and profit from their innovations in a long-term view.

2.4. Organizational recognition

While most studies on ACAP focus on the distinction between PACAP and RACAP, scholars tend to forget that the recognition precedes the acquisition and assimilation of knowledge as the two components of the PACAP. According to Cohen & Levinthal (1990), the first original component of ACAP is the recognition, followed by the assimilation and the application. Therefore, knowledge recognition involves searching, identifying, and valuing novel external knowledge. Moreover, Cohen & Levinthal (1990) argued that previous scientific and technical expertise is necessary to value new external knowledge. Indeed, firms with strong absorptive capacities are more likely to be proactive and sense and seize external opportunities. Organizations with high absorptive capacity could examine previous related knowledge, partner-specific absorptive capacity, knowledge similarities, routines interactions, frequency, and other factors (Dyer & Singh et al., 1998).

The intensity of a firm's efforts to develop absorptive capacity is partly determined by "activation triggers" which encourage the firm to prioritize the acquisition of new knowledge (Zahra & George, 2002). Such triggers often emerge in the form of crises that force the firm to intensify its efforts to learn new skills and seek external knowledge (Huber, 1991; Kim, 1998). According to Doz et al. (2000), the nature of the trigger will affect the content and direction of technological search. For example, in the case of a radical technological shift in the industry, a firm will likely invest in acquiring specific knowledge relevant to the new technology (Rosenkopf & Nerkar, 2001).

Recognition capacity is related to open innovation activities and the set of actions referring to the scanning of external markets and technologies (Chen et al., 2011; Chesbrough & Crowther, 2006), searching widely and thoroughly across external knowledge sources (Laursen & Salter, 2006), external technology and trend scouting, road mapping, and R&D mining (Caetano & Amaral, 2011; Ili et al., 2010; Porter & Newman, 2011). Others activities include evaluating external innovation and sources (Chiaroni et al., 2011), identifying fit with the firm's core businesses (Chesbrough & Crowther, 2006), recombining firm's resources with partners (Almirall & Casadesus-Masanell, 2010), and valuating unsolicited external ideas and proposals (Alexy et al., 2011).

Past studies regarding the significance of open innovation on absorptive capacity have acquired mixed results about the conclusions of open innovation, proposing positive, curvilinear, and even negative relationships between openness and innovation performance (Cheng & Huizingh, 2014; Du et al., 2014; Knudsen & Mortensen, 2011; Laursen & Salter, 2006). The open innovation activities and actions related to this component connect employees with external knowledge sources (Foss et al., 2011). This includes the assignment of new roles and responsibilities such as boundary spanners (Chiaroni et al., 2011; Holmes & Smart, 2009),

coordinating and synchronizing external innovation resources (Du Chatenier et al., 2009).

Using the firm-level as the unit of analysis, the empirical study of Zobel (2017) supported the hypothesis by which "Recognition capacity is positively associated with external technological resource access" (p. 274). Thus, the recognition capacity has a positive relationship with the acquisition of external knowledge. Still, she argued that the recognition capacity does not have a direct link with the competitive advantage a firm (Zobel, 2017) which require further studies.

Indeed, Zobel (2017) proposes a positive but indirect link between external technological knowledge access and a competitive advantage in product innovation. The results indicate that the technology-oriented capabilities of the company fully mediate this relationship. Firms can capture value from open innovation by transforming acquired external knowledge into firm-specific technology-related capabilities. These results are adjusted according to the extended resource-based view perspective (Lorenzoni & Lipparini, 1999; Zander & Zander, 2005). Connecting open innovation to absorptive capacity literature (Zahra & George, 2002) shows that the three components of absorptive capacity allow and condition the level to which companies benefit from open innovation.

According to Sidhu et al. (2007), company innovativeness is based on three searches: demand-side search, supply-side search, and spatial search. Despite this research discussion about the importance of need knowledge, it acknowledges some information about how companies can transfer needed need knowledge crossing boundaries and use it for innovation (Priem et al., 2012). Whether a firm can absorb knowledge about consumers and competitors or not is based on previous research of the market (Jiménez-Castillo & Sánchez-Pérez, 2013). Thus, Murovec & Prodan (2009) stated that the demand-pull absorptive capacity that aims to gather information from competitors and consumers. There is also science push absorptive capacity, which seeks input from institutions like universities and research centers. Such pull and push deliver innovation to the company.

2.5. Organizational acquisition

Acquisition is the first element of absorptive capacity, out of four, according to Zahra & George (2002). Following Szulanski (1996) and Zahra & George (2002), acquisition refers to the company's efforts to acquire knowledge. Adding to that, Camisón & Forés (2010) and Filippini et al. (2012) described acquisition, as a firm's ability to locate, identify, value, and acquire external knowledge that is key to its functioning. Furthermore, Singh & Zollo (2004) argued that the mechanism to obtain resources externally, within time constraints, can lead to intangible assets transfer of knowledge (Teece, 1982).

Fosfuri & Tribó (2008) argued that there is a need to obtain new knowledge from various sources. Consequently, firms can acquire knowledge from suppliers, customers (Von Hippel, 1988), and universities (Fabrizio, 2006). The literature emphasizes that a sufficient share of innovative activities occurs outside of the organization (Anderson et al., 2014; Priem et al., 2012; Von Hippel, 1994) where consumers need to be managed (Von Hippel, 1988; Von Hippel et al. 2012).

The inflow from external knowledge is not the only mean to increase the acquisition of knowledge. Karim & Mitchell (2004) analyzed firms' acquisitions and the internal development of Johnson & Johnson and their operation within their firm's boundaries. The authors observed that they recombine business units and resources instead of recombining knowledge from external sources. Knowledge acquisition and assimilation contribute to strengthening PACAP and the continuation of knowledge stock (Jansen et al., 2005). However, Hamel (1991) argues that acquiring access to skills and internalizing them are two separate abilities.

2.6. Organizational assimilation

Piaget (1952) put forth the basis for knowledge assimilation and suggested that learning processes consisted of assimilation and accommodation. Assimilation can also be defined as the recipient's capacity to analyze, process, and understand the new knowledge acquired from an external partner, as stated by Szulanski (1996) and Zahra & George (2002) or as the firm's capability to study and understand new knowledge (Jansen et al., 2005). The assimilation process is firm-specific and is heavily controlled by tacit knowledge (Cohen & Levinthal, 1990). Overall, assimilation capacity can be defined as the processes and routines that allow the new information or knowledge acquired to be analyzed, processed, interpreted, understood, internalized, and classified (Zahra & George, 2002; Szulanski, 1996b; and Camisón & Forés, 2010).

From their qualitative study of MAT, a Belgian company, Faems et al. (2007) mainly focused on PACAP and the ability to acquire and assimilate knowledge. Faems et al. (2007) argued that an experiential process is implemented when there is a different degree of technological expertise (expert versus novice partner). Faems et al. (2007) stated that an experiential process is executed when there is a difference in technological expertise. Faems et al. (2007) claimed that the lack of knowledge of a partner due to the absence of knowledge overlaps could be diminished in the smooth learning process in which the novice partners learn from the expert one.

Capaldo et al. (2014) also pointed out the drawbacks of external knowledge assimilation in the banking sector, and the difference between the external and internal knowledge base (Ben-Oz & Greve, 2015; Cohen & Levinthal, 1990a; Lane et al., 2006; Zahra & George, 2002). "Specifically, our findings suggest that even

if external knowledge is well established in the market, its absorption remains challenging if the inventors lack a related knowledge base. The challenges of incorporating and applying mature knowledge are ascribed to misinterpretation, misunderstanding, and misapplication of such knowledge, problems that grow with the technological distance between external knowledge and the inventors' domain of expertise. In fact, our findings reveal that when innovations incorporate mature knowledge beyond the current technological domain, the value of those innovations quickly diminishes" (Capaldo et al., 2017, p. 25).

2.7. Organizational transformation

The transformation requires the association of both the existing knowledge and the knowledge acquired externally (Zahra & George, 2002). According to Backmann et al. (2015), companies can transform, adjust, and combine new knowledge with existing internal knowledge if they have the ability of knowledge transformation (Fosfuri & Tribó, 2008). It enables the companies with such capability to combine newly acquired knowledge with previous previously owned knowledge (Lane et al., 2006). Moreover, Camisón & Forés (2010) consider it as a firm's ability to evolve and clarify the internal routines that ease the accumulation of prior knowledge with the newly acquired or assimilated knowledge. Regarding the four dimensions of absorptive capacity and particularly the transformation one, Ardito et al. (2015) argued that there is a need to further study "how firms should balance the use of new and old knowledge on introducing innovative products" (Ardito et al., 2015, p. 128).

Leonard (1995) and Nonaka & Takeuchi (1995) argued that knowledge creation is as important as exploiting it by creating new products to attain superior performance. In this sense, when firms acquire knowledge and are not familiar with this type of knowledge, it is transformed and/or adapted (Camisón & Forés, 2010). Nonetheless, before knowledge is applied or exploited, it is important to understand, comprehend, analyze, and codify the incoming knowledge even though both cognitive schemas are similar. Although they might be similar, the knowledge may come from different cultures and practices within a company that must be adapted to the new receiver (Camisón & Forés, 2010). Knowledge does not have to necessarily be transformed to be exploited or applied. It depends on the previous cognitive schemes that a firm had to manage the acquired knowledge (Todorova & Durisin, 2007).

Complementarity between an external search and internal knowledge has also been studied by Martini et al. (2015). Martini et al. (2015) state that "External search strategies remain ineffective without the ability of the firm to communicate and share internally generated experience what has been absorbed from the environment" (Martini et al., 2015, p. 1). Thus, in light of their study on medium and

large firms, Italian high-tech firms, Martini et al. (2015) established some counterintuitive results wherein the external search processes' effectiveness does not depend on the internal firm's absorption abilities. In particular, Martini et al. (2015) discussed the significance of the recombination process in which external knowledge needs to be successfully merged to internal knowledge by breaking functional silos down. This enhances the good transformation process with different tools available to firms such as agile software. Strengthening Jansen et al. (2005) findings, Martini et al. (2015) argued that "when the configuration of internal practices do not support the firm's absorptive capacity, the lower the effort for the search of external knowledge, the higher the innovation performance, as firms should concentrate on harvesting the results of past internal R&D investments. The more these firms use external search practices, the lower their sales revenues from new products" (Martini et al., 2015, p. 15).

2.8. Organizational exploitation

Exploitation refers to the application of knowledge. Cohen & Levinthal (1994) described that absorptive capacity guides the exploitation of external knowledge and allows more accurate predictions of future technological advances. According to Zahra & George (2002), knowledge exploitation permits companies to develop their technology-related skills to build new products. Camisón & Forés (2010) define exploitation, as the organizational capacity, based on routines, that enable firms to incorporate acquired, assimilated, and transformed knowledge into their operations and routines. This is done to create new operations, competences competencies, routines, goods, and organizational forms and not just to refine, perfect, expand, and leverage existing routines, processes, competences, competencies, and knowledge.

Chapter 3

Ambidexterity

Similarly to absorptive capacity, to best benefit from strategic alliances, firms should, across the different partners, define the ones who should conduct exploration activities, and the ones who should focus on exploitation activities. Ambidexterity across organizations appear as being crucial to best benefit from strategic alliances. Therefore, ambidexterity, as a moderator, strengthens the relation between the engagement in strategic alliances and the outcomes.

3.1. Introduction to Ambidexterity

The concept of ambidexterity relying on both exploration and exploitation is mostly discussed by strategic and innovation management (March, 1991). Exploration is recommended for developing new technologies in the long term (Levinthal & March, 1981; Nelson & Winter, 1982), while exploitation allows for the optimal use of previous knowledge, enables the development of new opportunities, and requires adaptive systems (Holland, 1975; March, 1991). Hence, many studies have emphasized the importance of balancing exploration and exploitation for attaining a sustained competitive advantage (March, 1991; Tushman & O'Reilly, 1996; He & Wong, 2004).

Duncan (1976), one of the pioneers in the ambidexterity literature, suggested that exploration benefits from organic designs, while mechanistic designs support exploitation that uses accumulated information about the evolution of a particular technological design to the firm's advantage. So, while exploitation involves deploying existing knowledge towards value creation, exploration leads to an increase in the stock of knowledge (March, 1991; Spender, 1992). And in order to stay innovative in the long term, firms need to simultaneously explore new knowledge and ideas (March, 1991; Levinthal & March, 1993). Hence, organizational ambidexterity can be defined as the capacity to search for new opportunities while exploiting existing skills (Tushman & O'Reilly, 1996; Cao, Gedajlovic & Zhang, 2009).

Exploration (March, 1991) or knowledge generation (Spender, 1992) is "the pursuit of knowledge, of things that might come to be known" (Levinthal & March, 1993, p. 105). It may provide long-term returns but is inherently uncertain (March, 1991). Explorative collaboration is a key means of creating new organizational

competencies (Faems et al., 2005). The emphasis is therefore placed on joint experimentation and learning (Koza & Lewin, 1998). The primary concern is about novelty, rather than efficiency (Faems et al., 2005).

On the other hand, according to Burgelman (1984), the success rates of projects are related to the degree of exploration within such projects. This is because knowledge acquisition occurs most during the exploration phase rather than exploitation (Grant & Baden-Fuller, 2004). Hence, strategic alliances have different outcomes depending on whether they occur during the exploration or exploitation stages (Koza & Lewin, 1998).

Exploitation (March, 1991) or knowledge application (Spender, 1992) is "the use and development of things already known" (Levinthal & March, 1993, p. 105). March (1991) opined that the "essence of exploitation is the refinement and extension of existing competencies, technologies, and paradigms" (March, 1991, p. 85). The focus is on leveraging existing skills (Koza & Lewin, 1998) and acquiring complementary knowledge to support the further development of existing technologies (Teece, 1992). Indeed, exploitative collaboration is primarily concerned with enhancing existing organizational competencies (Faems et al., 2005). Levinthal and March (1981) argue that the use of these available technologies during the exploitation phase helps reduce errors and failure rates in a firm, which leads to increased efficiency.

