

**Performance Implications of Strategic Restructuring through
Knowledge Acquisition:
Longitudinal Analysis of German Biotechnology Firms**

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LIST OF ABBREVIATIONS

BRIC	Brazil, Russia, India, China
KBV	Knowledge-Based View
M&A	Merger & Acquisition
MD&L	Marketing, Distribution & Licensing
MNC	Multinational Corporation
OT	Organization Theory
RBV	Resource-Based View
R&D	Research & Development
TCE	Transaction Cost Economics

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1 INTRODUCTION

1.1 Relevance: corporate restructuring as effective response to hypercompetition

Currently, firms are preoccupied with a period of relentless change driven by market disruptions and institutional transitions. In fact, powerful political, economic, socio-cultural, and technological forces turn the established rules of doing business upside down. Politically, the efforts toward liberalization in many emerging economies have led to a general decrease of international trade barriers over the last decade (Bals, Hartmann, and Jahns, 2006).

Economically, the center of gravity is moving from the Triad (i.e. USA, Europe, Japan) (Ohmae, 2002) to the BRIC region (i.e. Brazil, Russia, India, China) (Goldman Sachs, 2007). This allows for leveraging unmet market opportunities, such as those at the bottom of the economic pyramid (London and Hart, 2004). In addition, this leads to competitive pressure, insofar as a growing number of multinational corporations (MNCs) from those emerging markets, such as Huawei, Geely, or Build Your Dreams are increasingly able to compete with western incumbents, by continuously improving the quality and innovativeness of their product offerings (Zeng and Williamson, 2007; Williamson, 2010). Also, these MNCs have initiated a wave of cross-country take-overs leading to an immense market and industry concentration (Luo and Tung, 2007).

Furthermore, established management practices are challenged by prevailing socio-cultural trends, such as the increasing importance of social networks and web 2.0 solutions (Bughin, Chui, and Manyika, 2010). Finally, immense developments in information and communication technologies have paved the way for offshoring and outsourcing (Contractor, Kumar, Kundu, and Pedersen, 2010). Together, that value chain disaggregation has made it possible to design completely new business models that have traditionally been rather characterized by vertical integration (Wassmer, 2010).

Collectively combined, those market disruptions and institutional transitions have speeded up competitive dynamics and, in turn, led to reduced certainty and stability in almost every industry (Voelpel, Leibold, and Eden, 2004: 263). Thus, the competitive landscape has experienced a fundamental modification. As a result, we have entered a situation best characterized by hypercompetition (D'Aveni, 1994; D'Aveni, 1999; D'Aveni, Dagnino, and Smith, 2010). The latter is "characterized by intense and rapid competitive moves, in which competitors must move quickly to build [new] advantages and erode the advantages of their rivals" (D'Aveni, 1994: 217-218). It has also been labeled high velocity competition (Brown and Eisenhardt, 1998) with reference to the speed of change.

Market disruptions and hypercompetition tend to contribute to amongst others the dethronement of industry leaders, financial instability, and even failure (D'Aveni, 1994; D'Aveni, 1995; Bettis and Hitt, 1995; Brown and Eisenhardt, 1998; Christensen, 1997; Hamel, 2000; Quinn, 1992; Slywotzky, 1996). Thus, firms across industries have to find an effective competitive response to face market disruptions in order to prevail and survive in the current hypercompetitive epoch. This implies building a clear competitive differentiation relative to rivals (Porter, 1996). There is evidence that many corporations have relied particularly on corporate restructuring in order to set apart or differentiate themselves from the competition (Markides, 1995). Also prior literature has characterized corporate restructuring as purposeful and effective means to deal with strategy and industry pressures (Donaldson, 1990; Brauer, 2006; Bruner, 2004). In fact, extant literature has found that firms leverage corporate restructuring as means to increase their internal efficiency and to face takeover markets (Jensen, 1993; Kaplan and Weisbach, 1992; Shleifer and Vishny, 1991). Moreover, corporate restructuring has shown to assist firms to reverse extremely diversified strategies to more reasonable or optimal levels to best leverage core competences (Bergh and Lawless, 1998; Comment and Jarrell, 1995; Jones and Hill, 1988; Markides, 1992; Markides, 1995). Evidently, corporate restructuring has attracted much attention due to its implications for firms to

adjust strategies in the face of market disruptions. Given that intense practical relevance, this dissertation will take on the effort of further studying corporate restructuring.

1.2 Derivation of research questions

Corporate restructuring refers to a major change in the composition of a firm's assets in combination with a major change in its corporate strategy (Hoskisson and Turk, 1990). With regard to a systemization, prior research has identified three distinct types that are portfolio, financial, and organizational restructuring (Bowman and Singh, 1993). It is intuitive that these three types of corporate restructuring and their specific levers all aim at providing synergies in multi-business corporations (Hoskisson and Turk, 1990). In this context, corporate restructuring is a means to generate parenting advantage (Goold and Campbell, 1998). As a consequence, the total body of restructuring research has mainly been preoccupied with studying financial performance measures, such as efficiency, return on investment, or stock market performance to account for synergistic effects at the corporate level (Heugens and Schenk, 2004; Hoskisson and Johnson, 1992).

Despite its uncontested significance, extant restructuring research must be criticized for its sole preoccupation within the corporate strategy field. Prior research has neglected so far to transfer the restructuring concept to the business unit level, thereby integrating the corporate strategy and the competitive strategy literatures. As such, corporate restructuring is restricted to multi-business firms, while single-business firms are overlooked in prior research. In addition, although the financial focus of prior restructuring research has enriched our understanding of how firms can strengthen their operational effectiveness, every solely financial approach overlooks central aspects of value creation at the business unit level (Chakravarthy, 1986). As such, it is inadequate to account for strategic positioning and competitive advantage. Thus, further research is required, which studies restructuring from a competitive strategy perspective applicable to single-business firms and business units, thereby linking it to competitive advantage and, ultimately, strategic measures of firm performance, such as innovation, vertical integration, or survival.

This dissertation addresses the identified gap in the literature. To that end, I examine a so far neglected angle of restructuring from the competitive strategy perspective that single-business firms and business units can apply for improving their strategic positioning and achieving competitive advantage, which I label strategic restructuring. I perceive strategic restructuring as a bundle of strategic levers as consequence of market disruptions at the business unit level that aim to improve the firm's strategic positioning in order to strengthen the firm's competitiveness. Specifically, I conceptualize strategic restructuring as a three-dimensional construct involving 1) the firm's engagement in alliances and networks; 2) business model design; and 3) managing dynamic capabilities. From a theoretical perspective strategic restructuring is important, as it integrates constructs that have been emphasized recently in the strategic management literature (Lavie, 2007; Zott and Amit, 2008; Teece, 2007). From a managerial perspective, strategic restructuring is relevant, as it provides firms with a set of tools that they can apply to enhance their strategic performance, such as innovation, vertical integration, and survival. In particular, by building on the knowledge-based view, I argue that strategic restructuring allows firms to increase their knowledge base. Thus, I presume that strategic restructuring assists firms in generating strategic performance, by accessing external knowledge flows and building up internal learning capabilities.

This dissertation aims to solve four research questions. How can firms strategically restructure to improve their strategic performance in terms of innovation, vertical integration, and survival (i.e. overall research question of this dissertation)? How do alliance portfolio configuration and capabilities impact new venture innovation performance (i.e. research question of the first study)? How do network partner configurations and absorptive capacity influence the expansion of vertical integration (i.e. research question of the second study)? How do business model design and internationalization impact new ventures' competing exit strategies (i.e. research question of the third study)? I answer the posed research questions empirically, by using a unique longitudinal dataset on the entire German biotechnology population during the period 1996-2009.

1.3 Structure of the dissertation

This dissertation is structured as follows. Subsequently to the introduction, the second chapter presents the conceptual, theoretical, and empirical framework underlying this dissertation. To that end, I first develop the concept of strategic restructuring. In addition, I present the theoretical grounding of the dissertation. Based on the rationale of the knowledge-based view, I argue that firms are forced to ensure and maintain access to external knowledge stocks and continuous learning in order to strengthen their competitiveness from a strategic viewpoint. Moreover, I provide an overview of the empirical framework. To that end, I characterize the research setting of the three studies. I also present the data base used and the methods applied for the purpose of this dissertation. Finally, I distinguish my research from existing and research which draws on the same data base.

Chapters three up to five include the three empirical research studies. The first study examines how alliance portfolio configuration and capabilities influence new venture innovation. Alliance portfolio configuration refers to the set-up of the portfolio with regard to three dimensions: partner characteristics, relational properties, and structural properties. Alliance portfolio capabilities represent the collection of managerial routines that assist firms to deal with the inherent challenges of alliance portfolio management. I extend prior alliance portfolio literature, by merging configurational and managerial drivers of innovation in alliance portfolios that have always been analyzed in separation. In doing so, I show that the established relationship between diverse alliance portfolio configurations and innovation performance becomes reversed for new ventures. Thus, based on their inability to handle flows of diverse knowledge, I show that designing a homogeneous alliance portfolio is an innovation enhancing strategy for new ventures. In addition, I find that portfolio capabilities per se do not assist new ventures in enhancing innovation, as increasing portfolio capabilities also increase complexity. Furthermore, I find that there is an interaction effect

between configuration and capabilities that increases innovativeness. Empirical evidence is based on a longitudinal dataset of the entire German biotechnology population between 1996 and 2009.

The second study aims to explain how knowledge flows provided by network embeddedness and absorptive capacity drive firms' tendency toward vertical integration. I argue that network partner configurations at three levels of analysis (i.e. ego-network, regional network, and whole global network) provide or restrict the access to knowledge flows which influence a firm's tendency to expand its vertical integration. In addition, I presume that absorptive capacity directly and indirectly affects knowledge access through expanding vertical integration. Based on a longitudinal event history data base of the entire German biotechnology population between 1996 and 2009, I show that the expansion of vertical integration is a firm's purposeful strategy to access knowledge in the light of unfavorable network partner configurations and absorptive capacity. I fill a significant gap in the literature, as prior vertical integration research has largely neglected the network perspective. My results imply that managers can rely on vertical integration as a viable knowledge accessing strategy as an alternative to sourcing knowledge in networks.

The third study aims to examine new ventures' competing exit strategies, in particular their decision over whether to dissolve their business or to sell it off to another company. Based on a longitudinal event history analysis of the entire German biotechnology population, I show that stocks of business knowledge and internationalization knowledge acquired through learning processes affect those two competing exit strategies. Thereby, business knowledge stems from business model design, while internationalization knowledge results from internationalization. This paper contributes to both the exit literature and the M&A literature. First, it fills a significant gap in the exit literature, as prior research has most of the time neglected to study competing exit modes. However, such a differentiated approach is important to account for the strategic dimension of business exit. Second, I contribute to the M&A research following the knowledge-based view of the firm that emphasizes the transfer of knowledge from the acquired to the acquiring firm as the main motivation for a takeover (Ahuja and Katila, 2001; Ranft and Lord, 2002; Capron and Mitchell,

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2004). In particular, I show how the scope (i.e. local vs. distant knowledge) and nature (i.e. explicit vs. tacit knowledge) of knowledge determines M&A decisions. My research implies that managers and entrepreneurs should actively design their business models and should use internationalization as a lever to manage their exit from a strategic viewpoint.

In addition, chapter six is dedicated to a summary and presentation of limitations, followed by a discussion of findings provided by this dissertation. In particular, I present theoretical and managerial implications of the three studies and the dissertation as a whole. Finally, suggestions for further research are given.

2 OVERARCHING FRAMEWORK

- *Adapted version of the following chapter was presented at the SMS Annual Conference 2012 in Prague, Czech Republic*

The following chapter will present the conceptual, theoretical, and empirical framework underlying the three studies that constitute this dissertation. To that end, section 2.1 will provide an overview of the conceptual framework. Additionally, in section 2.2, I will present the theoretical grounding of this dissertation. Finally, section 2.3 will report on the empirical basis.

2.1 Conceptual framework

The subsequent section will present the conceptual framework underlying this cumulative dissertation. Specifically, I develop strategic restructuring as the central construct that represents the conceptual umbrella which ties the three studies together. To that end, I will first review the antecedents to and conceptual roots of strategic restructuring that are embedded in the corporate restructuring literature. Subsequently, I will emphasize the significance of strategic restructuring as a so far neglected area of research. Finally, I will conceptualize the construct, thereby presenting its dimensions that are covered in the individual studies throughout the dissertation.

2.1.1 Antecedents of strategic restructuring: corporate restructuring

Corporate restructuring has been studied extensively in prior strategic management literature (Markides, 1995). In general, restructuring is a set of specific decisive measures taken in order to increase the competitiveness of the firm (Crum and Goldberg, 1998). More specifically, corporate restructuring refers to a change in the configuration of a firm's assets in combination with a change in its corporate strategy (Hoskisson and Turk, 1990). By integrating existing definitions, I define corporate restructuring as a bundle of strategic levers as consequence of market disruptions at the corporate level that aim to increase the firm's competitiveness. It is evident from this definition that

corporate restructuring is a multi-dimensional concept focusing on a wide spectrum of facets. In fact, corporate strategic initiatives, such as mergers and acquisitions (M&A), divestitures, consolidations, and leveraged recapitalizations can all fall under the concept (Markides, 1995).

With regard to a systemization, prior research has identified mainly three distinct types that are portfolio, financial, and organizational restructuring (Bowman and Singh, 1993). Portfolio restructuring includes both divestitures and investments, by selling lines of business, that are assumed to be peripheral to the long-term strategy, or making significant acquisitions. Financial restructuring involves a change of the firm's capital structure usually through the infusion of debt to finance leveraged buyouts, to buy back stock from equity investors, or to pay large one-time dividends. Organizational restructuring is preoccupied with efforts to improve the firm's efficiency and effectiveness through significant changes in organizational structure, which is often accompanied by downsizing (Bowman and Singh, 1993). It is intuitive that these three types of corporate restructuring and their specific levers all aim at providing synergies in multi-business corporations (Hoskisson and Turk, 1990). In this context, corporate restructuring is a means to generate parenting advantage referring to the fact that the business units constituting the corporations perform not only better than they would as standalone entities but also better than they would under the patronage of any other parent (Goold and Campbell, 1998; Goold, Campbell, and Alexander, 1998). Ultimately, corporate restructuring enhances a corporation's competitiveness, by contributing to parenting advantage.

Due to its multi-dimensionality, corporate restructuring has been examined from different research disciplines. In fact, it has ever been an area of interest to strategy, finance, and organizational scholars (Bowman and Singh, 1993; Heugens and Schenk, 2004). Despite that interdisciplinary scope, the total body of restructuring research can be categorized according to the object of analysis in two main streams. On the one hand, a sizeable fraction of the corporate restructuring literature seeks to explain the occurrence of restructuring transactions. In much of the literature the rationale advanced for many transactions is the search for greater efficiency (Bowman

and Singh, 1993). Mergers and acquisitions, for example, are often traced back to economies of scale and scope. Downsizing and refocusing is often justified in terms of the cost savings they are supposed to realize (Heugens and Schenk, 2004). Others have stated that firms leverage restructuring efforts to increase the internal efficiency in response to active takeover markets (Jensen, 1993; Kaplan and Weisbach, 1992; Shleifer and Vishny, 1991). On the other hand, a bulk of studies explains the impact of restructuring activities on financial performance measures. To give an example, within the divestiture literature some studies report a positive relationship between divestiture and firm financial performance (Bergh, 1998; Hoskisson and Johnson, 1992), while others find a negative relationship (Bergh, 1995; Montgomery and Thomas, 1988). It is evident from this rough snapshot that the collective body of prior corporate restructuring research has mainly been preoccupied with studying financial performance measures, such as efficiency, return on investment, or stock market performance. These performance implications seem suitable to account for synergies and parenting advantages that are at the core of the extant restructuring literature.

2.1.2 Importance of strategic restructuring as a field of research

Existing restructuring research must be criticized for its exclusive focus on the corporate strategy field. Extant research has not managed to transfer the corporate restructuring concept to the business unit level and to integrate it with business level strategies. The latter have always focused on explaining competitiveness with competitive advantages resulting from superior strategic positioning vis-à-vis rivals operating in the same industry (Porter, 1985; Barney, 1991). This dissertation addresses the identified gap. To that end, I examine strategic restructuring that I perceive as a so far neglected angle of restructuring. In particular, I view strategic restructuring as being relevant for single-business firms and business units to improve their strategic positioning and achieving competitive advantage. These firms have most of time been overlooked in prior restructuring research that has always emphasized multi-business firms.

Building on my definition of corporate restructuring given above, I perceive strategic restructuring as a bundle of strategic levers as consequence of market disruptions at the business unit level that aim to improve the firm's strategic positioning in order to strengthen the firm's competitiveness (please find a detailed conceptualization of strategic restructuring in section 2.1.3 below). As such, this type of restructuring is conceptually close to the repositioning literature. The latter has identified frameworks and approaches that assist firms in facing market disruptions and improve their strategic position. Amongst others extant literature has proposed strategic innovation (Markides, 1997), disruptive technologies and innovations (Christensen, 1997), blue ocean strategy (Kim and Mauborgne, 2005), and business model innovation (Johnson, 2010; Johnson, Christensen, and Kagermann, 2008). Those approaches are valuable from a practitioner perspective, as they present ways how firms avoid competition, by creating new markets. However, these approaches lack theoretical grounding and an empirical investigation.

In this dissertation, I take on this challenge to theoretically and empirically approach strategic restructuring. In line with prior corporate restructuring research this dissertation aims to empirically investigate the performance implications of strategic restructuring. However, I take a different focus than prior literature. Undoubtedly, the taken financial focus of prior restructuring research reviewed above enriches our understanding of how firms can strengthen operational effectiveness, generate parenting advantage, and enhance financial competitiveness. However, every solely financial approach overlooks central aspects of value creation at the business unit level, such as i. e. innovation or long-term survival (Chakravarthy, 1986). As such, it is inadequate to account for strategic positioning and competitive advantage. Thus, I aim to explain strategic performance measures that are suitable for the business unit strategy perspective of this dissertation, as they imply a long-term and future orientation for explaining sustainable value creation and competitive advantages (Barney, 1991; Porter, 1985).

Specifically, I focus on three such strategic performance measures that are innovation, vertical integration, and firm survival. I focus on these specific measures, as they have shown to

improve strategic positioning and to be important for value creation in prior research. First, innovation has become increasingly desirable for firms, as prior research has found that innovative firms have higher profitability, greater market value, superior credit ratings, and higher survival probabilities (Czarnitzki and Kraft, 2004). In addition, determining firm boundaries is important for value creation, particularly in high-technology industries (Teece, 1986, Teece, 1992; Hill and Rothaermel, 2003). In fact, firms vertically integrate to erect barriers to entry, enable investments in specialized assets, defend product quality, and increase scheduling and coordination issues (Williamson, 1975; Harrigan, 1985; Harrigan, 1986). Finally, studying firm survival deserves research attention, as survival is the necessary and sufficient condition for value creation. In fact, surviving is a basic prerequisite for firm success (Cefis and Marsili, 2012) and is has been argued to be an indicator of firm performance (Audretsch, 1995; Caves, 1998; Klepper, 2002). In line with the bulk of existing survival research (e.g. Manjón-Antolín and Arauzo-Carod, 2007; Everett and Watson, 1998) I study market exit as a reflection of survival.

2.1.3 Conceptualization of strategic restructuring

As defined above, strategic restructuring involves a bundle of strategic levers as consequence of market disruptions at the business unit level that aim to improve the firm's strategic position. This definition intuitively raises the question of which are these levers that can satisfy the three requirements according to the above definition to be destined to constitute strategic restructuring. The answer to that question lies in the recent strategic management literature. The latter has identified three theoretical concepts that are best suitable to constitute those levers of strategic restructuring: 1.) strategic alliances, alliance portfolios, and networks; 2.) business models; and 3.) dynamic capabilities (see the figure below for an illustration). In the following, I will argue that strategic restructuring is composed of those three specific levers or concepts. To that end, I will first review the emergence and development of these concepts in the management literature as consequence of market disruptions. In addition, I will provide definitions of these concepts that

indicate their legacy at the business unit level, followed by a characterization of their potential to improve the firm's strategic positioning. Finally, I will specify the precise aspects of the concepts that will be studied throughout the dissertation.

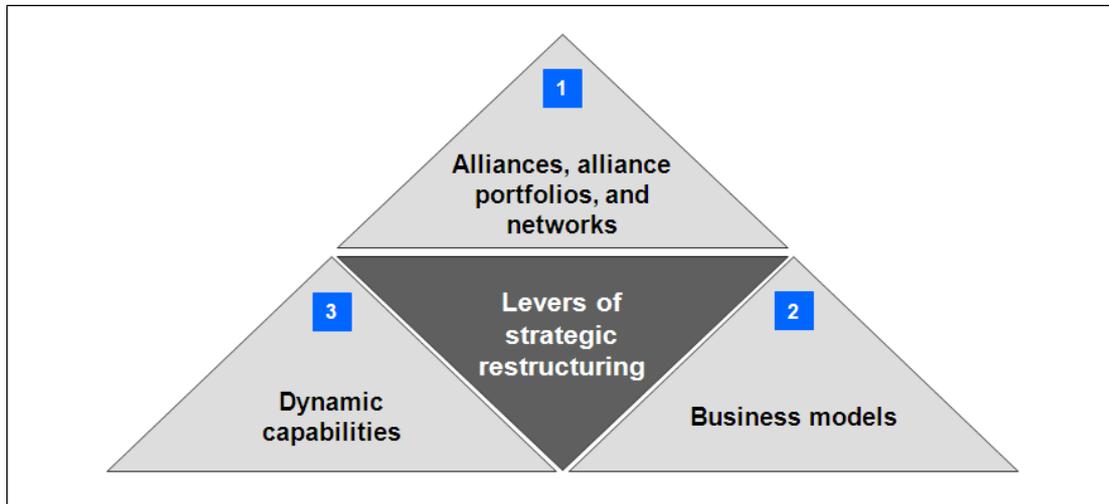


Figure 1: The three levers of strategic restructuring.

2.1.3.1 Strategic alliances, alliance portfolios, and networks

Research on cooperative strategies has proliferated in correspondence with their increasing relevance in business. In fact, market disruptions and the resulting hypercompetition have forced firms to advance core competencies and trust on external sources for supplementary and complementary capabilities (Santoro and Chakrabarti, 2002). As a result, through outsourcing firms have reduced the depth of value adding resulting in strategic alliances (Wassmer, 2010). In knowledge-intensive industries there is increasing evidence that firms do not only engage in one strategic alliance, but enter into multiple simultaneous alliances (Hagedoorn, 2002; Hoang and Rothaermel, 2005). Consequently, those firms are engaged in the challenge to build up, configure, manage, and control a complex alliance portfolio (Hoffmann, 2007; Lavie, 2007). However, a focal firm's alliance portfolio does not represent an atomistic, isolated entity (Granovetter, 1985). The respective ego-network is rather embedded in a network of firms spanning many industries, regions, and countries. Neglecting those networks in which firms and their alliance portfolios are embedded can lead to an incomplete understanding of alliance portfolios (Gulati, 1999).

By definition, alliances are voluntary arrangements among independent firms to exchange or share resources and engage in the co-development or provision of products, services, or technologies (Gulati, 1998). An alliance portfolio describes a focal firm's ego-network of alliances, those still active as well as those terminated earlier on, spanning along a variety of dimensions (i.e. partners; contents; scope) (Bae and Gargiulo, 2004; Lavie and Miller, 2008). A network is a group of individuals or organizations connected in ways that facilitate the achievement of a common goal (Kilduff and Tsai, 2003; Provan, Fish, and Sydow, 2007). Strategic alliances, alliance portfolios, and the engagement in networks have become a central element of strategy aiming at value creation (Das and Teng, 2000a; Gulati, 1998; Gulati, Nohria, and Zaheer, 2000). Thus, it is evident that they take effect at the business unit level, thereby assisting firms in improving their strategic position vis-à-vis rivals.

Strategic alliances, alliance portfolios, and networks are strategically important, as they improve the firm's strategic positioning through value creation (Das and Teng, 2000a; Ireland, Hitt, and Vaidyanath, 2002). First, alliances generate value through several ways, including scale economies, effective risk management, as well as learning from alliance partners (Alvarez and Barney, 2001). Furthermore, alliances assist firms to cope with uncertainty, reduce their resource dependency, and strategically reposition themselves in dynamic environments and markets (Das and Teng, 1996; Das and Teng, 2000b; Spekman, Forbes, Isabella, and MacAvoy, 1998; Young-Ybarra and Wiersema, 1999). Second, alliance portfolios assist firms in improving their strategic positioning. Existing literature particularly emphasizes the significance of partners for accessing complementary resources and capabilities (Lavie, 2007; Lavie and Miller, 2008). Further, interdependencies in the alliance portfolio can create synergies that mainly result from the transfer of knowledge across alliances (Powell *et al.*, 1996) as well as economies of scale and scope (Doz and Hamel, 1998). These synergies make the total value created by the alliance portfolio greater than the sum of the values created by each individual strategic alliance in the alliance portfolio (Vassolo, Anand, and Folta, 2004). Finally, prior research identifies benefits that network

membership can provide referred to as social capital (Portes, 1998). Social capital may improve the firm's strategic positioning, by enhancing innovation (Ahuja, 2000), knowledge transfer (Burt, 1992; Inkpen and Tsang, 2005), and intellectual capital (Nahapiet and Ghoshal, 1998).

The total body of literature dealing with strategic alliances, alliance portfolios, and networks can be systemized according to the object of analysis in three major research areas each representing an important phase in their life cycle: formation, configuration, and management (Wassmer 2010). Within social network research the focus has mainly been on configurational issues (Wassermann and Faust, 1994). This research tradition has been taken over by the strategic management literature. The latter has often tended to analyze the effect of alliance (portfolio) and network configurations on a strategic outcome variable. In fact, partner characteristics (e. g. Lavie, 2007), relational properties (Rowley, Behrens, and Krackhardt, 2000), and structural properties (Gulati, 1999) have been analyzed. In this dissertation, I focus on two specific configurational aspects. I examine the implications of multi-dimensional alliance portfolio configuration and multi-level network partner configurations. I believe that both aspects deserve special research attention from a strategic point of view, as the firm can actively and consciously design its alliance portfolio and select its network partners to face managerial challenges that arise from market disruptions. Hence, these two aspects very well reflect the first lever of the strategic restructuring concept.

2.1.3.2 Business models

In the past few years, more precisely since the mid-1990s, the business model concept has become the focus of considerable attention from both academics and practitioners. Developments and market disruptions, such as the advent of the internet and the social media (Amit and Zott, 2001) have provided firms with the actual opportunity to redesign their overall business models that have traditionally been quite similar within industries. First, the rapid development of e-commerce and with it the emergence of numerous start-ups moved the topic into the focus of practitioners and scholars (Chesbrough and Rosenbloom, 2002). Thus, much of the early business model work has

concentrated on e-business models (Timmers, 1998; Amit and Zott, 2001; Mahadevan, 2000; Weill and Vitale, 2001). After the burst of the dot.com-bubble in 2000, the business model concept has been gradually adopted and researched in the field of strategic management and gathers momentum since then (Hedman and Kalling, 2003; Mitchell and Bruckner-Coles, 2004; Morris, Schindehutte, and Allen, 2005). Recently, the concept has also been studied in the context of emerging markets due their rapid economic development and the augmenting interest in “bottom-of-the-pyramid” issues (London and Hart, 2004; Seelos and Mair, 2007; Thompson and MacMillan, 2010). Extant literature argues that firms should design new business models in order to serve the untapped bottom of the pyramid and middle market segments in emerging markets (London and Hart, 2004).

