

AN INTEGRATION OF THE RESOURCE BASED VIEW AND REAL OPTIONS THEORY FOR INVESTMENTS IN OUTSIDE OPPORTUNITIES

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ABSTRACT

There is a growing trend by established firms to use a multitude of External Corporate Venturing (ECV) mechanisms (alliances, partnerships, joint ventures, acquisitions, licensing agreements and investments in corporate venture capital) to acquire external innovations. In this paper, we develop a framework within which firms choose ECV mechanisms that are best aligned with characteristics of the target company. More precisely, we investigate the effect of *relatedness* and *uncertainty* on governance mode choices by combining the Resource-based View of the firm and Real Options Theory. We propose a bi-dimensional matrix to show under which conditions of relatedness and uncertainty corporations choose among corporate venture capital, strategic alliance, joint venture and acquisition. We suggest that: (a) When the level of relatedness between the corporation and the target company is high and the level of uncertainty surrounding the target company is low, corporations are more likely to choose acquisitions as mechanism of ECV. (b) When both the levels of relatedness and uncertainty are high, corporations are more likely to choose strategic alliances (and corporate venture capital as second alternative). (c) When the level of relatedness is low and the level of uncertainty is high, corporations are more likely to choose corporate venture capital (and strategic alliances as second alternative). (d) When both the levels of relatedness and uncertainty are low, corporations are more likely to choose joint ventures as mechanism of ECV. Finally, we present a dynamic perspective to assess how these different forms of ECV transit over time, once part of uncertainty is resolved and a certain level of familiarity with the new knowledge is achieved.

Key-words: External Corporate Venturing, Strategic Real Options, Resource-based View

INTRODUCTION

Researchers have long understood the importance of investments in internal R&D as source of knowledge and innovation (Childs and Triantis, 1999; McGrath and Nerkar 2004, Oriani and Sobrero 2008). However, these investments provide only a partial contribution to a firm's growth and profitability leading to a "closed innovation system" in which research projects are launched exclusively from the technology base of the firm (Chesbrough, 2003). In a world with strong mobility of highly experienced and skilled people, fast time to market and high levels of uncertainty, however, considering resources that reside outside the firm's boundaries is a vital way to achieve competitive advantages and spawn innovation. Chesbrough (2003: xxiv) pointed out that to shift from a closed to an "open innovation system" "[...] firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology.". This is confirmed by Peter Drucker (2008, p. 799) who suggested that "[t]he search for innovation needs to be outside of the ongoing managerial business".

Firms generally resort to a wide range of mechanisms to rejuvenate their business models by exploiting external resources. These *external corporate venturing* (ECV) mechanisms include alliances, joint ventures, acquisitions, licensing agreements, collaborations with universities and investments in corporate venture capital (Roberts and Berry 1985; Arora and Gambardella, 1990). In presence of this broad variety of governance modes, it is critical for corporations figure out *which ECV mechanism they should choose*.

We propose a framework based on two theoretical perspectives - the Resource Based View (RBV) and Real Options Theory (ROT) - to address this issue. We complement such perspectives with insights from interviews with some of the bigger corporations engaged in external venturing activities. More precisely, we suggest that the decision making process needs to refer to two attributes characterizing the target company of the collaboration: the level of relatedness with the partner (as suggested by the RBV) and the level of uncertainty surrounding its activities (as suggested by ROT). Overlaying these two dimensions, we formalize a set of propositions and we propose a new representation of ECV to help firms in the choice of their corporate development trajectories by evaluating potential investments and determining when and how a form of external corporate venturing is more appropriate than another, as instrument of strategic growth. Our integrated framework helps explain why certain types of collaboration proliferate under high levels of relatedness and uncertainty, why other types better persist with low relatedness and uncertainty, and why still others make more sense with a combination of low relatedness and high uncertainty, or vice versa.

Finally, we describe the evolution of ECV mechanisms over time. Adopting a dynamic perspective based on real options, corporations can figure out how actively manage their collaborations by changing the design of the initial governance modes in response to changes in the intensity of relatedness and uncertainty characterizing the potential target company. We, thus, help firms answering a second dilemma: *Once an ECV mode is established, should the firm upgrade the relationship into a different mode of collaboration? And if so, how?*

This paper sheds new insights contributing to the previous literature on strategic management in several ways. Previous research discussing governance mode choice was limited for two main reasons. First, most studies focused on a single governance mode (Gulati and Singh, 1998; Folta and Miller, 2002; Kogut, 1991; Hellmann, 2002; Chesbrough, 2002; Dushnitsky and Lenox, 2005a, 2005b and 2006), or on the choice between two or three different governance modes: acquisition and alliances (Folta, 1998; Vanhaverbeke et al., 2002; Dyer et al., 2004), equity and non-equity alliances (Pisano, 1989; Oxley, 1997), make or buy (Monteverde and Teece, 1982), joint ventures and acquisitions (Folta, 1998), corporate venture capital, strategic alliances and acquisition (van de Vrande et al., 2006). Second, prior research generally examined ECV choices within one theoretical perspective. Kogut (1991), Folta and Leiblein (1994) and Folta (1998) applied the real options perspective; Walker and Weber (1984), Williamson (1991), Gulati and Singh (1998) and Vanhaverbeke et al. (2002) referred to the transaction cost economics; Kogut and Zander (1992) and Zollo et al. (2002) chose the resource-based view.

We fill these two gaps by connecting ROT to the RBV in order to investigate how firms choose among four different types of collaborations - corporate venture capital, strategic alliance, joint venture and acquisition. This multi-theoretical framework provides a richer description of decision making and allows to improve our understanding of when and how firms create competitive advantages through investments in external sources. This addresses the need posed by Reuer and Tong (2007) “*to better articulate real options theory’s link to other theories in the field [of strategic management] and to specify the theory’s appropriate boundaries.*”. In particular, ROT contributes to other theories in two ways: first, it deeply analyzes the impact of uncertainty on investments decisions and, second, it introduces a dynamic perspective by highlighting the sequential nature of external corporate development activities. Thus, a real option theory of governance modes can complement existing theories because ECV mechanisms face uncertainty in different ways, leading firms to use them discriminately to structure their investments. ROT has the potential to depict firms’ corporate development trajectories and explain the heterogeneous investment behaviors of firms when characterized by similar set of resources, but facing different levels of external uncertainty (Tong and Reuer, 2004).

The importance to address the issue on governance mode choices is also driven by the evidence that firms tend to manage external investments through separate units aimed to manage alliances, venture capital investments, joint ventures, licensing agreements and acquisitions. This consideration highlights the need to help firms in deciding which organizational unit is more suitable in order to identify, manage and exploit the collaboration with a potential partner. An “optimal” organizational separation which reflects managers’ view of ECV modes as distinct activities is, thus, critical to achieve. In this sense, our paper has important managerial implications about how to build a nimble infrastructure that allows to respond to opportunities with speed and flexibility. The creation of different organizational units to handle different types of opportunities, combined with the development of an efficient communicative systems in order to sustain interactions among them, is a prerequisite to create and manage external opportunities and succeed in uncertain environments.

The rest of the paper is structured as follows. We firstly provide a definition of ECV to circumscribe the context of our analysis. It also reviews the previous literature on ECV based on the RBV to highlight the major contributes and gaps. In particular, we focus on the role of relatedness in governance mode choices. Second, we introduce ROT by examining the role played by uncertainty. This session allows us to characterize ECV modes depending on the level of flexibility and reversibility, characteristics that corporations should consider in their investment decisions, especially when the level of uncertainty is high. Third, we describe a new taxonomy for ECV mechanisms by linking together the RBV and ROT. Then, we depict an investment in external sources as a multi-stage process based on the creation and management of real options. This session allows us to highlight the second contributions provided by real option theory, that is the possibility to dynamically analyze the evolution of collaborative modes over time. Finally, we offer some conclusive observations.

THEORETICAL BACKGROUND ON EXTERNAL CORPORATE VENTURING

A definition of external corporate venturing

The interest on corporate venturing (CV) is based on the need of large firms to renovate themselves through the creation of new opportunities and capabilities instead of focusing on the exploitation of their current competencies (Narayanan et al., 2008). The general definition of CV available in the literature is based on the classification which distinguishes between internal and external venturing (Sharma and Chrisman, 1999). Following this criterion, firms can be split between those nurturing opportunities that are already in house (internal venturing) and those financing autonomous organizational entities that reside outside the existing boundaries of the corporation (external

venturing). More precisely, Sharma and Chrisman (1999) defined internal venturing as “*corporate venturing activities that result in the creation of organizational entities that reside within an organizational domain*”, while external corporate was defined as “*corporate venturing activities that result in the creation of semi-autonomous or autonomous organizational entities that reside outside the existing organizational domain*”.

In this paper, we focus on *external corporate venturing* (ECV). We stylize the definition of EVC process as follows. A corporation decides to commit (human and financial) resources in a non-specified mechanism of EVC to obtain value from a target company and sustain its corporate financial and strategic goals. The corporation represents the active player which settles on the investment, the target company is the opportunity identified by the corporation and the ECV mechanism is the intermediary¹.