March (1991) states that existing knowledge must be constantly exploited by firms to provide short-term productivity. Moreover, in the exploitation stage, there is a need to share knowledge (Spender, 1996b). In this stage, the shift from knowledge to operations occurs (Tiemessen et al., 1997; Van den Bosch, Volberda & De Boer, 1999). According to March (1991) and Benner & Tushman (2003), companies with exploitation capabilities generate incremental modifications to the firm's ability to create value. Therefore, exploitation is the stage in which knowledge is converted into new products (Kogut & Zander, 1996). The outcomes of such modifications could incorporate the creation of new products, processes, or organizational procedures (Spender, 1996). Though much emphasis on exploitation could reduce the ability to obtain breakthrough innovations in a firm, it was still proposed as a means of creating expected productivity for a short period. Exploitation offers more predictable, short-term returns (March, 1991). Yet, exploitation focused on improving short-term performance may cause firms to get stuck in a trap.

The majority of the ambidexterity research is based on a macro-level perspective, which has provided solid bases for understanding the procedures, structures, and methods to enhance the firm-level capacity to simultaneously explore and exploit knowledge (see Raisch & Birkinshaw (2008) for a review). Given that organizational ambidexterity is critical for establishing a competitive advantage over time (He & Wong, 2004; O'Reilly & Tushman, 2013), there has been an increasing

interest in studying it during the past few years. This research has also focused on the trends, determinants, and effects of ambidexterity in an organization (O'Reilly & Tushman, 2013). These ideas have been investigated on various levels (Raisch & Birkinshaw, 2008), comprising all the hierarchical structures of a firm (Beckman, 2006; Uotila et al., 2009; Phelps, 2010; Jansen, Simsek and Cao, 2012; Lee & Meyer-Doyle, 2017).

3.2. Balance and imbalance between exploration and exploitation

Achieving an appropriate balance between exploration and exploitation activities is a critical element of organizational success (Katila & Ahuja, 2002; Tushman & O'Reilly, 1996). While, on the other hand, Raisch (2008) argues that firms with a decentralized structure are more likely to pursue exploration than exploitation, most research suggests that internal routines favoring local search (Helfat, 1994), the modern focus on improving quality and efficiency metrics (Benner & Tushman, 2003) and an emphasis on short-term financial performance (Leonard-Barton, 1992) lead firms to devote a disproportionate effort to exploitation (Rosenkopf & Almeida, 2003). For example, Sorensen and Stuart (2000) found that an excessive focus on exploitation among older semiconductor firms leads these firms to produce innovations with a lesser impact on the technological community.

Furthermore, Piao & Zajac (2016) highlight a common belief in the strategy and organizational literature with regard to the tension between exploitation and exploration; specifically, that firms will usually favor exploitation over exploration. This can be attributed to either a competency trap (Levitt & March, 1988), core rigidity (Leonard-Barton, 1992), co-evolutionary lock-in (Burgelman, 2002), cognitive inertia (Tripsas & Gavetti, 2000), institutionalization (Dougherty & Heller, 1994), and/or resource competition (Levinthal & March, 1993).

When an organization decides that the main focus is to have exploitative R&D, it can fall into "competency traps". This means that it is harder to find new ways to innovate, so when time passes, the firm could become obsolete (Levitt & March, 1988). Additionally, when firms decide to make a huge amount of exploratory R&D, they will be restricted because of the existence of many boundaries, such as trying to put a commercial value to all the ideas they find (Levinthal & March, 1993).

Tensions that arise between exploration and exploitation activities are making their simultaneous pursuit difficult (March, 1991; Tushman & O'Reilly, 1996; Gibson & Birkinshaw, 2004). Therefore, March (1991) established that a trade-off in the organization that will guide the decision between pursuing exploration or ex-

ploitation must exist. For this reason, the concept of organizational ambidexterity also refers to several methods of managing the tensions and conflicting demands that arise from simultaneously pursuing different activities within an organization (Tushman & O'Reilly, 1996; Gibson & Birkinshaw, 2004).

Hence, the exploration vs. exploitation dilemma arises. An example of the explore vs. exploit dilemma takes place when making decisions to either implement new and innovative routines or continue exploiting the same routines that are done repetitively by multiple individuals (Feldman & Pentland, 2003). In contrast, other researchers have found that the decision between exploration or exploitation is completely independent; it is not considered as a trade-off (Katila & Ahuja, 2002). Thus, there are mixed empirical explanations based on the exploitation and exploration trade-off (Volberda & Lewin, 2003; Gibson & Birkinshaw, 2004; He & Wong, 2004; Atuahene-Gima, 2005; Gupta et al., 2006; Raisch & Birkinshaw, 2008; Voss & Voss, 2013).

Hence, organizational ambidexterity has to be applied correctly because it can create fundamental challenges and tensions for a firm (Smith & Tushman, 2005; Jansen et al., 2009). Tushman et al. (2010) argue that while some firms accomplish performance improvements on a large scale when managing both exploration and exploitation, few others face great issues in perceiving the economic value of their business strategies. Hence, ambidexterity is also connected to an organization's capacity to address two organizationally incompatible objectives equally well (Birkinshaw & Gupta, 2013). Especially, firms that are under resource constraints face substantial difficulties when attempting to devote a balanced amount of resources to exploration and exploitation (Ahn, Lee & Lee, 2006).

The past consideration of ambidexterity was considering exploration and exploitation within inventions as two ends of a continuum (Lavie & Rosenkopf, 2006; March, 1991; Uotila et al., 2009). Other researchers also consider ambidexterity to be a bi-polar construct, treating exploitation and exploration as the opposite ends of a single continuum (Pertusa-Ortega et al., 2019). On the other hand, some other researchers consider exploitation and exploration innovation as two distinct dimensions, rather than two ends of a unidimensional scale (orthogonal) (Gibson & Birkinshaw, 2004; He & Wong, 2004; Jansen et al., 2009). Nevertheless, firms tend to experience inherent challenges when trying to do exploratory and exploitative innovations (Cho & Kim, 2017).

3.3. The relationship between exploration and exploitation

Literature analyzing ambidexterity at firm levels usually suggest that exploration and exploitation are positively correlated (Cao et al., 2009). However, the

results of Kauppila and Tempelaar (2016) demonstrate a strong negative correlation between explorative and exploitative activities. Therefore, Piao and Zajac (2016) propose that the universality of the relationship between exploitation and exploration is not clear. Consequently, they ask and strive to answer the following question: "when and why might some firms be less susceptible to this presumed negative relationship between exploitation and exploration?" (Piao & Zajac, 2016, p. 1431).

In addition, Piao & Zajac (2016) offer "an original examination of a longstanding and fundamental question on organizational learning and adaptive change: How does exploitation affect exploration?" (p. 1431). To answer the question, Piao & Zajac (2016) suggest that "strategy and organizational scholars seeking to analyze the impact of exploitation on exploration would benefit by stepping away from the typically assumed unitary perspective on exploitation" (p. 1431). Piao & Zajac (2016) add that "by advancing and testing a multifaceted perspective on exploitation, we were able to explain how and why exploitation can have negative or positive connections with exploration, depending on the type of exploitation to which firms choose to primarily devote their attention" (p. 1445).

Therefore, Piao & Zajac (2016) propose a "multifaceted perspective on exploitation by theoretically and empirically distinguishing between repetitive exploitation versus incremental exploitation" (p. 1431). According to Piao & Zajac (2016), "repetitive exploitation occurs when a firm repeats its existing designs for its existing products" (p. 1432). This corresponds with how March (1991) describes exploitation, using words like "production", "efficiency", "implementation", and "execution" (p. 71). On the other hand, "incremental exploitation happens when a firm creates new designs for its existing products" (Piao and Zajac, 2016, p. 1432). Therefore, Piao & Zajac (2016) move forward with the idea that "repetitive and incremental exploitation are two theoretically distinct constructs" (p. 1432).

The arguments of Piao & Zajac (2016) were tested using extensive longitudinal data from the hard disk drive (HDD) industry. Hypothesis 1: "The more intensively firms engage in repetitive exploitation, the less likely they are to pursue exploration" (Piao & Zajac, 2016, p. 1433). The findings of Piao & Zajac (2016) show that repetitive exploitation will hinder exploration by activating rapid and accurate learning, validating hypothesis 1. Hypothesis 2: "The more intensively firms engage in incremental exploitation, the more likely they are to pursue exploration" (Piao & Zajac, 2016, p. 1435). Contrarily, incremental exploitation will compel exploration by warranting slow and inaccurate learning. Moreover, incremental exploitation can also drive exploration and accelerate the responses of firms to environmental changes. Hence, hypothesis 2 of Piao & Zajac (2016) is also validated.

3.4. Solutions for Ambidexterity

Many studies have proven that exploration and exploitation cannot be done simultaneously because organizations are not capable of this (March, 1991, 1996, 2006; He & Wong, 2004). Tushman and Romanelli (1985) are one of the first to examine the concept of sequential ambidexterity. Sequential ambidexterity happens when firms decide to innovate depending on the market conditions (Tushman & Romanelli, 1985). Moreover, sequential ambidexterity has also been examined when it comes to seeing how exploration and exploitation are implemented (Brown & Dacin, 1997; Brown & Eisenhardt, 1997). Sequential ambidexterity is not free from risk. For instance, Swift (2016) states that "prior work evaluates the performance benefits of practicing sequential ambidexterity but does not consider the risks". Consequently, the author did "focus not on firm performance, but firm survival." (p. 1689). Swift (2016) shows that "sequential ambidexterity has ramifications far beyond firm performance, and indeed, has serious impacts on the very survival of the firm" (Swift, 2016, p. 1689). As a consequence, adjustments between exploration and exploitation are considered inevitable (Simsek et al., 2009).

In addition, it is known that there is a leap between R&D-based exploitation and exploration. This leap is necessary for an organization to achieve a sustainable competitive advantage. At the same time, this could also be very dangerous for an organization. It is important to highlight that a firm can fail in the leap between exploration and exploitation. This happens when the leap is made at the wrong time, but also when there is a lack of R&D allocation monitoring (Swift, 2016). Mudambi and Swift (2011) found that when firms decide to select exploratory R&D over exploitation, it is shown that the leap leads to a better performance for the organization. Moreover, Swift (2016) argues that in order to survive the leap from exploitation to exploration it is important that firms reduce their R&D expenditure.

To tackle the tensions that arise from the pursuit of exploration and exploitation, some studies have proposed to either sequence them over time (Nickerson & Zenger, 2002; Siggelkow & Levinthal, 2003; Gulati & Puranam, 2009) or to separate them in a structured way across organizational units (Tushman & O'Reilly, 1996; Fang, Lee & Schilling, 2010). Consequently, ambidexterity was also considered as the ability of firms to balance two opposing structures like exploration and exploitation in order to achieve sustainable performance (Tushman & O'Reilly, 1996; He & Wong, 2004; Cao, Gedajlovic & Zhang, 2009). These views either focus on a structural separation and the division of tasks into units that differ from each other (Tushman & O'Reilly, 1996; Raisch & Tushman, 2016), or the integration of both tasks in a unique and single unit with an ambidextrous context (Gibson & Birkinshaw, 2004; Carmeli & Halevi, 2009).

Furthermore, Raisch (2008) has researched the organizational mechanisms that can be used to cope with both these activities, and proposes three solutions:

(1) temporal separation with a period of exploration and a period of exploitation (Siggelkow & Levinthal, 2003), (2) structural separation between two different entities (Christensen, 1998; Levinthal, 1997), and (3) parallel structures that allow employees to alternate between exploration and exploitation (Nonaka & Takeuchi, 1995).

3.5. Ambidexterity and Absorptive Capacity

Organizational ambidexterity and absorptive capacity help companies to improve the accessibility to external knowledge and increase their innovation performance. It illustrates the firm's ability to "leverage the knowledge that is absorbed" (Zahra & George, 2002, p. 190). Organizational ambidexterity enables firms to simultaneously explore and exploit knowledge (Gibson & Birkinshaw, 2004; Rothaermel & Alexandre, 2009; Tushman & O'Reilly, 2007). Indeed, the literature in the field indicated that firms should become ambidextrous by simultaneously developing exploratory and exploitative innovation (Chen & Kannan-Narasimhan, 2015; Gibson & Birkinshaw, 2004; He & Wong, 2004; Raisch et al., 2009; Wei et al., 2014; Crescenzi & Gagliardi, 2018; Raisch & Birkinshaw, 2008). Crescenzi & Gagliardi (2018) stated that companies' absorptive capacities are primarily vital to balance the internal-external trade-off of knowledge. Only then are firms able to develop ambidexterity by ultimately balancing exploration and exploitation.

Cassiman & Veugelers (2006) and Teece et al. (1997) states that a focus on only internal or external knowledge may result in obsolescence and lockout. Cohen & Levinthal (1990) stated that "a systematic and enduring neglect of technical opportunities may result from the effect of absorptive capacity on the organization's aspiration level when the innovative activity (R&D) contributes to absorptive capacity, which is often the case in technologically progressive environments" (Cohen & Levinthal, 1990, p. 137).