Despite the increasing importance of the concept in the face of technological and economic market disruptions, the management literature still lacks a widely-adopted and precise definition of the business model (Alt and Zimmermann, 2001; Shafer, Smith, and Linder, 2005). Some authors abstractly define the business model as “a representation of how a business creates and delivers value, both for the customer and the company” (Johnson, 2010: 22; Timmers, 1998: 4; Weill and Vitale, 2001: 34; Teece, 2010: 173). Others perceive the business model as how firms manage their transactions with other stakeholders (Hamel, 1999), thereby referring to the organization’s value architecture (Timmers, 1998). As such, the business model is a reflection of a firm’s realized strategy (Shafer *et al.*, 2005; Casadesus-Masanell and Ricart, 2010) Thus, business model design and product-market strategy are not substitutes, but complement each other (Zott and Amit, 2008). Hence, it is evident that the business model is a business level concept.

Prior literature acknowledges the role of business models for the firm’s strategic positioning. Although there exist diverse definitions of business models, all coincide that at the core “a business model performs two important functions: value creation [for customers] and value capture [for the firm]” (Chesbrough, 2007: 12). As a result, success and failure of firms are attributed to the design of their business models (Zott and Amit, 2007; Zott and Amit, 2008). For the purpose of this dissertation, I join this recent research stream and also focus on business model design. I believe

that this aspect is best suited to represent the second lever of strategic restructuring, as the firm can proactively design its business to face market disruptions.

2.1.3.3 Dynamic capabilities

The dynamic capabilities view (Teece, Pisano, and Shuen, 1997) has become increasingly important within the strategic management literature in recent years. Extant literature has argued that dynamic capabilities provide an important response to the crucial challenge of environments characterized by market disruptions and hypercompetition (Teece *et al.*, 1997; Eisenhardt and Martin, 2000, Teece, 2007). In this situation firms should build predominantly temporary advantages (D'Aveni, 1994; Eisenhardt and Martin, 2000). It is widely established in the strategic management literature that firms are able to integrate, build and reconfigure their internal and external capacities to face those changing environment through the use of dynamic capabilities (Teece *et al.*, 1997).

According to Teece et al. (1997: 516) dynamic capabilities refer to “the firm’s ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments”. Following this original and inspiring work, a huge body of literature emerged attempting to refine the definition of dynamic capabilities. The table below lists an overview of the most influential definitions of dynamic capabilities as identified by Di Stefano, Peteraf and Verona (2010) in chronological order. It becomes obvious that these definitions are mostly adaptations of Teece *et al.*’s (1997) original definition. They all share the idea that dynamic capabilities are organizational processes that enable a company to change and adjust its capabilities and resource base over time induced by shifting environmental conditions (Zahra *et al.*, 2006). Thereby, dynamic capabilities have always been conceptualized as a source of competitive advantage making them effective at the business unit level (Teece *et al.* 1997).

Furthermore, it is widely accepted that dynamic capabilities assist firms in improving the strategic position vis-à-vis rivals and create value (Helfat and Peteraf, 2003). In general, the theory tries to explain how it is possible that some companies perform more successfully within dynamic

markets than others (Easterby-Smith and Prieto, 2008; Teece *et al.*, 1997). In line, Zollo and Winter (2002: 341) supposed a direct relationship between dynamic capabilities and superior performance and survival, by admitting that “both superiority and viability will prove transient for an organization that has no dynamic capabilities” in changing environmental conditions. Recently, Teece (2007: 1320) restated that “the ambition of the dynamic capabilities framework is nothing less than to explain the sources of enterprise-level competitive advantage over time”. However, other researchers challenge the direct impact of dynamic capabilities on strategic positioning and value creation. In fact, Eisenhardt and Martin (2000: 1106) argue that “dynamic capabilities are necessary, but not sufficient, conditions for competitive advantage.” According to them, superior positioning is not dependent on dynamic capabilities per se, but on “using dynamic capabilities sooner, more astutely, more fortuitously than the competition” (Eisenhardt and Martin 2000: 1117). In the same vein, Zott (2003) presumed that dynamic capabilities are not directly linked to firm performance. He rather proposed that they affect performance, by transforming a firm’s resources and processes. Given, this controversy in prior literature, throughout this dissertation I go beyond advancing the dynamic capabilities-strategic performance measures relationship by introducing a contingency perspective. In fact, in order to embrace the above outlined theoretical discussion, I analyze the direct and moderating strategic performance implications of dynamic capabilities.

It is widely accepted that organizational capabilities emerge through a process of organizational learning (Levitt and March, 1988; Szulanski, 2003; Zollo and Winter, 2002). More specifically, through experiential learning (Cyert and March, 1963; Levitt and March, 1988; Martin and Salomon, 2003; Nelson and Winter, 1982) capabilities result from and develop with accumulated experience in managing the challenges inherent to strategic restructuring. These are amongst others managing alliances, alliance portfolios, and networks; managing knowledge exchanges between the firm and its partners; and generally facing dynamic environments, such as the international arena in which strategic restructuring takes place (see section 2.3.1 for a concretization). For the purpose of this dissertation, I will examine the implications of three specific

capabilities firms do develop as a by-product of managing the above characterized challenges inherent to strategic restructuring: alliance portfolio capabilities, absorptive capacity, and dynamic capabilities that emerge during the internationalization process. Alliance portfolio capabilities refer to the collection of managerial routines that are available to the focal firms to deal with the inherent challenges of alliance portfolio management (Sarkar, Aulakh, and Madhok, 2009). Absorptive capacity is referred to “the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends” (Cohen and Levinthal, 1990: 128). As a result, absorptive capacity leads to better learning from partners, integration of external knowledge and transformation of this into firm-embedded knowledge (Wang and Ahmed, 2007: 37). Finally, we focus on dynamic capabilities that firms develop as a by-product of internationalization. In fact, prior research has argued that the more a firm internationalizes, the more deeply imprinted are its dynamic capabilities (Hannan 1998; Sapienza, Autio, George, and Zahra, 2006). Emphasizing the international context is important given the ever increasing rate of globalization that firms have to consider in their strategic restructuring.

Study	Definition
<i>Eisenhardt and Martin, 2000: 1107</i>	Dynamic capabilities are “The firm’s processes that use resources – specifically the processes to integrate, reconfigure, gain and release resources – to match or even create market change. Dynamic capabilities thus are the organizational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve and die.”
<i>Zollo and Winter, 2002: 340</i>	“A dynamic capability is a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness.”
<i>Winter, 2003: 991</i>	Dynamic capabilities “are those that operate to extend, modify or create ordinary capabilities.”
<i>Zahra, Sapienza, and Davidsson, 2006: 918</i>	Dynamic capabilities are “the abilities to reconfigure a firm’s resources and routines in the manner envisioned and deemed appropriate by its principal decision-maker(s).”

<i>Wu, 2006: 448</i>	“Dynamic capability is the firm’s ability to integrate, learn and reconfigure resources; its ability to transform the existing resource base and to internalize external resources in order to be effective in a rapidly evolving environment.”
<i>Wang and Ahmed, 2007: 35</i>	Dynamic capabilities are “a firm’s behavioral orientation constantly to integrate, reconfigure, renew and recreate its resources and capabilities and, most importantly, upgrade and reconstruct its core capabilities in response to the changing environment to attain and sustain competitive advantage.”
<i>Helfat et al., 2007: 1</i>	“A dynamic capability is the capacity of an organization to purposefully create, extend or modify its resource base.”
<i>Teece, 2009: 206</i>	Dynamic capabilities are “[t]he ability to sense and then seize new opportunities, and to reconfigure and protect knowledge assets, competencies and complementary assets so as to achieve sustained competitive advantage.”
<i>Barreto, 2010: 271</i>	“A dynamic capability is the firm’s potential to systematically solve problems, formed by its propensity to sense opportunities and threats, to make timely and market-oriented decisions, and to change its resource base.”

Table 1: Definitions of dynamic capabilities.

2.1.3.4 Summary and derivation of research questions

It has become evident that the three concepts have been developed and introduced in the strategic management literature as consequence to market disruptions. Also, they have shown to take effect at the business unit level. Moreover, extant literature has proposed them to affect and improve the firm’s strategic position. Hence, I conclude that these three concepts are best suitable to represent the levers constituting strategic restructuring. The figure below illustrates the overarching conceptual framework that underlies this dissertation. The specific research questions of the three studies at the core of this dissertation arise from putting into relation to each other the developed concepts that are all embedded in this overall conceptual framework. By doing so, I ensure a holistic empirical examination of the strategic performance implications of strategic restructuring.

To that end, the first study is concerned with the question of how multi-dimensional alliance portfolio configuration and alliance portfolio capabilities impact innovation performance. In addition, the second study examines how multi-level network partner configurations and absorptive capacity influence the expansion of vertical integration. Finally, the third study aims to explain how

business model design and dynamic capabilities stemming from firm internationalization impact new venture survival (i.e. conceptualized as exit).

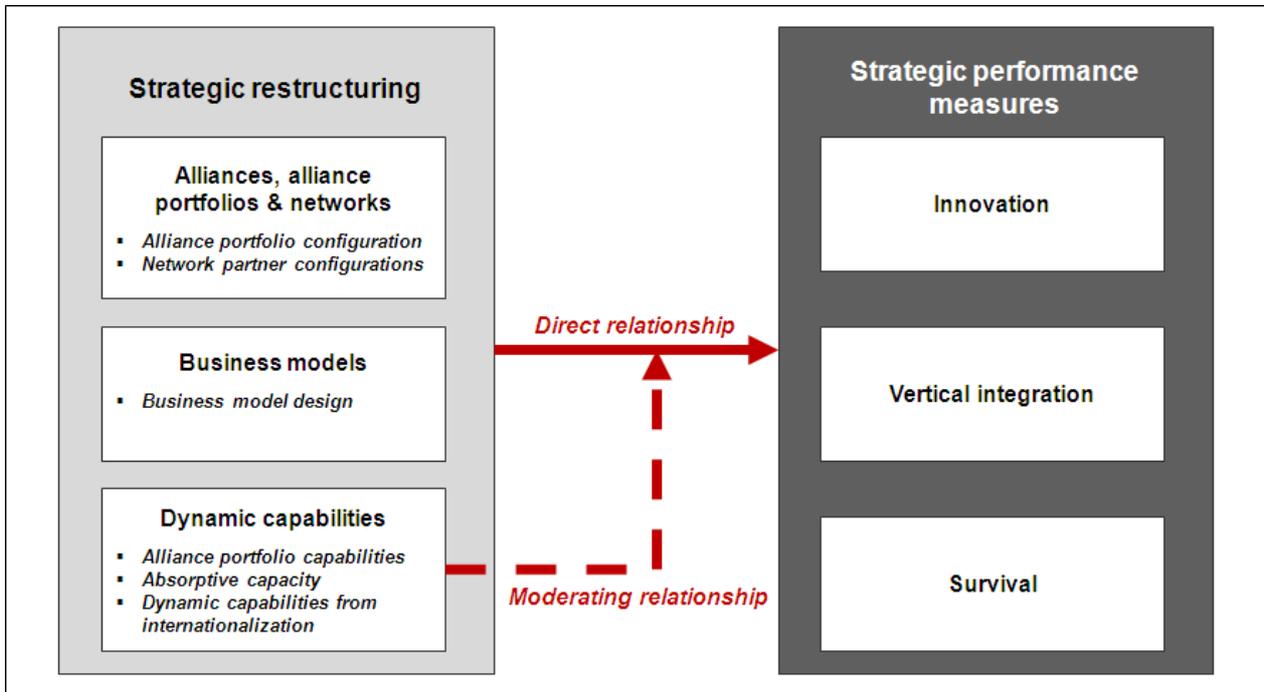


Figure 2: Conceptual framework of the dissertation.

2.2 Theoretical foundation

The subsequent section will present the theoretical framework underlying this cumulative dissertation. Specifically, I build on the knowledge-based view (KBV) as the central theoretical frame of reference. I will first briefly discuss the suitability of the KBV as the theoretical grounding for this dissertation. In addition, I will review the theoretical antecedents to the KBV that lie in the transaction cost economics (TCE), the resource-based view (RBV), and organization theory (OT). Subsequently, I will define and conceptualize knowledge and distinguish it from the organizational learning construct. Moreover, I will present the KBV as a strategic theory of firm performance, thereby discussing its assumptions for firm existence, firm boundaries, the internal organization of the firm, and performance heterogeneity among firms. Finally, I characterize a KBV of strategic restructuring, thereby linking that concept theoretically to the observed strategic performance measures.

2.2.1 Origins of the knowledge-based view

The KBV is adequate to explain firm behavior and its implications for performance in the present knowledge-based economy (Stewart, 1997; Grant, 2010), where intangible resources, particularly knowledge, are highly valued (Grant, 2010; Mathews, 2003). Following the definition of strategic restructuring provided above, the concept aims at improving the firm's strategic positioning. Given the knowledge-based economy of today (e. g. Grant and Baden-Fuller, 2004) strengthening the strategic position mainly involves ensuring and maintaining access to knowledge and learning. In this context, the KBV seems best suitable for explaining the strategic performance implications of strategic restructuring to face market disruptions.

It is intuitive that a theoretical perspective, such as the KBV does not emerge and develop in a theoretical vacuum. By contrast, the scholars that have advanced the field have been influenced by preceding theoretical streams, in particular by TCE, the RBV, and OT. I will review them briefly, thereby presenting the theoretical antecedents to the KBV. First, the KBV is perceived to be a reaction to the TCE that generally aims to explain firm existence relative to markets in terms of optimizing transaction costs. Coase (1937) assumed that firm existence is due to a more efficient functioning than markets with regard to the use of price mechanisms to negotiate contracts and in directing and control resources. Alchian and Demsetz (1972) stated that firms do exist, as they provide monitoring facilities that help to fulfill contractual conditions. Williamson (1975) suggested that firms have a higher effectiveness than markets due to their ability to control opportunism associated with asset specificity. KBV scholars have criticized TCE for neglecting heterogeneous firm performance (Liebeskind, 1996) and for overlooking the question of how knowledge is treated and explained for firm existence (Holmstrom and Roberts, 1998).

Moreover, it is widely established that the KBV is a recent extension to the RBV (Grant, 1996; Hoskisson, Hitt, Wan, and Yiu, 1999; DeCarolis, 2003). Penrose (1959), 'founding father of the RBV, perceived the firm as being endowed with a bundle of resources that result in strategic

advantages. Wernerfelt (1984) further developed this approach, by acknowledging that a firm's competitive advantage is dependent on a specific set of physical, financial, human or organizational resources, which the firm should build up, maintain, and defend. Barney (1991), in turn, argued that resources lead to a firm's sustainable competitive advantage vis-à-vis rivals, if these resources are valuable, rare, neither perfectly imitable nor easily substitutable, and can be fully leveraged by the organization. For scholars advancing the KBV, the RBV under-emphasizes the significance of knowledge, by treating it as a generic resource being of equal importance as other resources (Eisenhardt and Santos, 2006). In contrast, the KBV focuses upon knowledge as the crucial resource in the development of competitive advantages and firm success (Spender, 1996; Grant, 1996).

Finally, KBV theories build on the OT literature which assumes that individuals are restricted by their bounded rationality (March and Simon, 1958). Thus, individuals are constrained with regard to neurophysiology and language (Williamson, 1975). The first refers to the fact that individuals are limited to a certain quantity of information that they are able to receive, assimilate, store, and process without errors. The second points to the phenomenon that individuals are unable to articulate all of the knowledge and feelings they dispose of (Williamson, 1975). Thus, individuals and firms specialize on certain knowledge tasks that are integrated during the production process (Argyris and Schön, 1978; Grant, 1996). KBV theorists have criticized the OT stream for completely neglecting the reference to firm performance.

2.2.2 Knowledge and learning in the knowledge-based view

After having underlined the suitability of the KBV for studying strategic restructuring and having reviewed the theoretical antecedents to the KBV, this section will provide the conceptual background of the KBV. To that end, in the following, I will define and conceptualize the notion of knowledge, thereby distinguishing it from the notion of learning. Knowledge is a multifaceted concept with multilayered meanings. Traditionally, strategy researchers have relied on a

conceptualization of knowledge grounded in the Western epistemology. Herein, knowledge is perceived as “justified true belief” (Nonaka, 1994: 15). Others, rooted in cognitive psychology and sociology, have considered knowledge as a socially constructed concept that is created in continuing social interactions embedded in working practices (Weick and Roberts, 1993; Cook and Brown, 1999) and in the specific social and cultural context (Blackler, 1995; Galunic and Rodan, 1998). Thus, truth should be rather considered as an outcome of the knowledge creation process than as the constituting characteristic of knowledge (Tell, 1997). By integrating both streams, I define knowledge as a justified true belief that is given or created by social context.

Knowledge can be conceptualized along two dimensions that is the epistemological and the ontological (Nonaka, 1994). The first concerns the modes of expression of knowledge, whereas the latter relates to the locus of knowledge (Lam, 2000). On the one hand, epistemologically, Polanyi (1996) categorized knowledge into two categories, namely explicit and tacit knowledge. Explicit knowledge refers to knowledge that can be transmitted in a systematic language. By contrast, tacit knowledge is difficult to formalize and to communicate, as it has a personal quality, and can only be acquired through practical experience in the relevant context, i. e. ‘learning-by-doing’ (Lam, 2000). Polanyi (1966: 4) famously characterized tacit knowledge, by admitting that “we know more than we can say that we know”. As acknowledged by Spender and Grant (1996), tacit knowledge is of critical strategic importance, as it is both inimitable and appropriable. However, new knowledge is created through the dynamic interaction and combination of these two types (Nonaka and Takeuchi, 1995). This dissertation deals with both explicit and tacit knowledge.

On the other hand, the ontological category relates to the locus of knowledge that can be either at the individual or at the collective level (Lam, 2000). In fact, the range goes from the individual level at one end of the spectrum to the team, the group, and the organizational level at the other end (Nonaka, 1994). Individual knowledge resides in the brains and skills of the individual members of the organization (Lam, 2000). By contrast, collective or organizational knowledge is the accumulated knowledge of the organization embedded in processes and routines that guides the

interaction between the members of the organization (Lam, 2000). As such, it refers to the memory or collective mind of the organization (Walsh and Ungson, 1991). Organizational knowledge may be conceptualized by both stocks and flows (Dierickx and Cool, 1989). Stocks of knowledge refer to accumulated knowledge within the firm. By contrast, flows of knowledge are external knowledge streams into the firm that may be assimilated and developed into stocks of knowledge (DeCarolis and Deeds, 1999). This dissertation deals with organizational knowledge, thereby distinguishing between stocks and flows of knowledge.

Moreover, knowledge can be categorized according to its content. Firms can accumulate three types of knowledge that is institutional knowledge, business knowledge and internationalization knowledge (Eriksson, Johanson, Majkgard, and Sharma, 1997). Thereby, institutional knowledge concerns knowledge on institutions, and the current rules and regulations. Business knowledge concerns knowledge on clients, their needs and their decision making process. Finally, internationalization knowledge involves having knowledge of the external resources and capabilities of the firm in question, as well as its internal ones (Eriksson *et al.*, 1997). This dissertation considers all three types of knowledge content, as every type has its unique explanatory power.

Conceptually, organizational knowledge is tightly linked to organizational learning. The latter has traditionally been conceptualized as a routine-based process (Eisenhardt and Santos, 2006). In fact, Cyert and March (1963) suggested that organizational routines are the basis of learning in the organization. Thereafter, Nelson and Winter (1982) integrated organizational knowledge and organizational routines. They conceptualized the firm as an accumulation of organizational knowledge represented by routines that guide organizational action. Subsequently, learning has been increasingly conceptualized in terms of organizational knowledge. Levitt and March (1988) assume that organizations generate knowledge through organizational learning. Kogut and Zander (1992) argue that firms learn in areas that are closely related to their existing knowledge bases. Argote (1999) assumes that learning is the processes through which organizations

generate and combine knowledge. Miller (1996: 486) accentuates the link between learning and knowledge in stating that “organizational learning is the acquisition of new knowledge by actors who are able and willing to apply that knowledge in making decisions or influencing others in organizations”. Thus, summarizing, organizational learning is the process through which organizational knowledge is developed within firm boundaries.

2.2.3 The knowledge-based view as a theory of firm performance

Extant literature has tried to integrate different knowledge-based and -driven approaches into a dedicated theory of firm performance known as the KBV in strategic management. In extending traditional ‘theories of the firm’, such as TCE, theories of firm performance aim to explain firm existence, firm boundaries, the internal organization of the firm, as well as competitive advantage leading to performance differences among firms (Rumelt 1984; Foss 1996). In the following, I will present the key assumptions of the KBV as a theory of firm performance.

2.2.3.1 Knowledge as determinant of firm existence

The KBV offers explanations about how knowledge is related to the very existence of firms, thereby clearly separating from traditional TCE rationale. In particular, the KBV argues that firms exist because they represent a context where mainly three knowledge tasks can be performed (Eisenhardt and Santos, 2006). First, firms provide an organizational context for individuals to integrate their specialist knowledge (Grant, 1996). In addition, secondly, according to Kogut and Zander (1992: 383) “the central competitive dimension of what firms know how to do is to create and transfer knowledge efficiently within an organizational context”. In particular, extant research emphasizes firms’ knowledge creation ability in acknowledging that they protect the knowledge creation process (Von Krogh, Roos, and Slocum, 1994), ensure alliances between independent knowledge generating individuals (Spender, 1996), and share intellectual capital (Nahapiet and Ghoshal, 1998). Thereby, firms dispose of this knowledge creation ability, by lowering

communication and coordination costs through the development of identity (Kogut and Zander, 1996). Furthermore, thirdly, it is suggested that “firms exist because they provide a social community of voluntaristic action structured by organizing principles that are not reducible to individuals” (Kogut and Zander, 1992: 384). As a result, they can encourage learning processes and achieve coordination that cannot be realized under market conditions. This particularly applies to the integration and creation of tacit knowledge which cannot be exchanged at markets. Hence, summarizing, firms exist because they are able to create, integrate, transfer and apply knowledge, particularly tacit knowledge, more efficiently than other forms of governance.

2.2.3.2 Knowledge as determinant of firm boundaries

The KBV also theorizes about the scope of operations reflected by firm boundaries. Whereas traditional TCE focuses on transaction costs as being the determinants of firm boundaries, the KBV emphasizes knowledge-based considerations. Demsetz (1991) presumes that the firm’s vertical boundaries are determined by the extent to which knowledge can be integrated and transferred effectively. By contrast, Conner and Prahalad (1996) argue from the perspective of the individual and assume that the latter chooses between hierarchy and market depending on where its knowledge creates the greatest impact. Further, firm boundaries are determined by the rate of knowledge conversion (Nonaka *et al.*, 1999), by the ability to replicate and imitate tacit knowledge (Teece, 1998), or by the capacity to solve agency issues among individual knowledge creators (Spender, 1996). To conclude, firms design their boundaries in such a manner, that strategically important knowledge can be best created, protected, and applied. In addition, knowledge can also be integrated externally through alliances and networks that span organizational boundaries (Grant, 1996; Kogut and Zander, 1996; Kogut, 2000). These knowledge accessing alliances and networks are increasingly gaining in importance given the market disruptions and hypercompetition that force firms to focus on core competencies (Grant and Baden-Fuller, 2004).

2.2.3.3 Knowledge as determinant of firm organization

Moreover, the extant KBV literature discusses the implications of knowledge-based considerations on organizational structure. In particular, prior research critically discusses the role of hierarchy for performing knowledge-related tasks. On the one hand, a bulk of researchers emphasizes the value of hierarchical structures. In fact, hierarchies enable the coordination of specialized and localized knowledge stocks (Conner and Prahalad, 1996; Loasby, 1998). In addition, hierarchy is tightly linked to higher order principles that can integrate individual and collective knowledge (Kogut and Zander, 1992). On the other hand, a notable body of research critically views the role of hierarchies for knowledge-related tasks. It is acknowledged that tacit knowledge can be better coordinated in team-based organizational structures than under hierarchical order (Alchian and Demsetz, 1972; Grant, 1996). Also, hierarchies have assumed to be not effective for the integration and management of teams (Spender, 1998). Inspired by this tension, a differentiated internal firm structure that balances hierarchy and more team- or project-based organizations has been suggested (Nonaka, 1994; Nonaka, Nagata, and Toyama, 2000). Such structures are best suitable to enable the knowledge-generating and learning organization (Simonin, 1997; Senge, 1990). Evidently, research has been predominantly preoccupied with the role of organizational structures for performing knowledge-related tasks and learning processes. Other important organizational facets, such as differing business model designs have been neglected so far.

2.2.3.4 Knowledge as determinant of firm performance

From a strategic management perspective, linking knowledge and firm performance is the critical aspect of any knowledge-based theory. Generally, in contrast to the traditional economic conceptualization of the firm as a black box and production function, the KBV emphasizes the role of internal knowledge bases and learning processes in explaining a firm's competitive advantage and superior performance (Grant, 1996). Moreover, recent developments emphasize that a firm's knowledge base constitutes its most unique source of radical innovation development (e.g. Hill and

Rothaermel, 2003; Miller, Fern, and Cardinal, 2007; Subramaniam and Youndt, 2005; Zhou and Wu, 2010). Hence, according to Nonaka (1991) the most important and lasting competitive advantage is knowledge, the so called knowledge-based advantage (McEvily and Chakravarthy, 2002). In particular, tacit knowledge is perceived as the strategically most important resource of the firm. First, tacit knowledge assists firms to transform knowledge into valuable products and services (Polanyi 1966; Spender 1996; Liebeskind 1996). Second, as tacit knowledge is difficult to imitate and relatively immobile, it constitutes the basis of sustained competitive advantages (Grant, 1996; Decarolis and Deeds, 1999; Gupta and Govindarajan, 2000). Furthermore, heterogeneous knowledge bases are perceived as being the main determinants of performance differences (Kogut and Zander, 1992; Spender, 1996; Spender and Grant, 1996). Therefore, scholars emphasize the importance of managing the dynamic balance between applying a firm's given knowledge stocks (exploitation) and accessing external knowledge flows (exploration) (March 1991; DeCarolis and Deeds, 1999) for superior firm performance (Kogut and Zander, 1992). Hence, firms should pursue a two-fold strategy: on the one hand, accessing knowledge outside the boundaries of firms; on the other hand, and simultaneously, building up internal learning capabilities to integrate, transform and apply new and prior knowledge to products and services (DeCarolis and Deeds, 1999; Galunic and Rodan 1998; Kogut and Zander, 1992).