Insert Figure 1 about here

Three theoretical approaches have been generally applied to the study of collaborative modes – transaction cost economics, resource-based view and real options theory. Based on these frameworks, Leiblein (2003) identified two main streams of research involving the study of various organizational governance forms. The first investigates the conditions that favor the use of one ECV mechanism in respect to others (i.e. Walker and Weber, 1984; Oxley, 1997); the second describes the relationship between governance mode and performance (i.e. McGahan and Villalonga, 2003). The former line of research generally follows transaction cost economic theory and argues that the optimal form of organization is primarily driven by efficiency considerations (i.e. Williamson, 1975 and 1985). On the other hand, the prior literature on the performance implications of different types of investment has commonly relied on resource-based reasoning (i.e. Wernerfelt, 1984; Barney, 1986) by identifying those resources that are more likely to provide competitive advantage. Finally, real option theory has tried to relate the choice of organizational governance forms to overall firm’s performance (i.e. Bowman and Hurry, 1993; Kogut, 1991). However, as Leiblein (2003: 938) pointed out “*little effort has been put forth to link insights from Real Option analysis with insights from transaction cost economics (TCE) or the resource-based view (RBV)*”. In this paper we contribute to this stream of research by investigating the link between the RBV and ROT. More precisely, as the choice of organizational governance forms impacts on the corporation’s ability to create and appropriate the value embedded in the target company (Leiblein, 2003), we examine the motives and conditions for initiating one form of collaboration rather than another.

¹ Note that these forms of collaboration generally create advantage for both the corporate and the target firms. However, in this paper we direct our attention only to the benefits created for the corporation.

We proceed in two steps. First, we analyze the RBV and ROT separately to identify which key-features such perspectives suggest to consider when corporations move toward outside opportunities. From the review on ECV based on the RBV, we identified the *level of relatedness* between the corporation and the target company as key-factor, while from ROT the *degree of uncertainty* surrounding the target company seems playing the most critical role. Second, we point out that only by assessing the heterogeneous nature of potential target companies along these two dimensions simultaneously, corporations can identify the ECV mechanism which better fits with the management of that kind of company.

The role of relatedness in inter-organizational relationships according to the resource-based view

Previous research based on the RBV suggests that inter-organizational relationships offer a significant source of learning as, through collaborations, firms can combine distinct pieces of knowledge by drawing on the resource base of their partners. Thus, the RBV depicts external corporate venturing activities as a means to acquire resources to maintain competitive advantage in a dynamic market. In this context, the concept of *relatedness* (or *overlap*) defined, in the literature, as the extent to which two entities are similar is critical. This dimension concerns the degree to which the entrepreneurial activities require capabilities and skills that are different from the core capabilities and skills of the corporation (Burgelman, 1984). Thus, when the level of relatedness is low, the level of dissimilarities between the corporation and the target company is high.

This feature, which characterizes the relationship between two entities, has broadly been used to address two main different issues. The first refers to the analysis of whether and how different levels of relatedness between the focal firm (i.e. the corporation) and its external partner (i.e. the target company) affect a certain dependent variable such as innovativeness, learning, or financial performance (Ahuja and Katila, 2001; Sapienza et al., 2004; Keil et al., 2008). These studies suggested an inverted U-shaped relationship between the level of relatedness and the subsequent growth of the focal firm. Indeed, when the knowledge bases of the firms partially overlap to each other there are more possibilities of learning. Thus, both too small and too great an overlap will inhibit growth. The former because limited knowledge overlap limits knowledge assimilation and the latter because great knowledge overlap hampers the creation of new knowledge combinations (Sapienza et al., 2004). The underlying idea is that common skills and shared languages enable partners to efficiently communicate enhancing learning. On the other hand, a knowledge base that is too similar to the focal firm's knowledge base may contribute little to subsequent learning.

The second line of research investigates how firms, given a specific level of relatedness, can capture value from their collaborations. In other words, this stream of research answered the questions about how different levels of relatedness impact on the firm's choice among several governance modes (Roberts and Berry, 1985; Folta, 1998; Villalonga and McGahn, 2005; Schildt et al., 2005). Roberts and Berry (1985) proposed that when firms decide to entry new and unfamiliar markets or technologies, they should prefer organizational modes with a low level of corporate involvement. Folta (1998), investigating the motives for initiating equity-based collaborations versus acquisitions suggested that partners whose primary business operations are dissimilar should prefer equity collaborations over acquisitions because the former allow firms to learn by exploring multiple opportunities for the cost of a single acquisition. Vanhaverbeke et al. (2002) suggested that a firm has the propensity to acquire the other company if it has similar technological competencies or when it is a member of the same industry. On the other hand, when the partner has completely new technologies to offer, strategic alliances are a more appropriate way to cooperate. Indeed, it is more difficult to assess the value of assets of companies operating in unknown sectors, than in one's own industry (Balakrishnan and Koza, 1993). Also, Villalonga and McGahan (2005), investigating the determinants of the choice among alliances, acquisitions, and divestitures, found that when the level of relatedness between the focal firm and its partner is high, acquisitions are preferred to alliances, and alliances are preferred to divestitures for two reasons. First, greater relatedness implies a lower cost of integration. Second, when the partners' knowledge bases are similar, the level of direct competition between the focal and the target firms becomes greater, thus, enhancing the need for protective (i.e. integrative) governance structures. Schildt et al. (2005), analyzing several forms of collaborations under the dichotomy between explorative and exploitative learning, found that highly integrated forms of collaborations are more likely to lead to exploitative (versus explorative) learning where the knowledge base among the partners is similar. This result derives from a two-step reasoning. First, starting from the idea that governance modes differ in the degree to which they support explorative and exploitative learning, the authors argue that such differences exist for two reasons: (i) ECV modes differently support transfer of knowledge, and (ii) ECV modes have different costs and time to manage the ventures. These two factors are embedded in the concept of integration between the partners. More precisely, close integration is considered an important requisite for exploitative learning. Second, the level to which external ventures are related to the focal firm determines which type of learning is mainly sustained. The authors suggested a negative relationship between relatedness and explorative learning. The more closely related two firms are, the more similar firms should be and such a similarity should allow two firms to exchange knowledge more easily. Accordingly, van de Vrande et al. (2006) suggested that when the

level of technological distance between the partner firms is high, corporations are more likely to use less integrated governance modes in order to increase potential learning effects deriving from the collaboration.

Although these studies contribute to our understanding of ECV, they do not address two important issues. First, these studies tend to use the same term of relatedness to indicate different concepts, thus, creating a strong misunderstanding about the real nuance considered in each paper. Indeed, the term relatedness is used to simultaneously indicate ‘similarity’, ‘fit’, ‘overlap’, ‘proximity’, ‘synergy’ or ‘complementarity’. As pointed out by Tanriverdi and Venkatraman (2005: 97), “[d]espite the centrality of the concept of ‘synergy’ in diversification research, existing relatedness constructs and measures intended to capture the underlying resource-based synergies of multibusiness firms are subject to several theoretical and methodological weaknesses.”. Second, they analyze the effect of relatedness on the choice among governance modes separately from other determinants. The natural outcome is a positioning of different ECV modes along a continuum in which a specific variable (i.e. relatedness or explorative learning) assumes several values. In this sense, the typical hypothesis formulated by such studies sounds as follows: “High levels of the determinant x is associated with the choice of mode 1 over mode 2, and mode 2 over mode 3”. For instance, Villalonga and McGahn (2005: 1188) predicted that “*The relatedness between the focal firm and the target (or partner) firm is associated with the choice of acquisitions over alliances, and alliances over divestitures.*”. Similarly, van de Vrande et al. (2006: 357) proposed that “*Under conditions of high technological distance between the investing firm and its partner, companies are more likely to choose corporate VC over strategic alliances, and strategic alliances over acquisitions*”. Thus, the previous literature misses to deeply investigate the optimal form of collaboration when multiple determinants are considered simultaneously creating an orthogonal representation.

In this paper, we try to address these issues (a) by providing a broad definition of relatedness, that embeds both the dimensions of similarity and complementarity, and (b) by advancing that the level of relatedness is not sufficient to explain ECV modes choice. As far as the latter, we integrate the effect of relatedness with that of uncertainty to figure out which combination of the two dimensions makes more likely the choice of one ECV mechanism in respect to the others. Indeed, we suggest that each ECV mode can be described in terms of *flexibility* which allows corporations to efficiently manage the collaboration when some conditions of relatedness and uncertainty are satisfied. In the following, we introduce the role played by uncertainty and flexibility for the context of external venturing and, then, we proceed with an integration of the two dimensions into a comprehensive framework.