Lane et al. (2006) argued that "little attention has been given to the implications of exploitative versus exploratory learning for absorptive capacity development" (Lane et al., 2006, p. 848). On the one hand, exploratory learning is crucial for modifying a company's knowledge base claims (Garud & Nayyar 1994; March, 1991). To acquire external knowledge that helps sustain a competitive advantage, companies need a high level of exploratory learning (Hamel, 1991; Leonard-Barton, 1992; Zahra & George, 2002). Indeed, exploratory learning denotes the acquisition of external knowledge, which relates to the concept of PACAP (Zahra & George, 2002). Therefore, exploratory learning refers especially to knowledge acquisition (Lane et al., 2006). Regarding the context of absorptive capacity, exploratory learning covers two main steps: identifying external knowledge and then integrating it into their activities (Arbussa & Coenders, 2007). Eventually, Jansen et al. (2006) and Levinthal & March (1993) stated how exploratory learning en-

ables companies to take advantage of constantly changing industry conditions by developing new goods and meeting the needs of developing markets.

On the other hand, exploitative learning is the use of acquired knowledge, which relates to the concept of RACAP (Zahra & George, 2002). While knowledge transformation associates these two processes and is related to knowledge retention over time (Garud & Nayyar, 1994). Moreover, companies integrate external knowledge by combining it with their existing previous experience (Lenox & King, 2004). Also, exploitative learning can transform knowledge into new products or services (Tsai, 2001). Indeed, companies with highly developed exploitative learning processes can obtain better performance by applying assimilated knowledge in their innovation processes (Zahra & George, 2002). Therefore, the process of exploitative learning emphasizes knowledge embedded on a product or service and is a broader perspective than external knowledge assimilation (Lane et al., 2006).

The transformative learning process associates exploratory and exploitative learning, and it is based on knowledge retention over time (Garud & Nayyar, 1994; Lane et al., 2006). Acquired knowledge needs to be maintained for several years before being applied into new product developments, and for this purpose, transformative learning is essential according to March (1991) and Rothaermel & Deeds (2004). If companies wish to maintain newly acquired skills and routines, they should initially enhance assimilated knowledge retention (Lane et al., 2006; Marsh & Stock, 2006). To sustain the balance of exploration and exploitation, Levinthal & March (1993) presented the limitations and the challenges of organizational learning. "This pathology is driven by three pervasive features of organizational life: 1. Most fresh ideas are bad ones, so most innovations are unrewarding. 2. The return from any particular innovation, technology, or reform is partly a function of an organization's experience with the new idea. Even successful innovations, when first introduced, are likely to perform poorly until experience has been accumulated in using them." (Levinthal & March, 1993, p. 106).

However, when organizations have absorptive capacity, they can manage an increase in R&D spending. Rothaermel and Alexandre (2009), show that absorptive capacity positively moderates the relationship between ambidexterity and firm performance. This is because it makes the organization capable of overcoming moments where the leap of exploration and exploitation can create tensions, leading to a better chance of survival (Rothaermel & Alexandre, 2009). Therefore, organizational failure is less likely to happen when the firm has adequate levels of absorptive capacity to support the leap (Swift, 2016). Todt et al. (2007) demonstrated this by highlighting a gap in the research on Valencian biotechnology in which exploration research follows the path of exploitation applications with some differences in regional dimensions. These results show that when a firm has a way to maintain a strong competitive advantage by identifying valuable knowledge, the leap between exploration and exploitation is easier (Swift, 2016). The absorptive

capacity in firms develops through engaging in R&D over time, turning into a valuable particularity in firms (Swift, 2016).

3.6. Ambidexterity in Alliances

Alliances between firms can be classified into two different categories: exploitative and exploratory (Koza & Lewin, 1998; March, 1991). Deciding to enter an exploration or an exploitation alliance is a strategic decision. Even if firms could profit from both types of alliances (Lavie & Rosenkopf, 2006), the choice between exploration and exploitation alliances depends on several factors, such as a firm's strategic objectives, learning potential, and expected returns from their technology resources (Koza & Lewin, 1998). The existing literature has given a contradictory viewpoint on this subject. For example, transaction cost theory claims that both types of knowledge management are non-complementary, which is better known as a make-buy decision (Arrow, 1962b; Coase, 1937; Love et al., 2014; Veugelers & Cassiman, 1999). However, some other authors claim the opposite by arguing that the exploration and exploitation are related (Cohen & Levinthal, 1990).

Exploration alliances engage firms to develop mutual learning and to generate new capabilities and competences. Indeed, exploratory alliances create new knowledge from both parties to develop critical innovations of a high strategic significance. Moreover, alliances provide opportunities for partners to improve their technological knowledge (via exploration) and future financial incomes of their technological resources (via exploitation) (Krammer, 2016). A higher proportion of exploratory alliances increase the firm's capacity to recognize opportunities and benefit from competition (Cui et al., 2018). This kind of alliance essentially allows the firm to better understand their partner's knowledge as it involves close and intensive interactions, according to Davis & Eisenhardt (2011). Exploratory interfirm arrangements that imply technological exchanges have recently received greater attention (Gnyawali & Park, 2011; Gulati, 1995b; Kale et al., 2000; Kim & Inkpen, 2005).

Exploratory collaborations have the objective of creating critical innovations that require demanding interactions, tacit knowledge sharing and the building of strong long-term relationships for future benefits (Lavie & Rosenkopf, 2006). The highly complex knowledge transfer in exploratory alliances enhances the sharing (Lavie & Rosenkopf, 2006; Rothaermel & Deeds, 2004) and the absorption of tacit knowledge (Lane & Lubatkin, 1998). As a result of how exploratory alliances involve sharing and articulating complex tacit knowledge, they augment a firm's ability to create competing products. Thus, this type of alliance requires intensive training to enable cooperative problem solving (Cui et al., 2018).

When universities and research centers collaborate, the outcome is primarily focused on exploration. Thus, Vega-Jurado et al. (2009) opined that scientific col-

laboration typically does not cover firms' needs, partially as they ask higher requirements of their absorptive capacity. Furthermore, customers can also bring exploratory technological knowledge, which the firm obtains by being close to them and by using strategies to catch their attention. Another way to reach new technological knowledge is by interacting with R&D partners (Kale & Singh, 2007; Rothaermel & Deeds, 2004).

Furthermore, marking another contrast to exploitative alliances, exploratory collaborations are not fully delimited to a contract because they involve non-routinized activities and experimentation with unknown outcomes (Cui et al., 2018). Relative exploration can be defined as the ratio of exploratory collaborations amongst all other collaborations between a company and its partner (Uotila et al., 2009; Yang et al., 2011). More specifically, relative exploration can be determined as the proportion of the number of exploratory collaborations to the total number of collaborations overall between two companies during a period of 5 years (Ang, 2008; H. Yang et al., 2011). It must be noted that this period of time was selected for this study because alliance databases report that the average duration of an alliance is usually no longer than 5 years (Yang et al., 2011).

Exploitation alliances are highly dedicated to leveraging existing resources and capabilities to obtain short-term benefits, according to March (1991). Exploitative collaborations are intended to share current resources to benefit from short-term results (Mowery et al., 1996a). With exploitation alliances, there is little overlap between the long-term risks of both firms, and a short-term view governs their relationship.

Alliances that mainly used present knowledge and resources (such as co-marketing, manufacturing, and licensing) can be considered as exploitative collaborations (Lavie & Rosenkopf, 2006; Rothaermel, 2001; Rothaermel & Deeds, 2004). In addition, suppliers' and customers' collaboration aim to exploit the market and technological opportunities to assist the firms in their competitive advantages, are also considered as exploitation alliances, in the study conducted by Faems et al. (2005). Firms may not be able to exploit the knowledge created through scientific collaboration if the supply chain is not involved in the production and diffusion process; in addition, new ideas coming from customers could potentially not be developed without scientific collaboration (Haus Reve et al., 2019). The best way to generate customer involvement is to have activities that make face-to-face interactions possible, such as marketing, sales, and customer support (Chatterji, 2009; Franke & Shah, 2003; von Hippel, 1976, 1977). Similarly, exploitative alliances that benefit from current technological competencies generate important technology transfers, which raises the productivity of SMEs in emerging markets (Lee & Beamish, 1995; Narula & Sadowski, 2002).

Cui et al. (2018) argued that the competition among two different firms is affected by diverse combinations of exploratory and exploitative alliances. Cui et al.

(2018) investigated the consequences of collaboration on competition between partners and product makers. They demonstrate that there is an inverted U-shaped relationship between relative exploration and the firm's competition against its partner. In other words, a company's competition with its partner can be improved when involved in exploratory alliances. However, there is a maximum point in which competition begins to weaken (Cui et al., 2018).This relation is negatively moderated by firms' relational and structural embeddedness, but positively moderated by their positional embeddedness.

From their empirical study of horizontal alliances occurring in the U.S. pharmaceutical industry, Cui et al. (2018) supported the following hypothesis: "There is a curvilinear relationship (taking an inverted U-shape) between relative exploration and the aggressiveness of a firm's competition against its partner in the product market" (Cui et al., 2018, p. 3121). Given the very specific empirical setting, Cui et al. (2018) advise that there should be some precaution about generalizing results to other types of alliances and industries.

A higher proportion of exploratory alliances in the alliance portfolio of a company creates incentives for the firm to compete with its partner. However, as the proportion of exploratory alliances in the alliance portfolio increases, so does the risk of long-term stakes overlap. This generates a higher dependence on developing new critical innovations (Pfeffer & Salancik, 1978). Consequently, firms will probably establish a "transaction-oriented partnership" if exploitative alliances are predominant in their portfolio, and having a portfolio with a high proportion of exploratory alliances will increase the competition between partners (Cui et al., 2018). Essentially, when the portfolio is primarily composed of exploratory alliances, the alliance acquires a strategic importance and thus, a "relation-oriented partnership" is created (Cui et al., 2018). Nevertheless, the increasing competition risk may reach a turning point at which the cost of competition exceeds its short-term benefit. An inverted U-shape relationship forms between relative exploration and the company, and the company's competition with its partner, which peaks at a medium level of relative exploration (Grant & Schwartz, 2011; Hanns et al., 2016).

Firms use exploration to find a suitable solution for technological challenges. Focusing on exploration may improve firms' ability to renovate their knowledge bases. However, this brings the risk to keep exploring without ending up with any commercialization (Volberda & Lewin, 2003). Hence, exploration may be inefficient and negative for exploiting resources and technology (Katila & Ahuja, 2002; Wang & Li, 2008). In contrast, firms can be stagnant and not see beyond the present if they depend only on exploitation, thereby lagging behind the latest opportunities and technologies. Therefore, researchers have argued that firms can achieve innovative portfolios when they balance exploration and exploitation, so by being ambidextrous (Raisch & Birkinshaw, 2008). As it was previously stated, explora-

tion and exploitation catalyze innovation (He & Wong, 2004; Atuahene-Gima, 2005; Jansen et al., 2006).

Previous research investigated technology-related innovation and the impact of balancing exploration and exploitation in marketing, while the effect of ambidexterity interaction across various areas has been neglected (Zhang et al., 2017). The examination of how firms balance exploration and exploitation in both marketing innovation and technological innovation majorly contributes to the research line by Zhang et al. (2017). Concerning organizational ambidexterity, Zhang et al. (2017) examine the influence of the four configurations of technology and market-related innovations on a firm's performance. The four different types of configurations are: (1) market leveraging, (2) technology leveraging (3) pure exploitation, and (4) pure exploration. These configurations can be seen in the figure below.

According to O'reilly and Tushman (2008), ambidexterity is a fundamental driver of renewal and long-term performance in a firm by simultaneously exploring and exploiting (O'Reilly & Tushman, 2008; Raisch, 2008). Indeed, one of the important outcomes of ambidexterity is the ability for firms to gain and sustain a competitive advantage (March, 1991; Tushman & O'Reilly, 1996; He & Wong, 2004; O'Reilly & Tushman, 2013). After conducting firm exploration, Ahuja & Lampert (2001) and Burgelman (1983) observed an interest in the development of innovative inventions, in order for them to be subsequently turned into the main source of new business development. In other words, breakthrough inventions prove to be critical for the promotion of entrepreneurial activities, increasing welfare and creating Schumpeterian rents (Harhoff et al., 1999; Schumpeter, 1942; Trajtenberg, 1990) which are the key entry and growth of firms (Schumpeter, 1939). To this end, firm exploration is considered as a criteria for firms to adhere to in order to achieve revolutionary inventions (Henderson & Clark, 1990; Cohen & Levinthal, 1990; Ahuja & Lapert, 2001; Katila & Ahuja, 2002; Katila & Chen, 2008). In a like manner, breakthrough inventions have been observed to be more likely to ensue from the search of knowledge outside the local domains. This is also supported by the discussion on the ability of firms to overcome dependency and achieve breakthrough inventions (Ahuja & Lampert, 2001b; Fleming & Sorenson, 2001; Rosenkopf & Nerkar, 2001). However, considering the outcomes of firm exploration, March (1991) argued that it increases inventive performance, while it also increase the uncertainty of success or failure of those outcomes. In other words, March (1991) and Fleming & Sorenson (2001) overall illustrated that firm exploration is more likely to generate innovative inventions and to improve performance, including both successes and failures as factors.

Chapter 4

Positive outcomes: Innovation

One of the main positive outcomes for firms to engage in strategic alliances is related to the capability to better innovate across firms.

4.1. Seminal definition of innovation

The definition of innovation was strongly influenced by Schumpeter (1934), who distinguished between five different types of innovation: "new production processes, new products, new materials or resources, new markets and new forms of organizations" (Schumpeter, 1934, p. 66). Moreover, Schumpeter (1934) considered innovation to be a non-incremental process opposed to the theories of economic equilibrium, which are valid only if the innovation has been fully absorbed or diffused into the economy (Brouwer, 1991). On the other hand, according to Rosenberg (1992), innovation found its roots in research-based discovery – at the junction between exploration and examination. Still, the roots of innovation remain of interest to economists. However, Edquist, Hommen and McKelvey (2001) supported the view on innovation as stated by Schumpeter (1934).