2.2.4 A knowledge-based view of strategic restructuring

Recently, literature has developed the constructs 'learning strategy' or 'knowledge strategy'. Bierly and Chakrabarti (1996) perceive a knowledge strategy as the collection of strategic choices that determine the firm's knowledge base and direct the firm's learning process. Refining this work, Zack (1999) adds that a knowledge strategy also entails decisions concerning the creation, development, and maintenance of a firm's knowledge resources and capabilities. Following these considerations and drawing on the intertwined relation between knowledge and learning, this dissertation conceptualizes strategic restructuring as knowledge and learning strategies. In line with

the firms' central challenge to balance exploitation and exploration mentioned above, I view strategic restructuring as a two-lever strategy. On the one hand, strategic restructuring aims at accessing and acquiring external knowledge that helps firms to source additional knowledge flows. On the other hand, strategic restructuring aims at creating internal learning routines that assist firms to produce new knowledge stocks. In turn, this dissertation examines the strategic performance implications of those knowledge and learning strategies underlying strategic restructuring.

Engaging in strategic alliances, building up alliance portfolios, and positioning in networks has been conceptualized as being a constituting lever of strategic restructuring. I argue that doing so has implications on strategic positioning and on the observed strategic performance measures. This is due to the fact that, as mentioned above, alliances and networks provide external knowledge flows (Grant, 1996; Kogut and Zander, 1996; Kogut, 2000). More precisely, prior studies have distinguished two types of knowledge sharing within alliances and networks: knowledge acquisition and knowledge access (Grant and Baden-Fuller, 2004). Inkpen (1998: 72) acknowledge that "in some alliances, partners aggressively seek to acquire alliance knowledge, while in others the partners take a more passive approach to knowledge acquisition". I argue that that the access to and acquisition of knowledge represents the main motive for engaging in knowledge-based strategic alliances, alliance portfolios, and networks (Grant and Baden-Fuller, 2004). This view is consistent with the trend in corporate strategy towards refocusing on a core set of knowledge skills (Quinn, 1992). Hence, I argue that strategic restructuring via engaging in alliances and networks is a knowledge accessing and acquiring strategy. To that end, two studies (study I and study II) examine how these additional external knowledge flows affect the observed strategic performance measures.

As stated, I conceptualize business model design and dynamic capabilities as being the other two critical levers constituting strategic restructuring. Theoretically, I argue that both concepts entail learning processes (for detailed conceptual explanations please see the studies). As such, during path-dependent, trial-and-error learning processes that are underlying both business model design and dynamic capabilities, firms gradually adopt and apply knowledge that leads to favorable

outcomes (Levitt and March, 1988). Hence, I argue that strategic restructuring via designing business models and developing dynamic capabilities is a learning strategy. To that end, study III examines how learning routines inherent to business model design influence firm survival (i.e. conceptualized as exit). In addition, I integrate a dynamic capability perspective in each study in order to investigate how organizational learning routines underlying dynamic capabilities affect the observed strategic performance measures both directly and indirectly (as moderating effect).

2.3 Empirical framework

The following section provides an overview of the empirical framework underlying this dissertation. To that end, I first characterize the research setting for the three research studies. In addition, I present the data collected and the methods applied for the purpose of this dissertation. Finally, I distinguish this dissertation from existing research which draws on the same data base.

2.3.1 Setting: the total population of German biotechnology firms between 1996 and 2009

The following sub-section will present the setting used for the purpose of this dissertation and its three constituting studies which is the total population of German biotechnology firms between 1996 and 2009 (in total 1,167 firms). In comparison to the U.S. biotechnology sector, the German biotechnology industry actually did not exist prior to the mid-1990s (Casper, 2000; Kaiser and Prange, 2004). The reason for this was a hostile and restrictive regulatory environment for genetic research through-out the 1980s and the early 1990s (Al-Laham and Souitaris, 2008). Up to that time, only a few commercial biotechnology laboratories were in existence, most of which were spillovers of large pharmaceutical firms (Amburgey *et al.*, 2008). However, in the mid-1990s, the German government introduced a series of new technology policies designed to organize the development of innovative technologies and start-ups (Kaiser and Prange, 2004). Among those policies were the liberalization of genetic testing regulations in 1993 and the introduction of substantial technology promotion programs since 1995, such as amongst others the “Bio-Regio”

competition of regional clusters (Al-Laham and Amburgey, 2008). Additionally, many public grants, loans and subsidiary programs were created to finance biotechnology start-ups. To offer finance opportunities for young firms, the German Government also collaborated with the financial community to introduce measures designed to stimulate the provision of higher risk investment capital (Casper, 2000). As a result, in 1997, a new stock exchange, called “Neuer Markt”, was created that favored young start-ups, by applying substantial lower listing requirements than those existing for the main stock market (Al-Laham and Souitaris, 2008). Collectively combined, these institutional changes have led to a substantial increase in the number of German biotechnology start-ups, most of which are located in the mentioned “Bio-Regio” clusters around universities and public research institutes (Ernst&Young, 2003).

Apart from the distinctiveness at the industry level there are also certain unique firm level characteristics that distinguish firms in the biotechnology industry from other industries. In fact, firms operating in biotechnology rely on knowledge extensive capabilities transforming scientific know-how in products (Powell *et al.*, 1996; Hagedoorn, 2002). Thus, commercialization heavily depends on core competencies dealing with scientific discoveries (Amburgey *et al.*, 2008). For such a business model to be successful, sourcing specialized knowledge from external institutions, such as universities is indispensable. Recently, time-to-market and cost pressures – due to intense global competition with U.S. biotechnology firms and emerging rivals originating in pharmaceuticals or chemicals – have even increased the significance of accessing knowledge externally and developing learning capabilities internally (Ernst&Young, 2010).

As a result, by today, biotechnology firms are forced to strategically restructure to face the manifold challenges of the current competitive situation. In fact, it is evident that biotechnology firms are forced to actively manage alliances and networks, continuously designing their business models, and developing dynamic capabilities to stay competitive in their changing industry. Given the strategic importance of knowledge accessing and learning strategies mentioned above, the applied knowledge-based view of strategic restructuring is greatly suitable. In addition, high-

technology new ventures have always been overlooked in prior restructuring research that has always examined large and multi-divisional corporations (Hoskisson and Turk, 1990). Summarizing, the German biotechnology industry represents a very appropriate setting that is best appropriate for the purpose of this dissertation.

2.3.2 Data

This dissertation relies on a data base that entails five data sources. The first data source is the daily (de)registration records of the German Commercial Register (“Bundeszentralregister”) in Berlin. In addition, I use the “Yearbooks of the German Biotechnology Industry” published yearly by the German Biocom AG. The “Yearbook of the German Biotechnology Industry” is a collection of firm-specific information gathered from an annual survey of all organizations in the field of biotechnology. The addresses from this source were used to identify the geographic location of the firms, their age as well as the number of employees. The third source is archival data coded from the monthly TRANSCRIPT newsmagazine that reports on the German biotech industry. With the help of this journal, I coded my different events (alliances, vertical integration etc.). Moreover, my patent data stem from records offered by the European Patent Office in Brussels. Finally, data stem from German and European newsmagazines such as “Financial Times Deutschland”, “Frankfurter Allgemeine Zeitung”, or “Handelsblatt”.

These five data sources assisted to identify a consolidated list of biotechnology firms. The latter, however, also included non-German firms and non-independent entities (e. g. subsidiaries). After an adjustment for those factors, the final data base entails 528 German biotechnology firms that form the entire German biotechnology population in 2009. The sample also includes firms from the pharmaceutical and chemical industries who have changed their business model, and have finally transformed into biotechnology firms. Other types of organizations, such as universities, government laboratories, pharmaceutical or chemical firms are considered as alliance partners of the biotechnology firms.

This unique data base, which observes the development of the entire population of German biotechnology firms from 1996 until 2009 has been originated and maintained by my first dissertation supervisor Prof. Dr. Andreas Al-Laham. Additional data work supplementing the original set-up of the data base involving data updates, additional data collection, and recoding of specific variables has been conducted during an extensive three-year research project (2009-2012) at the Chair of Strategic and International Management of the University of Mannheim, to which I have contributed extensively during my doctoral studies and further engagement at the Chair.

2.3.3 Research methods

This subsection will characterize the research methods applied for the purpose of this dissertation. As presented above, I rely on unique longitudinal data for the purpose of this dissertation. Generally, longitudinal research studies are highly appraised in the strategic management field (Barnett and Burgelman, 1996; Porter, 1991; Schendel, 1996). This rise of longitudinal methods has been pushed by critiques of the limitations inherent to cross-sectional studies among strategic management researchers (Bergh, 1993; Bergh and Holbein, 1997; Bowen and Wiersema, 1999). To be specific, Lubatkin and Chatterjee (1991) note that the reliance on cross-sectional data for a single year prevents strategy researchers from accounting for any trend effects in their investigation. In line, Rumelt (1991) argues that observing a single year of data can in an inability to determine the true causal relationship. The increasing popularity of longitudinal studies can also be explained with reference to the overall conception of strategic management. Most definitions and theories of strategic management are longitudinal in nature (Ginsberg, 1988; Mintzberg and Waters, 1985; Porter, 1991). Miller and Friesen (1982: 1020) underlined the longitudinal nature of strategy, by acknowledging that “strategy can be best understood by tracking it over time; by looking at behavior rather than condition; by studying what happens in response to what”. This also applies to this dissertation. In order to study the long-term implications of strategic restructuring, a longitudinal research design is necessary.

Specifically, the data characterized above are used to construct an event history for each German biotechnology firm. Event histories are data structures that include information on the number, timing and sequence of the events that are being examined (Al-Laham and Souitaris, 2008). Consequently, this dissertation mainly relies on event history analysis (Allison, 1984). This method is uniquely suited to the study of discrete events occurring across a time series, as well as ‘right-censored’ cases, when no event has occurred by the end of the study period (Park and Russo, 1996). Event history provides a way to include explanatory variables that change over time (Baucus and Near, 1991). Thus, I can study how changes or reconfigurations in alliances and networks engagements, business model designs, and capabilities affect the observed strategic performance measures. As such, event history analysis is best suitable to examine the dynamic facets and implications of strategic restructuring.

2.3.4 Differentiation of this dissertation from extant research by Professor Al-Laham

As mentioned, the data used for the purpose of this dissertation emanate from a unique secondary data base originated by my dissertation supervisor Professor Al-Laham. In fact, there are four research papers published by Al-Laham (Al-Laham and Souitaris, 2008; Al-Laham and Amburgey, 2009; Al-Laham and Amburgey, 2010; Al-Laham and Amburgey, 2011) that rely on the German biotechnology data base characterized above. Generally, these studies examine different strategic implications of German biotechnology firms’ network embeddedness. Specifically, Al-Laham and Souitaris (2008) analyze the influence of international research alliances on German biotechnology firms’ propensity to internationalize. Al-Laham and Amburgey (2009) examine the impact of alliances and absorptive capacity on firm exits. Further, Al-Laham and Amburgey (2010) investigate whether and how a firm’s alliance history can influence its position within the research network. Finally, Al-Laham and Amburgey (2011) observe the influence of alliances and networks on firm innovation performance (see the figure below for a more detailed overview).

This dissertation clearly differentiates itself from extant research conducted by Al-Laham both conceptually, as I examine additional frameworks, and empirically, as I study additional variables. As a result, this dissertation represents a unique piece of work that can advance the strategic management field. Leveraging secondary data bases, thereby generating insights through examining different frameworks, recombining variables, and constructing new dependent variables is an established approach in the research field preoccupied with alliances and networks of high technology firms. As data of the most of the time small firms are difficult to collect, star scientists in the field, such as Professor Gautam Ahuja, Professor Dovev Lavie, or Professor Frank Rothaermel (all three greatly published in the field's leading outlets, such as Strategic Management Journal, Organization Science, or Academy of Management Review), are very successful in creating impactful research, by pursuing the characterized approach that I am following in this dissertation.

On the one hand, conceptually, this dissertation addresses a broader spectrum of strategic issues that are relevant to German biotechnology firms than in Al-Laham's prior studies. I establish the holistic framework strategic restructuring (as provided in detail in section 2.1) that assists German biotechnology firms to access external knowledge flows and develop internal learning capabilities. Specifically, within the scope of strategic restructuring, this dissertation examines alliance portfolios, business model design, and dynamic capabilities. These constructs have not been covered so far in Al-Laham's research. In contrast, Al-Laham has solely focused on examining the effects of alliances and networks. Thus, whilst subscribing me to the 'knowledge-based network view' initiated by Grant and Baden Fuller (2004) and developed forward through empirical research by Al-Laham, I avail myself of occupying a dedicated research niche within that school of thought that is unique in nature. In particular, in the first paper I examine the interplay of alliance portfolio configuration and management as the determinants of innovation. Both recent constructs have not been touched by Al-Laham so far. Thus, I can advance extant research dealing with alliance portfolio diversity and alliance portfolio capabilities that have not been addressed by

Al-Laham so far. The second research study analyzes a completely new conceptual framework, which Al-Laham has not studied before, that is the impact of knowledge flows from network partner configurations on firms' tendency to expand vertical integration. As such, I can conceptually link two modes of governance and explain how vertical integration is influenced by network embeddedness. Finally, the third study analyzes the influence of knowledge flows inherent to business model design and dynamic capabilities (as a by-product of firm internationalization) on competing exit strategies. This framework that links business knowledge and internationalization knowledge is distinct from existing research by Al-Laham.

On the other hand, empirically, this dissertation entails several significant novelties that have not been covered by Al-Laham so far. To begin with, this dissertation analysis the entire population of German biotechnology firms until the end of 2009, whereas the period under observation in prior research has reached only until 2006 at the utmost. In order to extend the period of observation, a massive amount of additional data had to be collected. Further, all existing variables had to be updated. Extending the period of observation allows for higher reliability due to a higher number of observable events.

Moreover, the first study applies a negative binominal regression model of the patent count, whereas Al-Laham and Amburgey (2011) have relied on a hazard rate model to account for the patent rate. To that end, I collected new data on patent applications from the European Patent Office, while prior research has always relied on less reliable patent data stemming from the German Patent and Trademark Office in Munich published by PATHOS GmbH. In addition, I have constructed tie strength (operationalized as capital committed toward the respective alliance) as a new independent variable influencing new venture innovation performance. Integrating tie strength that has been overlooked in Al-Laham's prior papers is important to account for relational properties that have been shown to be significant for performance (e.g. Granovetter, 1985; Rowley *et al.*, 2000). Furthermore, I have constructed alliance portfolio capabilities (operationalized as the

cumulative count of prior strategic alliances) as a new independent and moderating variable, which has not been considered in Al-Laham's existing studies.

For the purpose of the second study, which emanates from the first study, I have constructed a new dependent variable which has not been analyzed so far by Al-Laham: the vertical integration expansion rate (see section 4.3.1 for an operationalization). In doing so, I can analyze the influence of network partner characteristics on the expansion of vertical integration. Moreover, I include absorptive capacity as an independent and moderating variable.

Whereas Al-Laham and Amburgey (2009) solely conceptualize dissolution as firm exit, my third study also views sell-off through M&A as a viable competing exit mode. Hence, for the purpose of the paper, I consider knowledge flows and more specifically the nature of the knowledge flows as antecedents to an exit event, within a model that allows their effects on two alternative modes of exit that are dissolution (i.e. bankruptcy) and sell-off (i.e. M&A) to be assessed within the same framework. To that end, I have recollected and recoded German biotechnology firms' exits, to include both dissolution sell-off. Also, I estimate a competing-risk model which has not been run in Al-Laham and Amburgey (2009) to clearly distinguish my study empirically from previous research that rely on the German biotechnology data base.

OVERARCHING FRAMEWORK

Paper (Journal)	Research question	Data set and research method	Dependent variable	Independent variables
Al-Laham & Souitaris, 2008 (<i>Journal of Business Venturing</i>)	How do international research alliances influence firm internationalization?	<ul style="list-style-type: none"> Entire population of German biotech firms between 1995 and 2004 Event history analysis 	International alliance formation rate	<ul style="list-style-type: none"> International alliance intensity of the cluster Density of the cluster with public research institutions Organizational diversity of the cluster (Herfindahl) Prior local research alliances with public research institutions Prior national research alliances Centrality within the national research network
Al-Laham & Amburgey, 2009 (<i>Zeitschrift für Betriebswirtschaft</i>)	How do strategic alliances and absorptive capacity impact firm survival?	<ul style="list-style-type: none"> Entire population of German biotech firms between 1995 and 2004 Event history analysis 	Exit rate	<ul style="list-style-type: none"> Prior international strategic alliances of the firm Research domains of the firm Sophistication of technological capabilities Density of the local research cluster
Al-Laham & Amburgey, 2010 (<i>Management International Review</i>)	How does a firm's alliance history influence its position within the research network?	<ul style="list-style-type: none"> Entire population of German biotech firms between 1995 and 2006 Event history analysis 	Eigenvector centrality	<ul style="list-style-type: none"> Prior research alliances of the firm with domestic or foreign partners Prior research alliances of the firm with other firms or with public organizations Prior research alliances of the firm with multiple partners Diversity of countries within which the biotech firms have formed alliances
Al-Laham & Amburgey, 2011 (<i>Advances in Strategic Management</i>)	How do alliances and networks influence firm innovation performance?	<ul style="list-style-type: none"> Entire population of German biotech firms between 1995 and 2004 Event history analysis 	Patent rate	<ul style="list-style-type: none"> Research munificence of local cluster Density of local cluster (four variables) Cluster diversity (Herfindahl) Cluster age Prior research alliances of the firm with foreign partners Research network centrality of the firm
Research study 1	How do alliance portfolio configurations and alliance portfolio capabilities impact new venture innovation performance?	<ul style="list-style-type: none"> Entire population of German biotech firms between 1996 and 2009 Event history analysis 	Patent count	<ul style="list-style-type: none"> Partner international diversity: number of international partners in the alliance portfolio Tie strength: intensity of capital dedicated to the respective strategic alliance Partner network status: eigenvector centrality Alliance portfolio capabilities: prior strategic alliances
Research study 2	How do multi-level network partner configurations and absorptive capacity influence the expansion of vertical integration?	<ul style="list-style-type: none"> Entire population of German biotech firms between 1995 and 2009 Event history analysis 	Vertical integration expansion rate	<ul style="list-style-type: none"> Ego-network partners' international diversity: number of international partners Regional network partners' research munificence Global network partners' status: eigenvector centrality Absorptive capacity: prior strategic alliances
Research study 3	How do business model design and internationalization impact new ventures' competing exit strategies?	<ul style="list-style-type: none"> Entire population of German biotech firms between 1995 and 2009 Event history analysis 	Competing exit rates: dissolution rate & sell-off rate	<ul style="list-style-type: none"> Business model exploration: prior research & development alliances Business model exploitation: prior marketing, distribution & licensing alliances Internationalization: prior international alliances

Figure 3: Overview of research papers based on the German biotechnology data base.

3 RESEARCH STUDY I: ALLIANCE PORTFOLIO CONFIGURATIONS, PORTFOLIO CAPABILITIES, AND NEW VENTURE INNOVATION

- *Study conducted in collaboration with Suleika Bort and Andreas Al-Laham (†)*
- *Earlier version of the study presented at the AIB Annual Conference 2011 in Nagoya, Japan*
- *Conceptual part of the study published in T. K. Das (Ed.) (2012): Management Dynamics in Strategic Alliances (23-52), Charlotte: Information Age Publishing*

3.1 Introduction

Studying new venture strategies is an established research stream in strategic management. In fact, prior research on new ventures dealt with competitive strategy (e.g. Carter, Stearns, Reynolds, and Miller, 1994), cooperative strategy (e.g. McGee, Dowling, and Megginson, 1995), strategy process (e.g. Delmar and Shane, 2003; Fern, Cardinal, and O'Neill, 2012), and stakeholder strategy (e.g. Wang and Bansal, 2012). In particular, prior strategy literature has been interested in explaining new venture innovation (e.g. Li and Atuahene-Gima, 2001; Romijn and Albaladejo, 2002; Thornhill, 2006; Gilbert, McDougall, and Audretsch, 2008; Zhang and Li, 2010). Indeed, innovating, by turning research discoveries into patents and transferring them into marketable products, is indispensable for new ventures to generate cash flows (Haeussler, Patzelt, and Zahra, 2012). In addition, innovation assists new ventures to improve their survival chances (Schoonhoven, Eisenhardt, and Lyman 1990). Given the strategic importance of innovation for new ventures, this paper aims to explain new venture innovation performance.

In prior literature the knowledge-based view is the dominant theory to explain innovation performance. Herein, innovation results from the recombining existing internal knowledge (i.e. knowledge stocks) and additional external knowledge (i.e. knowledge flows) (Grant, 1996; Spender, 1996; Kogut and Zander, 1992; McEvily and Chakravarthy, 2002; Van de Ven, 1986). The existing knowledge-based research on innovation has emphasized the significance of single strategic alliances as the key to access knowledge flows (Grant and Baden-Fuller, 2004; Al-Laham

and Souitaris, 2008; Fernhaber, McDougall-Covin, and Shepherd, 2009). A strategic alliance is “any voluntarily initiated interfirm cooperative agreement that involves knowledge sharing, or co-development” (Gulati, 1995: 619). However, in its foundation the knowledge-based view itself is agnostic to the single alliance perspective towards sourcing knowledge (Kogut and Zander, 1992). In contrast, it has always been arguing a multi-alliance perspective, insofar as knowledge can come from everywhere and will come from everywhere at the same time (Grant, 1996). Given this theoretical grounding, any potential contribution to the knowledge-based view from studies the unit of observation of which is a singular alliance may be flawed. To overcome the characterized theoretical shortcoming of the current literature, I take a multi-alliance perspective, namely the alliance portfolio perspective. By definition, an alliance portfolio describes a firm’s ego-network of alliances, those still active and those terminated earlier on, spanning along a variety of dimensions (i.e. partners; contents; scope) (Wassmer, 2010). Despite the increasing interest in alliance portfolios (Hoffmann, 2007; Koka and Prescott, 2008; Wuyts and Dutta, 2012), to my knowledge no study has analyzed how alliance portfolios affect the innovation performance of new ventures.

I identify two main research streams in the alliance portfolio literature: the configurational and the managerial perspective (Wassmer, 2010). The configurational perspective is preoccupied with the innovation performance implications of alliance portfolio configuration. The latter refers to the set-up of the portfolio with regard to three dimensions: partner characteristics (e.g. Lavie, 2007; Lavie and Miller, 2008), relational properties (e.g. Rowley, Behrens, and Krackhardt, 2000; Tiwana, 2008), and structural properties (e.g. Gulati, 1999; Baum, Calabrese, and Silverman, 2000). The managerial perspective is preoccupied with the innovation performance implications of alliance portfolio capabilities (e.g. Hoffmann, 2007). The latter refer to the collection of managerial routines that are available to the focal firms to deal with the inherent challenges of alliance portfolio management (Sarkar, Aulakh, Madhok, 2009). As a major shortcoming of prior literature, configurational and managerial drivers of innovation have always been analyzed in separation,

thereby ignoring the interactions between them (Wassmer, 2010; Faems, Janssens, and Neyens, 2012). In order to fill that gap, I view the interplay of portfolio configuration and capabilities as the wellsprings of knowledge flows and innovation.

Thus, my study aims to solve three specific research questions. How does alliance portfolio configuration impact new venture innovation performance? How do alliance portfolio capabilities influence new venture innovation performance? How do those capabilities moderate the portfolio configuration-innovation performance links? Based on a unique longitudinal dataset on the entire German biotechnology population during the period 1996-2009, I am able to show that for new ventures homogeneous alliance portfolio configurations (i.e. alliance portfolio homogeneity) enhance innovation. Also, I find that alliance portfolio capabilities per se do not certainly assist new ventures in enhancing innovation. Finally, I am able to show that the interaction of alliance portfolio configuration and capabilities does not increase innovativeness. Thus, I can emphasize the individual significance of both alliance portfolio configurations and capabilities.

My paper contributes to prior knowledge-based and alliance portfolio literature in four ways. First, I can enrich the current knowledge-based literature that has always taken a single alliance perspective (Grant and Baden-Fuller, 2004; Al-Laham and Souitaris, 2008; Fernhaber, McDougall-Covin, and Shepherd, 2009). In line with the original theoretical understanding of the knowledge-based view, which is agnostic to single strategic alliances as a means to access knowledge flows, I take a multi-alliance perspective to account for the fact that knowledge can come from everywhere at the same time. Second, I extend the alliance portfolio literature, by merging configurational and managerial drivers of innovation in portfolios that were always analyzed separately (Wassmer, 2010). As such, I satisfy the call for moderators in papers dealing with alliance portfolio configuration, as not all firms benefit equally from certain portfolio configurations (Schilke and Goerzen, 2010; Schilling and Phelps, 2007). Third, I can contribute to current literature dealing with alliance portfolio configuration, by showing that the established positive relationship between

alliance portfolio diversity (Baum, Calabrese, and Silverman, 2000; Powell, Koput, and Smith-Doerr, 1996; Silverman and Baum, 2002; Watson, 2007; Bruyaka and Durand, 2012; Wuyts and Dutta, 2012) and innovation performance becomes reversed for new ventures. Based on their inability to assimilate flows of diverse knowledge due to their limited cognitive capacity (March and Simon, 1958; Cyert and March, 1963), which refers to a limited rate at which diverse knowledge can be assimilated and applied (Simon, 1945: 40-41; Nickerson and Zenger, 2004), I show that the implicit assumption according to which firms can readily assimilate incoming external knowledge does not hold for new ventures. Hence, for new ventures designing a homogeneous alliance portfolio is an innovation enhancing strategy. In addition, I can advance the literature on alliance portfolio capabilities. I show that new ventures may not have enough alliance experience for it to have a real performance impact. In addition, increasing portfolio capabilities also increases complexity and because new ventures are small they may not be able to appropriate all the knowledge co-created in the alliance portfolio.

My paper is organized as follows. First, I introduce the underlying conceptual basis. Next, I derive hypotheses from theoretical considerations. In addition, I report on the methodology and the results of the study. Finally, I discuss my findings and end up with a conclusion including limitations, avenues for further research, and managerial implications.

3.2 Conceptual framework

3.2.1 A knowledge-based view of new venture innovation

Knowledge is a “justified true belief” (Nonaka, 1994: 15). A firm’s knowledge base may be conceptualized by knowledge stocks and flows (Dierickx and Cool, 1989). Knowledge stocks are internal knowledge assets. Knowledge flows are external knowledge streams that may be assimilated and developed into stocks of knowledge (DeCarolis and Deeds, 1999). Conceptually, organizational knowledge is tightly linked to organizational learning, as firms generate knowledge

through organizational learning (Levitt and March, 1988; Miller, 1996). The only way to enhance innovation performance is by constantly augmenting the organizational knowledge base (Iansiti and Clark, 1994; Spender, 1996; March, 1991). Prior studies have highlighted the integration of external knowledge flows and internal knowledge stocks as a means to generate innovation (DeCarolis and Deeds, 1999; Galunic and Rodan 1998; Kogut and Zander, 1992). Recent papers have affirmed the essential role of accessing external knowledge to enhance innovation (Grant and Baden-Fuller, 2004; Lichtenthaler and Lichtenthaler, 2009; Phene, Fladmoe-Lindquist, and Marsh, 2006; Rosenkopf and Nerkar, 2001).