EXTERNAL CORPORATE VENTURING UNDER REAL OPTION LENS: THE ROLE OF UNCERTAINTY AND FLEXIBILITY

Real options theory provides a useful framework for analyzing investments whose structure are similar to financial options. The key concept is the commitment of an upfront payment that provides the opportunity, but not the obligation, to take possession of an asset at a later time. In the context of ECV, the initial investment represents the payment required to purchase the option, while the later decision to increase the commitment of resources, transfer knowledge, enter new markets, develop new technologies (at additional costs) are examples of exercise of the option. One of the most important contribution of ROT is to provide corporations with a different manner to consider the uncertainty surrounding the underlying asset (i.e. the target company). In contrast to traditional views (i.e. the RBV) suggesting that when uncertainty is high managerial discretion is limited, or that organizational inertia dominates, ROT asserts that firms can use and benefit from uncertainty by investing in options to respond to unstable futures and by managing the investments in a sequential manner once uncertainty is resolved (Kogut, 1991; Dixit and Pindyck, 1994; Kogut and Kulatilaka, 2001). Thus, ROT is appropriate for analyzing investment decisions that are characterized by uncertainty and managerial discretion (Dixit and Pindyck, 1994; Kogut and Kulatilaka, 2001; Huchzermeier and Loch, 2001).

Starting from these considerations, we suggest that the presence of uncertainty should be reflected in investment decisions, that is, in the choice among several ECV mechanisms. More precisely, we assert that ECV modes are differently able to manage uncertainty depending on the level of flexibility and reversibility they provide to corporations. *Flexibility* refers to the possibility to make critical decisions in the future when part of the uncertainty surrounding an investment is resolved. *Reversibility*, instead, can be defined as the extent to which corporations can easily exit from the investment or decrease the involvement in the collaboration if adverse conditions occur. In other words, investments are irreversible when they cannot be fully recovered without incurring some exit costs. High levels of flexibility and reversibility are also generally associated to low levels of *involvement* of the corporation in the collaboration and low levels of *integration* between partners (Burgelman, 1984; Roberts and Berry, 1985; Shildt et al., 2005). The former dimension refers to how many resources the corporation commits toward the collaboration, while the latter can be described as the extent to which the coupling of the operations between the corporate and the target company is strong. High levels of involvement and integration correspond to low levels of flexibility and reversibility and vice versa.

Previous research has pointed out the need for flexible governance modes in case of environmental turbulence. Lambe and Spekman (1997) argued that in presence of discontinuous

technological changes the use of alliances is preferred to both acquisitions and traditional internal development. Indeed, the advent of a radical innovation is characterized by low levels of certainty about how the new technology will affect the industry. Because a technological discontinuity radically changes the industry in which it occurs, corporations need to refine the firm's core competencies. On one hand, the increased urgency to acquire new competencies leads corporations to evaluate the attractiveness of an external technology acquisition rather than internally develop such competencies. This allows to decrease the time to market for the development of new products. On the other hand, the increased level of uncertainty deriving from a technological discontinuity leads corporations to prefer alliances over acquisitions in order to limit costs and avoid acquiring superfluous technologies. Only when industry uncertainty decreases and technology and market requirements are relatively stable, this preference changes in favor of acquisitions. Steensma and Corley (2000), investigating the link between attributes of the technology to acquire through external collaborations with the performance outcomes of technology-sourcing partnerships, found that technological dynamism and commercial uncertainty increase the likelihood to create loosely coupled agreements. Indeed, in such environments the risk to be locked into a technology that may not be commercially valuable is high and, thus, corporations should prefer collaborations that create real options to defer higher levels of commitments and share the risk of failure. Licensing agreements, for example, allow firms to avoid huge investments and acquire the possibility to shift to a different technology if the first is not more valuable (Kogut, 1991). Also joint development provides firms with similar benefits. Acquisitions, instead, are positioned at the opposite end of the spectrum as they represent the highest level of commitment (Roberts and Berry, 1985). In line with these findings, a study by van de Vrande and colleagues (2006) suggested that when a technology is relatively new and its commercial potential is unknown, firms tend to delay commitment by using flexible governance modes. As a result, corporate venture capital investments are chosen over strategic alliances, and strategic alliances are preferred to acquisitions.

The general explanation underlying these results is that committing prematurely resources to a new venture imposes considerable risks because the firm gives up the possibility to wait for new information that might affect the desirability and timing of the investment. In this sense, CVC investments represent the less involved and integrated form of collaboration as the corporation interacts with the investee company by creating a separate fund beyond its boundaries and supplying it with a certain stock of resources which is devoted to the investee companies in small amounts along a sequential process (Schildt et al., 2005). Thus, small participations in CVC investments are like taking an option on know-how of yet uncertain value to exercise if the scenario

is profitable (Bowman and Hurry, 1993). This strategy gives the firm high flexibility and reversibility in the management of the decisional process because the corporation can decide step by step its involvement in the collaboration. Thus, high levels of uncertainty are easily managed over time through CVC and the corporation can exploit the benefits of downside risk reduction and upside potential enhancement (Bowman and Hurry, 1993; Kogut and Kulatilaka, 1994; Trigeorgis, 1996; McGrath, 1997; Amram and Kulatilaka, 1999).

Proceeding with this line of reasoning, non-equity (strategic) alliances can be considered less flexible and reversible than CVC. In strategic alliances, cooperation takes place directly with at least a business unit and committing a greater amount of resources than in CVC, thus increasing the level of integration and involvement of the firms and decreasing the level of flexibility and reversibility in respect to CVC investments. On the other hand, strategic alliances can be described as more flexible and reversible than equity alliances or acquisitions (Folta, 1998). Strategic alliances are cooperative efforts in which separate organizations join forces to share reciprocal inputs, but maintaining their own corporate identities. Joint ventures, instead, occurring when two firms agree to create a new entity by both contributing equity and sharing revenues, expenses, and control of the new enterprise, are characterized by stronger integration and less flexibility under conditions of high uncertainty than the previous two ECV modes. Finally, acquisitions have the strongest level of integration and involvement as they result in the creation of an organizational hierarchy where the corporate firm obtains the majority ownership of the target company. In this case, the corporation commits a vast amount of resources in an unique step and cannot decide to dismiss the investment if it is not more profitable, except that by occurring in high exit costs. Through acquisitions, firms give up high levels of flexibility in place of obtaining the direct control of the target company.

Summarizing, the ability to delay an irreversible investment expenditure is an important source of flexibility and affects the decision about how to invest in a new venture. High uncertainty incentives to postpone huge investments (McDonald and Siegel, 1986) by adopting flexible collaborative modes, while the resolution of uncertainty motivates commitment decisions (Folta and Miller, 2002) through ECV modes that require more involvement.

COMBINING RESOURCE-BASED AND REAL OPTIONS PERSPECTIVES TO ANALYZE EXTERNAL CORPORATE VENTURING

In the previous sessions we pointed out how corporations invest in external opportunities under specific levels of relatedness or uncertainty. Now, we combine the two dimensions to figure out *how* corporations invest in external ventures when they are characterized by the same level of

relatedness with the target company, but face different levels of exogenous uncertainty, or when in front of the same level of uncertainty they are differently related to the target company. To this purpose, we refer to the following definitions.

Technological relatedness

Relatedness can be defined along several dimensions, such as product or manufacturing relatedness (Rumelt, 1974, St. John and Harrison, 1999; Cassiman et al., 2005), technological or R&D relatedness (Robins and Wiersema, 1995; Silverman, 1999, Chatterjee and Wernerfelt, 1991; Cassiman et al., 2005), downstream vertical relatedness (Schildt et al., 2005) marketing or advertising relatedness (Capron and Hulland, 1999, Chatterjee and Wernerfelt, 1991), managerial relatedness (Ilinitich and Zeithaml, 1995; Prahalad and Bettis, 1986) and human resource relatedness (Farjoun, 1994). However, for the purpose of this paper, we chose to focus on technological relatedness for the following reasons. In the previous literature, ECV modes have been often associated to the development of innovations and their effect on the innovative performance is considered an interesting topic (Ahuja, 2000; Stuart, 2000; Ahuja and Katila, 2001; Dushnitsky and Lenox, 2005b). Ahuja and Katila (2001), for instance, suggest that studying acquisitions under the technological innovation lens is important as it helps us understand how firms absorb and use external knowledge. Similarly, the alliance literature has found that innovative collaborations may provide important learning benefits to firms and help them to adapt to technological changes (Stuart, 2000; Rothaermel, 2001).

Technological relatedness, thus, determines whether a firm is positioned in a technological segment that has a potential to share and combine resources with another firm belonging to another technological domain. Note that, through this definition, we consider similarity and the possibility to obtain complementarities among resources as two different concepts. On one hand, *similarity* captures the extent to which two firms have similar inputs and can share common knowledge. Indeed, high relatedness implies common skills, shared languages and similar cognitive structures (Sorrentino and Williams, 1995) which enable partners to communicate, make marginal improvements and refinements of their current knowledge base (Lane and Lubatkin, 1998, Ahuja and Katila, 2001; Sapienza et al., 2004) and enhance the firms' ability to evaluate effectively the value of external knowledge and assimilate it within their organizations (Sapienza et al., 2004). In the literature, existing measures typically rely on hierarchical classification system like the Standard Industry Classification (SIC), for the market relatedness, and the International Patent Classification (IPC), for the technological relatedness. Thus, two businesses are unrelated if they do not share the same two, three, or four digits SIC or IPC code, and vice versa.