Moreover, from a strategic perspective, Moran and Ghoshal (1999) defined innovation as a primary means of creating value. While others have defined innovation as a multidimensional phenomenon (Avlonitis et al., 2001; Dahlin & Behrens, 2005; Danneels & Kleinschmidt, 2001; Garcia & Calantone, 2002; Gatignon et al., 2002; Green et al., 1995; Salomo et al., 2003; Tidd & Bodley, 2002). Similarly, Asheim and Gertler (2005) defined innovation as a firm's ability to create new knowledge and apply it into the creation of new products or into an improved version of an existing product/process, as well as the combination between different inputs and markets. On the other hand, Freeman and Engel (2007) defined innovation as "a process that begins with a novel idea and concludes with market introduction" (Freeman & Engel, 2007, p. 94). More recently, Tavassoli and Karlsson (2015) argued that the Schumpeterian definition of innovation as a process, product, organizational, and marketing innovation is still present today.

However, the distinction between innovation and invention has been argued as follows: "Innovation is the creation of new products and processes through the de-

velopment of new knowledge or the combination of existing knowledge. Hence, innovation is the initial commercialization of invention by producing and marketing a good or service or by using a new method of production" (Grant, 2008, p. 290–291).

4.2. Process innovation

Process innovation is one the main types of innovation and is also known as a collective invention by Allen (1983). Similarly, Tavassoli and Karlsson (2015) state that "a process innovation is direct linked with production methods, either to reach a lower cost of product or better quality at the commercial moment of a product or service" (Tavassoli & Karlsson, 2015, p. 1890). Moreover, according to Tavassoli and Karlsson (2015), the primary goal of process innovation is to find a better way to reduce the unitarian cost of products through the acquisition of new machinery that contains embodied knowledge. Furthermore, another important goal of this type of innovation is to preserve or increase the quality of the products produced. Furthermore, Bernstein (2007) considers process innovation to be a means of production to increase product quantity. Process innovations are also linked with product innovations that involve the launching of new products (Tavassoli & Karlsson, 2015). Tavassoli and Karlsson (2015) argued that being in an innovation process may increase the probability for firms to introduce a product innovation in the coming period.

4.3. Product innovation

Gobeli and Brown (1987) define product innovation as a new setting of product attributes that have been modified. Product innovation has been studied by scholars from diverse perspectives: market share (Chaney & Devinney, 1992), the ability to adapt to changing market and technology conditions (Eisenhardt & Tabrizi, 1995), and survival (Tripsas, 1997). In addition, according to Murovec and Prodan (2009), the number of product innovation outputs has exploded, with an increasing range of goods or services and a growing market. More recently, Tavassoli and Karlsson (2015) defined product innovations as the creation of a new product or an improvement/variation of an existing one that has been introduced in the marketplace in order to satisfy demand needs. In addition, Tavassoli and Karlsson (2015) argued that product innovation gets the gold medal of persistency and it can be explained by "success breeds success".

Moreover, to link buyers and sellers, it is necessary to consider product value as a usefulness, security, availability, and rarity. Bennett and Cooper (1981) define product value as "a business orientation that recognizes that product val-

ue is key to profits. It stresses competing on the basis of satisfying customer needs with superior, higher value products. Value depends on the customer's perception of the product attributes, which are largely a function of the firm's technological, design, and manufacturing strengths and skills" (Bennett & Cooper, 1981, p. 59).

In addition, Bennett and Cooper (1981) state that "the marketplace provides a rough measure of the worth or value of a product: the price a product can command is a monetary measure that the customer places on the product. Thus, profits are the difference between a product's value, which is measured by its price, and the product's cost" (Bennett & Cooper, 1981, p. 57). Moreover, Bennett and Cooper (1981) reinforced the idea that firms can maintain good control of competitive costs by offering superior products. In that sense, Bennett and Cooper (1981) discuss the payment of a price premium for superior goods.

Therefore, based on the work of Levitt (1960) on the topic of marketing myopia and the influence of marketing on product innovation, Bennett and Cooper (1979) argue on the necessity of firms to be need-oriented. Need-oriented firms are encouraged to develop products with the sole purpose of satisfying customer needs and wants. However, this orientation has a negative effect on the creation of true product innovation. This type of innovation is more likely to emerge from a technology push driven by scientific discoveries, which have offered numerous innovations to society over time.

Furthermore, Mahoney and Pandian (1993) argue that new product innovation constitutes a distinctive competitive advantage for a firm. According to them, the main goal of product innovation is to gain a monopoly position in the market by either introducing a new product or design varieties from an existing one. Thus, to make a product unique, there is a need of newness and value (Ekvall, 1997). Additionally, O'Cass and Sok (2013) studied the innovation capability by which a service firm creates superior value with the involvement of managers, employees and customers. In turn, such firms have the freedom to set a price above marginal costs (Tavassoli & Karlsson, 2015).

4.4. New materials or resources innovation

Calantone et al. (2010) confirmed the determinant effect of the resource-based view (rare, non-imitable and non-substitutable) on innovation (Penrose, 1959; Day, 1994; Peteraf, 1993), especially in Western countries. In addition, similar to the knowledge-based view, Kehoe and Tzabbar (2015) argue that the resource dependence theory has recognized that a key determinant of organizational behavior is the mutual dependence in social relationships, which is managed by individuals' decision over their key resource.

4.5. Market innovation

According to Schumpeter's classification, the opening of new markets is directly related to marketing innovation. Bennett and Cooper (1981) define marketing innovation as "a business philosophy that places the customer at the top of the corporate organizational chart. It states that the firm should be 'market-oriented' and the satisfaction of customer needs is the key to corporate profits" (Bennett & Cooper, 1981, p. 52). Furthermore, Bennett and Cooper (1981) discussed the early effects of market research on options for consumers to clearly detail their wants and needs. Nevertheless, Bennett & Cooper (1981) argued that 'market-pull' new product development is largely mainstream, which does not encourage discoveries or breakthrough innovation. In addition, Tavassoli and Karlsson (2015) suggest that being a marketing innovator may increase the probability for firms to introduce a product innovation in the coming period.

However, there is an overlap between the concept of marketing and product innovation. The distinction between these two types of innovation is still not clear. Yet, Tavassoli and Karlsson (2015) argue that the aim of marketing innovation is to impact sales volume by potentializing economies of scale in order to compete effectively with prices in segmented markets, and in turn, reach a higher surplus and cover a larger market share. In addition, another aim is to increase consumers' willingness to pay for a product. Nonetheless, according to Tavassoli and Karlsson (2015), firms must make a strategic decision by choosing between selling low-cost products, differentiated products, or products that focus on a distinct niche market.

4.6. Organizational innovation

Miller (1987) defines organizational structure as the sustainable allocation of work roles and administrative mechanisms that enable organizations to conduct, coordinate, and control. Moreover, Damanpour (1991) argues that change occurring within an organization is an important means of innovation. In addition, Schermerhorn (1993) states that it is the duty and responsibility of managers to stimulate, support and achieve innovation. Thus, according to Tavassoli and Karlsson (2015), new forms of organizations constitute an important type of innovation. This innovation involves changes within firms aiming to improve their performance, like increasing efficiency, productivity, flexibility and creativity by using disembodied knowledge.

Furthermore, organizational innovations may be seen as the "(i) introduction and implementation of new strategies, (ii) introduction of knowledge management systems that improves the skills in searching, adopting, sharing, coding, storing and diffusing knowledge among employees, (iii) introduction of new administra-

tive and control systems and processes, (iv) introduction of new internal structures with their associated incentive structures including decentralized decision-making and team work (v) introduction of new types of external network relations with other firms and/or public organizations including, vertical cooperation with suppliers and/or customers, alliances, partnerships, sub-contracting, out-sourcing and off- shoring, and (vi) hiring of new personnel for key positions in the firm" (Tavassoli & Karlsson, 2015, p. 1890).

Overall, organizational innovation is different from product innovations. However, Hollen et al. (2013) argue that both complement each other and are combined over the time within the innovation process. So, "innovation input positively affects all types of innovation" (Tavassoli & Karlsson, 2015, p. 1897), since this variable counts with elements that can act as technologically related innovations and non-technologically related innovation (Tavassoli & Karlsson, 2015).

4.7. Radical and incremental innovation

First and foremost, it is important to perceive that changes can either be continuous (Hegel, 1952) or revolutionary (Adler, 1927). The available literature presents many articles studying the differentiation between evolutionary (continuous) and revolutionary innovation, as, for instance, the representative example of Lynn & Akgun (2001).

On the one side, gradualism introduced by Alfred Marshall in his book 'Principles of Economics', is a theory of economic evolution, offering a gradual process approach represented by the motto "Nature does not make a leap" (Marshall, 1920). To elucidate incremental changes, Marshall developed a constructive theory studying long-term-oriented innovation dynamics. More specifically, he upheld that the sudden changes happening in innovation are uncommon and sporadic, in comparison to the number of smooth, minor, and incremental innovations that result in major changes after a period of accumulation. The economic theory of gradualism has also been established in the field of biology, through studies regarding new species emergence, where minor changes and continuous adaptation processes are crucial (Eldredge & Gould, 1972). Further studies on gradualism were conducted by Mokyr (1990) taking into consideration the work of technology historians and innovation economists. By revisiting the Marshallian theory on gradualism, Mokyr confirmed that "radical" innovations are, in fact, composed of a series of smaller, combined innovations. In addition, Levinthal (1998) also contributed to this body of knowledge by presenting a study on the gradual evolution of the development of wireless technology.

On the other side, contrary to gradualism theory, radicalism raised a great deal of interest in the innovation management and economics. As the father of radical innovation, Schumpeter (1934, 1942) published the theory of economic develop-

ment (1934) as well as capitalism, socialism and democracy (1942). Based on a static classical theory and the equilibrium theory, he developed a dynamic vision considering both evolution and innovation to be discontinuous and disharmonious by nature.

Inspired by the Kuhnian scientific paradigm, Dosi, (1982) developed the technological paradigms, according to which any technological development's growth follows either a normal or a cumulative path. In that sense, innovation can follow the continuity of the technological trajectory, or demonstrate a discontinuity through technical change. Subsequently, the challenge of discrimination arises between the incremental (normal) progresses and the radical (emerging) new paradigm. Abernathy & Clark (1985) defined the difference between incremental and radical innovation as the distance between the technological trajectory and the product. More precisely, radical innovations are characterized by a clear divergence from the technological trajectory, whereas incremental innovations only demonstrate a small degree of divergence (Abernathy & Utterback, 1978; Tushman & Anderson, 1986; Anderson & Tushman, 1990). Likewise, Chandy & Tellis (1998) argued that radical innovations mainly impact the price or performance frontier and diverge from the technological trajectory, while incremental innovations mainly improve the traditional technological trajectory involving minor changes in technology and low incremental customer benefits.

To qualify an innovation as radical, it is necessary to evaluate its degree of technological novelty, which, in turn, is evaluated either by the experts in the field, or by the producer (Dewar & Dutton, 1986; Kleinschmidt & Cooper, 1991; Veryzer, 1998). On the contrary, Robertson & Gatignon (1986) have emphasized that the consideration of an innovation as radical or not, is of subjective nature and depends on people, including producers or potential adopters who may each have a different perspective.

The term "breakthrough" has been employed to describe two different phenomena. The first one is the path-breaking discontinuity in technological development (Tushman & Anderson, 1986; Henderson & Clark, 1990; Meyer, Brooks, & Goes, 1990; Romanelli & Tushman, 1994), where due to external factors, firms often turn existing technologies into obsolete ones (Lavie et al., 2010). Trajtenberg et al. (1997) considered this process to be the foundation of new technologies. The second phenomenon described as "breakthrough" is the employment of an invention to subsequently create further technological developments (Trajtenberg, 1990; Ahuja & Lapert, 2001; Zucker, Darby, & Armstrong, 2002). Likewise, Nelson (1982) also stated that existing inventions are able to serve as an input for future inventions in order to achieve further technological developments. Hence, an invention can be considered as a "breakthrough" when subsequent researchers use it as a foundation for newer inventions (Simonton, 1999; Fleming & Waguespack, 2007).

To further elaborate onto incremental innovation, a threefold of main features has been established through literature. First of all, Mandler (1982) observed that organizations tend to lean on the side of incremental innovation, since it appears to benefit from low-intensity emotions and represents a certain degree of certainty and safety. Secondly, Rosenberg & Steinmueller (1988) argued that technical changes are incremental within a given industry, based on the use of knowledge and imitation. In the process of technical changes, incremental innovations follow an "S" curve in relation to other strategies, such as total quality management (White & Prybutok, 2001). Thirdly, incremental innovation poses advantages as well as limitations. On the one hand, focusing on its effect and cost, Loch & Huberman (1999) observed positive outcomes generated by its adoption as well as an appealing level of switching costs of adopters. On the other hand, incremental innovation has been proven to pose limitations on the occurrence of breakthrough innovation. Bennett & Cooper (1979), rightly observed that breakthrough innovation cannot occur when scientists are marketing oriented. Indeed, market research may limit the scope of ideas to improve current products to only an incremental manner.

Product innovativeness was studied by Garcia & Calantone (2002) in measuring the newness to firms, the newness to industry and the newness to customers. Such product innovativeness is positively related to product performance (Katz, 2000; Tidd et al., 2001; Henard & Szymanski, 2001). Moreover, the degree of newness of innovation is often associated with the patenting mechanism (Brockhoff, 2003), which has an effect on innovative performance. Indeed, Artz et al. (2010) associated invention with the creation of new ideas assessed by the number of patents and innovation with the commercialization of new products on the market. Artz et al. (2010) argued for the existence of a positive link between patenting and innovation outcomes. In the same line, Lettl, Herstatt, & Gemuenden (2006, p. 252) identified radical innovations as "new products or services with a high degree of innovativeness". They further elaborated that "an innovation is radical in the market dimension if it satisfies unmet needs for the first time, resulting in a quantum leap in customer value". In this study, they also discussed the complementarity of technology in radical innovation, as well as the employment of innovation networks as a mean to transform prototypes into radical innovation sold on the market.