Accessing external knowledge flows is especially relevant for new ventures to generate innovation, as their internal knowledge space is limited (Zhang and Li, 2010). In this context prior literature has emphasized the importance of new ventures' alliances for enhancing innovation (Shan, Walker, and Kogut, 1994; Deeds and Hill, 1996; Baum, Calabrese, and Silverman, 2000). Although alliance portfolios have gained in importance in strategic management (Bae and Gargiulo, 2004; Vassolo, Anand, and Folta 2004; Hoffmann, 2007; Lavie, 2007; Jiang, Tao, and Santoro, 2010; Wassmer and Dussauge, 2012), no study so far has analyzed the influence of alliance portfolios on new venture innovation performance. To fill that gap in the literature, I study alliance portfolios as wellsprings for external knowledge flows that new ventures can leverage for strengthening their innovation performance.

There is an implicit assumption that firms can readily assimilate incoming external knowledge from the alliance portfolio. However, there are also restrictions with regard to accessing and assimilating knowledge for innovation. Behavioral theory, a theoretical antecedent of the knowledge-based view, assumes that individuals are limited in their cognitive capacity (March and Simon, 1958; Cyert and March, 1963). This means that individuals have difficulties in assimilating, accumulating, and applying diverse knowledge (Simon, 1945: 40-41; Nickerson and Zenger, 2004). This is due to constraints with regard to neurophysiology and language (Williamson, 1975). The

first refers to the fact that individuals are limited to a certain amount and scope of knowledge that they can receive, store, and process without errors. The second points to the phenomenon that individuals are unable to articulate all of the knowledge they dispose of (Williamson, 1975). As a result, individuals specialize on certain knowledge tasks which are integrated during the production process (Grant, 1996). Analogously, as individuals constitute firms (Chandler and Hanks, 1994), firms have a limited cognitive capacity and specialize on knowledge tasks within the industry value chain.

I assume that new ventures suffer from a more limited cognitive capacity than mature firms. I argue that this is due to their liabilities of newness and smallness (Stinchcombe, 1965, Carroll and Hannan, 2000; Wiklund, Baker, and Shepherd, 2010). Hence, they are more limited in the ability to assimilate and apply diverse knowledge than mature firms. As an additional consequence of their limited cognitive capacity, new ventures do have more specialized knowledge than mature firms that mainly resides within the entrepreneurial team (Chrisman, Bauerschmidt, and Hofer, 1998). Thus, they require more specialized external knowledge than mature firms to achieve innovation, as the ability to assimilate external knowledge flows depends on the similarity of knowledge bases (Hamel, 1991; Lane and Lubatkin, 1998; Simonin, 1999). Hence, the implicit assumption that firms can readily assimilate incoming external knowledge from the alliance portfolio does not hold for new ventures. This implies that I have to reverse concepts and relationships in knowledge-related alliance portfolio research, which have been established in the context of mature firms, and transfer them to new ventures.

3.2.2 Alliance portfolios, knowledge flows, and new venture innovation

What are alliance portfolios and why are they superior to looking at alliances individually? An alliance portfolio describes a firm's ego-network of alliances, those still active and those terminated earlier on, spanning along a variety of dimensions (i.e. partners; contents; scope) (Wassmer, 2010).

Hence, by studying alliance portfolios, the analysis shifts to an intermediate level, as the focus is on a focal firm's simultaneous collection of alliances that are embedded in a global network (Lavie, 2007). Neglecting those networks in which alliance portfolios are embedded can lead to an incomplete understanding of them (Gulati, 1999). Hence, taking the portfolio perspective “eschews the reductionism that occurs when an analyzed pair of firms is abstracted out of their embedded context” (Sarkar, Aulakh, Madhok, 2009: 588). As such, the alliance portfolio accounts for the original theoretical rationale of the knowledge-based view that has been flawed by the single alliance perspective: knowledge can come from everywhere, and will come from everywhere at the same time (Grant, 1996).

How do alliance portfolios contribute to firm innovativeness? Innovation results from the integration of knowledge stemming from both the firm's configuration and management of its portfolio (Wassmer, 2010). On the one hand, prior research has argued that firms can consciously configure three dimensions of their alliance portfolios, namely partner characteristics (e.g. Lavie, 2007; Lavie and Miller, 2008), relational properties (e.g. Rowley *et al.*, 2000; Tiwana, 2008), and structural properties (e.g. Gulati, 1999; Baum *et al.*, 2000). As firms can actively influence, shape, and manage their alliance portfolios (Lavie, 2006; Ozcan and Eisenhardt, 2009), I argue that they can also actively configure their partners, the relational properties, and the structural properties of their alliance portfolios. It is established that these three dimensions represent social interactions (Wassmer, 2010; Phelps, Heidl, and Wadhwa, 2012). Also, it is known that knowledge is created in such social interactions (Weick and Roberts, 1993; Cook and Brown, 1999; Galunic and Rodan, 1998). I conclude that new ventures can leverage knowledge flows stemming from their alliance portfolio configuration for strengthening their innovation performance. On the other hand, new ventures can develop distinct knowledge management capabilities (Lei, Hitt, and Bettis, 1996) that are effective in the specific context of alliance portfolios and may assist them to create innovative outcomes (Heimeriks *et al.*, 2009; Sarkar *et al.*, 2009). Thus, collectively combined, alliance

portfolio configuration and management allows new ventures to access knowledge flows and enhance innovation.

3.2.3 The role of alliance portfolio configuration for new venture innovation

As outlined, alliance portfolio configuration refers to the way how new ventures set up partners, relational properties, and structural properties in their alliance portfolios. Within these three configurational dimensions I examine only those concepts that have been greatly emphasized theoretically in existing literature, in particular from the knowledge-based perspective. Regarding the partner dimension, *partner international diversity* has been argued to be the most significant concept given the heterogeneity in the knowledge base of international partners (Al-Laham and Souitaris, 2008; Lavie and Miller, 2008). I study international partner diversity and not partners' industry diversity, partners' technological diversity, or partners' organizational diversity, as the ability to seize knowledge-based opportunities from foreign partners is increasingly important for creating competitive advantage through innovation (Zaheer, 1995; Sapienza *et al.*, 2006).

To account for relational properties in alliance portfolio configuration, prior research has focused predominantly on *tie strength* due to its importance for knowledge access (Granovetter, 1973; Wassmer, 2010; Phelps *et al.*, 2012). In this paper, I also examine tie strength, thereby distinguishing between weak and strong ties that provide access to different types of knowledge flows (e.g. Tiwana, 2008; Burt, 1992). A weak tie is an alliance to which a focal new venture is not much committed in terms of time (i.e. frequency of interaction) (McEvily and Zaheer, 1999). In contrast, a strong tie refers to an alliance that gets a lot of attention from the focal new venture.

Finally, the examination of structural network positions provides valuable insights into the potential access firms have to knowledge (Gulati and Gargiulo, 1999; Podolny and Stuart, 1995). I focus on network status, as among network positioning features the latter is the most valuable (Bonacich, 1987; Podolny, 1993). Generally, status is “a socially constructed, intersubjectively

agreed upon and accepted ordering or ranking of individuals, groups, organizations, or activities in a social system” (Washington and Zajac, 2005: 284). Status indicates an actor’s relative standing in a social system based on prestige and influence (Thye, 2000). Specifically, network status refers to a firm’s positional ranking in its network based on prestige and influence in interfirm relationships (Podolny, 1993; Washington and Zajac, 2005; Lin, Yang, and Arya, 2009). I conceptualize network status in terms of Bonacich’s (1987) eigenvector centrality, as the latter is a widely used measure of network status in prior studies (e.g. Baum, Rowley, Shipilov, and Chuang, 2005; Jensen, 2003; Podolny, 1993). A firm has a high eigenvector centrality if it maintains many ties with other firms that have network status because they maintain many ties with other firms that have network status and so on (Jensen, 2003). In particular, it is established that a firm’s (innovation) performance is influenced by its partners’ status level (Baum and Oliver, 1991; Podolny, 1994). Hence, firms often tend to engage in strategic alliances to improve their own status, by taking on the prestige of more established partners (Hitt, Dacin, Levitas, Arregle, and Borza, 2000). Given its strategic performance, I examine *partner network status* to account for structural properties in alliance portfolio configuration.

There are two different types of alliance portfolio configuration: diversity and homogeneity. On the one hand, alliance portfolio diversity refers to a balanced configuration (i.e. mix of international partners, tie strength, and network status). On the other hand, alliance portfolio homogeneity refers to a focused alliance portfolio configuration (i.e. similarity of international partners, tie strength, and network status). Prior research has suggested that a firm should aim for alliance portfolio diversity. It is empirically shown that such a diverse alliance portfolio configuration contributes best to its (innovation) performance (Rothaermel, Hitt, and Jobe, 2006; Jiang *et al.* 2010). In explaining this finding the literature has argued that alliance portfolio diversity provides access to a wide array of resources, capabilities, and knowledge (Koka and Prescott, 2002). However, this demands firms to invest massive management time and effort to assimilate

those diverse resources and knowledge flows (Deeds and Hill, 1996; Rothaermel and Deeds, 2006). Some studies acknowledge this intense managerial challenge, by showing that too much diversity results in diminishing outcomes, such as increased risk of shut-down (Bruyaka and Durand 2012), decreased performance (Goerzen and Beamish, 2005) and reduced innovativeness (Sampson, 2007). The cited studies explain the diminishing performance outcomes of portfolio diversity with increased complexity and loss of focus. In line with the latter research stream, I argue that alliance portfolio diversity does not assist new ventures to strengthen innovation. On the contrary, I presume that configuring homogeneous alliance portfolios is an innovation enhancing strategy for new ventures. Building on my conceptual framework, I argue that new ventures are unable to handle and assimilate flows of diverse knowledge flows from diverse alliance portfolios and integrate them to enhance innovation.

3.2.4 The role of alliance portfolio capabilities for new venture innovation

Alliance portfolio capabilities are a specific set of dynamic capabilities (Wassmer, 2010). By definition, dynamic capabilities refer to “routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve, and die” (Eisenhardt and Martin, 2000). Hence, dynamic capabilities represent dynamic routines (Nelson and Winter, 1982). Consistent with the conceptualization of dynamic capabilities, I perceive alliance portfolio capabilities as the collection of dynamic managerial routines that are available to firms to deal with the inherent challenges of alliance portfolio management. As one of the most important challenges in alliance portfolios is the management of knowledge, prior research has often defined alliance portfolio capabilities in terms of the firm’s ability to coordinate knowledge flows in the portfolio (Hoffmann, 2007; Sarkar *et al.*, 2009), whereby that ability is embedded in second-order routines (Winter, 2003). As such, alliance portfolio capabilities are similar to the *knowledge management capabilities* referring to second-order dynamic capabilities or routines that aid firms to coordinate and manage

knowledge flows (Lichtenthaler and Lichtenthaler, 2009). It is established that general second-order alliance portfolio capabilities can be broken down into its skill-based and partner-specific competencies (Eisenhardt and Martin, 2000; Hoang and Rothaermel, 2005; Hoffmann, 2007; Sarkar *et al.*, 2009). Given my knowledge-based conceptualization of alliance portfolio capabilities I argue that they can be broken down into three knowledge- and skill-based partner-specific competencies: *connective capacity*, *absorptive capacity*, and *innovative capacity* (Lichtenthaler and Lichtenthaler, 2009) (see below for a detailed conceptualization).

Dynamic capabilities and alliance portfolio capabilities evolve through organizational learning (Cyert and March, 1963; Levitt and March, 1988; Martin and Salomon, 2003; Nelson and Winter, 1982). As such, alliance portfolio capabilities are the result of the total amount of alliance experience (Heimeriks and Duysters, 2007; Hoang and Rothaermel, 2005). Prior research has shown that firms can increase performance, by capitalizing on that alliance experience (Sarkar *et al.*, 2009; Anand and Khanna, 2000; Heimeriks, Duysters, and Vanhaverbeke, 2007; Kale *et al.*, 2002; Hoang and Rothaermel, 2005, Rothaermel and Deeds, 2006). By building on this argumentation and taking the perspective of the knowledge-based view, I argue that alliance portfolio capabilities assist new ventures in managing different knowledge processes and enhancing innovation performance. In doing so, I assume that alliance portfolio capabilities affect new venture innovation in two ways: directly and indirectly (i. e. as moderating effect). On the hand, portfolio capabilities per se aid new ventures in accessing and assimilating knowledge flows to be integrated to enhance innovation. On the other hand, portfolio capabilities assist new ventures in exploiting more knowledge from a given amount of knowledge flows provided by alliance portfolio configuration. These additional knowledge flows help to strengthen innovation.

3.3 Development of hypotheses

3.3.1 Influence of alliance portfolio configuration on new venture innovation performance

3.3.1.1 Relationship between partner international diversity and new venture innovation performance

Having partners differing in internationality is crucial for firms because of their variety in knowledge (Fernhaber, McDougall-Covin, and Shepherd, 2009; Lavie and Miller, 2008). They increase the diversity of technologies and ideas to which a firm is exposed (Barkema and Vermeulen, 1998; Huber, 1991). As such, foreign partners may offer the possibility to overcome a firm's tendency towards local search that limits and hampers opportunities to innovate through the recombination of knowledge (Nelson and Winter, 1982; Leonard-Barton, 1992; Leonard-Barton, 1995; Levitt and March, 1988). In particular, upstream strategic alliances formed with foreign partners may offer untapped technologies and resources that could be limited in the new venture's country of origin (Eisenhardt and Schoohoven, 1996; Hagedoorn, 1993). Hence, a moderate level of partner international diversity may offer opportunities for new ventures to strengthen their innovation performance resulting from access to additional knowledge flows.

However, I argue that international diversity predominantly restricts knowledge access and, ultimately, innovation for new ventures. This is due to the fact that new ventures are unable to handle and assimilate flows of diverse knowledge. In fact, at high levels of intensity, new ventures face conflicts (Madhok and Tallman, 1998; Park and Zhou, 2005; White and Lui, 2005) resulting from cultural divergence. Cultural differences between the focal new venture and its foreign alliance partners restrict the extent of shared values and goals that are needed to absorb and transfer knowledge in alliances (Parkhe, 1991). Differences in norms and values of culturally distant alliance partners tend to create divergent expectations that result in the lack of commitment and, ultimately, irresolvable conflicts (Lane and Beamish, 1990). Collectively combined, the outlined

liabilities decrease the effectiveness of cooperation with foreign partners (Kumar and Nti, 1998) and hamper the new venture's ability to leverage knowledge from the alliance portfolio (Powell *et al.*, 1996). Hence, I assume an inverted u-shaped relationship between partner international diversity and new venture performance.

HYPOTHESIS (1A): The relationship between partner international diversity and new venture innovation performance is curvilinear. The slope is positive at low and moderate levels of partner international diversity and is negative at high levels of partner international diversity indicating an inverted u-shaped relationship.

3.3.1.2 Relationship between tie strength and new venture innovation performance

From a knowledge-based view, strong ties and weak ties differ with regard to their potential to provide knowledge flows and enhance innovation performance (Al-Laham and Zock, 2012; Phelps *et al.*, 2012). On the one hand, prior research has argued that alliance portfolios characterized by a bulk of strong ties may lead to increased cross-fertilization of knowledge. In fact, empirical research shows that strong ties assist firms to create knowledge (e.g. Capaldo, 2007; Lavie, Lechner, and Singh, 2007) and transfer knowledge (e.g. Simonin, 1999; Williams, 2007). Existing studies also find that strong ties allow for constant, steady flows of new ideas (Rost, 2011) and increase innovation (Goes and Park, 1997; Kraatz, 1998). In explaining the potential of strong ties to provide knowledge and enhance innovation, research points to greater social interaction (Sobrero and Roberts, 2001). Indeed, as partners tend to share a common language in strong ties, they are able to absorb new ideas from each other's area of expertise and specialization better than partners in weak ties (Regans and McEvily, 2003).

However, excessively strong ties restrict firms' actions outside the pool of highly embedded actors (Granovetter, 1973; Podolny, 1994). As such, a portfolio composed of an intensive amount of strong ties is restricted to non-redundant knowledge flows (Uzzi, 1997). In fact, increasing levels of

interaction between strong portfolio ties can reduce their innovativeness, as they do not gain diverse knowledge flows from new partners (Molina-Morales and Martinez-Fernandez, 2009; Yli-Renko, Autio, and Sapienza, 2001). Thus, adding weak ties to the alliance portfolio has a greater potential for generating novel ideas than relying exclusively on strong ties (Tiwana, 2008). In fact, a portfolio composed of weak ties is assumed to assist firms in fostering innovation, by connecting focal firms to knowledge areas that are otherwise difficult to reach (Granovetter, 1973). The latter provide valuable non-redundant knowledge which is indispensable for enhancing innovation performance (Burt, 1992). However, it is assumed that weak ties do not ultimately lead to innovation due to their inability to successfully implement those innovative and knowledgeable ideas (Burt, 2004).

Hence, there is a tradeoff that the potential for novelty is lost by strong ties, and the potential for implementing novel knowledge is lost by weak ties (Tiwana, 2008). A balanced alliance portfolio that is high on both weak ties and strong ties would be the most suitable configuration to enhance innovation performance (Burt, 1992). However, new ventures face too high knowledge-related search costs in order to access and assimilate knowledge from such a balanced portfolio configuration (Zhang and Li, 2010). Search costs refer to the extent of effort to identify relevant knowledge flows (Dyer and Nobeoka, 2000). In this context, new ventures do not have the managerial resources and, in particular, the cognitive capacity (Cyert and March, 1963) that would be necessary for a differentiated knowledge-related search. The latter implies identifying the required knowledge, thereby distinguishing between weak and strong ties in order to avoid redundancy in knowledge (Burt, 1992). As a result, I can argue that the inability of new ventures to assimilate diverse knowledge flows stemming from balanced levels of tie strength results in decreasing innovation performance. In particular, I presume that for new ventures weak ties provide the most innovative potential due to their ability to spread information and knowledgeable resources. Taken together, I suggest a negative linear relationship between tie strength and innovation performance.

HYPOTHESIS (1B): Tie strength negatively affects new venture innovation performance.

3.3.1.3 Relationship between partner network status and new venture innovation performance

For designing their portfolios, new ventures can partner with low-status partners and high-status partners. It is obvious that new ventures, which are usually characterized by low-status due to their liabilities of newness and smallness, can easily partner with other low-status partners. According to the homophily principle (Gulati and Gargiulo, 1999), a high-status firm may be not willing to partner with low-status new ventures, but tends to favor firms of similar status as alliance portfolio partners, as partnering with low-status new ventures may weaken its own performance (Podolny, 1994; Washington and Zajac, 2005). As a consequence, low-status firms, such as new ventures tend to remain isolated on the periphery of the alliance portfolio, being tied to low-status firms (Gulati and Gargiulo, 1999). Due to their peripheral position low-status portfolio partners are willing to offer access to information and knowledge (Madhavan, Koka, and Prescott, 1998). The focal new venture can constantly access these knowledge flows for enhancing its innovation performance. However, the overall knowledge accessing potential from peripheral portfolio partners is limited due to their unfavorable structural position.

Although, according to the mentioned homophily principle, high-status firms in the portfolio have low incentives to partner with peripheral and low-status firms (e.g. new ventures), exceptions arise. This especially applies, when new ventures dispose of or control resources or assets that a high-status firm might need, such as new technologies (Shane and Stuart, 2002). In particular, biotechnology new ventures are valuable upstream partners for large and experienced pharmaceutical and chemical firms (Baum *et al.*, 2000). While these established pharmaceutical and chemical firms have the routines and competencies to manage a new drug to the regulatory process, new ventures do have highly specialized knowledge that incumbents often are dependent on for innovative outcomes (Rothaermel and Deeds, 2004). Hence, new ventures are also able to build

partnerships with high-status firms. Partnering with high-status partners allows access to knowledge pools that cannot be easily gained over the market (Lin, Yang, and Arya, 2009). In particular, by adding intensively high-status partners to their alliance portfolio, new ventures can tap into knowledge embedded in the larger network as well as into specialized human capital. On the one hand, alliances with high-status partners assist a new venture to access other valuable knowledgeable resources within the broader network of those high-status partners (Stuart, 2000). Indeed, new ventures with an alliance portfolio mainly composed of high-status partners can leverage knowledge flows from the larger global network, in which the portfolio is embedded (Gulati, 1999). As alliances tend to be formed more likely between firms occupying central positions in the network structure (Podolny, 1994; Gulati and Gargiulo, 1999; Chung, Singh, and Lee, 2000), new ventures with high-status portfolio partners gain timely and easy access to network resources that improves their innovation performance (Powell *et al.*, 1996). On the other hand, those high-status portfolio partners can easily access specialized human capital. This is due to the fact that highly qualified employees, such as specialized scientists, prefer to work for high-status firms (Frank, 1985).

It is obvious that both low-status and high-status portfolio partners offer access to knowledge flows that can be leveraged to enhance innovation performance. In order to generate knowledge-related complementarities, firms should best engage in a diverse configuration referring to a mix of low-status and high-status portfolio partners. However, such diverse configurations may be detrimental for new ventures to access knowledge and generate innovation performance. In fact, new ventures that blend low-status and high-status portfolio partners might be unable to appropriate the knowledge that their alliance portfolios offer (Bae and Gargiulo, 2004). Accessing and appropriating knowledge from an unspecialized mix of low-status and high-status partners requires a highly differentiated search. In turn, the latter requires large investments in time and managerial resources, which new ventures do not have (Zhang and Li, 2010). In particular, the lack of focus in

alliance portfolio configuration results in an insufficient relative bargaining power of new ventures vis-à-vis their pool of high-status portfolio partners. By definition, bargaining power refers to a focal firm's capacity to influence the outcomes of negotiations in such a way that that focal firm may obtain accommodations from partners and is able to favorably change the terms of agreements, (Yan and Gray, 1994). Relative bargaining power affects rent distribution in alliances (Hamel, 1991). As a result, these high-status partners are assumed to be able to restrict the knowledge appropriation capacity of new ventures (Lavie, 2007). This implies that new ventures may not be able to absorb valuable network knowledge, as their partners restrict access to it. Such limited knowledge accessing potential may undermine the firms' innovation performance. Hence, I propose an inverted u-shaped relationship between partner network status and innovation performance:

HYPOTHESIS (1C): The relationship between partner network status and new venture innovation performance is curvilinear. The slope is positive at low and moderate levels of partner network status and is negative at high levels of partner network status indicating an inverted u-shaped relationship.

3.3.2 Influence of alliance portfolio capabilities on new venture innovation performance

3.3.2.1 Direct influence of alliance portfolio capabilities on new venture innovation performance

My second hypothesis draws upon the observation that there might be direct effects of alliance portfolio capabilities on new venture innovation performance. As outlined, based on the knowledge-based view, I conceptualize alliance portfolio capabilities as knowledge management capabilities composed of three partner-specific capacities: connective capacity, absorptive capacity, and innovative capacity. Connective capacity means the ability to institute relational safeguards with partners (Sarkar *et al.*, 2009), which results in the firm's ability to access external knowledge flows without acquiring it (Grant and Baden-Fuller, 2004). Absorptive capacity refers to "the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to

commercial ends” (Cohen and Levinthal, 1990: 128). Finally, innovative capacity refers to the firm’s ability to exploit knowledge flows and transfer them to innovative outcomes (Lichtenthaler and Lichtenthaler, 2009). As such, innovative capacity represents realized absorptive capacity (Zahra and George, 2002; Lane, Koka, and Pathak, 2006; Lichtenthaler and Lichtenthaler, 2009). I argue that, collectively combined, these three knowledge management capacities that constitute alliance portfolio capabilities assist new ventures in accessing and assimilating, knowledge flows and, ultimately, transferring them to innovation.

In addition, the overarching second-order knowledge management capabilities allow firms to reconfigure the three partner-specific knowledge capacities (Lichtenthaler and Lichtenthaler, 2009). Reconfiguration implies transforming the partner-specific knowledge capacities in the face of changing markets and technologies (Marsh and Stock, 2006). Such a dynamic perspective is especially important for high technology new ventures that operate in volatile and quickly changing business environments (Katila and Shane, 2005; Li and Atuahene-Gima, 2001; Smith, Collins, and Clark, 2005). Due to these changing markets and technologies new ventures are forced to continuously terminate existing alliances and switch their portfolio partners, as roughly half of the formed alliances end up in failure (Park and Ungson, 2001; Al-Laham, Amburgey, and Bates, 2008). Terminating existing alliances and forming new alliances, thereby switching partners, implies that the partner-specific knowledge capacities lose impact. However, as second-order alliance portfolio capabilities assist new ventures to reconfigure their knowledge-capacities to fit new partners, new ventures rich in capabilities are able to gain sustaining superior innovation performance over time (Lichtenthaler and Lichtenthaler, 2009). Based on my theoretical thoughts I can derive the following hypotheses.

HYPOTHESIS (2): Alliance portfolio capabilities positively affect new venture innovation performance.

3.3.2.2 Moderating influence of alliance portfolio capabilities on the relationship between alliance portfolio configuration and new venture innovation performance

I have assumed that new ventures have difficulties to access, assimilate, and integrate diverse knowledge flows from diverse alliance portfolios. This inability impedes their innovation performance. In the following, I argue that second-order alliance portfolio capabilities and their constituting partner-specific knowledge management capacities (i. e. connective capacity, absorptive capacity, and innovative capacity) assist new ventures to deal with the knowledge-related conflicts inherent to alliance portfolio diversity. First, new ventures that are rich in connective capacity are able to *access* more knowledge flows from diverse portfolio configurations than their poor counterparts. In fact, connective capacity assists new ventures to develop informal safeguards in their alliance relationships (Lorenzoni and Lipparini, 1999). These relational mechanisms improve resource sharing in alliances (Das and Teng, 1998). More specifically, they enhance knowledge sharing (Dyer and Singh, 1998; Kale *et al.*, 2000; Lorenzoni and Lipparini, 1999; Garud and Nayyar, 1994; Grant and Baden-Fuller, 2004). In fact, connective capacity enhances a firm's ability to benefit from partnering, by providing it with effective and efficient routines for searching for and accessing new knowledge within the alliance portfolio (Zollo, Reuer, and Singh, 2002). I conclude that the more connective capacity a new venture has, the more knowledge it can access from the alliance portfolio configuration.

In addition, I presume that absorptive capacity assists new ventures to *assimilate* diverse knowledge flows (Cohen and Levinthal, 1990) from diverse portfolio configurations. In fact, absorptive capacity helps to understand international partners' genuine national environments and to extract more knowledge from alliance partners that are ever more distinct in their characteristics (Lavie and Rosenkopf, 2006). Thus, the knowledge-related challenges inherent to cultural divergence that are effective at intensive levels of partner international diversity can be overcome (Lavie and Miller, 2008). In addition, absorptive capacity empowers new ventures to assimilate

diverse knowledge flows from balanced tie strength (i.e. strong and weak ties). In explaining this assumption I refer to the fact that absorptive capacity allows a differentiated search for knowledge, as it helps to “understand, interpret and to appraise knowledge that has been placed upon the shelf” (Rosenberg 1990: 171). Furthermore, I argue that absorptive capacity assists new ventures in assimilating more knowledge from balanced portfolio configurations with regard to partner network status. It is established that firms rich in absorptive capacity are able to appropriate a higher given quantity of identified external knowledge flows (Escribano, Fosfuri, and Tribó, 2009; Zahra and George, 2002). Further, absorptive capacity increases the efficacy of knowledge transfer from partners (Zhao and Anand, 2009) and the knowledge-creating benefits it derives from them (Rothaermel and Alexandre, 2009; Rothaermel and Hess, 2007). Therefore, I conclude that absorptive capacity assists new ventures in appropriating more knowledge from high-status partners.