On the other hand, *complementarity* refers to the extent to which increasing one of the two activities increases also the returns of the other. Thus, two firms are complementary if they can procure inputs jointly to obtain an output whose whole value is more than the sum of the value of both the parts in isolation. Thus, complementarity implies super-additive value of combining different activities, characteristic that is not included in the definition of relatedness, where, instead, the focus is on similarity between activities. Thus, complementarities can arise both between related and unrelated activities. In the literature, there is no generally accepted empirical measure of complementarities as they are either difficult to operationalize, or imprecise in defining the value of complementarities, or require information for which data is not readily available. An interesting measure of complementary is the “stack” representation proposed by Gao and Iyer (2006), where several units or “layers” interact to each other according to a strict ordering relationship. Thus, two firms are technologically complementary if they operate in adjacent layers (Gao et al., 2008). In the software industry, for instance, the stack consists of five layers linked together by the following bottom-up order: computer hardware, system software, middleware software, application software and services. As firms are generally specialized in one or few layers of the stack, they need to rely on other firms for the adjacent layers. This configuration creates a collaborative context where providers belonging to different layers depend to each other, and the value of a firm increases if also the value of the other firm increases.

Technological uncertainty

Uncertainty is an exogenous variable which is beyond the firm’s control and refers to the volatility of the expected returns from an investment. This volatility can be ascribed to different sources of uncertainty (i.e. market and technological uncertainty). As suggested by Oriani and Sobrero (2008: 344) “[m]arket uncertainty is related to the variability of the expected level of demand for a firm’s products. It depends on exogenous factors, such as the economic cycle, the evolution of customer preferences, demographic changes, institutional factors [...]. Technological uncertainty exists when it is not clear which technology will emerge to dominate in the industry [...]. The established technology, in fact, often competes with one or more alternative technologies. Under these conditions, firms must select which technology to embed in their products and processes to fulfill future market requirements [...]”.

Schumpeter (1939: 85) argued that "*the making of the invention and the carrying out of the corresponding innovation are, economically and sociologically, two entirely different things*". Thus, while technological invention and commercial innovation remain interdependent, their fusion confuses our explanations of their respective processes and contributions to uncertainty. To avoid

such confusion, this paper will focus on purely technological sources of uncertainty. Many scholars suggested that technological uncertainty, in the traditional product-life cycle representation, peaks early, decreases following convergence on a dominant design and increases again in presence of a subsequent technological change (Tushman and Anderson, 1990; Klepper, 1997). Thus, uncertainty decreases when technology evolves (Fleming, 2001). Through technology-based collaborations, firms may be able to adapt to different levels of technological uncertainty embedded in radical and incremental technological changes if they have the necessary resources to manage such an adaptation (Christensen and Bower, 1996). Microsoft, for example, the dominant pre-Internet software provider, has embraced the technological shift caused by the emergence of Internet and incorporated it throughout its business. Microsoft, however, did not develop the new technology through internal R&D investments, but it gained access to the new technology through different forms of technological collaborations like equity financing, licensing agreements, strategic alliances, joint ventures and acquisitions.

Thus, when a firm faces technological uncertainty, adopting an options approach significantly increases the benefit to the firm for two main reasons. First, options have greater value in new markets where the volatility (and, thus, uncertainty) is greater than in established markets. Second, viewing the technological challenge as a series of sequentially exercised options creates a milestone-oriented, iterative management process that permits project redirection, advances learning, and allows investment to be discontinued when not more valuable (Bowman and Hurry, 1993; McGrath, 1997)

Choice among different external corporate venturing modes

When looking at ECV as a business development tool, different approaches can be identified. More precisely, based on the above-mentioned definitions, various combinations of technological relatedness and technological uncertainty produce different design alternatives. The matrix presented in Figure 2 shows four different design alternatives to choose depending on the characteristics of the target company in terms of level of technological relatedness with the corporate firm and level of uncertainty surrounding its technological domain. As we will explain later with a set of comprehensive examples, the concept of complementarity is embedded in all these four ECV modes, thus, acting as a precondition for corporations to create collaborative relationships with potential target companies. Indeed, the presence of complementarities allows firms to create, nurture and harness strategic benefits.

The vertical axis of the matrix represents the level of technological relatedness (high or low) between the corporation and the target company, while the horizontal axis indicates if the degree of

technological uncertainty surrounding the target company is low or high. From the intersection of these dimensions, a specific ECV mechanism is identified.

Insert Figure 2 about here

The broad literature investigating the conditions under which corporations choose strategic alliances over acquisitions pointed out two important contributions. First, when firms face high uncertainty in their environments tend to prefer less integrated organizations with external parties and more flexible forms of collaborations such as strategic alliances (Harrigan, 1985; Ciborra, 1991; Hagedoorn and Duysters, 2002). Ciborra (1991) suggested that environments that require a large degree of learning and flexibility will see a prevalence of alliances, whereas acquisitions can be expected to be more popular when learning and flexibility is less important. Indeed, under conditions of rapid changes, learning, organizational change and quick strategic response ask for flexible forms of collaboration because new knowledge expires quickly and timely learning from partners appears more appropriate than control through formal, integrated and hierarchical organizations (Hagedoorn, 1993; Folta, 1998). Thus, this stream of research highlights that uncertain environments are characterized by higher level of learning than stable environments which, instead, are more focused on the immediate exploitation of synergies between corporate and external innovative capabilities.

Second, Hagedoorn and Duysters (2002) also suggested that if firms decide to collaborate with external companies in order to search for capabilities that are related to their core businesses, an acquisition generates the necessary control and power in the decision making process. High levels of integration and control are particularly important when the target company is close to the core business of the corporation in order to allow corporations to directly manage and immediately exploit the benefits deriving from positive synergies and shared resources, competencies and knowledge (Hagedoorn and Duysters, 2002; Vanhaverbeke et al., 2002). Indeed, a crucial advantage of acquisitions is the speed of entry into markets and technological fields. Thus, when the strategic importance of the target company for the corporation is high and has to be immediately exploited, corporations refer to ECV mechanisms providing them with high degrees of control to maintain over the new business development (Burgelman, 1984; Belderbos, 2003).

Joining together these considerations, we suggest that acquisitions are more favorable in low-uncertain environments, where flexibility is not strongly required, and where the level of relatedness is high to easily integrate external know how within the corporation and exploit

economies of scale and scope (Hoffmann and Schaper-Rinkel, 2001). This corresponds to the upper left side of our matrix.

Proposition 1: When the level of relatedness between the corporation and the target company is high and the level of uncertainty surrounding the target company is low, corporations are more likely to choose acquisitions as mechanism of external corporate venturing.

For instance, EMC Corporation, the world leader in information management and storage, acquired in June 2006 ProActivity Software Solution Ltd, a privately held provider of content management software for business process management. The goal of this acquisition was to address the EMC costumers' need to optimize their business processes such as invoice processing, claims processing and loan origination. Thus, ProActivity brought to EMC a critical content management technology set to augment EMC's ability to address these needs through the industry-leading EMC Documentum business Process Management (BPM) software suite. This acquisition also enhanced EMC's lead in bringing Information Lifecycle Management (ILM) to life for customers through open software. Avi Fogel, ProActivity Chairman and CEO, said that "EMC is a perfect fit due to our clear functional and architectural technology alignment, and our common culture based on customer-driven innovation.". Thus, the presence of high levels of technological relatedness (both similarity and complementarities) between the two firms and the low levels of uncertainty surrounding these types of technologies allowed EMC Corporation to integrate the new knowledge into its existing set of capability and create competitive advantage.

When the level of uncertainty is high, acquisitions are not more suitable as they lack that level of flexibility needed in dynamic contexts. Under these situations, CVC investments or strategic alliances are more appropriate. Indeed, in respect to acquisitions, these ECV modes are characterized by lower levels of control and initial commitment and greater degrees of reversibility and flexibility which enable corporations to decide about the collaboration in a flexible way. In innovative and turbulent environments, governance mode enabling rapid adjustment to changing conditions in subsequent steps is critical (Kogut and Kulatilaka, 1993).

Furthermore, strategic alliances and corporate venture capital are generally deployed to open a window on a new technology or an emerging market where the corporation does not possess the required set of capabilities to compete. Learning, which implies the search for exploration and the absence of direct and immediate exploitative aims (Schildt et al., 2005), is the common feature to

these goals. For definition, exploration implies low relatedness and needs flexibility because the corporation invests in something new, unfamiliar and uncertain (Roberts and Berry, 1985). As previously suggested, CVC investments and alliances are the forms of ECV which better fit with this description. Stuart (2000) asserted that when the focus of the collaboration is the search for learning, alliances and CVC can be defined as “access relationships” to distinguish them from “acquire relationships”. Combining high uncertainty and learning, CVC and strategic alliances prevail in the bottom right side of the matrix.