4.8. Innovativeness and firm performance

Radical products have fundamentally been considered as economically significant (Enos, 1958; Kline & Rosenberg, 1986). Firstly, Schumpeter (1942) argued that firm's innovativeness and performance relate. He argued that, through innovation, firms may obtain a monopoly market position, bringing them higher performance and enabling them to extract rents. In subsequent literature, innovativeness is pos-

itively associated with performance (Srinivasan & Hanssens, 2009; Tellis et al., 2009). Indeed, it has been observed that innovativeness positively impacts various performance outcomes, such as firms' value in stock, or their market and financial position (Sorescu et al., 2003; Pauwels, Silva-Risso, & Srinivasan, 2004). Furthermore, Rubera & Kirca (2012, p. 143), concentrating on parameters such as radical innovation capability, including senior leadership, organizational culture, organizational architecture, product innovation development process and product launch strategy, came to the conclusion that "radical innovations consistently generate more positive performance outcomes than incremental innovation", based on their meta-analysis studying the effect of firm innovativeness on performance. Correspondingly, Slater, Mohr, & Sengupta (2014, p. 552), supported the conclusion that "radical product innovations offer unprecedented customer benefits, substantial cost reductions, or the ability to create new businesses, any of which should lead to superior organizational performance".

In order to differentiate between the impact of radical and incremental innovation, Rubera and Kirca (2012, p. 136) raised the hypothesis that "the positive relationship between firm innovativeness and (a) market position, (b) financial position, and (c) firm value is stronger for radical innovations than that for incremental innovations". Moreover, the statement that "radical innovations consistently generate more positive performance outcomes than incremental innovations" (Rubera & Kirca, 2012, p. 138) can be used to accurately describe the relationship between innovation and performance.

Kleinschmidt & Cooper (1991) described that radical innovation has a serious potential to obliterate any new entrants in the market, enabling firms to dominate it, and thus to maintain their powerful market position. Likewise, Tellis et al. (2009) supported that radical innovation is, comparatively, more beneficial for firms, given the consumers preference to radical over incremental innovation, and due to its bolder effect on reinforcing the market position in comparison to incremental. Considering these observations, the value of radical innovation is perceived by customers at a premium in comparison to the value of incremental invention, correspondingly influencing their willingness to buy and invest (Kleinschmidt & Cooper, 1991). In regard to the market position, Schilling (2008) concluded that a firm who introduces a new product to the market can be characterized as a first mover, and, therefore, is able to obtain an advantageous market position. More precisely, radical innovation has the potential to enhance a firm's ability to generate substantial returns, improve its financial outcomes, increase its cash flows, and raise its stock value (Sood & Tellis, 2005; Evanschitzky, Eisend, Calantone, & Jiang, 2012).

In addition, Russell (1999) stated that the demonstration of a firm's radical innovation is a key factor in order to obtain a competitive advantage, to enhance entrepreneurial spirit and to raise motivation. Moreover, a firm's the implemen-

tation of radical innovation leads not only to the achievement of differentiation advantages, but also to the increased likelihood of new business growth (Gatignon, Tushman, Smith, & Anderson, 2002; Oviatt & McDougall, 2005; Powell, White, Koput, & Owen-Smith, 2005; Phene, Fladmoe-Lindquist, & Marsh, 2006). In a similar manner, Langerak & Hultink (2006) further confirmed that radical innovation promotes and ensures a firm's achievement of competitive advantage.

Interfirm alliances are also favored for empowering accomplishments, such as strategic goals and competitive advantages which would have been impossible for single firms to accomplish (Clements et al., 2007; Hanna & Walsh, 2002; Merchant & Schendel, 2000). Strategic alliances have become vital to corporations in order to allow them to benefit from new access to market, new economies of scale and new competencies (Hamel et al., 1989; Lorange & Roos, 1992; Ring & Van de Ven, 1994). Alliances enable access to new resources with decreased transaction costs, which aids in acquiring a market advantage (Anand & Khanna, 2000).

Existing research has shown a positive link between firm alliance counts and performance (Baum, Calabrese, et al., 2000; Powell et al., 1996; Rowley et al., 2000). Stuart (2000) exhibited that companies stand to benefit from higher performance when they form alliances with big, innovative firms. However, Huang et al. (2016) stated a few years later that profit motives that cooperative alliances need to fulfill are still issues for future research interests. Additionally, strategic alliances which pressure the performance of this collaboration could lead to disappointments (Harrigan, 1986; Kogut & Singh, 1988; Porter, 1987).

Goerzen (2007) and Rowley et al. (2000) displayed negative effects on firm performance when firms form alliances with companies that are strongly linked with them. Mitsuhashi & Greve (2009), however, criticize that research by emphasizing that one of its shortcomings is that those studies did not test if the complementarity and compatibility of alliance partners had impacted these relationships. Thus, the findings from Hagedoorn et al. (2018) complement existing studies by studying relationships between several measures of alliance portfolio diversity and firm performance (Baum, Calabrese, et al., 2000; De Leeuw et al., 2014; Nieto & Santamaría, 2007; Srivastava & Gnyawali, 2011; Wuyts & Dutta, 2014).

Despite the literature proposing that partner type diversity in alliance portfolios has an effect on firm performance, there is still a gap on performance effects of different dimensions of partner type diversity. Past research has analyzed different types of diversity (Jiang et al., 2010; van de Vrande, 2013). However, Hagedoorn et al. (2018) contribute to the existing literature by advising that even within the analysis of the same type of diversity, there are several dimensions that need to be considered. For example, the dimension of partner type relevance, which was analyzed in this paper alongside its effects on innovation performance.

4.9. Innovation in Alliances

Some authors have demonstrated that competitiveness can be improved via alliances, due to knowledge sharing and acquisition that enable companies to develop new capabilities (Baum, Calabrese, et al., 2000; Hagedoorn & Schakenraad, 1994; Sampson, 2007). Positive outcomes of alliances can be connected to innovation (Ahuja & Katila, 2001; Dyer & Singh, 1998; Frost, 2001; Jones et al., 2001; Koza & Lewin, 1998; Lane & Lubatkin, 1998; Larsson et al., 1998; Santangelo, 2000; Shenkar & Li, 1999; Simonin, 1999) and firm performance (Lane et al., 2001).

Existing research has studied many kinds of alliance portfolio diversity, for instance, technological, governance, national, or partner type diversity. It is interesting to note that empirical research found mixed results regarding the effect of alliance portfolio diversity types on innovation performance, varying from positive (Nieto & Santamaría, 2007; Srivastava & Gnyawali, 2011), to negative relationships (Cui & O'Connor, 2012), inverted U-shaped (De Leeuw et al., 2014; Oerlemans et al., 2013) and U-shaped relationships (Wuyts & Dutta, 2014). Rooted in the knowledge-based view, we contribute to the literature by analyzing the link between alliance portfolio diversity and innovation performance thoroughly.

Alliance portfolios have a positive effect on the improvement of new skills and products through diverse knowledge inputs (Rothaermel & Alexandre, 2009). Thus, alliance portfolios are likely to stimulate the innovation performance of a company. Various existing studies have emphasized the benefits of alliance portfolio diversity, and have also empirically demonstrated that a relationship exists between the alliance portfolio diversity of a firm and its innovation performance (Baum, Calabrese, et al., 2000; Wuyts et al., 2004). Organizational objectives, like the stimulation of innovation, are not reached with only one successful alliance, but through the combined influence of the overall alliance portfolio (Lavie, 2007; Wassmer, 2010). R&D alliances can also enable the firm to grow further from the initial focus of innovation (Hohberger et al., 2015). According to Belderbos et al. (2015); Rothaermel & Deeds (2004); Srivastava & Gnyawali (2011); and van Burg et al. (2008), several performance parameters, such as innovation, can be affected by R&D collaboration. Additionally, a few studies have observed a connection between the involvement in strategic alliances and research outputs, measured with the patenting propensity (Shan et al., 1994), degree of product innovativeness (Kotabe & Swan, 1995a), as well as products under development (Deeds & Hill, 1996).

Degener et al. (2018) question an often-acknowledged linear relationship between alliance portfolio diversity and innovation. This has been backed up by Baum et al. (2000), Faems et al. (2005), Phelps (2010) and Wuyts et al. (2004). A few studies by Duysters & Lokshin (2011), Hagedoorn et al. (2018), and Samp-

son (2007) have concluded that between alliance portfolio diversity, and innovation performance there is an inverted U-shaped relationship and not a linear relationship. While recent studies have obtained inconclusive empirical results, a few of them propose an inverted U-shaped relationship (De Leeuw et al., 2014; Duysters & Lokshin, 2011; Sampson, 2007). These researchers state that alliance portfolio diversity could enhance innovation up until the point when the disadvantages of alliance portfolio diversity outstrip the benefits, while the innovation results decrease.

Some scholars argued that there is a non-significant relationship between alliance portfolio diversity and innovation outcomes (Cui & O'Connor, 2012; Eisingerich et al., 2009; Faems et al., 2010), meaning that alliance portfolio diversity does not have any significant impact on innovation outcomes. These findings also complement previous research studying relationships between several measures of alliance portfolio diversity and firm performance (Baum, Calabrese, et al., 2000; De Leeuw et al., 2014; Nieto & Santamaría, 2007; Srivastava & Gnyawali, 2011; Wuyts & Dutta, 2014).

According to Haus Reve et al. (2019), there is a need to reevaluate the assumption that both collaborations are reciprocal and complementary. The paper empirically contributes to the literature by investigating the complementarity between supply chain and scientific collaboration. They argue that scientific-supply chain collaboration has a negative impact on innovation (Haus Reve et al., 2019). In contrast, their results support the positive relation between firm level innovation and the combination of multiple types of collaboration (Haus Reve et al., 2019).

The link between R&D alliances and the development of new products for the market has been emphasized in the existing literature (Chen & Li, 1999; Deeds et al., 1999; Deeds & Hill, 1996; Kotabe & Swan, 1995a; Rothaermel & Deeds, 2004). When companies get involved in R&D alliances, typically their goals are to bring a new product to the market by making use of the synergies of research in new technologies, products and/or processes from the market as demonstrated by Hagedoorn (1993). Grunwald & Kieser (2007) analyzed the way that strategic alliances result in product innovation through a recombination of technologies and learning. Based on a dataset from the period between 1994 and 1999, Frankort (2016) investigated manufacturing firms from the technology sector that were engaged in R&D alliances. Although the relationship between R&D alliances and new product development relates, they are more enhanced when all parties from the partnership are dealing with similar technological domains (Frankort, 2016). Frankort (2016) opines that this positive relation is hampered when partners are focused on the same product market.

Another branch stream of the literature serves to support the existence of a link between R&D alliances and the creation of new products launched into the market (Chen & Li, 1999; Deeds et al., 1999; Deeds & Hill, 1996; Kotabe & Swan, 1995b;

Rothaermel & Deeds, 2004). Firms may also engage in new alliances to enter new markets (Glaister, 1996) and then subsequently to increase its market power (Kogut, 1991). Grant & Baden-Fuller (2004) mentioned that companies get involved in alliances to get quicker access to the knowledge of partners rather than obtaining it. This permits the firm to decrease the time-to-market and to accomplish an early-mover advantage.

Chapter 5

Negative outcomes: Knowledge spillovers

However, when firms engage in strategic alliances, there are not only advantages in term of innovation and performance, but also some shortcomings, such as the increasing risk of unintended knowledge spillovers. According to early studies, unintended knowledge spillovers are considered to be a deterrent to R&D activity (Nelson, 1959; Arrow, 1962; Spence, 1984) that occurs through borrowing or stealing (Jaffe, 1985). Furthermore, according to Griliches (1992), knowledge spillovers happen when the receiver organizations take advantage of knowledge that is initially created by another organization that is called the source company.

5.1. Issues faced

Hamel (1991) opines that companies that take part in alliances usually prioritize their individual benefits over common interests. Beyond the positive aspects of accessing external knowledge through strategic alliances, the acquisition of new knowledge is quite demanding (Inkpen & Tsang, 2008). From the research from 1025 alliances within the Australian mining industry between 2002 and 2011, Bakker (2016) stated that "First, cooperation in and of itself does not ensure alliance success" (p. 1921).

Despite the increase in the use of strategic alliances, existing literature has suggested high failure rates, with empirical evidence showing that around 50% of alliances are unsuccessful as has been stressed by Koza & Lewin (2000). Thus, practitioners and scholars have focused their attention on determining the drivers of alliance performance (Dyer & Singh, 1998; Koka & Prescott, 2002). A similar failure rate has been reported by Kale et al. (2002) as well as by Argyres et al. (2007), who explain such failure because of the huge investments made and the costs generated by the alliances. Moreover, when the organization does not clearly see the benefit of the alliance, there is a high likelihood of failure as suggested by Sethi et al. (2001).

From studies made in the field of alliance after formation such as the works of Greve et al. (2010), Gulati (1995), Puranam & Vanneste (2009), and Rowley et al. (2005), some issues have been reported: conflicting resources between firms, lack of trust, low individual attachment, bargaining power conflicts, and a lack of previous bonds. Therefore, those circumstances explain the difficulties to obtain ex-

pected results when engaging in strategic alliances (Das & Teng, 2000; Inkpen & Beamish, 1997). More specifically, the firms' resources may not be compatible between partners (Greve et al., 2010), individuals may have a reduced attachment (Broschak, 2004), there are existent or new alternatives outside the alliance (Greve et al., 2013), or because of the differences in power relations within firms (Rowley et al., 2005). However, factors provoking alliances' dissolution require further studies and there is a need to treat them with a more holistic viewpoint (Rogan, 2014).