Finally, I state that innovative capacity allows new ventures to *integrate* diverse knowledge flows from alliance portfolio diversity with internal stocks of knowledge to enhance innovation performance (Khilji, Mroczkowski, and Bernstein, 2006). Innovative capacity contributes to the reduction of partner conflicts and simultaneously to increasing complementarities between diverse partners (Cassiman and Veugelers, 2006) and between weak and strong ties (Tiwana, 2008). Complementarities are said to exist when having more of one thing increases the returns of having more of another (Milgrom and Roberts, 1995). Managing complementarities in alliance portfolios can create synergies that enhance knowledge transfer and integration across alliances within the alliance portfolio (Powell *et al.*, 1996; Raisch and Birkinshaw, 2008; Lavie, 2007; Lavie and Miller, 2008). As a consequence, new ventures can better integrate internal knowledge stocks and external knowledge flows (Hagedoorn and Duysters, 2002; Rothaermel and Deeds, 2004) as a means to generate innovation (DeCarolis and Deeds, 1999; Galunic and Rodan 1998; Kogut and Zander, 1992).

Given those theoretical considerations I assume that new ventures rich in knowledge capacities that constitute second-order alliance portfolio capabilities tend to access, assimilate, and integrate more easily diverse knowledge flows from alliance portfolio diversity. Thereby, as described above, the second-order alliance portfolio capabilities allow firms to reconfigure the three partner-specific knowledge capacities (Lichtenthaler and Lichtenthaler, 2009). I assume that these mechanisms result in an increasing innovation performance. Hence I can derive the following hypotheses:

HYPOTHESIS (3): Alliance portfolio capabilities positively moderate the relationship between (3A) partner international diversity; (3B) tie strength; (3C) partner network status and new venture innovation performance.

The figure below summarizes my conceptual thoughts.

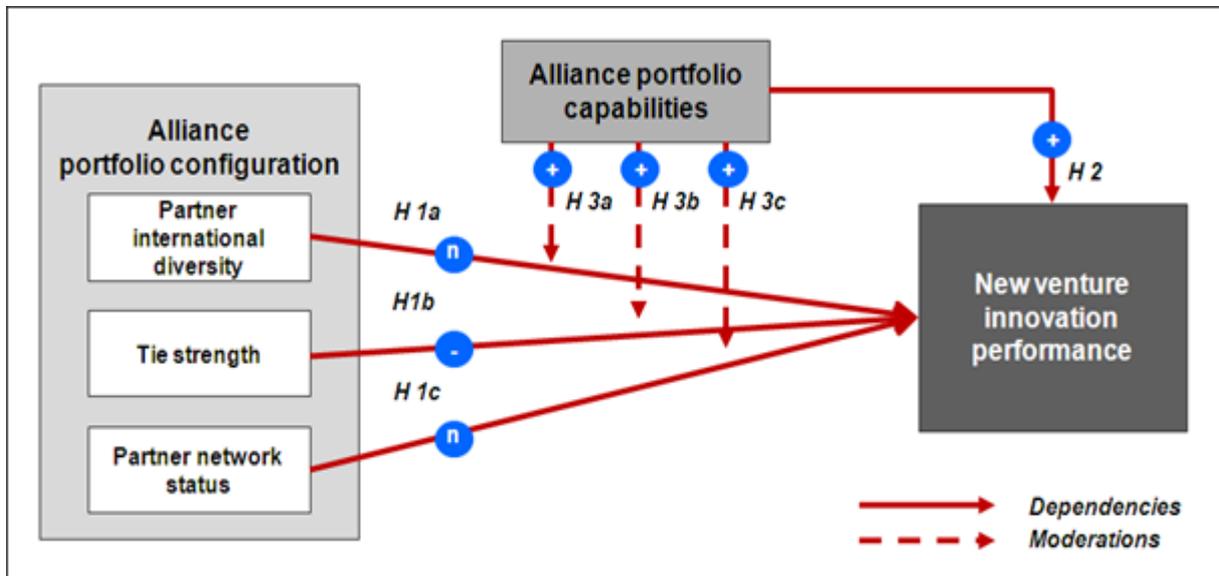


Figure 4: Conceptual framework and hypotheses of the first research study.

3.4 Methodology

3.4.1 Research setting: the German biotechnology industry

The setting used for the purpose of this study is composed of the entire population of German biotechnology firms (in total 1,167 firms) founded in 1996 or thereafter. I examine this setting until 2009, when 528 German biotechnology firms were still existent. Although the majority of firms were founded after 1996 (roughly 97%), my sample includes firms from the pharmaceutical and chemical industries who have changed their business model and transformed into biotechnology firms. Firms operating in biotechnology rely on knowledge extensive capabilities transforming scientific know-how in products (Powell *et al.*, 1996; Hagedoorn, 2002). For such a business model to be successful, global partnering is indispensable in order to source specialized knowledge from external institutions, such as multinational pharmaceutical firms. Due to institutional constraints firms in German biotech are increasingly sourcing knowledge globally. As a result, firms are engaged in multiple simultaneous alliances in R&D, marketing, or sales (Rothaermel and Deeds, 2006). In fact, biotechnology has been identified as the industry with the greatest partnering affinity among several industries characterized by high alliance activity (Hagedoorn, 2002). As such, this specific research setting is very valuable to examine the role of alliance portfolio configuration and capabilities for firm innovation performance.

3.4.2 Data

I use several primary sources to compile the sample. The first data source is the daily (de)registration records of the German Commercial Register (“Bundeszentralregister”) in Berlin. I used this source to identify the date of market entry and market exit. In addition, I use the “Yearbooks of the German Biotechnology Industry” published yearly by the German Biocom AG. The “Yearbook of the German Biotechnology Industry” is a collection of firm-specific information

gathered from an annual survey of all organizations in the field of biotechnology. The addresses from this source were used to identify the geographic location of the firms, the number of employees, their core business area, and their age. The third source is archival data coded from the monthly TRANSCRIPT newsmagazine that reports on the German biotech industry. With the help of this journal, I coded my different strategic alliance events ranging from research and development alliance, marketing and distribution alliance to licensing or production alliance. I used the time of the announcement as the starting point of the alliances. I also coded all reported termination events of strategic alliances. Finally, my patent data stem from records offered by the European Patent Office in Brussels. Prior research on this data base has been published already (Al-Laham and Souitaris, 2008; Al-Laham and Amburgey, 2009; Al-Laham and Amburgey, 2010; Al-Laham and Amburgey, 2011).

These data were used to construct an event history for each company. Event histories are data structures that include information on the number, timing and sequence of the events that are being examined. My variables constructed from the event histories are measured to the day. For example, my alliance variables (e. g. different types of alliances) are accurate to the day that the agreement is signed. Each firm's history began at the time of its incorporation or qualification to do business and ended at the time of an event or at the end of the month, whichever came first. The organization's second spell began on the following day and ended at the time of an event or the end of the month. This pattern continued until the firm exited (through failure or acquisition) or until the end of the observation period where spells were coded as "right censored." This procedure that has already been described in Al-Laham and Souitaris (2008) allowed time-varying covariates to be updated throughout the firm's history at monthly intervals. In those cases where only the month and year of an event could be determined, the day was set at the midpoint of the month to minimize errors in timing.

3.4.3 Measures

3.4.3.1 Dependent variable: new venture innovation performance

I link the innovation performance of a focal firm that is managing an alliance portfolio to its patent productivity. Patents are formalized, codified and explicit manifestations of innovative ideas, products or processes and embody a firm's technological and innovative knowledge (Al-Laham, Amburgey, and Baden-Fuller, 2010). Moreover, patent applications are the result of a highly uncertain R&D process (Kamien and Schwartz, 1982). If a firm disposes of a history of patenting, it has a foundation of (protected) technical knowledge that can enhance the rate of further innovation (Dierickx and Cool, 1989; Hagedoorn *et al.*, 2000; Al-Laham *et al.*, 2010). Thus, patents can be considered as an indicator of a firm's innovation performance (DeCarolis and Deeds, 1999, Powell *et al.*, 1996). Following methods used in prior research, I assigned a patent to a biotechnology firm on the date of application rather than the date of granting, because in general the application date is a more accurate representation of the date of innovation (Ahuja, 2000). Specifically, I measure my dependent variable as the cumulative count of patent applications per firm and year (in accordance to Ahuja, 2000). However, since I do not assume that my dependent and my independent variables exert their effects at the same time, I leaved my patent count variable by one year.

3.4.3.2 Independent variables: partner international diversity, tie strength, partner network status

To measure partner international diversity I wanted to account for the disparity or distance each partner has relative to the focal German firm. Thus, I looked at publicly available data of the Global Competitiveness Report (Schwab, 2009; see also: Chao and Kumar, 2010; Xu, Pan, and Beamish, 2004). The report currently includes a total of 134 economies and over 100 indicators. In this sense, the report is one of the most comprehensive assessments of its kind. The report is published on a yearly basis. The documented indicators entail over 170 items that can be categorized into twelve factors: institutions, infrastructure, macroeconomic stability, health and primary education, higher

education and training, goods market efficiency, labor market efficiency, financial market sophistication, technological readiness, market size, business sophistication, and innovation (Schwab, 2009). I used the factors ‘institutions’ and ‘goods market efficiency’ to measure the constructs of regulative and normative distance (see also Chao and Kumar, 2010; Xu *et al.*, 2004). The ‘institutions’ factor in the Global Competitiveness Report includes different survey items that describe a country’s civil systems and the ‘goods market efficiency’ factor includes survey items that describe market efficiency in a country. In total, I used six items that describe the regulative and normative aspects of a country’s environment (see Table 1 for details). The simple numerical average of those six items for each country was taken as the country’s score. If an alliance had more than one partner, I used the sum of the different scores. In doing so, I accounted for the additional difficulties in handling an alliance with multiple different international partners.

Global Competitiveness Report 2008/2009	
<i>Category: Institution</i>	
<i>Normative</i>	Intellectual property protection: Intellectual property protection and anti-counterfeiting measures in your country are (1 = weak and not enforced, 7 = strong and enforced)
<i>Normative</i>	Ethical behavior of firms: The corporate ethics (ethical behavior in interactions with public officials, politicians, and other enterprises) of firms in your country are (1 = among the worst in the world, 7 = among the best in the world)
<i>Regulative</i>	Burden of government regulation: Complying with administrative requirements (permits, regulations, reporting) issued by the government in your country is (1 = burdensome, 7 = not burdensome)
<i>Regulative</i>	Efficiency of legal framework: The legal framework in your country for private businesses to settle disputes and challenge the legality of government actions and/or regulations is (1 = inefficient and subject to manipulation, 7 = efficient and follows a clear, neutral process)

<i>Category: Goods market efficiency</i>	
Regulative	Business impact of rules on FDI: In your country, rules governing foreign direct investment (1 = discourage foreign direct investment, 7 = encourage foreign direct investment)
Normative	Degree of customer orientation: Customer orientation: Firms in your country (1 = generally treat their customers badly, 7 = are highly responsive to customers and customer retention)

Table 2: Operationalization of partner international diversity.

I measure tie strength in terms of repeated partners. Having a strategic alliance with a partner that has been a partner before reflects the degree of commitment and trust given to the partnership. I argue that trust and commitment is a good indicator of frequency of interaction which is at the heart of the tie strength concept (see conceptual framework for argumentation and sources).

In order to account for partner network status, I used UCINET to compute Bonacich's eigenvector centrality score. I calculated this score for each partner (up to 8) and used the highest score value (Podolny, 1993; Podolny, 1994; Baum *et al.*, 2005). I updated this variable for each quarter. The index is defined as:

$$s_t(a,B) = \sum_{K=0}^{\infty} aB^K R_t^{K+1} \mathbf{1}.$$

In this expression, a is a scaling coefficient, B is a weighting parameter that can range between zero and the absolute value of the inverse of the value of the maximum eigenvalue of the sociomatrix R_t , $\mathbf{1}$ is a column vector where each element has the value "1," and s_t is also a column vector where element $S_{i,t}$ denotes the status of biotech organization i . A focal new venture's eigenvector centrality is a function of the centrality of its partners. In turn, centrality of these partners is the function of the position of their partners, and so on. High eigenvector centrality of a focal new venture implies that their portfolio partners are highly embedded and influential in the larger global network. Their portfolio partners enjoy high network status.

3.4.3.3 Independent and moderating variable: alliance portfolio capabilities

Alliance experience constitutes an important antecedent for building collaborative know-how and alliance portfolio capabilities (Heimeriks and Duysters, 2007; Hoang and Rothaermel, 2005; Kale *et al.*, 2002). Thereby, alliance experience increases with the number of initiated strategic alliances. Hence, in order to measure the hypothesized positive direct and moderating effects of alliance portfolio capabilities, I use the cumulative prior alliances reflecting alliance experience. I argue that this is an adequate measure of management competency. In its core that assumption is similar to the fact that every veteran manager or athlete (e.g. in soccer) will have more theoretical and conceptual competencies than every 1st-year rookie that needs to learn the most important management tasks or field tactics.

3.4.3.4 Control variables

In order to account for the portfolio perspective I only included those biotechnology firms in the sample that have at least two partners (i.e. two as the minimal alliance portfolio size). Additionally, I included the following control variables that are expected to affect new venture innovation performance but have not been included in my hypotheses. First, the quarter variable was included to allow for time dependence. Second, age of the new venture was measured as the number of years since the founding of the new venture. I also controlled for the size of the firms in terms of their number of employees. Furthermore, I controlled for the number of research fields. Finally, I controlled for being a member of a dedicated research regional cluster that have shown to influence innovation (e.g. Al-Laham and Amburgey, 2011)

3.4.4 Model

I use a negative binomial model to analyze my data, as my dependent variable is the number of patent applications by a firm in my sample per year, which can only take discrete nonnegative integer values (see also: Ahuja, 2000; Hausman *et al.*, 1984). I used the negative binomial model

and not the Poisson distribution due to the overdispersion of the data. The basic Poisson model for event count data is:

$$\Pr(Y_t = y) = \exp(-\lambda(x_t)) \lambda(x_t)^y / y!$$

where both the probability of a given number of events in a unit interval, $\Pr(Y_t = y)$ and the variance of the number of events in each interval equal the rate $\lambda(x_t)$. However, for count data, the variance may often exceed the mean. I estimated the log-transformed over-dispersion parameter ($1/\alpha$), since the alpha value is constrained to zero in a Poisson model. Based on a likelihood ratio test, which compared this model to a Poisson model I calculated alpha. Alpha and the related chi-squared value is 9523.86 with one degree of freedom. This suggests that alpha is different from zero. As a result, the negative binomial model is more appropriate than the Poisson model. Thus, since my data shows such a pattern, and in order to correct for overdispersion, the negative binomial regression model with mixed effects is used. All parameters were estimated using the STATA 12 program.

3.5 Results

Overall I coded 1,632 strategic alliances. The number of alliances range from 1 up to 91. However, since I am interested in the alliance portfolios, I needed to exclude those firms that have only one alliance event because here I cannot talk about having an alliance portfolio. I also searched for the termination dates of the alliances events and deleted these alliance from the portfolio. This was the case for 23% of the alliances. I also found that 6% of the alliances events were extensions of previous agreements. Thus, my sample for this particular study includes 199 German biotechnology firms with 1,451 alliances portfolio observations. In the year 1996 I observed only four alliance portfolios. In the year 2003 the number reached its maxima with about 247 alliance portfolios. The number decreased and stayed rather constant over the last number of years with around 100 alliance

events within a portfolio. The firms applied for overall 2,808 patents (please see the figure below for an illustration).

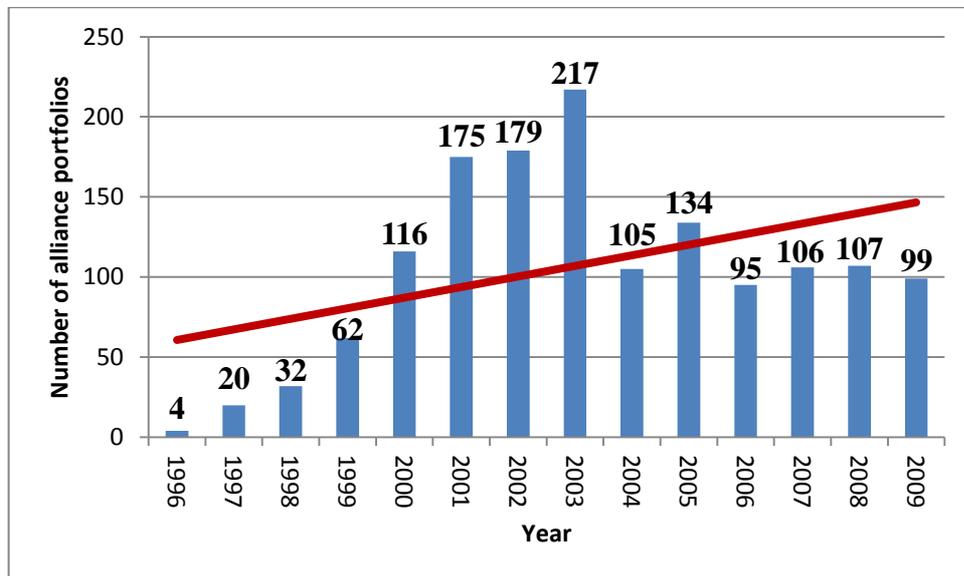


Figure 5: Development of the number of alliance portfolios per year.

Table 1 reports descriptive statistics including means, standard deviations, minimum and maximum values for all variables used in my analysis. Table 2 provides the Spearman’s rank correlation coefficients for my main variables.

Variable	Observations	Mean	Std. Dev.	Min	Max
Patents dummy	9660	.2906832	.4541011	0	1
Quarter	9660	90.51097	14.14809	0	115
Age firms	9660	17.06851	16.56307	1	66
Topcluster	9660	.1883694	.3910273	0	1
Size	9660	137.1006	333.268	2	3041
No. research fields	9660	2.230947	2.338033	0	9
Distance	9660	3.939987	7.33637	0	48.21
Repeated tie	9660	.0355805	.1852515	0	1
Status	9660	.0035734	.0311111	0	.685549
Capabilities	9660	1.85559	8.050953	0	91

Table 3: Descriptive statistics of the first research study.

RESEARCH STUDY I: ALLIANCE PORTFOLIO CONFIGURATIONS, PORTFOLIO CAPABILITIES, AND NEW VENTURE INNOVATION

	Quarter	Age firms	Top-cluster	Size	Res. fields	Distance	Repea- ted ties	Status	Capa- bilities
Quarter	1.0000								
Age firms	-0.0700*	1.0000							
Top-cluster	-0.0705*	0.0474*	1.0000						
Size	0.0056	0.3981*	0.0310	1.0000					
Res. fields	-0.0449*	0.0900*	0.0083	-0.0028	1.0000				
Distance	-0.0293	0.2631*	0.1685*	0.5401*	0.0150	1.0000			
Repea- ted ties	-0.0351*	0.0060	0.2079*	-0.0072	0.0083	0.0343	1.0000		
Status	0.0066	0.0013	0.2231*	0.0614*	-0.0277	0.1147*	0.0903*	1.0000	
Capa- bilities	-0.0419*	0.0306	0.3159*	0.0489*	-0.0265	0.1038*	0.6845*	0.3160*	1.0000

Table 4: Correlation matrix (*p<0.05) of the first research study.

Table 4 provides the results of my negative binominal regression model to explain innovation performance operationalized as patent count. Therein, Model 1 is the baseline model that provides parameter estimates for the control variables only. Model 2 adds parameter estimates for the variables constituting alliance portfolio configuration (i.e. partner international diversity, tie strength, partner network status). Model 3-5 introduces the interaction term of the three variables constituting alliance portfolio configuration with alliance portfolio capabilities. I test my hypotheses on that full model (model 5).

RESEARCH STUDY I: ALLIANCE PORTFOLIO CONFIGURATIONS, PORTFOLIO CAPABILITIES, AND NEW VENTURE INNOVATION

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Quarter	-.00173302 (.00128264)	-.00090737 (.00119436)	-.0009163 (.00119439)	-.00088263 (.00119485)	-.0007995 (.00119409)
Age firms	-.00591189*** (.00111291)	-.00356059*** (.001037)	-.00352873*** (.00103746)	-.00352406*** (.00103738)	-.00349854*** (.00103705)
Topcluster	-.12476502* (.05032001)	-.26566693** (.05134918)	-.26153812*** (.05158187)	-.26123478*** (.05156376)	-.20927088*** (.05911508)
Size	.00077107*** (.00006081)	.00067233*** (.00005355)	.00067286*** (.00005356)	.00067246*** (.00005356)	.00067334*** (.00005356)
No. research fields	-.03470092*** (.00792341)	-.01636037* (.00748334)	-.01620066* (.00748225)	-.01609831* (.00748273)	-.01574459* (.00748162)
Distance		.11974028*** (.00662223)	.11991809*** (.00662318)	.1198362*** (.00661837)	.11936429*** (.00661956)
Distance squard		-.00314491*** (.00020771)	-.00315088*** (.00020762)	-.00315109*** (.00020728)	-.00314078*** (.00020721)
Repeated tie		-.01059457* (.00482389)	-.01036163* (.00482941)	-.01383891* (.00680041)	-.01348051* (.00681323)
Status		.53545152 (1.4902516)	.49028884 (1.490096)	.51925263 (1.4915279)	.56354477 (1.4897806)
Status squard		.01718444 (2.6188819)	.08685873 (2.6197674)	.04552383 (2.6204322)	-.02579403 (2.6203755)
Capabilities		.01397088* (.00711179)	.01454575* (.00719707)	.01322604 (.00741571)	.01703692* (.00770159)
Capabilies squard		-.0003232* (.0001377)	-.00027723 (.00014753)	-.00026242 (.00014922)	-.0003127* (.0001498)
Interaction distance x cap.			-.01043351 (.01068133)	-.01122934 (.01073052)	-.0093873 (.01080644)
Interaction repeated tie x cap.				.00060543 (.00084979)	.00058764 (.00084929)
Interaction status x cap.					.00001322 (.000007231)
Constant	2.479105*** (.1222769)	2.0521368*** (.11570571)	2.0510613*** (.11569944)	2.0485795*** (.1157039)	1.9110038*** (.13792181)
Ln alpha					
Constant	-.39558908*** (.03142361)	-.54694194*** (.03278383)	-.54738402*** (.03278867)	-.54769349*** (.03279379)	-.54908153*** (.03280418)

Statistics					
Chi2	256.36982	600.18566	601.12109	601.64036	60.494.771
df	7	14	15	16	17
N	2,441	2,441	2,441	2,441	2,441
Observation spells	9,660	9,660	9,660	9,660	9,660
Aic	15931.713	15601.897	15602.962	15604.443	15.603.135
Bic	15972.314	15683.1	15689.964	15697.245	15.701.738

*Legend: coefficient / (standard error); * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$*

Table 5: Negative binominal model of the patent count.

Model 5 shows that the root term for partner international diversity is highly significant and positive ($\beta = 0.119$, *** $p < 0.001$), while the squared term is highly significant and negative ($\beta = -0.031$, *** $p < 0.001$) indicating an inverted u-shaped relationship, as suggested in hypothesis (1A). In addition, the root term for tie strength is significant and negative ($\beta = -0.013$, * $p < 0.05$), thereby supporting the linear negative relationship that I proposed in hypothesis (1B). The findings also show that the root term for partner network status is positive ($\beta = 0.564$), while the squared term is negative ($\beta = -0.258$). However, as both terms are not significant, I can only partly support hypothesis (1C).

In addition, my results show that the root term for alliance portfolio capabilities is significant and positive ($\beta = 0.017$, * $p < 0.05$), while the squared term is significant and negative ($\beta = -0.0003$, * $p < 0.05$) As this partly contradicts my hypothesis (2), I have to discuss potential explanations for as well as the implications of my findings (see discussion below).

My hypotheses (3A)-(3C) assumed a positive moderating effect of alliance portfolio capabilities on the relationships between alliance portfolio configuration and new venture innovation performance. Based on the empirical evidence of my data, I can only partly confirm hypotheses (3A) and (3B). The linear interaction terms of tie strength and partner network status with alliance portfolio capabilities are slightly positive ($\beta = 0.0006$ for tie strength; $\beta = 0.00001$ for partner network status), yet not significant. Hypothesis (3A) cannot be supported by the data, as the linear

interaction term is negative and not significant ($\beta = -0.009$). I discuss my findings and their implications below.

3.6 Discussion and conclusion

3.6.1 Discussion and theoretical implications

3.6.1.1 Influence of alliance portfolio configuration on new venture innovation performance

I show that alliance portfolio configuration determines new venture innovation performance. Given my empirical evidence I can confirm my conceptual framework drawn on the knowledge-based view: configuring homogeneous alliance portfolios is an innovation enhancing strategy for new ventures. Thereby, I extend current literature in alliance portfolios, by showing that the established positive relationship between alliance portfolio diversity (Baum *et al.*, 2000; Powell *et al.*, 1996; Silverman and Baum, 2002; Watson, 2007; Bruyaka and Durand, 2012; Wuyts and Dutta, 2012) and innovation performance becomes reversed for new ventures. Based on their inability to handle flows of diverse knowledge, I show the implicit assumption that firms can readily assimilate incoming external knowledge does not hold for new ventures. In the following, I explain my findings in-depth, thereby relying on the theoretical rationale of the knowledge-based view.

As presumed in hypothesis (1A), I show an inverted u-shaped link between international diversity and innovation. Theoretically, I ascribe this to the interplay of knowledge-related opportunities and challenges of partner international diversity. At moderate levels of international diversity the existence of heterogeneous knowledge enriches the possibility of new knowledge combinations and enhances new venture innovation performance. However, at high levels of diversity cultural differences restrict the ability of new ventures to access and assimilate knowledge and to leverage innovation.

In addition, I find a linear negative link between tie strength and new venture innovation. This is in line with my hypothesis (1B). Hence, I can show that alliance portfolios composed mainly of weak ties provide external knowledge flows that new ventures can transfer into innovative outcomes. Also, I can confirm that a balanced configuration characterized by a mix from strong and weak ties increases knowledge-related search costs that impede new ventures in accessing knowledge and generating innovation.

Finally, I can confirm the hypothesized inverted u-shaped relationship between partner network status and new venture innovation performance. Thus, I show that new ventures that build portfolios that are composed of mainly low-status partners have a higher innovativeness. By contrast, new ventures that blend low-status and high-status portfolio partners cannot realize innovative outcomes; as such an unspecialized mix of low-status and high-status partners requires large investments in time and managerial resources that new ventures, which suffer from a limited cognitive capacity, do not have.