However, although both strategic alliances and CVC investments have similar characteristics, strategic alliances are more appropriate under high levels of relatedness, while corporate venture capital is preferred to strategic alliances when the level of relatedness decreases. To explain these differences we need to refer to the nature of the relationship and organization characterizing such ECV modes. On one hand, several works highlighted that strategic alliances help firms access to partners’ knowledge and resources (Ahuja, 2000; Stuart, 2000; Grant and Baden-Fuller, 2004) through a relation based on mutual dependence and resource commitments. Thus, the creation of a collaboration in which both partners strive toward shared goals and seek to appropriate financial gains and strategic benefits needs the definition of a common goal between partners to support the mutual transfer of knowledge (Kann, 2000; Dushnitsky and Lavie, 2008). This is more likely achievable if a some degree of relatedness and affinity between the partners’ capabilities exist. The combination of high relatedness and high uncertainty is depicted in the upper right side of our matrix. Summarizing,

Proposition 2: When the level of relatedness between the corporation and the target company is high and the level of uncertainty surrounding the target company is high, corporations are more likely to choose strategic alliances (and corporate venture capital as second alternative) as mechanism of external corporate venturing.

In the production of the new technology OLED, several firms launched the creation of technological collaborations to jointly develop complex technologies. The technological alliance between Universal Display Corporation, an innovator behind displays and lighting, and LG Display, a leading innovator of thin film transistor liquid crystal display, has been formed to combine different specialized competencies and become leaders in the production and development of active matrix organic light emitting diodes (AMOLEDs), which will replace the currently dominant LCD panels. Steven V. Abramson, President and Chief Executive Officer of Universal Display said that "LG Display has been an excellent partner in advancing flexible OLEDs toward commercial

practicability, and our success has been driven by strong, collaborative team work. In just over a year, our collaboration with LGD has yielded significant gains in the design and functionality of flexible OLED displays and our joint development will drive continued progress". Thus, the presence of high uncertainty, as in the case of this new technology, and the existence of related and complementary competencies to develop AMOLEDs require the creation of strategic alliances to efficiently develop complex technologies as in the case of OLED.

CVC investments, on the other hand, entail disparity between the corporate investor and the investee company, identifying an unidirectional flow of resources and appropriation claims from the investor to the founded company (Dushinitsky and Lavie, 2008). Thus, a tight similarity between the partners is not necessary to make this form of ECV successful. As suggested by Kann (2000): *"Most organizational types of strategic alliances center around very specific goals, such as the development of a particular technological capability or the co-marketing of a specific product (e.g., Hagedoorn, 1993). While a corporate venture capital program is typically mandated with a specific strategic investment goal, the individual investments are often less specific and are not necessarily associated with an ex-ante identified strategic purpose. Rather, corporations tend to invest in a relatively diverse portfolio of entrepreneurial firms whose assets or technologies may not reveal an immediately obvious fit with the corporate investor's line of business"*. This search for new competencies (Brody and Ehrlich, 1998; Keil, 2004; Ernst et al., 2005; Chesbrough and Tucci, 2004, Dushnitsky and Lenox, 2005a and 2005b) requires that the level of relatedness between the corporation and the target company should be low. Furthermore, to obtain these objectives characterized by high uncertainty, CVC investments generally consist in an initial small equity investment in the new venture which serves as the first link in a chain of subsequent investments. Since CVC investments are typically staged as traditional venture capital investments (Sahlman, 1990), the corporation is not obligated to continue funding the investee venture after the prior financing round. This gives the firm high levels of flexibility in its investment decisions. Indeed, *"[s]taging investment as a series of outlays creates the option to abandon the enterprise in midstream if new information is unfavorable"* (Trigeorgis, 1996:2). Summarizing, the above-mentioned features make CVC investments preferable under conditions of high uncertainty and low relatedness, followed by strategic alliances (lower right side of Figure 3).

Proposition 3: When the level of relatedness between the corporation and the target company is low and the level of uncertainty surrounding the target company is high,

corporations are more likely to choose corporate venture capital (and strategic alliances as second alternative) as mechanism of external corporate venturing.

For instance, Intel Capital, the venture capital arm of Intel Corporation, is investing in several companies active in the development of clean-technologies worldwide. Intel focus is not circumscribed to a single phase of the value chain of this new and promising industry, but it is interested in all the steps, from the energy generation and storage to transportation, consumption, transmission and distributions. Recent investments include, for instance, Trony Solar and NP Holdings in China, Sulfurcell in Germany and SpectraWatt and GridNet in the US. The strategic aim of these investments is to explore and boost Intel knowledge in this emergent and promising technological field, develop new sources of power for Intel and drive energy-efficiencies within its own products and operations. "There's so much activity (in clean technology) and it takes time to figure out where you can have the biggest impact," Eichenlaub, Managing Director of Intel Capital, said. Mr. Eichenlaub has had to learn a lot in the last year about how utilities deploy energy and how people and companies decide to use it. Thus, the loosely coupled relationship (i.e. low relatedness) between clean technology and microprocessors, representing the core capability of Intel, and the high level of technological uncertainty surrounding this industry - Maneesh Mehta, National Leader of the Cleantech practice with Deloitte's Financial Advisory group, said that "These are still early days for investing in green technologies. This means both additional elements of uncertainty compared to other types of investment, and much remaining room for growth" - need flexibility to readapt investments when more information is available and, thus, make CVC the most suitable ECV mode. Note that, although the level of relatedness is low, some kinds of complementarities between Intel and clean-tech companies exist as asserted by Mr. Eichenlaub: "[...] clean technology is also more and more about software, which is one reason the area is attracting so many former technology folks in Silicon Valley. Smart meters are powered by software, and if the United States gets around to building a market for trading carbon credits, that will be software too". Thus, relatedness and complementarity are two different concepts that can coexist and have different impact on the ECV mode decisions.

Finally, Hurry et al. (1992) and Folta (1998) view minority investments in joint ventures as efficient modes to explore market and technical domains that are distantly related. Indeed, when firms enter unfamiliar areas of activity, the marginal efficiency of internalizing the target firm diminishes. For this reason, joint ventures, defined as the creation of a new entity in which two firms dedicate equity for the development of new and shared knowledge, are suitable mechanisms

in presence of low levels of relatedness as they allow to create a new entry in the market place without incurring in high costs of integration of the new knowledge. Kogut (1991, p. 19) points out that “[d]ue to its benefits of sharing risk and of reducing overall investment costs, joint ventures serve as an attractive mechanism to invest in an option to expand [...]”. Thus, joint ventures can be considered real options as one of the parts acquires the right, but not the obligation, to expand (through an acquisition) in response to future market and technological developments.

Proposition 4: When the level of relatedness between the corporation and the target company is low and the level of uncertainty surrounding the target company is low, corporations are more likely to choose joint ventures as mechanism of external corporate venturing.

In the oil and gas industry, joint ventures are really common and are often cooperative relationships between a local company and foreign firm. Foreign firms generally form joint ventures with domestic companies already present in specific markets where the foreign firms would like to enter. The foreign and the local firms contribute different assets and capabilities into the collaboration. On one hand, foreign firms more heavily bring into the joint venture new technologies, business practices, product design, manufacturing know-how and special equipment, while the domestic companies more contribute in the areas of knowledge about and skills for dealing with the local government or other institutional infrastructure and efficiently operating in the domestic industry. For instance, Texaco and Saudi Aramco formed a joint venture, Star Enterprise, with the aim to refine and market Texaco-branded products in 26 East and Gulf Coast states and the District of Columbia. The presence of unrelated capabilities (technologies and products for Texaco and distribution channels for Saudi Aramco) and a low level of uncertainty (as in the oil and gas industry) make a joint venture the right mechanism. Similarly, in the petrochemicals sector, Infineum, a joint venture between ExxonMobil Chemical, which have chemical manufacturing and marketing operations around the world, and Shell Chemicals, that manufacture and deliver petrochemical building blocks to industrial customers, has been established in January 1999 to produce and market fuel and lubricant additives for automotive, heavy-duty diesel and marine engines. In a case study by (1994: 1492) the authors report that in joint ventures between partners from the US and China, the typical comment of the US corporation is that “We have the technology and certain know-how. The Chinese partner knows how to make things happen in China. You put the two together right, it works”. Also in these examples, the presence of unrelated competencies does not preclude the existence of complementarities among the partners involved in the collaborative relationship.