Fonti et al. (2017) opine that the success of multi-party alliances relies on the commitment and willingness of the partners to put their effort towards common objectives. The authors discovered that there is a negative link between the perception of collaboration of peer organizations among partners and the free-riding phenomenon. Apart from the failure, partner composition – one partner entering or leaving an alliance or firm – is one of the forms of partner reconfiguration where firms typically experience extreme changes within the whole life cycle of an alliance. In line with this, Reuer et al. (2002) found that there were crucial post-formation changes in 44% of the alliances of the biotechnological and pharmaceutical firms.

5.2. Negative outcomes of radical innovation

On the other hand, a number of researchers have argued that there is actually no proven association between innovativeness and the rise of revenues, to the point where even negative correlation between the two has been observed (Baum, Calabrese, et al., 2000; Mengüç & Auh, 2006). In addition, this argument has been upheld by the research of Kochar & David (1991), who clarified that innovativeness does not necessarily turn in revenues for the firm. This discrepancy is due to the fact that the R&D department's output cannot instantly be turned to tangible products, and, secondly, due to the fact that only a fraction of all patents are ever employed as innovations. As a consequence, Rubera & Kirca (2012, p. 145), suggested that "the innovation literature would benefit from taking a broader, multilevel perspective in understanding the effects of innovativeness on firm performance by focusing on broader outcomes than those simply associated with economic valuation (by shareholders, managers, or customers)".

Moreover, in the same manner, Li (2017) concluded that high resource consumption and high uncertainty can be identified as two main disadvantages that characterize the process of radical innovation. To further elaborate on this perspective, Li (2017) conducted a study observing a sample of 508 Chinese firms, with the results clearly indicating that "the specific effects of resource acquisition and resource accumulation on radical innovation are contingent upon resource flexibility and coordination flexibility" (Li et al., 2017, p. 471).

High R&D costs, uncertainty, unclear customer needs, and the difficulty to set standards leading to a reduced chance of market adoption (O'Connor & DeMartino, 2006; Schilling, 2008) constitutes major drawbacks of radical innovation in the nanotechnology industry. In such an industry, Maine & Garnsey (2006) argued that radical technological innovation generates a high degree of technological risk and a similarly high degree of market risk. In addition, radical innovation in relation to technology has been proven to generate a high risk of unintended knowledge and imitation (Atuahene-Gima & Ko, 2001; Danneels & Kleinschmidt, 2001; McDermott & O'Connor, 2002). Carrying radical innovation is inhibited by the presence of major barriers, such as the need for complementarity between innovation activities, and the need for trialability. Such a risk increases the probability to negatively affect stakeholders and consumers (Sorescu & Spanjol, 2008).

According to Dosi (1982), it is important to focus not only on technological, but also on market changes when regarding the concept of radical innovation. Cooper & Kleinschmidt (1987) and Song & Parry (1996) indicated that a lower presence of radical innovation is seemingly the key to a lower level of market uncertainty and to higher likelihood of success. As pointed out by Henderson & Clark (1990), the cause of the market's skepticism is that radical innovations are often subject to a perception of incongruity, and are prone to generate high-intensity emotional responses, which can either be negative, if associated with frustration, or positive, if associated with significant improvements in utility and practicality (Mick & Fournier, 1998). With regard to the perspective of the market, on the one hand, von Hippel (1986), Moore (1991), and Rogers (1995) all confirmed that both lead users and innovators are more likely to be accepting of radical innovation through their involvement in its process. On the other hand, Rindova & Petkova (2007) suggested that the combination of the perpetuation of familiar shapes of already existing products like cars, computers and mobile phones, with the simultaneous introduction of original, state-of-the-art capabilities, is the means to increased customer acceptance. Groenewegen & de Langen (2012) studied the factors observed to affect the success of start-up firms specifically regarding the concept of radical innovation, and argued that both the uniqueness of innovation as well as the involvement of customers, reinforce and lead to the success of start-ups firms.

5.3. Knowledge spillovers

The R&D activities of firms generate spillovers of knowledge to third parties that are able to take advantage of this knowledge (Acs et al., 1992, 1994; Jaffe, 1986; Macdissi & Negassi, 2002). Patents often have spillover effects in some industries (Scherer, 1982, 1984) and in related clusters (Jaffe, 1985, 1986, 1988). Griliches

(1992) argues that knowledge spillovers transpire due to two major reasons; firstly, because of the imperfect appropriability of innovation, and secondly, because there is an increasing inequality in knowledge distribution that encourages weaker stakeholders to capture unintended knowledge spillovers as a tactic for organizational survival.

Losses from piracy are evaluated from a financial perspective. In 1982, the United States economy lost $6 to 8 billion to overseas pirating. In 1986, this figure rose to $61 billion (Sullivan, 1989). The cost of piracy can be associated with multiple outcomes, including the costs of brand image erosion (Keller, 1993; McDonald & Roberts, 1994), costs related to lost sales of the legal version of a product (Globerman, 2001; Johnson, 1985; Nill & Schultz II, 1996), and the cost of enforcement (Rice, 2002). In addition, piracy losses consist of direct sales losses (Givon et al., 1995) – including estimated losses in software equal to $1.5 billion per year (Givon et al., 1995; McDonald & Roberts, 1994) – and a broader group of losses that includes profits, tax revenues, employee welfare, and working conduction. Total worldwide losses from piracy were estimated at $265 billion annually in 1999 (Trembly, 1999). Moreover, knowledge spillovers as the main cause of counterfeit products represented $200 billion in 2007 (OECD, 2007). Additionally, these counterfeit products also carry health and safety product risks, negatively impact the economy, employee welfare (through illegal or clandestine activities), innovation processes, and economic growth (Haie-Fayle & Hubner, 2007).

Venturini et al. (2019) studied the effect of knowledge spillovers to competitors on the cross-functional knowledge integration of a firm regarding the R&D role in manufacturing companies. The authors utilized data collected by a Carnegie-Mellon University (CMU) survey with the purpose of analyzing R&D activities of corporate laboratories of manufacturing companies in the U.S. The data used was a representative sample of all U.S. R&D labs of manufacturing companies. Venturini et al. (2019) found that knowledge integration activities can increase the risk of knowledge spillovers which benefits competitors. This may occur due to employee turnover, informal conversations between employees of competing companies, or during scientific conferences. Based on the study's findings, researchers argue that the intensity of R&D knowledge spillovers at the industry-level decreases the likelihood for companies to execute or accomplish knowledge integration (Venturini et al., 2019). In addition, the findings of Venturini et al. (2019) also point to the risk that knowledge spillovers could have a significant impact on the management of knowledge flows and the implementations of practices in a company. Therefore, it is essential to underline the impact of knowledge spillovers that could shape the decision of the company to search for knowledge from external sources while also including the integration of internal knowledge. Ultimately, the impact of spillovers on external knowledge sources could influence the innovation performance of a company.

Moreover, in knowledge dynamics, accidental knowledge spillovers are negative downstream. Various studies have investigated the impact "fear of imitation" has on the R&D decisions of companies; for instance, in the collaborative R&D project situations, mobility limitations of employees, selection of the company location, and also on the overall ability to source external R&D knowledge (Agarwal et al., 2009; Cassiman & Veugelers, 2002, 2006; Giarratana & Mariani, 2014; Liebeskind, 1996; Oxley & Sampson, 2004). Specifically, Brossard and Vicente (2007) demonstrated this issue in the ICT sector. So far it has been a challenge to determine the quantity of knowledge spillovers, the origin or the destination of this knowledge, the estimate of spillovers, the final use and the risk of poor use that could damage the end user as well as the lack of legal responsibility.

Spillovers does not suffice to firms willing to imitate because of the existence of imitation costs and the speed of obsolescence. Mansfield et al. (1981) obtained information about the costs of imitation, and suggested that "all costs of developing and introducing the imitative product, including applied research, product specification, pilot plant or prototype construction, investment in plant equipment, and manufacturing and marketing start-up (if there was a patent on the innovation, the cost of inventing around it is included) represent 65% of innovation costs" (p. 907). This means that imitators tend to have limited R&D expenditures.

5.4. Knowledge spillovers in alliances

Dussauge et al. (2000) state that firms involved with rivals in alliances tend to gain their partner's capabilities. As such, alliances may indeed face difficulties when firms are exploiting internal knowledge from each other, which may include challenges such as transmitting and protecting valuable and strategic knowledge (Giarratana & Mariani, 2014). The literature has looked at various kinds of knowledge-related issues originated from these collaborations such as asymmetric learning (Hamel et al., 1989), learning races (Khanna et al., 1998), constant competition for the gaining of intellectual properties (Khanna et al., 1998), inseparability of operational procedures across functions (Oxley & Sampson, 2004), and alliance failure (Park & Russo, 1996).

The openness and availability of knowledge create positive externalities known as knowledge spillovers, the value of and access to which positively affects all partners (Arrow, 1962; Grossman & Helpman, 1991; Romer, 1990). The positive externality from R&D activities have been acknowledged since the 1980's by Audretsch et al. (1996) and Griliches (1991), and it is pertinent to observe that these knowledge spillovers can be intended or unintended. In the case of intended knowledge spillovers, there is a conscious and intentional exchange of information and know-how from all partners (Dyer & Singh, 1998). On the other hand, unintended

spillovers take place when firms become more knowledgeable than expected after the intended spillover.

However, companies can also acquire capabilities from the partner through non-planned alliance activities (Easterby-Smith et al., 2008) at reduced cost or no cost at all (Feinberg & Gupta, 2004; Jaffe et al., 1993). Knowledge spillovers have been defined by Agarwal et al. (2010) as "the external benefits from knowledge creation that is enjoyed by parties other than the party investing in the creation" (p. 272). The risk of knowledge spillover increases when firms cooperate in R&D activities, by which other partners may be willing to use knowledge to acquire some private gain (Oxley, 1997). Competitors may be able to compete more effectively when getting access to strategic information through knowledge leakages. Thus, alliance literature has strongly stressed the topics of knowledge leakage and misappropriation (Gulati & Singh, 1998; Oxley, 1997; Pisano, 1990).

While firms need to share information and knowledge with partners in accordance with the cooperative agreement, they may also incorrectly acquire information and knowledge outside the ambit of the agreement (Anokhin et al., 2011). They could even engage in illicit activities, thereby breaking the agreement's spirit (Das & Kumar, 2011). Research on the alliances of firms has emphasized analyzing the competitive tensions involved in collaborations between rivals, especially the risk of knowledge stealing that comes with partner competition. Chen (2008) investigated the risks faced by rival firms when getting involved in R&D alliances, such as knowledge leakage and misappropriation. Jiang et al. (2016) define knowledge-leakage risk "as the focal firms perceived risk of losing its critical information and knowledge to partners beyond the cooperative agreement" (p. 107). Alliances require a larger quantity of knowledge exchange that are at risk of leakage; specifically in alliances with a wider vertical scope, knowledge sharing between allies occurs as a result of an increasing number of contacts (Reuer et al., 2002).

When companies are involved in R&D alliances, different types of knowledge are at risk, such as company strategies, future technology search, benchmarking data, confidential formulas or designs and tacit knowledge (Oxley & Sampson, 2004). Additionally, Oxley & Sampson (2004) have shown that allies that belong to the same market tend to emphasize their R&D alliance in R&D alone and are not involved in any other organizational activities to avoid knowledge losses.

The results of this study conducted by Ryu et al. (2018) contribute to the alliance literature by analyzing the competitive features of alliances and the possible risks of collaborating with competitors (Hamel et al., 1989; Khanna et al., 1998; Oxley & Sampson, 2004; Park & Russo, 1996). Furthermore, alliance literature has considered dyadic relationships with direct competitors, and recent research has considered the threats presented by knowledge leakage to rivals through indirect links; for instance, having common suppliers, sharing intermediary companies, and board links (Hernandez et al., 2015; Mesquita et al., 2008; Pahnke et al.,

2015). Ryu et al. (2018) focused solely on the increasing risk of knowledge spillovers and misappropriation when the allied firms are co-located in the same geographical area. This is the first research that explicitly examines how co-location between allies has an impact on the design and governance of R&D alliances (Ryu et al., 2018), as the authors argue that co-location improves the chances of rivals' accessing the focal firm's knowledge. Consequently, the focal firm could decrease this risk by applying equity governance structures which offer greater incentive alignment, control, and monitoring. Focal firms may also limit the alliance scope and task interdependence in order to reduce indirect knowledge losses to rivals (Ryu et al., 2018). Moreover, according to Ryu et al. (2018), this study may inspire future research to consider the negative implications of agglomeration in a competitive context of collaboration. Ryu et al. (2018) argued "For these reasons, we see the leakage concern as a first-order influence compared to the potential benefit of indirect access to competitive intelligence. However, future research could explore situations where potential benefits of knowledge spill-ins play a larger role than potential risk of knowledge spillovers and misappropriation" (p. 961). This research also subscribes to agglomeration literature, the primary focus of which has been on the benefits of geographic clustering, such as the access to a pool of knowledge spillovers. However, few studies have stressed the concern that firms not only take knowledge from that pool but also contribute to it (Ryu et al., 2018). Consequently, Ryu et al. (2018) "encourage future research that devotes more attention to the downsides of clusters and how firms might still obtain benefits of clusters despite the risks that firms encounter" (p. 961). Jiang et al. (2016) argued that there are no research instruments to measure knowledge-leakage risk, which is a clear deficiency in the field.

5.5. Remedies

According to Simonin (1999), knowledge protection is a "conscientious and intended state of information filtering" (p. 600). Thus, organizations often use knowledge protection to avoid abuse of their know-how by their partners (Kale et al., 2000; Norman, 2001; Oxley & Sampson, 2004). However, in order to improve the learning to and from the partners, organizations need to expand their knowledge boundaries (Hamel, 1991; Khanna et al., 1998).