3.6.1.2 Influence of alliance portfolio capabilities on new venture innovation performance

Moreover, empirical evidence shows that alliance portfolio capabilities determine new venture innovation performance. Opposed to my hypotheses (2), data indicate that intensive amounts of portfolio capabilities slightly negatively influence new venture innovation performance. Such a finding is surprising, as it contradicts prior literature that has always emphasized the positive performance implications of developing alliance portfolio management capabilities (Sarkar *et al.*, 2009; Heimeriks *et al.*, 2009; Al-Laham and Zock, 2012). I try to clarify this result, thereby referring to the specifics of new ventures. Generally, prior research has emphasized the importance of organizational mechanisms for integrating internal and external knowledge (Cassiman and Veugelers, 2006; Gibson and Birkinshaw, 2004; Jansen, van den Bosch, and Volberda, 2005). Special attention has been given to the alliance portfolio function that assists firms in coordinating

the resources and knowledge flows within the alliance portfolio (Kale and Singh, 2007; Sarkar *et al.*, 2009). I argue that new ventures tend not to have such knowledge coordinating mechanisms due to their liabilities of smallness and newness. As a result, new ventures lack an organizational umbrella that supervises their routine-based alliance portfolio capabilities to strengthen knowledge integration and, in turn, innovation. In addition, generally organizational routines are a well-known source of inertia (Hannan and Freeman, 1983) and inflexibility (Weiss and Ilgen, 1985), competency traps (March, 1991). I argue that this process is of particular significance in new ventures. With augmenting standardized routines that are inherent to alliance portfolio capabilities new ventures lose their agility, thereby developing core rigidities (Leonard-Barton, 1992; Leonard-Barton, 1995). Thus, increasing portfolio capabilities also increases complexity and because new ventures are small they may not be able to appropriate all the knowledge co-created in the alliance portfolio. Therefore, I find an inverted u-shaped effect of alliance portfolio capabilities on new venture innovation performance.

Finally, empirical evidence does not prove the importance of alliance portfolio capabilities as an effect moderating the relationship between portfolio configuration and new venture innovation – as assumed in my hypotheses (3A-3C). Thus, alliance portfolio capabilities do not assist new ventures in leveraging more knowledge and subsequent innovation from their portfolio configurations. Also, obviously it does not help them to overcome knowledge-related conflicts inherent to diverse portfolio configurations. By contrast, my data indicate the individual importance of alliance portfolio configurations and alliance portfolio capabilities.

3.6.2 Managerial implications

Innovation is of crucial importance for new ventures in high technology industries, such as biotechnology. Only those new ventures that are able to continuously generate innovative outcomes will survive and generate superior financial performance. From the paper at hand I can derive some

significant recommendations of how new ventures can increase their innovation performance. My research implies that new ventures should actively configure and manage their alliance portfolio to enhance their innovation performance.

On the one hand, empirical evidence indicates that new ventures should build a homogeneous alliance portfolio in terms of partners, relational and structural properties. From a normative perspective, new ventures should add moderately diverse partners with high network status, thereby relying on weak ties (i.e. avoid repeated ties). I have shown that such a configuration results in the most innovative outcomes for new ventures. To get there, new ventures should install an effective due diligence process allowing for the compliance of three-dimensional alliance portfolio homogeneity. In order to account for dynamics in alliance portfolio configuration, an effective monitoring and controlling system should be established.

On the other hand, empirical results show that new ventures benefit from alliance portfolio capabilities – in essence from moderate amounts of capabilities. I recommend that new ventures establish a dedicated alliance portfolio function. The latter is a formal department, such as the procurement department, that manages all portfolio-related tasks. I believe that such a formalized function will be the effective organizational umbrella that supervises their routine-based alliance portfolio capabilities to strengthen knowledge integration and, in turn, innovation. New ventures that build such an organizational umbrella are able to coordinate the resources and knowledge flows within the alliance portfolio.

3.6.3 Limitations and avenues for further research

There are two limitations of my study that need to be emphasized. First, the use of patent applications as a proxy for innovation performance might be questioned. Although the problems with using patents as performance variable are known, I believe – in line with other researchers – that they remain a critical measure of innovation for firms in knowledge-intensive industries

(Ahuja, 2000; Almeida and Kogut, 1999; Rosenkopf and Nerkar, 2001; Sorensen and Stuart, 2000).

In addition, the generalizability of my results could also be challenged, as the sample represents a single industry (biotechnology) in one country (Germany). In particular, the examined industry has several specific characteristics, such as amongst others long and resource-intensive product development and approval cycles, heavy reliance upon basic research. Despite these specifics of the studied context it is established that research results from the biotechnology industry are generalizable to other high-technology industries such as semiconductors (Almeida, 1996; Al-Laham and Souitaris, 2008).

In this paper I extend current literature in alliance portfolios, by showing that the established positive relationship between alliance portfolio diversity and innovation performance becomes reversed for new ventures. In addition, I show – in contradiction to the bulk of prior research that has proposed positive effects – that alliance capabilities do not certainly positively affect innovation performance in new ventures. Due to their genuine characteristics new ventures are diametrically different than mature firms. As a consequence, it is not sufficient to simply transfer concepts or cause-and-effect relationships that have been established in the context of mature firms to new ventures. Further research should follow my approach and take on the effort to test those established concepts and relationships on new ventures, thereby eventually reversing them. In doing so, research can provide a realistic and differentiated picture of new venture strategies.

4 RESEARCH STUDY II: NETWORK EMBEDDEDNESS, KNOWLEDGE ACCESS, AND VERTICAL INTEGRATION

- *Study conducted in collaboration with Suleika Bort and Andreas Al-Laham (†)*
- *Earlier version of the study presented at the AIB Annual Conference 2012 in Washington D.C., USA*
- *Earlier version of the study presented at the AoM Annual Conference 2012 in Boston, USA*

4.1 Introduction

How does a firm's network embeddedness influence its vertical integration strategy? Despite the large body of existing vertical integration literature (Argyres, 1996; Coase, 1937; Leiblein and Miller, 2003; Mahoney, 1992; Rothaermel, Hitt, and Jobe, 2006; Williamson, 1975), research so far offers very limited insights into this intriguing phenomenon. Traditionally, vertical integration – most generally defined as performing a value activity within firm boundaries (Liebermann, 1991) – has been explained with transaction cost economics (TCE) (Leiblein and Miller, 2003; Poppo and Zenger, 1998; Walker, 2007). According to TCE, firms tend to vertically integrate when opportunism or asset specificity make market transactions more costly than internalization (Poppo and Zenger, 1998; Williamson, 1985). Apart from examining transaction-level drivers, existing research has also analyzed firm-level characteristics, such as organizational resources and competencies, and their effects on vertical integration (Diez-Vial, 2009; Leiblein and Miller, 2003). To do so, these studies have most often applied the theoretical lenses of the resource-based view (RBV) (Wernerfelt, 1984; Barney, 1991). However, “vertical integration is actually in its infancy as an area of research” (Walker, 2007: 227), as established perspectives – first and foremost the network perspective – have not been considered in this research field yet.

As a matter of fact, despite the wide incorporation of network embeddedness logic in the strategic management literature (e.g. Ahuja, Polidoro, and Mitchell, 2009; Granovetter, 1985; Gulati, 1998; Gulati, 1999; Lavie, 2007; Lavie and Miller 2008; Polidoro, Ahuja, and Mitchell,

2011; Wang and Zajac, 2007), vertical integration research has widely neglected the network perspective so far. Such neglect loses track of business reality, as “the image of atomistic actors [...] is increasingly inadequate in a world in which firms are embedded in networks [...] with other organizational actors” (Gulati, Nohria, and Zaheer, 2000: 203). Thus, explaining vertical integration with network embeddedness is highly significant to account for the network paradigm in business practice. Moreover, doing so is an important research task, as prior literature has already taken the effort to analyze the role of network embeddedness in influencing alternative governance modes, in particular firms’ alliance formation (Pfeffer and Nowak, 1976; Kogut, 1988; Gulati, 1995; Mitchell and Singh, 1996; Ahuja *et al.*, 2009). Hence, as a logical step, research is needed that investigates the effect of network embeddedness on vertical integration. To my knowledge, there are only two exceptions in prior research which include the network-level to explain mechanisms driving firms’ vertical integration decisions, in particular mergers and acquisitions (M&A) (Lin, Peng, Yang, and Sun, 2009; McEvily and Marcus, 2005). I want to contribute to this emerging research stream in order to fill the identified gap in the literature.

To that end, I develop a theoretical framework drawn upon the knowledge-based view. The latter is the suitable theoretical grounding given the ever increasing importance of knowledge for firms, in particular in high-technology and hypercompetitive industries (Grant and Baden-Fuller, 2004; Bettis and Hitt, 1995). The knowledge-based view argues that a firm as a pool of specific knowledge tends to vertically integrate those value activities and processes that are crucial to differentiate it from competitors (Grant, 1996; Kogut and Zander, 1992). Furthermore, it presumes that firms have to dynamically balance between exploiting knowledge internally through vertical integration (Nonaka, 1994) and tapping into external knowledge provided by network ties (Grant and Baden-Fuller, 2004). It is widely accepted that the ability to absorb knowledge, referred to as absorptive capacity, is crucial for both knowledge sourcing mechanisms (Volberda, Foss, and Lyles, 2010). Thus, I go beyond advancing the network embeddedness-expansion of vertical

integration relationship by introducing absorptive capacity as a moderator. Given these conceptual considerations, I view the expansion of vertical integration as a firm's purposeful strategy to access knowledge in the light of unfavorable network partner configurations and absorptive capacity. Thus, I assume that firms which lack sufficient access to network partners' knowledge and the capacity to absorb that knowledge tend to expand their vertical integration. Furthermore, I conclude that their motivation towards expanding vertical integration decreases with increasingly favorable network partner configurations and increasing absorptive capacity.

My study aims to solve three research questions. How do multi-level network partner configurations influence the expansion of vertical integration? How does absorptive capacity per se influence the expansion of vertical integration? How does absorptive capacity moderate the multi-level network partner configurations-vertical integration relationships? I test the conceptual framework and the hypotheses and answer the three posed research questions empirically, by using a unique longitudinal event history dataset on the entire German biotechnology population during the period 1996-2009.

I can make three significant contributions to the strategic management literature. First, I show that the expansion of vertical integration is a firm's purposeful strategy to access knowledge in the light of unfavorable network partner configurations. This finding enriches the research dealing with vertical integration in providing a more realistic image, as the latter has largely overseen the network paradigm so far. Second, I contribute to the absorptive capacity literature. In fact, I can empirically confirm the conceptual distinction between potential and realized absorptive capacity (Zahra and George, 2002). I show the significance of absorptive capacity per se and as moderating effect for the expansion of vertical integration. Third, this paper can conceptually contribute to the embeddedness literature. As a major limitation most studies dealing with network embeddedness have solely taken a one-dimensional, single-level approach (Al-Laham, Zock, and

Bort, 2011). Hence, a multi-level conceptualization has not been provided yet. I take such a holistic and multi-level approach to conceptualizing network embeddedness.

The paper is organized as follows. First, I develop the underlying conceptual framework. Next, I derive hypotheses stemming from theoretical considerations. In addition, I report on the methodology and the results of the study. Finally, I discuss my findings and end up with a conclusion including limitations and avenues for further research, theoretical contributions, as well as managerial implications.

4.2 Conceptual framework

4.2.1 Knowledge-based view of vertical integration

Vertical integration is linked to the vertical configuration of the value chain. In designing their boundaries for their value chain activities and processes, firms can choose from two main choices: ‘buy’ or ‘make’. The ‘buy’ option refers to performing an activity outside the firm. In contrast, the ‘make’ option refers to vertical integration generally defined as performing an activity within firm boundaries (Lieberman, 1991; Walker and Weber, 1987). More specifically, vertical integration can be characterized along two dimensions: *degree* and *breadth* (Harrigan, 1985; Harrigan, 1986). The number of value chain activities or stages which a firm engages in – from purchasing raw materials to after sales – determines the *degree* of vertical integration (Harrigan, 1985). The number of processes a firm performs in-house at any particular value chain stage determines the *breadth* of vertical integration (Harrigan, 1986). Accordingly, in this paper, I follow this established conceptualization and view vertical integration as a two-dimensional concept (for an illustration see figure below).

In order to conceptually explain a firm’s decision to vertically integrate value chain activities and processes, I draw upon the knowledge-based view which emphasizes the significance of knowledge for firm existence and performance (Grant, 1996; Kogut and Zander, 1992). Grant

(1996) accentuates the primary role of the firm as integrating specialist knowledge of individuals into products/services. Furthermore, it is assumed that heterogeneous knowledge bases among firms represent the main determinants of firm performance differences (Grant, 1996; Spender, 1996; Spender and Grant, 1996). Thus, I conclude that a firm, as a pool of idiosyncratic knowledge, tends to internalize those value activities and processes in which it can apply this knowledge in order to differentiate itself from competitors.

In addition, I argue that firms dispose of two strategic levers for designing the gestalt of their vertical integration: expansion and contraction. Hence, on the one hand, firms can increase vertical integration, by adding an additional value chain activity or by expanding the scope of processes performed within a given activity (expansion of vertical integration). Analogously, on the other hand, firms can decrease vertical integration, by eliminating a value chain activity or by reducing the scope of processes within a given activity (contraction of vertical integration). From the knowledge-based view which I draw on, expansion of vertical integration implies a firm's purposive enhancement of its knowledge pool, whereas contraction of vertical integration refers to a firm's conscious cutback of its knowledge base. In this paper, I solely aim to explain the *expansion of vertical integration* (enlargement of knowledge pool), as the latter has been largely overlooked in studies dealing with firms' boundary choice. In fact, the large amount of outsourcing literature has analyzed the drivers for and consequences of contracting vertical integration, thereby clearly neglecting its expansion (Argyres, 1996; Gassmann, Reepmeyer, and Von Zedtwitz 2004; Quinn and Hilmer, 1994).

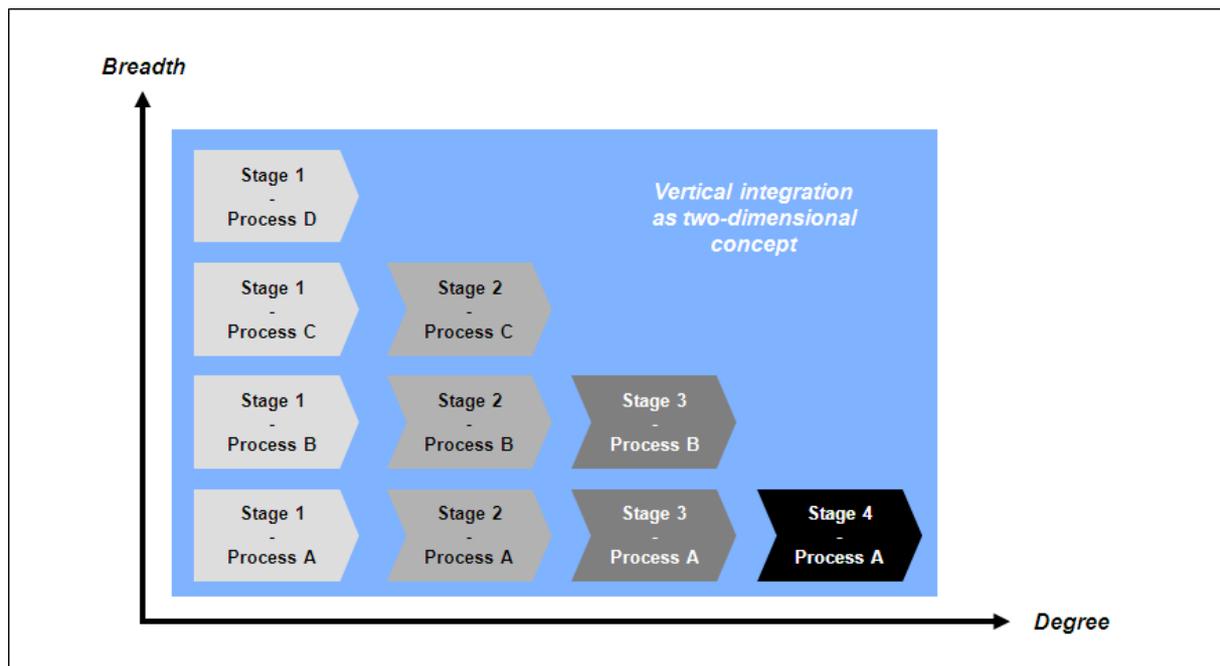


Figure 6: Vertical integration as a two dimensional concept.

4.2.2 Expansion of vertical integration as knowledge accessing strategy

As outlined, the knowledge-based view suggests that the expansion of vertical integration reflects a firm's purposeful enlargement of its knowledge pool. In this paper, I argue that such a decision reflects a knowledge accessing strategy in the pursuit of ensuring and sustaining innovation. The latter has become increasingly desirable for firms, as innovative firms tend to have higher profitability, greater market value, superior credit ratings, and higher survival chances (Czarnitzki and Kraft, 2004). I link innovation to the knowledge-based view arguing that innovation is a result of recombining existing and new knowledge (Ahuja and Katila, 2001; Grant, 1996; McEvily and Chakravarthy, 2002). Thus, the only way for a firm to ensure and maintain innovation is to continuously upgrading its knowledge base (Acs and Audretsch, 1990; Iansiti and Clark, 1994; Spender, 1996). Firms increasingly enlarge their knowledge base and enhance innovativeness, by tapping into external knowledge sources provided by alliances and networks (Laursen and Salter, 2006; Rothaermel and Deeds, 2004). Hereby, I assume that the primary motivation for knowledge-based network embeddedness is the access to knowledge rather than the acquisition of knowledge (Grant and Baden-Fuller, 2004). At the same time, there is still a need for creating knowledge

internally (Nonaka, 1994). As a result, firms face the challenge to strategically manage between applying current internal knowledge stocks and access new external knowledge flows (Al-Laham, Tzabbar, and Amburgey, 2011; DeCarolis and Deeds, 1999; Kogut and Zander, 1992; Galunic and Rodan 1998). Thus, they have to dynamically balance between exploiting knowledge internally through vertical integration (Nonaka, 1994) and source external knowledge provided by network embeddedness (Grant and Baden-Fuller, 2004). It is widely accepted that the ability to absorb knowledge, referred to as absorptive capacity, is crucial for both knowledge sourcing mechanisms (Volberda, Foss, and Lyles, 2010).

Given these conceptual considerations, I argue that the expansion of vertical integration is dependent on the degree of external network embeddedness of a firm and the utilization of absorptive capacity. In particular, I assume that firms which lack sufficient access to network knowledge and the capacity to absorb it tend to expand their vertical integration. Given those external knowledge constraints, I believe that such a strategy is a fruitful means to ensure and sustain innovation. Furthermore, I conclude that their pressure towards expanding vertical integration decreases with increasing network embeddedness and absorptive capacity. Hence, I presume that subsequent external knowledge flows and the ability to integrate them allow firms to ensure and maintain innovation without having to expand their vertical scope.

4.2.3 Network embeddedness: the role of multi-level network partner configurations

Generally defined, network embeddedness refers to the central paradigm that firms are not atomistic entities, but are engaged in interdependent network relations with social actors (e. g. Granovetter, 1985; Gulati *et al.*, 2000). Literature applying the embeddedness paradigm can be categorized according to the *level of analysis* into three main streams. The first focuses on alliance portfolios (Wassmer, 2010). The latter describe firms' ego-networks of alliances, those still active as well as those terminated earlier on (Hoffmann, 2005; Lavie and Miller, 2008). The second concentrates on

regional clusters defined as networks of organizations in a particular field of industry whose scope is limited to a geographical area (Krugman, 1991; Porter, 1998). The third is preoccupied with the entire network which refers to groups of organizations connected in ways that facilitate the achievement of a common goal (Kilduff and Tsai, 2003; Provan, Fish, and Sydow, 2007). It becomes obvious that each research stream deals with a unique network type in which the focal firm is embedded at a specific level of analysis (firm level, regional level, network level) (please see the figure below for an illustration). As a major limitation most studies dealing with network embeddedness have solely taken a one-dimensional, single-level approach (Al-Laham, Zock, and Bort, 2011). As a holistic and multi-level approach to conceptualizing network embeddedness has not been provided yet in prior research, I examine the role of *multi-level network embeddedness*.

Regardless of the level of analysis the embeddedness literature can also be systemized according to the *object of analysis* in three major research areas each representing an important phase in the life cycle of the respective network type: formation, configuration, and management (Al-Laham and Zock, 2012; Wassmer, 2010). Within social network research the focus has mainly been on configurational issues (Wassermann and Faust, 1994). This research tradition has been taken over by strategic management literature. Thus, the latter has often tended to analyze the effect of network configurations on an outcome variable. In fact, partner characteristics (e. g. Lavie, 2007), relational properties (Rowley *et al.*, 2000), and structural properties (Gulati, 1999) have been analyzed. In this paper, I examine the role of *multi-level network partner configurations*. I believe that this aspect deserves special attention from a strategic point of view, as the firm can actively and consciously select its network partners.

In particular, at the ego-network level I examine *partners' international diversity* referred to as the number of partners from different countries of origin (Lavie and Miller, 2008). International partner diversity is theoretically important, as prior research has indicated that international partners provide a fruitful knowledge accessing and learning arena due to the heterogeneity in their

knowledge base (Al-Laham and Souitaris, 2008). At the regional network level I focus on *research partner munificence* referred to as the concentration of universities and public or private research institutes (Phene, Fladmoe-Lindquist, and Marsh, 2006). Existing literature has shown that research munificence of the cluster enhances the set of opportunities provided to firms located in it to access additional knowledge (Almeida and Phene, 2004; Almeida, Dokko, and Rosenkopf, 2003; Gulati, 1999). At the global network level the examination of structural network positions provides valuable insights into the potential access firms have to knowledge (Gulati and Gargiulo, 1999; Podolny and Stuart, 1995). Among network positioning features network status, which indicates centrality, is the most valuable (Bonacich, 1987; Podolny, 1993). Thus, I examine *global network partners' status* referred to as their influence on the larger network (Bonacich, 1987, Podolny, 1993).

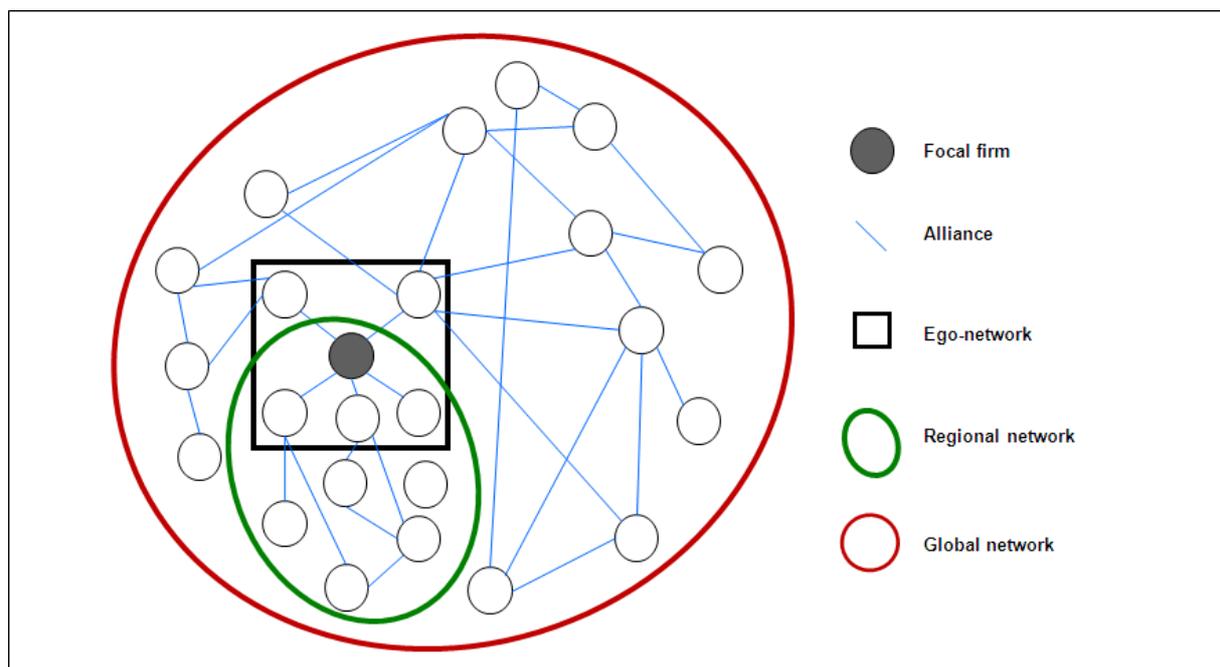


Figure 7: Multi-level network embeddedness.

4.2.4 Absorptive capacity: the role of prior strategic alliances

Prior research has proposed absorptive capacity as a powerful knowledge management capacity (Argote, McEvily, and Reagans, 2003; Lichtenthaler and Lichtenthaler, 2009). In fact, absorptive capacity concentrates on leveraging and utilizing external knowledge flows inside the firm (Cohen

and Levinthal, 1990; Lane, Koka, and Pathak, 2006). As a result, absorptive capacity assists firms to identify new knowledge from beyond its boundaries, to assimilate it, and integrate it with the firm's existing knowledge (Arora and Gambardella, 1994; Rothaermel and Alexandre, 2009). As such, the concept is best suitable to link external and internal knowledge tasks and, thus to link network embeddedness and vertical integration. Hence, I integrate absorptive capacity in my conceptual framework.

Originally, Kedia and Bhagat (1988) introduced the term “absorptive capacity” in the context of international technology transfer. However, the generally established definition was provided by Cohen and Levinthal (1989: 589; 1990; 1994) who view absorptive capacity as the “ability to identify, assimilate, and exploit knowledge from the environment”. Absorptive capacity is naturally perceived as a concept capturing the evolution of learning and knowledge that accumulates over time (Volberda *et al.*, 2010). Cohen and Levinthal (1990) proposed prior knowledge as the determinant of absorptive capacity. In other words, the accumulation of a stock of knowledge increases a firm's absorptive capacity (i.e., the greater the knowledge stock, the greater the knowledge assimilation) (Al-Laham *et al.*, 2011a).

It has been argued and shown in prior research that interorganizational relationships, such as strategic alliances and joint ventures, are antecedents to absorptive capacity (Puranam, Singh and Chauduri, 2009). In fact, network embeddedness affects absorptive capacity in a firm (Volberda *et al.*, 2010). Building on this research and considering the significance of partnering in knowledge-intensive industries such as biotechnology, I conceptualize absorptive capacity as a firm's knowledge stock stemming from prior strategic alliances. Thus, I observe absorptive capacity at the firm level of analysis, whereas the bulk of empirical research on absorptive capacity address the business unit level (Tsai, 2001) or the subsidiary level (Gupta and Govindarajan, 2000).

4.3 Development of hypotheses

4.3.1 Influence of multi-level network partner configurations on the expansion of vertical integration

My first hypothesis focuses on the impact of external knowledge flows provided by network partner configurations at three levels of analysis (i.e. ego-network, regional network, and whole global network) on its tendency to expand vertical integration.