THE TRANSITION OF EXTERNAL CORPORATE VENTURING MECHANISMS OVER TIME

The taxonomy proposed in the previous section depicts under which conditions of relatedness and uncertainty corporations are more likely to choose a form of ECV rather than another. In such representation, we referred to the first contribution ROT provides to the RBV. That is, firms can use and benefit from uncertainty by investing in options to respond to unstable futures. The same matrix can also be interpreted as a dynamic tool to understand how ECV mechanisms transit over time (Figure 4). To pursue this goal, we refer to the second contribution ROT introduces to the RBV. By highlighting the sequential nature of external corporate development activities, ROT recognizes two key insights. First, there are opportunity costs associated with irreversible investments under uncertainty. Second, many investments create valuable follow-on opportunities. Combining these features, external corporate venturing activities characterized by high uncertainty can be described as up-front investments which give the management the possibility to both capitalize on favorable opportunities and mitigate negative scenarios by proactively confronting uncertainty over time in a flexible manner (Kogut, 1991; Kogut and Kulatilaka 2001).

External corporate venturing as a multi-stage process based on real options

Most of the existing strategic management literature uses the orthodox discounted cash flow approach to analyze investment decisions. However, this approach is not adapt when investments are characterized by high levels of uncertainty. Under conditions of high uncertainty and instability, a certain level of flexibility available through an active management of the investment process is critical. ROT satisfies this requirement as it suggests that firms can benefit by investing in options to respond to uncertain futures and by managing the investments in a sequential and flexible manner as uncertainty is resolved (Dixit and Pindyck 1994; Kogut and Kulatilaka 2001). Accordingly, external corporate development activities have been commonly viewed as conferring that discretionary in future opportunities typical of a real option framework (Kogut, 1991; Smith and Triantis, 1995; Reuer and Tong, 2005).

A real option, deriving from the analogy with financial options, can be defined as the right, but not the obligation, to buy or sell the underlying asset at a specified price on or before a given date. However, differently from financial options in which specific contracts determine the exact conditions leading to an optimal exercise, real options have to be analyzed taking into consideration also what happens between the acquisition and the exercise of the option. Indeed, options based on real assets need to be actively managed by the holder from the moment in which the option is acquired till its time of maturity. Recent applications of ROT in the strategy field have examined

investment decisions in terms of purchase or exercise of particular types of options. However, these works do not offer specific frameworks to understand whether and how firms correctly manage and capture option value from such investments.

Insert Figure 3 about here

To fill this gap, we describe an investment in external sources as a dynamic multi-stage process based on real options, where each step is functional to the creation and exploitation of growth opportunities. We identify four phases of the process (Kulatilaka and Venkatraman, 2001): assess opportunities by thinking about the possible future outcomes, acquire options by making investments that confer flexibility to make decisions in the future when part of the uncertainty is resolved, nurture options by keeping the options alive, and harness value by exercising the options in a opportune way (see Figure 3). Disclosing our conclusions, we point out that each ECV mechanism manages the phases of this process in a different way.

Scan opportunities

The first step of the ECV process is the *scan* of the external environment to search for growth opportunities which give the firm the possibility to support existing businesses, improve internal processes, open a window on new markets and technologies, develop new products or seek new technological directions (Ahuja and Katila, 2001, Kogut, 1991; Chesbrough and Tucci, 2004; Dushnitsky and Lenox, 2006; MacMillan et al., 2007). Finding all the potential investments requires a definition of the right space in which this search has to be deployed. Indeed, external opportunities are not all alike. As previously pointed out, corporations should define their environment to look for opportunities along two main dimensions: the level of *relatedness* between the target company and the corporation and the degree of *uncertainty* characterizing the target company. Taking into consideration these two features together allows corporations to go over the traditional view which is inclined to sustain local search with high familiarity and low uncertainty in order to exploit path dependency (Nelson and Winter, 1982). Also the exploration of new opportunities which reside in far and unfamiliar domains and where the level of uncertainty is high can be valuable investments. ROT suggests that the benefits deriving from close and stable opportunities could be lower than the value created through far and uncertain opportunities, due to the greater value of the options embedded in the latter type of investment.

Acquire options

The second step of the ECV process corresponds to the *acquisition* of the option, that is how the collaboration is drawn. As ECV mechanisms are heterogeneous in terms of their ability to pursue and manage a specific type of option, alternative governance modes exhibit differences in their effectiveness and when they can be used (Nicholls-Nixon and Woo, 2003). This second step of the ECV process, thus, refers to the design of the collaborative structure. That is, given the nature of the opportunity identified in the previous step, how should firms design the collaboration to acquire the option? Corporations have to figure out which ECV mechanism assures the right level of strategic agility, control and positioning to capture potential future benefits from the opportunities.

As previously explained, ROT suggests that ECV mechanisms can be distinguished not only on the base of the level of integration and commitment, but also on the base of the level of *flexibility* and the degree of *reversibility*. More precisely, flexibility is the possibility to defer critical decisions in the future when more information is available and part of the uncertainty is resolved, while reversibility is the possibility to easily exit from an investment without incurring any costs. Summarizing previous results, the levels of flexibility and reversibility assume the greatest value for CVC investments, decrease for non-equity alliances, further decrease for joint ventures, and finally assume the lowest value for acquisitions (van de Vrande et al., 2006). Based on these features, we identified through the matrix of Figure 2 the ECV modes which corporations are more likely to adopt depending on the level of flexibility required to manage the collaboration with a specific type of target company.

Nurture options

While in the case of financial options the acquisition of the option is followed by its exercise in the future if the conditions are favorable, in the case of real options, it is needed to introduce an intermediate step to manage the option before its exercise. This is the so called *nurturing* phase in which the option's holder has an active role to keep the option alive and decide about its involvement in the collaboration over time. The possibility to restructure contracts and business agreements with external partners depends on the level of flexibility and reversibility of the ECV mechanism defined in the previous step. Thus, the initial allocation of resources impacts on the nurturing of the option as it defines the starting conditions of the contractual relationship and the possibility to dynamically change these initial conditions by adapting the ECV investments to the proposed scenario.

The sequential nature characterizing some ECV mechanisms gives the firms high flexibility and reversibility in the management of the collaboration by allowing to evaluate the convenience to proceed with the relationship, or change the level of involvement, or abandon the collaboration. As

previously pointed out, the staging process characterizing CVC investments is an useful tool to monitor the option over time. Sequential investments provide the investor with more information about the likelihood of success of the investment limiting its downside risk (Hsu, 2002). Similarly, a strategic alliance can be extended to an acquisition if the value of the partner becomes so high to induce the corporate firm to integrate it into its organization through an acquisition (Kogut, 1991). The underlying idea is that, if the circumstances are favorable, corporations should increase their involvement into the collaborative relationship and subsequently decrease the flexibility and reversibility of the investment. On the other hand, acquisitions provide corporations with a different scenario. The huge amount of resources committed in the unique initial stage to acquire the target company deprives corporations of those levels of flexibility and reversibility characterizing the previous forms of collaboration. Summarizing, the structure and complexity of the nurturing phase in terms of subsequent investments required to keep the option alive depend on the governance mode depicted in the second phase of the ECV process. CVC generally comprises the greatest number of nested investments (given by the total number of financing rounds toward the target company), followed by strategic alliance and joint venture (where the first of the two investments is undertaken to create the alliance/joint venture and the second to acquire, if useful, the target company); while acquisition generally corresponds to a compression of the nurturing phase into a single step as it has not subsequent follow-ups. We analyze the evolution of ECV modes over time in the next session.

Harness value

Harness value from the external investment represents the final exercise of the option. After this phase the option expires and the benefits embedded in the investment concretely reaches (or not) the corporation. If the nurture phase highlights the sequential nature of the options, the harness phase is more related to the link between actions and creation of value.

Two elements are particularly relevant to make this phase successful. First, the assessment of the *exercise price*. Second, the choice of the *exercise time*. Indeed, the basic decisional rule for growth options is that the option will be exercised, at a certain time, if the value of the underlying asset is greater than the exercise price. To define the exercise price, we need to look at the previous phases of the ECV process. As previously pointed out, when corporations choose a flexible mode of ECV to periodically evaluate and monitor the company's performance, the nurturing phase is long and requires several intermediate steps before reaching the final step – the “harness” phase. On the opposite side, in case of immediate acquisition of the target company, the nurturing phase tends to be null, due to the absence of the staging nature of the investment. When the nurturing phase is long

and articulated, the exercise price is the sum of all the resources invested in the nested phases to keep the option alive; when the nurturing phase is short the amount paid to use the knowledge of the target company is compared to the benefits deriving from such knowledge.

Furthermore, unlike financial options in which the expiration date is decided by specific contracts, in case of real options, acting at the right time is not a matter of luck. Empirical evidence shows that, even if conditions become favorable, several firms are unsuccessful in capturing value from their strategic option. This could occur because of the corporate firm's inability to manage the nurture phase or decide the time to exercise the option. As pointed out by Bowman and Hurry (1993), the option's strike can be influenced by the firm's organizational structure as different organization structures influence the extent to which decision makers are left free to strike options. This suggestion can be translated to the ECV context. That is, the harness phase is strictly related to the type of ECV mechanism designed in the acquiring phase and its structural evolution in the nurturing phase. Contractual structures that provide the investing firm with the optimal conditions to efficiently capture external signals will show greater ability in deciding the exercise time. Moreover, contractual structures that help firms in evaluating whether abandoning certain projects because they might not provide the necessary benefits is also important.