Nevertheless, the established literature show great disadvantages from knowledge protection (Shu et al., 2014). According to Simonin (1999), knowledge protection hinders knowledge transfer in partnerships. Shu et al. (2014) further argued that "Partners' knowledge protection sends a strong signal that the protected knowledge is valuable and thus rare" (p. 919). Shu et al. (2014) argued that "partners' knowledge protection, which is regarded as a knowledge filter, can increase knowl-

edge spillovers in an alliance. Moreover, this relationship is contingent on the strength of a focal firm's entrepreneurial orientation and on alliance type (equity joint venture versus nonequity joint venture). Results also reveal that knowledge spillovers in an alliance enhance alliance performance more significantly than they enhance firm performance" (p. 913). The authors made use of a quantitative method, acquiring their data from a cross-sectional survey which was conducted in 2007 on 219 different partnerships in 21 provinces of China. The use of cross-sectional surveys impede causality assessment, as explained by Shu et al. (2014). By making use of secondary data combined with subjective measures, this could be a path for further research (Shu et al., 2014).

As knowledge protection becomes more difficult in alliances with a wider vertical scope, companies may decrease the scope of the alliance to avoid knowledge leakages that could be strategically important for the company. For example, Oxley & Sampson (2004) stated that R&D allies that are direct competitors will typically exclude manufacturing and marketing activities from the alliance, as knowledge leakages could otherwise lead to high damage to their competitive position. The empirical study on 639 R&D alliances, including 543 pure R&D alliances and 96 R&D alliances associated with manufacturing and/or marketing activities, Ryu et al. (2018) supported the following hypothesis: "The greater the risk from partner–rival co-location, the greater the likelihood the R&D alliance has a narrow scope" (Ryu et al., 2018, p. 959).

Based on an empirical study on innovating firms of Spain (2004–2011) that belong to a large panel, Belderbos et al. (2018) argued that horizontal R&D collaboration with rivals is inclined to stimulate collaboration with other partner types in R&D collaboration. However, in order to reduce the possibility of knowledge spillover to competitors, Belderbos et al. (2018) demonstrate that, in horizontal collaboration, the alignment is delayed. However, the authors detected various limitations in the study. The research was reliant on information with regards to the involvement with the various partner types in R&D collaboration. Additionally, instead of monitoring the beginning and ending of separate R&D alliances, the study took a strategic perspective on R&D collaboration with different partner types (Belderbos et al. 2018). Thus, the authors assert that this research has some shortcomings which could be worked on in further research.

Moreover, Shaver & Flyer (2000) state that firms that possess valuable technologies or strong human capital will avoid being located in a cluster to prevent themselves from the risk of spillovers. This prevents rivals accessing this knowledge, which could decrease the firm's competitive advantage, as highlighted by Shaver & Flyer (2000)'s work. Based on strategic alliances gathered from 205 Chinese firms, Jiang et al. (2016) argued that knowledge leakage risk is a moderator on the link between Entrepreneurial Orientation (EO) and the outcomes of alliances. EO is key in the processes and outcomes of alliances (Stam & Elfring, 2008;

K. H. Tsai & Wang, 2008; Wiklund & Shepherd, 2005). Firms should thus pay special attention to managing the leakage of knowledge so as to keep their sustainable competitive advantages, by which knowledge is an key element (Li et al., 2008b; Norman, 2004; Oxley & Sampson, 2004).

Haus Reve et al. (2019) explain that product innovation is the result of collaboration between supply-chain and scientific partners. It is demonstrated that this type of collaboration leads to a greater likelihood of innovation even if it implies a negative interaction between them.

5.6. Legal mechanisms

Arrow (1962a) describes the appropriability problem as the difficulty of protecting profits from innovation. To cope with the appropriability problem, scholars began to consider regime appropriability as the level to which organizations could protect their new products and processes (Antonelli, 1999; Buzzacchi et al., 1995). When this level is low, there is less incentive to invest in absorptive capacity (Spence, 1984). On the contrary, strong appropriability encourages absorptive capacity and the protection of innovation with patents (Anton & Yao, 2000). According to Teece (1986), the ability to protect the advantages of new products or processes (the concept of appropriability) depends on the protection regime, patent policy, and the risk of imitation. Organizations attempt to strengthen regime appropriability through property rights (e.g., patents, trademark, copyrights, and/or trade secrets) (Teece, 1986, 2007). Teece (1986, 1998b) argues that a firm's appropriability is either strong or weak depending on how well it can protect against unintended knowledge spillovers.

According to Lindsay & Hopkins (2010), an "intellectual asset is broader than intellectual property (IP), for, in addition to patents, trademarks, and other items that can be legally owned, it also includes publications and other forms of information that are not owned." Reinforcing the salient aspect of regime appropriability, Cook & Brown (1999) argue that knowledge is an object of possession because it can be "acquired, modeled, and expressed most accurately in the most objective and explicit terms possible" (p. 384). Knowledge eventually became a storable and transferrable asset (Hansen & Løvas, 2004; Hasegawa, 2000; Zack, 1999a); the knowledge-based view of the firm depicts an organization that gathers, generates, applies and protects knowledge assets (Teece, 2000). According to Lindsay & Hopkins (2010), "intellectual asset is broader than intellectual property (IP), for, in addition to patents, trademarks, and other items that can be legally owned, it also includes publications and other forms of information that are not owned."

Levin et al. (1987) and Levin et al. (1983) consider the following six mechanisms that aim to capture and protect competitive advantages based on new pro-

cesses and new products: patents that protect against duplication; patents that secure royalty income; secrecy; lead time; moving quickly; and the complementarity of sales and service efforts. Strategic protection guides firms to invest to guard against knowledge spillovers (Arbussa & Coenders, 2007), and certain means of protection are industry specific (Levin, Klevorick, Nelson, & Winter, 1987; Mansfield et al., 1981; Mansfield, 1986; Arundel, 2001). Furthermore, according to Kogut & Zander (1996) and Steinmueller (2000), one key advantage is the possibility of transferring codified knowledge. Nonaka (1994) argues that knowledge can be transferred if it is explicit, a process that requires procedural routines and governance.

Knowledge spillovers may lead to a possible leak of the proprietary knowledge of the firm to its competitors (Agarwal et al., 2009; Almeida & Kogut, 1999; Rosenkopf & Almeida, 2003). Some researchers have investigated how legal defense mechanisms like contracting or intellectual property rights enable firms to curb the disadvantages of inter-organizational ties (Katila & Chen, 2008; Mayer & Salomon, 2006; Oxley & Sampson, 2004). According to Arbussa and Coenders (2007), strategic protection methods motivate firms to invest in protection against knowledge spillovers. Contracting, governance modes, limiting scope, or intellectual property rights aid in avoiding unintended knowledge spillovers (Katila & Chen, 2008; Mayer & Salomon, 2006; Oxley & Sampson, 2004).

To avoid issues of tacit knowledge, some organizations prioritize knowledge transfer through IPRs. Patenting is an effective protection mechanism in some industries (Mansfield, Schwartz, & Wagner, 1981; Levin, Klevorick, Nelson, & Winter, 1987). Harmon (1991) argued that 90% of infringed IPRs are valid (1982–1990 by the Court of Appeals for the Federal Circuit, CAFC). However, from a resource perspective, spin-offs cannot compete with large firms such as Texas Instruments, Intel, Wang Laboratories and Digital Equipment, which are able to spend from one million to several million dollars on these issues (Merges, 1999).

5.7. Patents

As an intellectual asset, a patent is defined by Griliches (1990) as "a document, issued by an authorized governmental agency, granting the right to exclude anyone else from the production or use of a specific new device, apparatus, or process for a stated number of years" (p. 1662). The patenting process has been studied and debated among three main schools: the NBER group (Griliches, Hall, Hausman, Jaffe, Pakes, Schankerman), the Yale group (Levin, Nelson, Klevorick, Winter, Reiss, Cohen), and the SPRU group (Freeman, Pavitt, Soete). A patent is granted when it satisfies the conditions of novelty and potential utility. Patents originally sought to catalyze invention and technical progress. Today, however, patents act

as barriers to technical progress that are retained by a limited number of stakeholders. In that sense, regime appropriability and the development of patenting policies truly changed the rules of the game (Nelson & Winter, 1982).

Furthermore, Griliches (1990) argued that "not all inventions are patentable, not all inventions are patented, and the inventions that are patented differ greatly in 'quality'" (p1669). Griliches (1990) further argued that "there are two major problems in using patents for economic analysis: classification and intrinsic variability" (p1666). Classification is based on technological and functional principles. The work of Scherer (1984b) aimed to classify patents according to industry. Griliches (1990) argued that patents carry additional information, such as the name of inventors, organizations, patent classes, cited patents and articles. Consequently, it is possible to study this content. Patents differ in importance according to industry. Consequently, it is necessary to control this parameter via SIC. Griliches (1990) argued that "small firms appear to be more 'efficient', receiving a larger number of patents per R&D dollar" (p. 1674). Griliches (1990) argued that the survival of firms differs between large or small firms. Consequently, the propensity to patent as a form of protective governance is lower for large firms and larger for small firms.

Patenting is an effective mechanism of protection in some industries (Mansfield et al., 1981; Levin et al., 1987). Patent protection reduces the all-round innovative activity and thus growth of the success of a firm depends upon its R&D intensity (Davidson & Segerstrom, 1998; Segerstrom, 1991; Taylor et al., 1993). An imitator does not just copy; they utilize the existing innovation for the purpose of further innovation which is made tough by patent protection (Aghion et al., 2001; Bessen & Maskin, 2009; Heller & Eisenberg, 1998; Mukoyama, 2003). Furthermore, Berger et al. (2012) utilized data from the German Patent Office and the European Patent Office to conduct a probability study on copying, patent, and trademark infringement. They found that strategic behavior and trademarks have an impact on the possibility of imitation (Berger et al., 2012). Additionally, financial benefits can be acquired from knowledge that is safeguarded from theft or imitation (Helms et al., 2000; Liebeskind, 1996). Therefore, other than safeguarding firms from knowledge spillover, patents can even create revenues for companies. Mazzeo et al. (2013) performed a regression analysis to investigate the variance of patent infringement awards by recognizing the predictors. The researchers analyzed 1,331 cases: 439 infringements and 340 awarded damages cases by accumulating data from the US federal courts between 1995 and 2008 and from PricewaterhouseCoopers LLP. They concluded that it foreseeing large or small awards from patent infringement is indeed possible (Mazzeo et al., 2013).

Antonelli, Krafft & Quatraro (2010) argued that recombinant knowledge offers new perspectives on investigation, more precisely perspectives on patenting. These

authors studied patent applications from the European Patent Office in a 22- year period (1981–2003). The recombination of knowledge is based on the strong complementarity of knowledge, which opens the door to new applications.

Griliches (1990) also questioned whether patents are input or output. He suggested a descriptive model rather than a theory. The model argues that research expenditures affect the generation of valuable knowledge, which itself influences both the number of patents as a quantitative indicator of the number of inventions and benefits from inventions conjointly with other observed and unobserved influences. The author argued that "a theory would have to be more explicit about the conditions (economic, technological, and legal) under which the benefits from applying for a patent outweigh the direct costs of application and the potential consequences of disclosing the technology."

Moreover, Griliches (1990) argued that patents are related to innovativeness and represent "a minimal quantum of invention that has passed both the scrutiny of the patent office as to its novelty and the test of the investment of effort and resources by the inventor and his organization into the development of this product or idea, indicating thereby the presence of a non-negligible expectation as to its ultimate utility and marketability" (Griliches, 1990, p. 1669). Griliches (1990) argued that "patents are a good index of inventive activity, a major aspect of which is also measured by R&D expenditures." Pakes & Griliches (1984) argued that there is a strong positive relationship between R&D spending and the number of patents (Pakes & Griliches, 1984; Bound, Cummins, Griliches, Hall, & Jaffe, 1984; Ahuja & Lampert, 2001; Hagedoorn & Duysters, 2002).

Griliches (1990) indicated that patents constitute a measure of the technological effectiveness of innovation activities. Furthermore, Griliches (1990) aimed to compare patents and stock market values as output indicators. According to Wenxiong Yao (2006), "having at least one patent in the previous year yielded an average gain of an extra 30% in current patenting. Therefore, past patents can alert firms to successful research paths." Artz et al. (2010) conducted a longitudinal study of the effects of R&D, patents and product innovation on firm performance, and the results were inconsistent with the inverse U-shaped relationship between R&D spending and product announcements. Instead, the authors argued that it is a U-shaped relationship.

Moreover, Cohen et al. (2000) state that secrecy and lead time surpass patents' performance. Nevertheless, according to Cohen et al. (2002), the imitation lag can be extended by a few months by patent protection. Similar results have been found for Germany, Portugal (De Faria & Sofka, 2010), Switzerland (Harabi, 1994), and the US, but not for Japan (Cohen et al., 2002). According to Engel and Kleine (2015), unless the law steps in and the patent forms a temporary monopoly, other users could just copy the invention. Moreover, Engel and Kleine (2015) claim that if innovators are not guarded against others acquiring their ideas, incentives for inno-

vation are sub-optimally low. In the policy debate, this is the straightforward reasoning which is used to justify the existence of intellectual property.

Griliches (1990) argued that "patents differ greatly in their technical and economic significance. Many of them reflect minor improvements of little economic value. Some of them, however, prove extremely valuable" (p. 1666). In addition, Griliches (1990) aimed to determine how to use patents as an indicator. Griliches (1990) expressed hope that patents can be considered an output in economics. Schmookler (1966) studied patents as capital goods linked with an industry. Although not successful, Schmookler (1966) aimed to measure patents to explain the total factor of productivity growth.

Chapter 6

Empirical study

To further discuss the relations between strategic alliances, ambidexterity, absorptive capacity, innovation, and unintended knowledge spillovers, an empirical study has been conducted.