4.3.1.1 Influence of ego-network partners' international diversity on the expansion of vertical integration

At the ego-network level of analysis the importance of partner diversity has been emphasized in the literature (e. g. Lavie, 2007). In particular, partners' international diversity has been assumed to have an impact (e. g. Lavie and Miller, 2008). In fact, ego-network partners from different countries of origin diverge with regard to their resource endowments (Harrison *et al.*, 2001). In particular, from a knowledge-based perspective, alliances with international partners provide a fertile learning ground given the diversity of their knowledge (Lane and Lubatkin, 1998). In fact, they increase the range of ideas and technologies to which a firm is exposed that could be limited in its home country (Barkema and Vermeulen, 1998; Eisenhardt and Schoonhoven, 1996; Hagedoorn, 1993; Huber, 1991). As such, foreign partners may offer the possibility to overcome a firm's tendency towards local search that limits the opportunities to generate innovation through the recombination of knowledge. Indeed, firms tend to search for new knowledge in the neighborhood of their current technological knowledge domain (Nelson and Winter, 1982). Such behavior restricts the acquisition of novel, more distant knowledge (Leonard-Barton, 1995; Levitt and March, 1988). By contrast, the existence of heterogeneous knowledge provided by international diversity of partners enhances the possibility of new combinations and enriches the likelihood for innovation (Henderson and

Cockburn, 1996). I argue that such innovative outcome has a significant impact on the vertical scope of firms which face the challenge to dynamically balance between exploiting knowledge internally through vertical integration (Nonaka, 1994) and source external knowledge provided by network partners (Al-Laham *et al.*, 2011b; Grant and Baden-Fuller, 2004; Kogut and Zander, 1992). In particular, I state that firms' tendency to internalize additional knowledge via expansion of vertical integration decreases with increasing avenues for innovation provided by ego-network partners' international diversity.

HYPOTHESIS (1A): Ego-network partners' international diversity negatively affects a firm's tendency towards expanding its vertical integration.

4.3.1.2 Influence of regional network partners' research munificence on the expansion of vertical integration

Generally, the importance of regional networks, so called clusters, has been highlighted in prior research (Porter, 1998). This is of particular relevance for knowledge intensive industries, such as biotechnology, (Al-Laham and Amburgey, 2011; Audretsch and Feldman, 1996; DeCarolis and Deeds, 1999; Lynn *et al.*, 1996; McKelvey *et al.*, 2003). One of the most largely discussed impacts of those clusters is knowledge spillovers, thereby referring to the theoretical rationale of the knowledge-based view (e.g. Al-Laham and Amburgey, 2011). In particular, existing literature has shown that research munificence (i.e. the concentration of universities and public or private research institutes) of the cluster enhances the set of opportunities to access additional knowledge offered to firms located in it (Almeida and Phene, 2004; Almeida, Dokko, and Rosenkopf, 2003; Gulati, 1999). Extant research has identified two main mechanisms for accessing that available knowledge. First, spin-off firms (i. e. from universities) usually hold formal engagements in their antecedent parent organization, and maintain several informal networking ties that facilitate flows of knowledge (Löfsten and Lindelöf, 2002). Second, the exchange of knowledge can be stimulated

by a local labor pool in the cluster, as specialized employees, such as scientists, preferably seek jobs within the same geographic area (Angel, 1989; Löfsten and Lindelöf, 2002). Both knowledge exchange mechanisms have recently been emphasized by (Al-Laham and Amburgey, 2011). Thus, firms embedded in a regional cluster with high research munificence tend to have access to knowledge flows that are difficult to access by geographically isolated firms. As a consequence, I assume that firms embedded in a cluster characterized by high research munificence can innovate more intensively through integrating their own knowledge with the additionally acquired knowledge (Henderson and Cockburn, 1994; Fleming, 2002; Phene *et al.*, 2006). Hence, to ensure and maintain a certain degree of innovation a focal firm located in a cluster characterized by high research munificence has to rely less on internal knowledge stocks than an isolated firm. As a result, I argue that this focal firm has a much lower tendency to expand vertical integration as a strategy to access knowledge than its isolated counterpart. Thus, I can state the following hypothesis:

HYPOTHESIS (1B): Regional network partners' research munificence negatively affects a firm's tendency towards expanding its vertical integration.

4.3.1.3 Influence of global network partners' status on the expansion of vertical integration

At the network level of analysis firms' positional embeddedness (Gulati and Gargiulo, 1999) referring to their structural position within the larger global network has received considerable research interest (Podolny and Stuart, 1995; Rowley and Baum, 2004). Among network positioning features network status, which involves influence, is probably the most valuable (Bonacich, 1987; Podolny, 1993). In particular, I state that the network status of a focal firm's partners provides valuable knowledge accessing potential for that focal firm. Basically, a focal firm can build network ties with partners that differ in the degree of their influence on the larger network. Compared to their lower-status counterparts, high-status network partners provide two sets of external knowledge

flows a focal firm can access. On the one hand, such high-status partners gain easily access to network knowledge (Powell *et al.*, 1996) for several reasons. First, this is due to the fact that lower-status firms in the global network are actively seeking a partnering involvement with them, thereby offering them access to knowledge in order to attract their attention (Madhavan *et al.*, 1998; Al-Laham and Amburgey, 2010). Second, high-status partners do know quite well the innovative efforts of other firms in the network (Bell, 2005) and have access to promising new ventures (Powell *et al.*, 1996) that may generate innovation as raised by Al-Laham and Amburgey (2011). In fact, multiple information and knowledge sources provide multiple channels to combine prior and new knowledge in new ways to generate innovation (Van de Ven, 1986). Apart from their potential to access a high quantity of network knowledge, high-status partners are also able to assess the quality of that network knowledge. In fact, such high-status partners tend to be better positioned to evaluate the reliability and veracity of the knowledge they receive, by comparing the gained information across multiple network sources (Burt, 1987). On the other hand, those high-status partners can easily access knowledge embedded in human capital (Al-Laham and Amburgey, 2011). This is due to the fact that highly qualified employees, such as specialized scientists, prefer to work for high-status firms (Frank, 1985). These two additional sources of knowledge may enhance a firm's innovation outcome (Al-Laham *et al.*, 2011b; Al-Laham and Zock, 2012). Building on my conceptual framework presented above, I can conclude that the larger the innovation leveraged through ties with high-status network partners, the lower the tendency towards expansion of vertical integration.

HYPOTHESIS (1C): Global network partners' status negatively affects a firm's tendency towards expanding its vertical integration

4.3.2 Influence of absorptive capacity on the expansion of vertical integration

From the theoretical lenses of the knowledge-based view, I argue that absorptive capacity plays two distinctive roles with respect to knowledge flows: access and exploitation (Cohen and Levinthal, 1989; Arora and Gambardella, 1994). This difference has been emphasized in prior research, thereby conceptually distinguishing between potential and realized absorptive capacity (Zahra and George, 2002). On the one hand, potential absorptive capacity assists the firm to identify and access more external knowledge (Escribano, Fosfuri, and Tribó, 2009; Zahra and George, 2002). On the other hand, realized absorptive capacity helps the firm to evaluate a given quantity of identified external knowledge flows and to exploit benefits from it (Escribano, Fosfuri, and Tribó, 2009; Zahra and George, 2002). In fact, prior research has found that absorptive capacity acts as a prerequisite for the successful integration of different external knowledge flows within the firm (Henderson and Cockburn, 1994; Pisano, 1994). As a result, I can argue that absorptive capacity directly and indirectly (moderating effect) enhances a firm's innovativeness. I derive two sets of hypotheses of how those two effects of absorptive capacity influence the expansion of vertical integration.

4.3.2.1 Direct influence of absorptive capacity on the expansion of vertical integration

My second hypothesis concentrates on the direct effect of a firm's absorptive capacity on the expansion of its vertical scope. Cohen and Levinthal (1990) assume that learning is a cumulative process. Further, they presume that learning performance has the greatest effect, when the object of learning is close and related to something already known. According to these assumptions, prior learning facilitates the learning and application of new, related knowledge (Al-Laham and Amburgey, 2005). Furthermore, "[...] knowledge diversity facilitates the innovative process by enabling the individual to make novel associations and linkages" (Cohen and Levinthal, 1990: 131). Thus, being engaged in and operating in diverse circumstances increases a focal firm's variety of

ideas and knowledge (Al-Laham and Amburgey, 2005). As a consequence, this results in a more extensive knowledge base (Huber, 1991; March, 1991). Therefore, having expertise in a specific knowledge domain or several distinct knowledge domains tend to jointly contribute to the firm's ability to subsequently identify and access new knowledge (Vermeulen and Barkema, 2001; Barkema and Vermeulen, 1998). Thus, absorptive capacity that I conceptualize as the cumulative number of prior alliances assists the firm to identify and access additional external knowledge (Escribano, Fosfuri, and Tribó, 2009). Building on the outlined theoretical foundation, I assume that knowledge and learning effects stemming from one previous alliance assist the firm to identify and access subsequent knowledge flows from additional alliances. According to the knowledge-based view, such additional external knowledge results in a higher innovative performance (McEvily and Chakravarthy, 2002; Grant, 1996). I argue that firms with superior innovation performance resulting from free access to external knowledge flows identified by high absorptive capacity can rely on their core knowledge and competencies. As a result, I conclude that these firms' tendency to expand vertical integration for accessing knowledge and, ultimately, developing innovative capabilities decreases with increasing absorptive capacity.

HYPOTHESIS (2): Absorptive capacity negatively affects a firm's tendency towards expanding its vertical integration

4.3.2.2 Moderating influence of absorptive capacity on the relationships between multi-level network partner configurations and the expansion of vertical integration

I have argued above that external knowledge flows and subsequent innovation outcomes provided by multi-level network partner configurations push the firm to reduce its tendency to expand its vertical scope (see hypotheses (1A)-(1C)). However, extant literature shows that the mere exposure and access to external knowledge flows is not sufficient to internalize and transfer it successfully (Escribano, Fosfuri, and Tribó, 2009). Therefore, my third set of hypotheses focuses on absorptive

capacity as a contingency factor which is assumed to moderate the relationships between multi-level network partner configurations and the expansion of vertical integration. Absorptive capacity assists a focal firm to “understand, interpret and to appraise knowledge that has been placed upon the shelf” (Rosenberg 1990, 171). In other words, the extent to which a focal firm is able to leverage knowledge accessed externally depends on the level of its absorptive capacity (Cohen and Levinthal, 1989; 1990). Therefore, absorptive capacity allows a firm to integrate the newly gained external knowledge with the firm’s existing knowledge (Arora and Gambardella, 1994). Kogut and Zander (1992: 384) termed this “combinative capability” and defined it as a firm’s ability “to synthesize and apply current and acquired knowledge”. I argue that firms that possess a high level of absorptive capacity are able to leverage more knowledge from their multi-level partner ties. In fact, prior research confirms that firms with a higher level of absorptive capacity communicate with their network partners more effectively (Nicholls-Nixon, 1995; Nicholls-Nixon and Woo, 2003; Rothaermel and Hill, 2005). Also, absorptive capacity has been shown to assist firms to extract more knowledge from partners that are distinctive in their characteristics (Lavie and Rosenkopf, 2006). As a consequence, firms rich in absorptive capacity are expected to better integrate prior and new knowledge and to convert knowledge into innovative success (Al-Laham and Amburgey, 2005). Ultimately, I presume that knowledge flows and innovation provided by multi-level partner ties have a stronger effect on the expansion of vertical integration in the presence of higher levels of absorptive capacity. Firms that are able to extract more knowledge and create more innovation from a given set of multi-level alliance partners are assumed to have a lower tendency to expand their vertical scope. I believe that these firms simply have no strategic necessity to access additional knowledge through expanding their vertical integration, as they can access sufficient external knowledge for ensuring and maintaining innovation.

HYPOTHESIS (3): Absorptive capacity negatively moderates the relationship between (3A) ego-network partners' international diversity; (3B) regional network partners' research munificence; (3C) global network partners' status and the expansion of vertical integration.

The figure below summarizes the conceptual framework and illustrates the hypotheses.

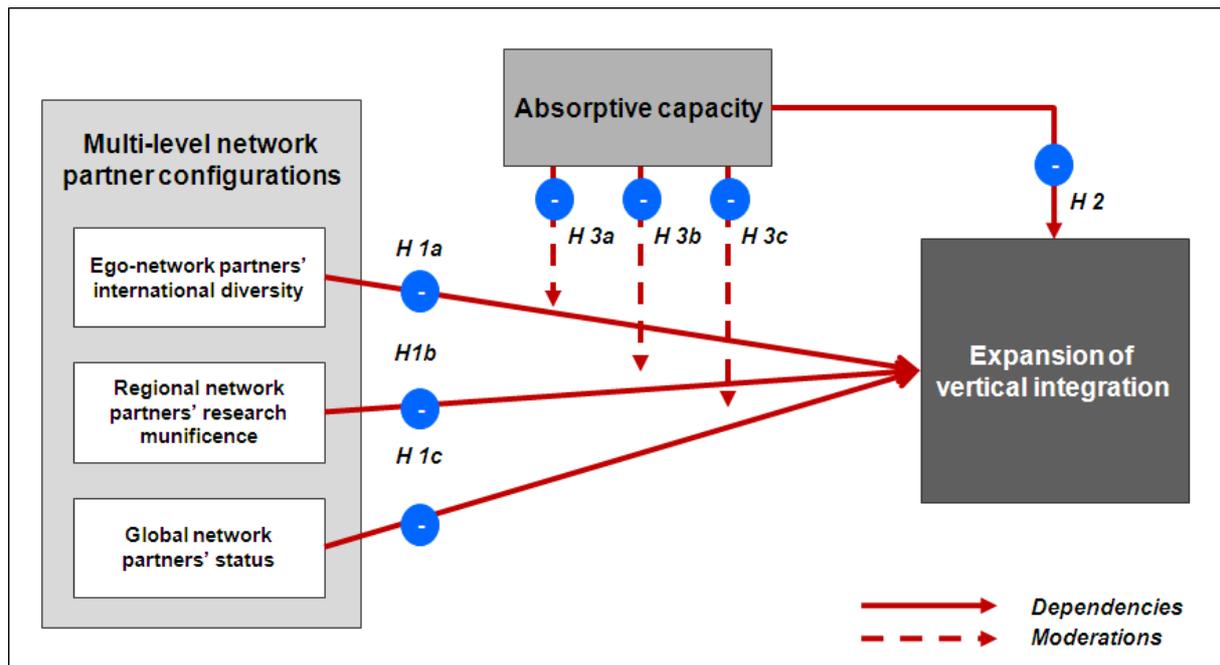


Figure 8: Conceptual framework and hypotheses of the second research study.

4.4 Methodology

4.4.1 Research setting: the German biotechnology industry

The setting used for the purpose of this study is composed of the entire population of German biotechnology firms (in total 1,167 firms) founded in 1996 or thereafter. I examine this setting until 2009, when 528 German biotechnology firms were still existent. Although the majority of firms were founded after 1996 (roughly 97%), my sample includes firms from the pharmaceutical and chemical industries who have changed their business model and transformed into biotechnology firms. Firms operating in biotechnology rely on knowledge extensive capabilities transforming scientific know-how in products (Powell *et al.*, 1996; Hagedorn 2002). For such a business model

to be successful, global partnering is indispensable in order to source specialized knowledge from external institutions, such as multinational pharmaceutical firms. Due to institutional constraints firms in German biotech are increasingly sourcing knowledge globally. As a result, firms are engaged in multiple simultaneous alliances in R&D, marketing, or sales (Amburgey and Al-Laham, 2010). In fact, biotechnology has been identified as the industry with the greatest partnering affinity among several industries characterized by high alliance activity (Hagedoorn, 2002). As such, this industry is best suitable for integrating the network perspective into vertical integration research.

4.4.2 Data

I use the following primary sources to compile the sample. The first data source is the daily (de)registration records of the German Commercial Register (“Bundeszentralregister”) in Berlin. In addition, I use the “Yearbooks of the German Biotechnology Industry” published yearly by the German company Biocom AG. The “Yearbook of the German Biotechnology Industry” is a collection of firm-specific information gathered from an annual survey of all organizations in the field of biotechnology. The addresses from this source were used to identify the geographic location of the firms, their age as well as the number of employees. The third source is archival data coded from the monthly TRANSCRIPT newsmagazine that reports on the German biotech industry. Prior research on this data base has been published already (Al-Laham and Souitaris, 2008; Al-Laham and Amburgey, 2009; Al-Laham and Amburgey, 2010; Al-Laham and Amburgey, 2011).

These data were used to construct an event history for each company. Event histories are data structures that include information on the number, timing and sequence of the events that are being examined. My variables constructed from the event histories are measured to the day. For example, my alliance variables (e. g. different types of alliances) are accurate to the day that the agreement is signed. Each firm’s history began at the time of its incorporation or qualification to do business and ended at the time of an event or at the end of the month, whichever came first. The

organization's second spell began on the following day and ended at the time of an event or the end of the month. This pattern continued until the firm exited (through failure or acquisition) or until the end of the observation period where spells were coded as "right censored." This procedure that has already been described in Al-Laham and Souitaris (2008) allowed time-varying covariates to be updated throughout the firm's history at monthly intervals. In those cases where only the month and year of an event could be determined, the day was set at the midpoint of the month to minimize errors in timing.

4.4.3 Measures

4.4.3.1 Dependent variable: expansion of vertical integration

The dependent variable is the vertical integration expansion rate $\lambda(t)$. The rate is defined as

$$\lambda(t) = \lim[q(t, t+\Delta t)/\Delta t], \Delta t \rightarrow 0$$

where q is the discrete probability of the firm expanding its vertical integration between t and $(t+\Delta t)$, conditional on the history of the process up to time t . This rate summarizes the information on the intervals of time between successive events, with higher values of the rate corresponding to shorter times between events and vice versa. Factors increasing the rate are therefore increasing the speed of the firm's vertical integration and vice versa. For the period under observation (1996–2009) 238 vertical integration expansion events by 365 firms have been recorded. Thereby, I take a holistic approach to measuring the expansion of vertical integration. I argue that firms can pursue two approaches for expanding their degree and breadth of vertical integration: organic and inorganic. Organic expansion of vertical integration refers to expanding the value chain through internal resources. Inorganic expansion refers to expanding the vertical scope through M&A or product line purchase.

4.4.3.2 Independent variables: ego-network partners' international diversity, regional network partners' research munificence, and global network partners' status

To measure ego-network partners' international diversity I coded a continuous variable, with '0' for an ego-network with no foreign partners, '1' with partners from one foreign country, '2' with partners from two foreign countries, and so on.

To measure regional network partners' research munificence I coded for the number of universities and private or public research institutes located in the same 2-digit postal code area as the firm. I then divided the count of research institutes within the cluster by the total number of organizations in the cluster. Thus, with the same number of research institutes in two clusters, the one with a smaller number of organizations has higher research munificence than the one with a larger number of organizations. The location information to construct the clusters was taken from the postal addresses published yearly in the Biocom AG Yearbooks. The German postal system uses a 5 digit system, whereas the first digit reflects the city, the second digit the suburbs within the city, and the last 3 digits the street level. Clustering at the 2-digit level represented a compromise between a smaller geographic region such as the street level, and a larger region such as the city district or the state ("Bundesland"). My measure, therefore, that has been applied in prior research (e.g. Al-Laham and Souitaris, 2008) reflects a significant smaller area than the Metropolitan Statistical Area that is commonly used in U.S. based cluster studies (Audretsch and Stephan, 1996; DeCarolis and Deeds, 1999; Krugman, 1991; Shaver and Flyer, 2000).

To measure global network partners' status, I used UCINET to compute Bonacich's eigenvector centrality score of a focal firm (Podolny, 1993; Podolny, 1994; Baum *et al.*, 2005). I updated this variable for each quarter. The index is defined as:

$$s_t(a,B) = \sum_{K=0}^{\infty} aB^K R_t^{K+1} \mathbf{1}.$$

In this expression, a is a scaling coefficient, B is a weighting parameter that can range between zero and the absolute value of the inverse of the value of the maximum eigenvalue of the sociomatrix R_t , $\mathbf{1}$ is a column vector where each element has the value "1," and s_t is also a column vector where element $S_{i,t}$ denotes the status of biotech organization i . The eigenvector centrality of a focal firm's partner is a function of the centrality of its partners. In turn, centrality of these partners is the function of the position of their partners, and so on. High eigenvector centrality of a focal firm's partner implies that its partners, in turn, are highly embedded and influential in the larger global network.

4.4.3.3 Independent and moderating variable: absorptive capacity

Absorptive capacity is typically viewed as a firm-level concept that captures the evolution of learning and utilization of new knowledge that accumulates over time (Volberda *et al.*, 2010). Cohen and Levinthal (1990) proposed prior related knowledge as determinant of absorptive capacity. Due to the significance of sourcing knowledge through partnering in biotechnology, I measure absorptive capacity as the cumulative number of a firm's prior strategic alliances.

4.4.3.4 Control variables

My single industry study design helps us to control for environmental variances. I also included additional controls that are expected to affect the expansion of vertical integration but have not been included in my hypotheses. The quarter variable was included to allow for time dependence. Age of

the firm was measured as the number of days since the founding of the firm. Size of the firm was measured by the number of employees the firm reported.

4.4.4 Model

Since the occurrence of expanding vertical integration over time for a firm constitutes a series of repeated events, event history analysis is a very useful analytical technique. The event series was modeled as a stochastic point process (Amburgey, 1986). The vertical integration expansion rate $\lambda(t)$ was specified as an exponential function of the independent variables and a set of parameters capturing the effects of the variables on the rate such that:

$$\lambda(t)=\exp(\beta X_t).$$

The use of an exponential baseline model, such as the one above, is common in event history analysis (Al-Laham and Souitaris, 2008). Parameters were estimated using maximum likelihood with the STATA 12 program. The estimation procedure clustered observations by firm to reduce the impact of unobserved firm-specific effects (White, 1982). The significance levels of the parameters were evaluated by examination of t-ratios, whereas the goodness-of-fit of the different models was evaluated by examination of likelihood ratio statistics. The likelihood ratio statistic describes the improvement in fit between hierarchically nested models and follows a chi-squared distribution with degrees of freedom that are equal to the difference in the number of parameters of the four models.

4.5 Results

Table 1 reports descriptive statistics including means, standard deviations, minimum and maximum values for all variables. Table 2 provides a correlation matrix for all variables.

Variable	Observation	Mean	Std. Dev.	Min	Max
Quarter	61897	78.90596	28.84722	0	111
Number of employees	27539	293.7798	12264.79	1	1010010
Age firms	29451	13.96082	22.51857	0	340
Diversity	808	3.806931	4.786117	1	29
Research region	53374	.115804	.1342814	0	1
Status	8721	.0351104	.0841719	0.5	.482044
Absorptive capacity	61897	.2595925	2.905948	0	82

Table 6: Descriptive statistics of the second research study.

	Quarter	Number of employees	Age firms	Diversity	Research region	Status	Absorptive capacity
Quarter	1.0000						
Number of employees	-0.1904*	1.0000					
Age firms	0.5391*	0.3507*	1.0000				
Diversity	-0.2343*	0.4208*	0.0040	1.0000			
Research region	-0.2013*	-0.1145*	-0.1140*	0.1351*	1.0000		
Status	0.4027*	0.2242*	0.3256*	0.1403*	-0.0726	1.0000	
Absorptive capacity	-0.1366*	0.3602*	0.1007	0.4604*	-0.0002	0.2700*	1.0000

Table 7: Correlation matrix (*p<0.05) of the second research study.

Table 3 provides the results of my exponential model to explain the expansion of vertical integration. Model 1 is the baseline model that provides parameter estimates for the control variables. Model 2 adds parameter estimates for the variables constituting multi-level network partner configurations. Model 3 introduces the absorptive capacity variable separately. Model 4,

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additionally includes the interaction term of the variables constituting multi-level network partner configurations with absorptive capacity. I test my hypotheses on that full model.

Variable	Model 1	Model 2	Model 3	Model 4
Quarter	.01460596** (.00509823)	.01564054 (.02013316)	-.07054163* (.02899112)	-.07337802 (.04707475)
Number of employees	-1.493e-06 (8.489e-06)	-.0000687 (.00019674)	.00896278*** (.00165894)	.02340732*** (.00422304)
Age firms	-.01743608** (.00667504)	.00521121 (.01888775)	-.01304027 (.05190496)	-.35685161* (.18047681)
Diversity		.44317998** (.16231095)	1.2006542*** (.28896)	1.5839064* (.27774862)
Diversity squared		-.02001371* (.00918481)	-.07688092*** (.01896247)	-.11445174*** (.01814659)
Research region		-5.6365093* (2.5939916)	-7.8587421* (3.2814653)	-8.02855** (2.9108117)
Status		3.7329399 (2.3952831)	7.724056 (5.3545524)	7.8181263 (4.4810216)
Absorptive capacity			-514.01254 (955.18781)	-1283.284* (629.23774)
Interaction Absorptive capacity x diversity				-.28584719 (.30223571)
Interaction Absorptive capacity x research region				13.83557 (9.4559906)
Interaction Absorptive capacity x status				-826.94328* (341.17541)
Constant	-12.602323*** (.4592584)	-9.1965556*** (1.993878)	-1.529724 (2.5771573)	-.25691404 (4.3800195)
Chi2	16.148287	21.1777	135.04469	166.02783
Observations (df)	20941 (3)	365 (7)	365 (8)	365 (11)
AIC	903.72162	-90.585337	-202.45233	-227.43546

Legend: coefficient/(standard error); * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 8: Multivariate results of the exponential model.

Model 4 shows that with increasing size in terms of employees firms tend to expand their vertical integration ($\beta = 0.023$, *** $p < 0.001$). Also, it shows that firms' tendency towards expanding their vertical integration declines with increasing age ($\beta = -0.357$, * $p < 0.05$). Apart from these general results, I can report interesting findings that concern the derived hypotheses. Data show that the root term for ego network partners' international diversity is highly significant and positive ($\beta = 1.584$, * $p < 0.05$), while the squared term is highly significant and negative ($\beta = -0.114$, *** $p < 0.001$)

indicating an inverted u-shaped link. Thus, hypothesis (1A) is supported by the data. However, I have to refine it (see “Discussion of results” section below). The findings also show that regional network partners’ research munificence does have a negative impact on the expansion of vertical integration indicated by a negative and highly significant linear term ($\beta = -8.029$, $**p < 0.01$). Hence, hypothesis (1B) is supported by the data. Global network partners’ status is positive, yet not significant. Thus, I have to reject hypothesis (1C). In addition, it is obvious from the data that absorptive capacity negatively affects a firm’s tendency for expanding vertical integration ($\beta = -1283.28$, $*p < 0.05$) which confirms my hypothesis (2). My hypotheses (3A-3C) assumed a negative moderating effect of absorptive capacity on the relationships between multi-level network partner configurations and the expansion of vertical integration. Based on the empirical evidence of my data, I can only confirm hypotheses (3C). The linear interaction term of global network partners’ status and absorptive capacity is significant and negative ($\beta = -826.94$, $*p < 0.05$). However, hypotheses (3A) and (3B) must be rejected, as they are not supported by the data. I discuss my findings and their implications below.