Summarizing, the multi-steps representation of ECV activities highlights the following insights:

1. Corporations need to scan the external environment along different dimensions such as the degrees of relatedness between their activities and those of the target company and the levels of uncertainty surrounding the target company.
2. ECV mechanisms proceed along manage each step of the process in different manners. Thus, each governance mode represents for the corporations a unique tool to use under particular conditions.
3. Under the real options lens, modes of ECV can be described along two dimensions: flexibility and reversibility. When the need of flexibility and reversibility is high, firms should prefer a loosely integrated collaborative contract which is structured as a staging process to progressively allocate resources and change their level of involvement over time. On the other hand, when the control is more important than flexibility and reversibility, corporations should choose ECV mechanisms which immediately capture the value embedded in the external opportunity.
4. The length and complexity of the nurturing phase depend on how the collaboration is drawn. Flexible and reversible relationships such as corporate venture capital or alliances give

corporations the possibility to manage the nurturing phase through a nested structure of intermediate steps in which the level of involvement progressively increases. On the other hand, acquisitions skip the nurturing phase by directly connecting the second step of option's creation to the final step in which its value is captured.

5. The assessment of the exercise price and the maturity time of the option in the final step of the strategic option navigator is affected by how the ECV mechanism is chosen and managed in the previous steps.

The evolution of external corporate venturing choices over time

To analyze how ECV modes transit over time, we firstly consider CVC where the level of relatedness is low and the degree of uncertainty is high. The choice to start from this case is driven by the consideration that CVC represents the most flexible and reversible ECV mode from which both relatedness and uncertainty can vary, by defining less flexible and reversible forms of collaboration.

Through this form of ECV, corporations are fully equipped to face all the aspects of new and uncertain businesses. Indeed, as previously pointed out, CVC investments are a form of collaboration which aims to learn from the target company about new, unfamiliar and uncertain market and technological domains. CVC can be, thus, considered the most general explorative activity to find out several types of potential partners, as suggested by Pfizer: *“Pfizer Venture Investments (PVI) serves as the venture capital arm of Pfizer, supporting a variety of worldwide business development (WWBD) activities. Using Pfizer capital, we invest in innovative healthcare businesses offering new technology platforms that align with our company's strategic direction.”* (Pfizer website).

Insert Figure 4 about here

From this initial condition, three possible paths can be drawn. The first occurs when the level of relatedness between the corporation and the target company increases, but the level of uncertainty is relatively unchanged. The second corresponds to the opposite scenario (unchanged relatedness and decrease of uncertainty). Finally, the third possibility shows a simultaneous improvement in the predictability of the environment (decrease of uncertainty) and familiarity with the new knowledge (increase of relatedness). In the following, we consider each case separately.

Arrows 1 and 2. Once a certain level of familiarity with the new knowledge has been built through a constant process of learning, the corporation is in a position to decide whether to allocate more resources to the target company and, thus, select a more appropriate mechanism for scenarios with greater levels of relatedness between the partners' knowledge bases. Folta and Miller (2002) examined equity partnerships suggesting that one of the factor affecting the decision to acquire additional equity in partner firms is the possibility to obtain further learning advantages to investors by internalizing the target and facilitating technology transfer. The corporation can switch from a CVC investment to an alliance where the level of flexibility and reversibility is still high, but lower than in the previous case (arrow 1). This is the case, for instance, of Bedcton, Dickeson and Company (BD), a global medical technology firm, and BD Ventures, its venture capital arm which invests in venture-stage companies that fit well with the BD's business segments (medical, diagnostics and biosciences). Indeed, "[...] several portfolio companies have entered into development and other strategic relationships with BD subsequent to BD Ventures' investment." (Bedcton, Dickeson and Company website). Also Microsoft follows the same evolution in ECV modes: "A recent example of a company that we've been working with is Tutor.com — an on-demand tutoring and homework help service that students can use when they're stuck with a homework problem, need to study for a test or want to improve their confidence and grades. [...] Like most startups, they had limited resources, so being able to use our technology and resources was a great help to them. [After an initial set of financing rounds], this summer we took it to another level when we announced a strategic alliance with Tutor.com [...]" (Microsoft website).

Subsequently, when also a huge part of the exogenous uncertainty is resolved, the strategic alliance can be converted in an acquisition to exploit a full control on the development of the new knowledge (arrow 2). Eisenhardt and Schoonhoven (1996) suggest that alliances may be formed to reduce market uncertainty and enhance industry coordination by sharing costs and risks. Thus, once uncertainty has been resolved, corporations may decide to engage in a more hierarchical governance mode to obtain strategic control on the partner. "Pfizer Inc. now owns more than 10% of Australian nanocap pSivida Ltd., but the pharmaceutical giant has no plans to acquire the drug delivery products developer." Indeed "[i]t was a contingent commitment by Pfizer at the time it entered into the strategic alliance with pSivida [...] that it would purchase additional shares if [it was] able to go out and raise a certain amount of additional capital [...]. Pfizer [typically] enters into these strategic alliances and as part of the agreement will commit to purchase some equity. In some cases, it's an initial purchase followed by a follow-up purchase." (Cohen, 2007). Although this is an example in which a corporation decides to not acquire its partner, it shows that after preliminary

collaborations in the form of strategic alliances, an acquisition could be the natural expansion of the relationship to increase control on the partner.

Arrows 3 and 4. A second possibility occurs when only the level of exogenous uncertainty decreases making the investment in an external company less risky. Here, the level of relatedness is unchanged but the higher stability in the market demand and in the technological trend allows corporations to become more involved in the collaboration. CVC investments (or strategic alliances) can, thus, become a joint venture where the firms engaged in the collaboration share resources to jointly develop new knowledge. Joint venture is appropriate in scenarios with low uncertainty and low relatedness, as the two firms commit relatively huge amount of their specific and often complementary resources to pursue a common goal (arrow 3). For instance, Pfizer's philosophy to collaborate is to “[p]rovide genuine value to Pfizer, patients and partners. [The] partner [will] be part of a team determining the best path for bringing programs forward. From the beginning, we're interested in exploring ways to work together that advance the goals of each of our organizations. This can be achieved with initial commitments in equity followed by more aggressive strategies like the creation of joint ventures with the most valuable partners or other forms of strategic alliances” (Interview with the Head of Pfizer's Venture Investment Division and Pfizer website).

Once a certain level of familiarity with the new knowledge has been achieved, the joint venture can expand in an acquisition (arrow 4). Indeed, as suggested by Kogut (1991), joint ventures provide firms real options to expand sequentially into new markets by acquiring the target company. Indeed, firms tend to exercise the option by buying out its partners when the joint venture experiences positive results, while it continues to hold onto its investments in the joint venture when negative signals materialize (Kogut, 1991). For instance, PepsiCo and General Mills established in the year 1992 a joint venture - Snack Ventures Europe (SVE). In the year 2004 PepsiCo acquired General Mills' 40.5 percent ownership interest in SVE determining the end of the joint venture. Now, the operations of the joint venture are wholly owned by PepsiCo. Similarly, Fujitsu Limited announced the acquisitions of Siemens's 50% share in their joint venture - Fujitsu Siemens Computers (FSC) because “[f]ully integrating Fujitsu Siemens Computers into the Fujitsu Group fits perfectly into our global growth strategy [...]” (Kuniaki Nozoe, president of Fujitsu).

Arrow 5. Finally, if both the conditions simultaneously occur, leading to a decrease of uncertainty and an increase of familiarity with the new knowledge, CVC investments can immediately be converted in an acquisition. Intel Corporation, through its wholly owned subsidiary Intel Capital,

invested through the year 2008 in Imagination Technologies Group with increasing equity stakes over time. After these investments, Intel claimed that “*Intel Corp. reserves the right to announce an offer or a possible offer to acquire the shares in Imagination Technologies Group which it does not already own [...] if there is a material change in circumstances or in [certain events]*” (London Stock Exchange website). Similarly, Siemens Venture Capital, the venture capital arm of Siemens, started its collaboration with Chantry Networks in 2003 - the leading provider of secure integrated mobility management solutions for wireless networks – through venture capital investments. In October 2005, Siemens announced its intent to acquire the venture “*to offer an integrated enterprise network management platform capable of handling the convergence of wired, wireless and voice systems.*” (Siemens website).

CONCLUSIONS

In addition to attractive financial returns External Corporate Venturing (ECV) provides strategic benefits which result from establishing strategic collaborations between small entrepreneurial companies and large mature corporations. There are several approaches to make ECV. Each approach requires a different level of commitment with respect to corporate resources and yields specific strategic benefits. In this paper, we address the following research question: *how should firms invest in external opportunities?*

Figure out which ECV mechanism is more adapt under specific circumstances is a challenge for big corporations. To help firms addressing this issue, we propose a theoretical model in which the characteristics of the target is a key-element to choose the correct ECV mechanisms. By combining the Resource Based View and Real Option Theory, we identify two dimensions - the level of relatedness between the corporation and the target venture and the uncertainty surrounding the target company – to detail the nature of outside opportunities and define the ECV mechanism which better manages a specific type of collaborative relationship.