6.1. Questionnaire development

A questionnaire was developed through a multi-stage process following Churchill (1979), Anderson & Gerbing (1988), Hazan & Shaver (1994), and Hazan & Zeifman (1999). We conducted a qualitative preliminary study by interviewing 36 experts. We then considered the scales from the literature to build our draft questionnaire. The questionnaire was evaluated by four academic experts in innovation management, two practitioners from a large firm and a start-up, and one person from Grenoble's Minalogic cluster. Based on the questionnaire's critical evaluation, we simplified some of the items from our constructs to shorten the questionnaire. We also added examples about the concepts to increase our respondents' understanding.

We refer to Schilke & Goerzen's (2010) study, which empirically studied firms' R&D alliances. We measured the individual involvement in strategic alliances using a 15-item adapted scale from Simonin (1999) and Schilke & Goerzen (2010) as a binary variable. ACAP has been assessed using a 3-item adapted scale from Zobel (2017) on a 7-point Likert scale. Most publications measure individual ambidexterity with two statistically independent variables: exploration and exploitation. These variables interact to form a single measurement of individual ambidexterity (Schultz, Schreyoegg, and Von Reitzenstein, 2013; Li, Lin & Tien, 2015; Mom, Fourné, and Jansen, 2015; Torres, Drago and Aqueveque, 2015). As per those past studies, we used a 2-item construct on a 7-point Likert adapted scale from Mom et al. (2007), Kauppila and Tempelaar (2016), and Tempelaar and Rosenkranz (2019). Like past research (Gibson & Birkinshaw, 2004; Mom et al., 2009; Tempelaar and Rosenkranz, 2019), we multiplied exploration and exploitation to create a variable of individual ambidexterity. Organizational innovativeness has been assessed using a 5-item adapted scale from Tavassoli & Karlsson (2015) on a 7-point Likert scale to measure the five Schumpeterian aspects of innovation: New production processes, new products, new materials or resources, new markets, and

new forms of organizations. Jiang et al. (2016) argued that no research instruments measure knowledge-leakage risk – a deficiency in the field. We measured negative outcomes, such as unintended knowledge spillovers and imitation, as a 2-item construct on a 7-point Likert adapted scale from Jiang et al. (2016) and Venturini et al. (2019).

6.2. Data collection

A pre-test was performed on 36 people from our sample of knowledge workers from firms in Grenoble's Minalogic cluster. We used SPSS version 25 to conduct the statistical analysis and checked the reliability of our constructs with Cronbach's Alpha. Since our early statistics were satisfactory, the survey was fully administrated.

We created a database, gathering 3145 knowledge workers from firms in the Minalogic cluster. It included the person's name, the firm name, the person's function, their e-mail, and their phone number (when available). We sent 3145 individualized e-mails mentioning the person's name and position, the firm's name, the reasons for choosing this firm in our sample, a cover letter for the project, and the link to our online survey. Finally, we sent two reminders by e-mail at one-week intervals.

We obtained 421 responses. No data was missing from our data collection because only fully completed questionnaires could be validated. However, we detected eight unengaged respondents that gave similar answers for all questions. Consequently, our final sample size was 413 valid responses, representing a 13.13% response rate. Table 1 presents the descriptive statistics. The test of early and late respondents was conducted to detect non-response bias (Armstrong & Overton, 1977). The first 10 and 20% of respondents' average values were compared with the last 10 and 20% of the respondents' values. We did not detect a significant difference between early and late respondents.

Table 1. Descriptive statistics

Dimension	Items	Frequency	Percentage
Gender	Female	95	23.00
	Male	318	77.00
Age	18–24	7	1.69
	25–34	79	19.13
	35–44	146	35.35
	45–54	140	33.90
	55–64	41	9.93

Education	High school graduate	6	1.45
	Bachelor's degree	19	4.60
	Master's degree	317	76.76
	Doctorate degree	71	17.19
Job type	CEO	6	1.45
	Executive, manager, intellectual profession	386	93.46
	Intermediate profession	21	5.08
Department	Head office and strategy	45	10.90
	Technological research and development	122	29.54
	Purchasing and logistics (supply chain management)	40	9.69
	Production and engineering	53	12.83
	Marketing	33	7.99
	Sales	29	7.02
	Human resources	19	4.60
	Financial management	10	2.42
	Managerial accounting and accounting	3	0.73
	Administration, legal and fiscal support	8	1.94
	Infrastructure and safety	6	1.45
	Information systems	25	6.05
	Quality and environment	20	4.84
Number of subordinates	0	192	46.49
	1–5	75	18.16
	6–10	50	12.11
	11–100	25	18.64
	101–1000	11	3.87
	Above 1001	3	0.73
Firm's size	1–10	14	3.39
	11–50	32	7.75
	51–100	22	5.33
	101–250	62	15.01
	251–500	59	14.29
	501–1000	50	12.11
	Above 1001	174	42.13

N=413

6.3. Analysis

The content validity was assessed in three ways: (1) academic experts, (2) the use of valid scales, and (3) the use of a reliability test. First, content validity was assessed by several academic experts. All academic experts agreed that the measurement scales were appropriate for measuring constructs. Second, content validity was assessed by the literature (Babbie, 2001). All measurement scales are widely used in the literature and were taken from the following journals: Research Policy, Journal of Management Studies, Journal of Management, and Journal of Product Innovation Management. Third, the content validity was assessed by reliability tests (Rust & Cooil, 1994; Zwick, 1988). The reliability of the four constructs was examined using Cronbach's Alpha. Cronbach's Alpha was greater than 0.70 (Nunnally & Bernstein, 1994) for all factors. Those results indicate the acceptable consistency of the measurement items (Nunnally, 1978).

Construct validity is measured with (1) convergent validity, (2) discriminant validity, and (3) nomological validity. To assess the convergent validity, we verified that the correlations between items from the same construct were at least 0.3. Such scale purification did not motivate any deletion. We also checked that all factor loadings were at least 0.5, which was the case. Referring to Anderson & Gerbing (1988), we assess that our data does not suffer from discriminant validity. Finally, we evaluated the nomological validity by analyzing the sign of two-by-two correlations. We did not remove any weak items to reduce the theoretical construct (Hair et al., 1998). Table 2 is presenting the Alpha Cronbach.

Table 2. Constructs, items, and reliability

Construct items	Factor loadings	Cronbach's Alpha
Involvement in strategic alliances		.88
Indicate in which strategic alliances you were involved last year. Tick the box „not involved" if you were not involved in such agreements.		
R&D Alliance		
R&D Agreement (A firm conduct's a product's R&D.)	.65	
Technology transfer (A firm develops a technology to be sold to another firm.)	.79	
Cross technology transfer (Two firms develop distinctive technologies to proceed to a technological exchange.)	.74	
Backward Alliance		
Supply agreement (A firm provides goods for a buyer.)	.64	
Original Equipment Manufacturer (laptop, integrated circuit, etc.)	.82	
Manufacturing agreement (final product)	.80	
Marketing agreement (door-to-door selling, communication, promotion)	.71	
Value-Added Reseller agreement (services, training of end-users)	.66	

Licensing Agreement		
Licensing agreement (The franchiser provides another firm with its know-how, training, and permanent help against money.)	.84	
Exclusive licensing agreement (The firm involved in a franchise uses only products and services from the franchisor.)	.86	
Cross licensing agreement (Two firms provide mutual assistance on know-how and training.)	.83	
Equity Agreement		
Equity stake purchase (investment in a form against shares)	.73	
Equity transfer (investment transfer from one firm to another)	.74	
Cross equity transfer (two firms are mutually investing funds in another firm)	.72	
Joint Venture (co-enterprise created by two or more firms owning variable shares)	.63	
Positive outcomes		.84
Indicate your degree of agreement regarding positive output linked to interactions between your organization and its partners.		
Interactions improve your company's overall efficiency.	.76	
Interactions lead to the acquisition of new clients.	.72	
Interactions help in determining future goals.	.68	
Interactions improve the firm's image.	.73	
Interactions improve processes.	.73	
Negative outcomes		.80
In the scope of your interaction with your partners, how to do evaluate unintended knowledge spillovers	.80	
In the scope of your interaction with your partners, how to do evaluate imitation	.84	

Construct items	Factor loadings	Cronbach's Alpha
ACAP		.76
Evaluate the capability of absorption of your organization. (e.g.: Your organization meets up with a pool of experts in nanotechnologies. Your organization is able to listen carefully, to understand and to appropriate the content)	.75	
Evaluate the capability of transfer of your organization. (e.g.: A research center has developed a technology for your organization. A transfer of knowledge occurs afterwards)	.76	
Evaluate the capability of learning of your organization. (e.g.: Your organization is capable do be in a continuous learning process)	.65	
Organizational innovativeness		.85
Please indicate the degree of innovation in the following domains within your organization		
New production processes	.74	
New products	.81	
New materials, resources and technologies	.80	
New markets	.71	
New forms of organizations	.50	

We performed the Skew and Kurtosis tests. We did not detect any multicollinearity-related issues by observing bivariate correlations or calculating the Variance Inflation Factor. Table 3 presents our constructs' correlations.

Table 3. Correlation matrix

	Alliance	ACAP	Ambidexterity	Innovation	Knowledge spillovers
Alliance	1				
ACAP	.176**	1			
Ambidexterity	.001	.141**	1		
Innovation	.191**	.444**	.128**	1	
Knowledge spillovers	.226**	.120*	.108*	.162**	1

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
N=413

From our analysis, our data suggests that the relations between all the constructs highly correlate, meaning that bringing together those theoretical concepts together is well supported by empirical investigation.

Conclusion

This monograph presented a thorough theoretical background on strategic alliances, by providing seminal definitions, as well as meaningful paths for further research, by embracing a large range of typologies of strategic alliances, for instance, vertical and horizontal alliances, non-equity and equity alliances, but also R&D alliances, Joint venture, OEM, and licensing. The way to engage in strategic alliances is by adopting a process view on various steps: Alliance formation, partner matching, alliance portfolio diversity, alliance experience, and alliance management capability.

To benefit from strategic alliances, engaged stakeholders should hold a strong absorptive capacity, understanding a strong potential and realized absorptive capacity. In particular, stakeholders should develop robust organizational recognition, acquisition, assimilation, transformation, and exploitation. Meanwhile, those engaged stakeholders should also have a strong ambidexterity, and the ability to balance exploration and exploitation. I elaborated on various solutions to achieve ambidexterity, the role played by ambidexterity in alliances, and the relation between ambidexterity and absorptive capacity.

I elaborated on the outcomes of strategic alliances, by considering both the positive outcomes such as innovation composed of various types: Process innovation, product innovation, new materials or resources innovation, market innovation, and organizational innovation. Given the degree of innovativeness, I further explain how innovation can either be radical or incremental. Apart from the financial performance, I also warn the organization on the negative aspects of strategic alliances, especially about the risk of unintended knowledge spillovers. Indeed, negative outcomes may appear due to the misuse of knowledge assets, especially in strategic alliances. I further encourage firms to adopt the suggested remedies, especially by using legal mechanisms such as patenting.

Our first contribution concerns the assessment of positive (Baum et al., 2000; Powell et al., 1996; Rowley et al., 2000) and negative outcomes (Greve et al., 2010; Puranam & Vanneste; 2009; Rowley et al., 2005; Goerzen, 2007) of strategic alliances, from the perspective of knowledge workers, which is new to the field. Our results argue that knowledge workers in firms engaged in strategic alliances observe proven pains but no proven gains from these alliances. We further consider the additional shortcomings of alliances, such as unintended knowledge spillovers (Nelson, 1959; Arrow, 1962; Spence, 1984), consequently filling the gap pointed

by Ryu et al. (2018), who called for future research on the benefits and potential risks of knowledge spillovers and misappropriation. We contribute to Jiang et al.'s (2016) research by suggesting a partial mediation of involvement in strategic alliances on the relation between individual knowledge divisibility and negative outcomes. Past studies focused mainly on a particular type of strategic alliance (Schilke & Goerzen, 2010). But we have been more inclusive. We considered R&D alliances (Hagedoorn, 2002; Reuer & Lahiri, 2014), backward vertical alliances (Bernstein & Kök, 2009; Großmann et al., 2016), forward vertical alliances (Isaksson et al., 2016; Robinson & Stuart, 2007), equity alliances (Gulati & Singh, 1998; Pisano, 1989; Glisters & Buckley, 1996; Oliver, 1990), and licensing agreements (Hermosillaa & Wu, 2018) in an inclusive KBA portfolio (Almeida et al., 2003; Rosenkopf & Nerkar, 2001). Consequently, we believe that our study satisfactorily undertook the paths for further research indicated by Schilke & Goerzen (2010).

The final implications of this monograph are the following. To CEOs, I advise them to weight the pros and cons of engaging in a strategic alliance, by not only looking at the financial results at the firm level, but also by developing specific dashboards on strategic alliances satisfaction. While today Open Innovation is in fashion, we would recommend firms to questions such trend and be able to measure the outcomes of strategic alliances. Firms may also be able to select the most suitable type of strategic alliances, between R&D alliances, backward vertical alliances, forward vertical alliances, equity alliances, and licensing agreements and weight the potential benefits and the risks. I suggest firms to favor organizational absorptive capacity and organizational ambidexterity. Based on those managerial recommendations, I hope that firms will increase the rate of success of strategic alliances, above the threshold of 50%.

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This monograph investigates the involvement of firms in strategic alliances and the interplay with organizational absorptive capacity and organizational ambidexterity. The theoretical work highlights the positive aspects, as well as the negative aspects, for firms engaging in strategic alliances. The main contribution relates to the evaluation of both positive and negative outcomes of various types of strategic alliances. This monograph presents different avenues for firms regarding how to benefit from strategic alliances in terms of innovation, while avoiding threats such as unintended knowledge spillovers.

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