The bi-dimensional matrix proposed in this paper aims to be a tool for corporations to evaluate investments in outside opportunities and determine when to use external corporate mechanisms in an appropriate manner as an instrument of strategic growth. However, the four ECV modes shown in the matrix are not to intend as exhaustive. Much room is left for refinement through further research. This framework only defines a preliminary conceptual foundation for a number of practices which arise in today's business environment. Future research could enrich this representation by integrating other dimensions such as the distinction between market and technological uncertainty, on one hand, and relatedness versus complementarity, on the other hand. First, previous studies on real options pointed out that uncertainty over outside investment returns

can be attributed to different sources - unexpected market and technological developments in the industry (Abernathy and Clark, 1985; Folta and O'Brien, 2004; Li and Mahoney, 2006; Oriani and Sobrero, 2008). This distinction is important to take into consideration whether and how different sources of uncertainty change the value of the real options created through external collaborations, and thus impact on the choice among ECV mechanisms. Second, the concept of relatedness does not recognize that synergies among activities can arise not only from similar resources, but also from complementary resources (Tanriverdi and Venkatraman, 2005). Thus, relatedness can be defined as the extent to which the collaboration uses common knowledge resources between the corporate and the target firms, while complementarity represents the extent to which the collaboration uses a complementary set of common knowledge resources between the corporate and the target firms.

Future research could also empirically test our framework with data from different databases to investigate how CVC investments, alliances, joint ventures, acquisitions and licensing agreements are different to each other depending on a set of variable like relatedness and uncertainty. Empirical investigations about the decisional choice among different mechanisms of external venturing miss in the literature. Finally, theoretical works in which different theories are integrated in a systematic way are scarce. In this paper we have combined the RBV with ROT, but also other frameworks such as organizational learning, transaction costs economic or dynamic capabilities can be jointly applied to explain this phenomenon.

This paper has important managerial implications. In the last years, the most common strategy pursued by firms is to create successful opportunities to identify, develop and commercialize products that bring value to their customers and to the firm itself. To achieve this goal, firms have to build a nimble infrastructure that allows to respond to opportunities with speed and flexibility. All too frequently large corporations lack the flexibility to respond quickly to transform a new idea into a successful product that provides a corporation with new growth and financial returns. The creation of different organizational units inside the same firm dedicated to the search and management of new opportunities is the starting point of this renewal. The importance to find differences between several forms of ECV is pointed out by the organizational structure of corporations in today's business activities. Indeed, managers typically view acquisitions, alliances and CVC investments as distinct entities, and thus they manage them through separate corporate units. Pfizer, for example, has a dedicated group to ensure that all the capabilities and resources necessary to evaluate and secure licensing, alliance and acquisition opportunities, as well as venture investments and investments in innovative, adjacent or synergistic businesses are in one place with a clear strategy and accountability for results. However, inside the group there are different and

distinct areas with specific competencies: “Venture Investments” to recognize strategic equity investments in biotech, specialty pharma, drug delivery, diagnostic and other technology; “Alliance Management” has the task to build trust and relationships between partners; “Licensing” is dedicated to identify portfolio assets as licensing candidates. From this description, it is evident how a clear definition of competencies and resource among units and an efficient coordination among different areas are critical elements to obtain value from new external opportunities. This is possible only if the characteristics of the target company in terms of relatedness and uncertainty are analyzed. With our framework, we intend to help firms in designing their organizations in order to create and harness potential value from different external sources.

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TABLES AND FIGURES

Figure 1. Typical structure of external corporate venturing.

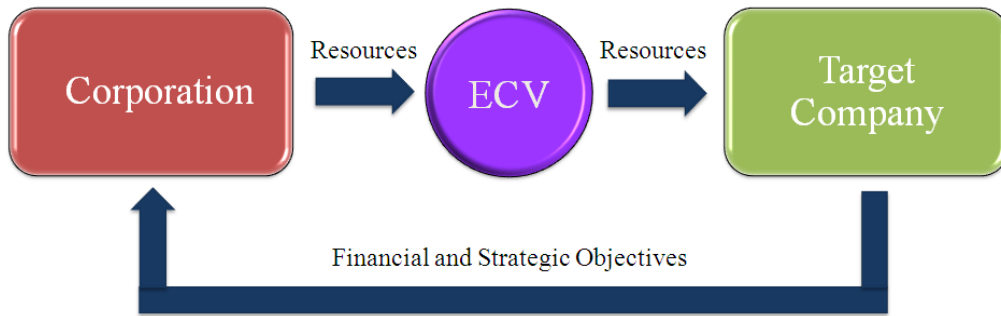


Figure 2. A taxonomy for external corporate venturing mechanisms.

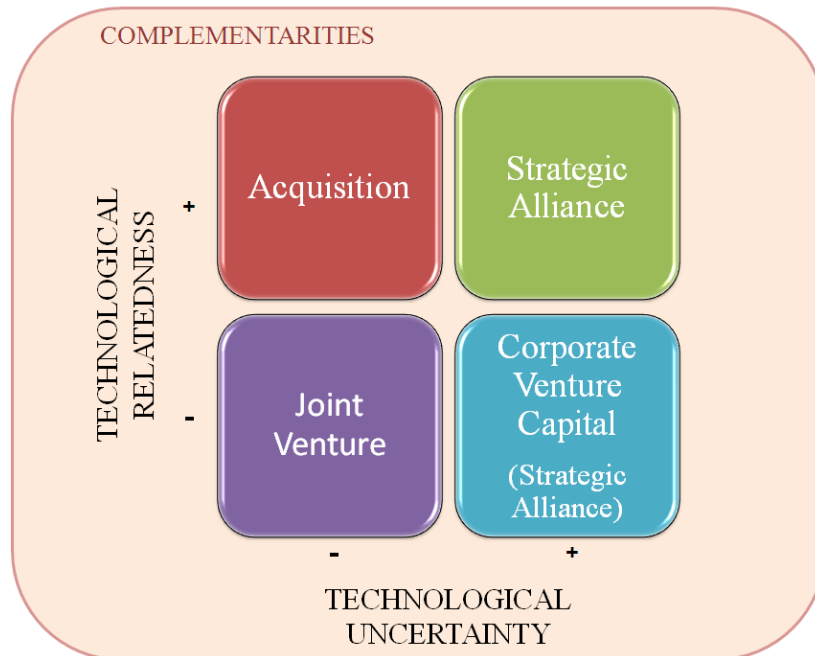


Figure 3. The multi-stage process for external corporate venturing activities (Source: adapted by Kulatilaka and Venkatraman, 2001).

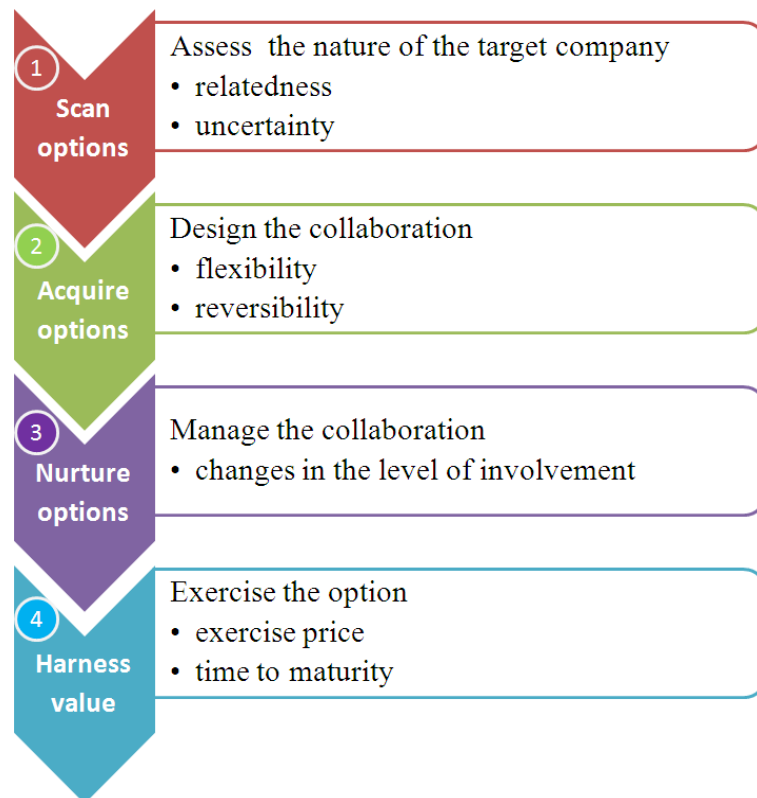


Figure 4. The evolution of external corporate venturing mechanisms over time.