4.6 Discussion and conclusion

4.6.1 Discussion and theoretical implications

4.6.1.1 Influence of multi-level network partner configurations on the expansion of vertical integration

I can confirm that a firm’s tendency towards expanding vertical integration is influenced by network embeddedness, in particular by multi-level network partner configurations. In line with my hypotheses (1A) and (1B), empirical evidence indicates that ego-network partners’ international diversity and regional network partners’ research munificence negatively determine the expansion of vertical integration. Given these findings, I can confirm my conceptual framework drawn on the

knowledge-based view: expanding vertical integration is a fruitful strategy to access knowledge in pursuit of ensuring and sustaining innovation. Hence, firms that lack sufficient access to network knowledge tend to expand their vertical integration, whereas firms that can rely on constant knowledge flows do have a wide lower tendency towards expanding vertical integration. Therefore, I can contribute to the research dealing with vertical integration. In fact, despite the wide incorporation of network embeddedness logic in strategic management literature, vertical integration research has widely neglected the network perspective so far. To my knowledge, there are only two exceptions which include the network-level to explain mechanisms driving firms' vertical integration decisions (Lin *et al.*, 2009; McEvily and Marcus, 2005). This study further enriches this emerging research stream in order to account for a more realistic picture of vertical integration which is influenced by the social context.

In the following, I explain my findings in-depth, thereby relying on the theoretical rationale of the knowledge-based view. As assumed in hypothesis (1A), I show that ego-network partners' international diversity negatively influences the firm's expansion of vertical integration. Theoretically, I ascribe this to additional knowledge flows and subsequent innovation outcomes a firm can realize from its pool of international partners. Such innovativeness decreases the firm's tendency towards expanding its vertical integration. However, my findings also indicate a positive and significant effect of rather low partners' international diversity on the expansion of vertical integration. This implies that a firm may be restricted to access knowledge and generate innovation despite – or precisely because of – the pool of international partners. I can explain this interesting finding with the psychic distance paradox (O'Grady and Lane, 1996). According to the latter, perceived similarities between the firm's home country and proximate countries can result in underperforming ties (Lavie and Miller, 2008). Consequently, the firm is not able to leverage knowledge from its international network partners (Powell *et al.*, 1996). Thus, at low levels of ego-network partners' international diversity the expansion of vertical integration represents a firm's

viable strategic option to ensure and maintain constant innovation. Therefore, I find a u-shaped link between ego-network partners' international diversity and the expansion of vertical integration.

In addition, regional network partners' research munificence is confirmed to have a negative impact on the expansion of vertical integration. This is in line with my hypothesis (1B). Hence, I can show that knowledge flows and subsequent innovative capabilities firms can draw from their local embeddedness decrease their incentive towards vertical integration. They simply do not have the need of accessing knowledge through vertical integration in the face of constant knowledge flows within the cluster. This finding joins a growing body of research pointing to the economic benefits of geographic clustering based on the benefits of labor pooling, specialized suppliers and knowledge spillovers (Al-Laham and Souitaris, 2008; Audretsch and Feldman, 1996; Porter, 1998; Pouder and St. John, 1996; Krugman, 1991).

Opposed to my hypothesis (1C), empirical evidence did not show a significant effect of global network partners' status and the expansion of vertical integration. By contrast, data show that there is a positive, yet not significant effect. I ascribe this to specific factors that restrict the access to knowledge from high-status partners (Al-Laham and Zock, 2012). In fact, a focal firm whose network comprises a considerably high number of partners enjoying high network status may be unable to appropriate knowledge (Bae and Gargiulo, 2004). The paradox here is that high-status partners who can make significant contribution to joint knowledge creation may also be able to restrict the knowledge appropriation capacity for that focal firm (Lavie, 2007). This implies that the focal firm may be not able to absorb valuable network knowledge, as their high-status network partners restrict access to it. Second, a network composed of many high-status firms can be referred to be structurally equivalent, insofar as a bulk of network members occupies similar central positions (Burt, 1997). The knowledge flows within such a structurally equivalent network tend to be rather redundant than diverse (Burt, 1992). Hence, with an increasing number of partners having high network status a focal firm's possibility to innovate decreases (Al-Laham and Zock, 2012). In

turn, to maintain a satisfactory degree of innovation performance such a focal firm tends to expand its vertical integration. I argue that this behavior is driven by its limited access to knowledge due to the intensive degree of their network partners' status. Thus, I can explain the positive effect of global partners' status on the expansion of vertical integration.

4.6.1.2 Direct and moderating influence of absorptive capacity on the expansion of vertical integration

In this study, I can empirically confirm the conceptual distinction between potential and realized absorptive capacity (Zahra and George, 2002). On the one hand, my findings indicate the significance of absorptive capacity for the expansion of vertical integration. In fact, the results of my analysis support my hypothesis (2), clearly showing that the more absorptive capacity a German biotechnology firm has, the lower is its probability to expand its vertical integration (linear and negative direct link). I explain this finding from a knowledge-based perspective: a firm's incentive to expand vertical integration decreases with an increasing ability to identify additional knowledge stocks. Thus, absorptive capacity which I conceptualize as the cumulative number of prior alliances assists the firm to recognize, access and exploit new, additional knowledge (Zahra and George, 2002; Lane, Salk, and Lyles, 2001; Escribano, Fosfuri, and Tribó, 2009). Such additional external knowledge results in higher innovativeness (McEvily and Chakravarthy, 2002; Grant, 1996). As a result, I can explain that a firm's tendency to expand vertical integration for accessing knowledge and, ultimately, developing innovativeness decreases with increasing potential absorptive capacity. Thus, this paper is one of the rather few studies that investigate and find a direct impact of absorptive capacity, which has traditionally been perceived as a moderating effect (Cohen and Levinthal, 1989, 1990), on an outcome variable.

On the other hand, empirical evidence also confirms the importance of absorptive capacity as an effect moderating the relationship between network embeddedness and the expansion of

vertical integration. As assumed in my hypothesis (3C), data show that absorptive capacity negatively influences the impact of global partners' status on the expansion of vertical integration. I conclude that realized absorptive capacity assists the firm to leverage more knowledge and subsequent innovation from global network partners' status resulting in a lower tendency to vertically integrate. In line with extant literature, I show that the mere exposure and access to external knowledge flows is not sufficient to internalize and transfer it successfully (Escribano, Fosfuri, and Tribó, 2009). However, opposed to my hypotheses (3A-3B), my findings do not show a negative moderation of absorptive capacity on the impacts of ego-partners' international diversity and regional network partners' research munificence on the expansion of vertical integration. To explain this interesting falsification of my derived hypotheses, I assume that firms can directly access a satisfactory amount of knowledge from their international and regional ties. In contrast to existing literature (Escribano, Fosfuri, and Tribó, 2009), I argue that with regard to international and regional partners the mere exposure and access to external knowledge flows is sufficient to vertically integrate it successfully. As a result, data do not show a moderation of absorptive capacity.

4.6.2 Managerial implications

In this paper, I link two modes of governance, by explaining the expansion of vertical integration with the firm's embeddedness in alliances and networks. In particular, I show that vertical integration is a knowledge accessing strategy in face of network constraints. Hence, empirical evidence of my study indicates that firms that have problems with accessing knowledge via alliance and network partners can expand the degree and breadth of vertical integration to ensure and maintain constant flows of innovation. To get there firms have to develop and maintain specific dynamic capabilities (i.e. sensing capacities) (Teece, Pisano, and Shuen, 1997; Teece, 2007) to manage the dynamic balance between external knowledge access and internal knowledge creation.

Also my results imply that firms should actively build up absorptive capacity to ensure and maintain constant flows of knowledge and, in turn, innovation. To do so, firms have to particularly address changes in organizational structure and culture. Amongst others they have to overcome the ‘not-invented-here’ syndrome that restricts absorptive capacity (Cohen and Levinthal, 1990; Lichtenthaler and Lichtenthaler, 2009).

4.6.3 Limitations and avenues for further research

There are two limitations of my study that need to be emphasized. First, my decision on the size of a cluster could be questioned as raised already in Al-Laham and Souitaris (2008). Using the first-digit (city) or the three-digit (street) post code would change the number of clusters. However, after consultation with colleagues, industry and postal experts I were convinced that the two-digit code was the most appropriate measure to capture the German biotech cluster. In addition, the generalizability of my results could also be challenged, as the sample represents a single industry (biotech) in one country (Germany). However, there is prior evidence that research results from the biotechnology industry are generalizable to other high-technology industries such as semiconductors (Almeida, 1996; Coombs *et al.*, 2006).

Further research should take on the effort and analyze the role of network embeddedness on firm behavior. Sticking to an atomistic picture of business practice is not realistic any more. As we live in a network economy, research should further investigate the implications of embedded action on firm strategy. This study does so, by explaining how network embeddedness affects vertical integration strategy. Future papers should analyze the consequences of embeddedness on additional strategic levers, such as outsourcing, offshoring, business model design, or restructuring.

5 RESEARCH STUDY III: BUSINESS MODEL DESIGN, INTERNATIONALIZATION, AND COMPETING EXIT STRATEGIES

- *Study conducted in collaboration with Suleika Bort*
- *Earlier conceptual version of the study presented at the EGOS Annual Conference 2012 in Helsinki*

5.1 Introduction

The idea of exit strategies has originally been emphasized in the strategy literature by Porter (1976). Subsequently, strategy scholars have confirmed the importance of exit as an overall strategy (Graebner and Eisenhardt, 2004). In fact, the literature presumes that most new ventures start their operations with an exit strategy in mind (DeTienne, 2010), as it is assumed to have a significant effect on the new venture and to be a key milestone in its business development (Rubenson and Gupta, 1996). Despite the acknowledged significance of exit as part of the new venture's overall strategy (Villalonga and McGahan, 2005), prior research has left many questions in the field unanswered so far. Indeed, the bulk of existing studies have only focused on one exit strategy, thereby overlooking the fact that there are different exit strategies. Prior research distinguishes between dissolution and sell-off (Harrigan, 1982, Mitchell, 1994; Decker and Mellewigt, 2007). As a result, prior studies have analyzed the determinants of either dissolution (e.g. Banbury and Mitchell, 1995; Brüderl and Schüssler, 1990; Huyhebaert and Van de Gucht, 2004) or sell-off (e.g. Dickerson, Gibson, and Tsakalotos, 2003; Lehto and Lehtoranta, 2004). This shortcoming is due to the fact that data restrictions or shortcomings did not allow for distinctions among different exit strategies (Agarwal and Audretsch, 2001). To my knowledge, so far there are only four exceptional studies that analyze firm exit as a heterogeneous event to account for different exit strategies (Cockburn and Wagner, 2010; Fortune and Mitchell, 2012; Mitchell, 1994; Cefis and Marsili, 2012). My study contributes to this emerging research stream in order to provide a more realistic picture of exit strategies.

Thus, I analyze new venture dissolution *and* sell-off. I take a knowledge-based view (Grant, 1996; Spender, 1996; Kogut and Zander, 1992) to explaining these two competing exit strategies that is scarce in extant literature. In particular, I apply a dynamic knowledge-based view that overcomes the static and path-dependent view that emphasizes the significance of pre-entry knowledge taken in extant literature (Klepper and Simons, 2000; Chandler and Jansen, 1993; Dencker, Gruber, and Shah, 2009; Shane, 2000). Applying the knowledge-based view is adequate to explain firm strategy and its implications in the present knowledge-based economy (Stewart, 1997; Grant and Baden-Fuller, 2004), where intangible resources, particularly knowledge, are highly valued (Mathews, 2003). Thus, I argue that different types of knowledge stocks acquired through learning processes influence new ventures' exit strategies. My understanding of knowledge builds upon the established distinction of business knowledge and internationalization knowledge (Eriksson, Johanson, Majkgard, and Sharma, 1997). Hence, I argue that new ventures' exit strategies are a result of knowledge stocks acquired through learning processes triggered by business model design (i.e. business knowledge) and internationalization (i.e. internationalization knowledge). Thus, my study aims to solve three specific research questions. How does business model design impact new ventures' competing exit strategies (i.e. dissolution and sell-off)? How does internationalization influence these two competing exit strategies? How does internationalization moderate the business model design-new ventures' competing exit links?

I conceptually link business model design to the exploration-exploitation framework (March, 1991). I argue and show that additional stocks of local knowledge accumulated through learning processes inherent to business model exploration and business model exploitation decrease the probability of dissolution and, simultaneously, decrease the propinquity toward sell-off. However, I presume and find that this only holds true up to a certain point wherefrom specific learning traps underlying the two distinctive business model designs result in opposing effects. In addition, I assume and show that stocks of distant knowledge acquired through internationalization

decrease the propinquity towards dissolution and, simultaneously, enhance the tendency toward sell-off. This applies to a certain point wherefrom knowledge-related conflicts inherent to massive amounts of tacit internationalization knowledge, which are difficult to integrate and transfer, increase dissolution and decrease sell-off. Also, I presume and find that internationalization moderates the business model design-exit links. In my argumentation I refer to dynamic capabilities, which I conceptualize as a byproduct of early internationalization, that assist new ventures to overcome the mentioned learning traps. Empirical evidence stems from an event history analysis (i.e. competing risk model) of a unique longitudinal dataset on the entire German biotechnology population between 1996 and 2009.

I contribute to the strategic management literature in four ways. First, I contribute to the knowledge-based view. Prior knowledge-based studies preoccupied with exit strategies are scarce, as extant exit literature has predominantly taken the industrial organization perspective, thereby studying structural factors (such as size and age) (e.g. Agarwal and Audretsch, 2001; Geroski, 1995) or the organizational ecology perspective, thereby studying firm characteristics and environmental conditions (e.g. Brüderl, Preisendorfer, and Ziegler, 1992; Persson, 2004). The few existing knowledge-based papers have most of the time taken a deterministic view, thereby analyzing the effect of the founder's pre-entry knowledge stocks (Klepper and Simons, 2000; Chandler and Jansen, 1993; Dencker, Gruber, and Shah, 2009; Shane, 2000). A dynamic knowledge-based view that links knowledge stocks acquired through organizational learning has not been provided yet.

Second, my paper contributes to the exit literature. In particular, I show that knowledge stocks acquired through organizational learning triggered by business model design and internationalization affect new ventures' decision over whether to dissolve a business or sell it off to another company. Both concepts emphasized greatly in the strategic management field (e.g. Lu and

Beamish, 2001; Zott and Amit, 2007; Zahra, 2005) have been neglected so far in extant literature dealing with different new venture exit strategies.

In addition, I contribute to the business model literature, by viewing business model design from a knowledge-based view. Of particular importance to this paper is March's (1991) distinction between exploration and exploitation. Explorative and exploitative learning have been applied in various contexts, such as technology development (e.g. Greve, 2007), senior-management teams (e.g. Beckman, 2006), and strategic alliances (e.g. Lavie and Rosenkopf, 2006). I transfer the exploration-exploitation framework to business model designs. Thus, I argue that new ventures can pursue explorative or exploitative business models. This allows an empirical examination of business model design that is scarce in existing research.

Fourth, I contribute to the M&A research following the knowledge-based view that accentuates the transfer of knowledge from the acquired to the acquiring firm as the main motivation for a takeover (Cefis and Marsili, 2012; Coff, 1999; Ahuja and Katila, 2001; Ranft and Lord, 2002; Capron and Mitchell, 2004). In particular, I further elaborate on the specifics of knowledge that drive M&A activities. Thereby, I am able to develop further the conceptualization or systemization of knowledge offered in existing literature (Eriksson *et al.*, 1997; Polanyi, 1966). In particular I show how the scope (i.e. local vs. distant knowledge) and nature (i.e. explicit vs. tacit knowledge) of knowledge determines M&A decisions.

The paper is organized as follows. First, I introduce the underlying conceptual basis. Next, I derive hypotheses stemming from theoretical considerations. In addition, I report on the methodology and the results of the study. Finally, I discuss my findings and end up with a conclusion including limitations, avenues for further research, and managerial implications.

5.2 Conceptual framework

5.2.1 Conceptualization of new ventures' exit strategies

Mata and Portugal (2002) use the term “new legal entity” to describe new ventures, whereas Weber and Zulehner provide a more detailed definition saying that new ventures “are small, dynamic, and risky enterprises, which are particularly sensitive to business decisions” (Weber and Zulehner, 2010: 358). Studying new ventures is an interesting topic within strategic management, as they have genuine characteristics that distinguish them from mature firms. Due to their liabilities of newness and smallness new ventures lack financial, managerial, and human resources (Lichtenstein and Brush, 2001; Stinchcombe, 1965; Wiklund, Baker, and Shepherd, 2010). As a result, they have a limited cognitive capacity in processing information and knowledge (Cyert and March, 1963). This means that they have difficulties in assimilating, accumulating, and applying diverse knowledge (Simon, 1945: 40-41; Nickerson and Zenger, 2004). As a consequence of their limited cognitive capacity, new ventures do have more specialized knowledge than mature firms (Chrisman, Bauerschmidt, and Hofer, 1998). Due to this specialization, their knowledge space is limited (Zhang and Li, 2010).

By definition, exit is a firm's asset strategic restructuring activity involving a divestiture (Decker and Mellewigt, 2007: 41). Extant literature acknowledges that firm exit can occur in different ways. I rely on the established conceptual distinction between dissolution and sell-off (Harrigan, 1982; Mitchell, 1994; Decker and Mellewigt, 2007), which has been applied in recent empirical literature (Fortune and Mitchell, 2012; Cefis and Marsili, 2012). Dissolution involves the closure of the entire business most often due to bankruptcy (Mitchell, 1994; Chang and Singh, 1999; Mata and Portugal, 2000). Sell-off means that a business is sold via mergers and acquisition (M&A) to another owner (Mata and Portugal, 2000). The latter tends to be a large and mature firm

with high amounts of capital willing to obtain resources – in particular knowledge – that are difficult to build internally (Cefis and Marsili, 2012).

5.2.2 A knowledge-based view of new ventures' exit strategies

In this paper I argue that the decision over whether to dissolve the new venture or sell it to another company is influenced by the accumulation of new knowledge stocks acquired through organizational learning. From a knowledge-based view, knowledge stocks are tightly linked to organizational learning, which has been conceptualized as a routine-based process (Eisenhardt and Santos, 2006). Levitt and March (1988) assume that firms generate additional knowledge stocks through organizational learning. Miller (1996: 486) accentuates the link between learning and knowledge when he states that “organizational learning is the acquisition of new knowledge”. In the context of new ventures organizational learning from external partners is the key to acquire new knowledge (Grant and Baden-Fuller, 2004), as their internal knowledge space is limited (Zhang and Li, 2010). In particular, the knowledge-based view emphasizes the significance of knowledge acquisition through learning for firm existence, superior performance, and survival (Grant, 1996; Kogut and Zander, 1992). In fact, Grant (1996) accentuates the primary role of the firm as integrating knowledge into products/services. Furthermore, it is assumed that heterogeneous knowledge bases among firms represent the main determinants of firm performance differences (Grant, 1996; Spender, 1996; Spender and Grant, 1996).

I presume that new ventures that cannot acquire additional knowledge stocks through learning from their external partners tend to *exit by dissolution*. Without additional knowledge acquisition new ventures cannot create value (Grant and Baden-Fuller, 2004; Al-Laham and Souitaris, 2008; Fernhaber, McDougall-Covin, and Shepherd, 2009; Rothaermel and Deeds, 2006). Indeed, knowledge acquisition assists new ventures to improve the likelihood of survival (Schoonhoven, Eisenhardt, and Lyman 1990). Thus, without additional knowledge acquisition new

ventures simply cannot survive in the dynamic market environment. In contrast, new ventures that are able to accumulate new knowledge stocks through organizational learning processes can enhance their survival chances, thereby decreasing the tendency toward exit by dissolution (Cefis, 2005).

Further, I argue that new ventures' knowledge stocks influence *exit by sell-off*. I assume that new ventures' knowledge stocks signal value to potential acquirers that aim to gain access to those knowledge stocks (Vermeulen and Barkema, 2001). Signaling refers to "observable attributes that alter the beliefs of, or convey information to, other individuals in the market about unobservable attributes and intentions" (Ndofor and Levitas, 2004: 688). The actual accomplishment of a M&A depends on two aspects, that is 1) the buyer's willingness to acquire the new venture's knowledge stocks that are difficult to build internally (Cockburn and Wagner, 2010; Cefis and Marsili, 2012); and 2) the buyer's ability to transfer the acquired knowledge stocks (Capron, Dussage, and Mitchell, 1998; Mowery, Oxley, and Silverman, 1996; Lyles and Salk, 1996). From the knowledge-based view, which I take in this paper, both the buyer's willingness to access knowledge and his ability to transfer it are dependent on the scope and the nature of the knowledge provided by the new venture. In characterizing the scope of knowledge, research distinguishes between local and distant knowledge (Rosenkopf and Nerkar, 2001; Levitt and March, 1988). Thereby, local knowledge refers to knowledge adjacent to the firm's technological domain, whereas distant knowledge is different from it (Nelson and Winter, 1982). As exclusively local knowledge is much more restricted in creating value (Henderson and Cockburn, 1996; Lavie and Miller, 2008), distant knowledge is much more attractive for potential acquirers to access than local knowledge. In characterizing the nature of knowledge, research distinguishes between explicit and tacit knowledge stocks (Polanyi, 1966). Explicit knowledge refers to knowledge that is transmittable in formal language (Polanyi, 1966). Tacit knowledge is difficult to formalize and communicate, and can only be acquired through practical experience in the relevant context, i.e. 'learning-by-doing' (Lam,

2000). As tacit knowledge is much more embedded in the context in which it is shaped (Kogut and Zander, 1993), it is more difficult to transfer than explicit knowledge (Coff, 1999; Ranft and Lord, 2002).

Extant literature acknowledges that there are various methods by which a firm can learn to acquire different types of additional knowledge stocks (Dencker, Gruber, and Shah, 2009). In particular, firms can accumulate two types of knowledge that is business knowledge and internationalization knowledge (Eriksson *et al.*, 1997). Business knowledge concerns technological knowledge and market knowledge (Eriksson *et al.*, 1997). As such, I assume that business knowledge is local and explicit in nature. Internationalization knowledge is about a firm's capability to engage in international operations (Yu, 1990). As such, I presume that internationalization knowledge is distant and tacit in nature. Accordingly, I examine the influence of two learning methods that generate the two types of knowledge stocks: learning triggered by business model design and learning initiated by internationalization. I argue that learning inherent to business model design results in the acquisition of business knowledge, whereas learning underlying internationalization leads to the accumulation of internationalization knowledge. Both concepts have been neglected so far in extant literature dealing with different new venture exit strategies. The latter has analyzed mode of entry, age, and size (Mitchell, 1994); capabilities (Fortune and Mitchell, 2012); and innovation (Cockburn and Wagner, 2010; Cefis and Marsili, 2012). I can advance this research stream, by examining business model design and internationalization as two additional explanatory drivers that have been emphasized in the strategy literature (e.g. Lu and Beamish, 2001; Zott and Amit, 2007; Zahra, 2005).

5.2.3 Business model design, knowledge stocks, and new ventures exit strategies

An emerging research stream analyzes how business model design directly or indirectly creates value (Patzelt *et al.*, 2008; Zott and Amit, 2007; Zott and Amit, 2008). Yet, empirical research is still in its infancy. I advance that research stream, by analyzing the impact of business model design on new ventures' exit strategies. In line with prior research (Patzelt, Knyphausen-Aufseß, and Nikol, 2008; Hamel, 1999), I define the business model as how firms manage their transactions with other organizations and stakeholders. Therefore, it constitutes the firm's value architecture (Timmers, 1998). Business model design refers to the configuration of a business model (Zott and Amit, 2007). In this regard, it refers to the configuration of the new venture's value architecture. Zott and Amit (2007) have proposed two major business model designs: novelty-centered and efficiency-centered business models. The essence of novelty-centered business model design is the adoption of new ways of doing business (Zott and Amit, 2007). By contrast, efficiency-centered business design refers to imitation of established business approaches (Zott and Amit, 2007). Despite their importance for systemizing extant business models, the mentioned design themes suffer from a major shortcoming, as they lack a convincing theoretical grounding.

In this paper, I view business model design from a knowledge-based view. The latter is important given the significance of knowledge stocks and learning for the success of business models – in particular in high technology industries. Of particular importance to this paper is March's (1991) distinction between exploration and exploitation. March (1991) defines exploration activities as “things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation” (March, 1991: 71). By contrast, exploitation refers to “such things as refinement, choice, production, efficiency, selection, implementation, execution” (March, 1991: 71). Levinthal and March (1993: 105) added that exploration involves “a pursuit of new knowledge”, whereas exploitation implies “the use and development of things already known”. Explorative and exploitative learning have been employed in various contexts, such as technology

development and product innovation (e.g. Greve, 2007; He and Wong, 2004), senior-management teams (e.g. Beckman, 2006), and strategic alliances (e.g. Lavie and Rosenkopf, 2006). I transfer the exploration-exploitation framework to the business model context, in claiming that they can serve as design themes. Thus, I argue that new ventures can pursue an explorative business model or an exploitative business model. I can illustrate this rather abstract and theoretical thought on the basis of concrete business models pursued in biotechnology. In fact, biotechnology firms are said to pursue either the biotherapeutic or the platform business model (Casper, 2000). Biotherapeutic firms are in constant search and experimentation for new drugs (Patzelt *et al.*, 2008). Platform firms are preoccupied with selling services and technologies (Casper, 2000). Hence, I argue that biotherapeutic firms pursue an explorative business model, whereas platform firms pursue the exploitative business model design. I emphasize that a hybrid or ambidextrous business model, referring to a combination of exploration and exploitation, is not relevant for new ventures that lack the resources to manage the complexity inherent to such an ambidexterity (March, 1991).

Due to their limited knowledge space (Zhang and Li, 2010) and their pressure towards acquiring additional knowledge (Grant and Baden-Fuller, 2004), I argue that strategic alliances are a central strategic lever of value creation for new ventures. As a result, strategic alliances are an important element of a new venture's value architecture. Building on my conceptualization of the business model above, I can conclude that strategic alliances reflect the new venture's business model. In particular, strategic alliances can well reflect the two business model designs, as they are a vehicle for exploration and exploitation (Lavie and Rosenkopf, 2006). In fact, upstream alliances that refer to partnerships in research and development (R&D) aim at accessing new knowledge and mirror exploration. By contrast, downstream alliances that refer to partnerships in marketing, distribution, and licensing (MD&L) aim at leveraging existing knowledge and mirror exploitation (Lavie and Rosenkopf, 2006). It is widely accepted that these two contrasting types of alliances provide two different types of business knowledge that result in two different outcomes. On the one

hand, R&D alliances provide technological knowledge that results in innovation through the recombination of new and existing technological knowledge (Iansiti and Clark, 1994; Spender and Grant, 1996; March, 1991). On the other hand, MD&L alliances provide market knowledge that results in increased commercialization (Baum, Calabrese, and Silverman, 2000; Rothaermel and Deeds, 2004). Building on my conceptual framework, I conclude that acquired knowledge stocks and, as a consequence of them, increased innovativeness and commercialization affect new venture exit strategies.

5.2.4 Internationalization, knowledge stocks, and new ventures' exit strategies

Prior research has emphasized the importance of internationalization for new ventures, especially for those in high technology industries (Al-Laham and Souitaris, 2008; Oviatt and McDougall, 1994; Zahra and George, 2002). Prior research has examined the antecedents (Chen and Martin, 2001, Oviatt and McDougall, 1997), processes (Oviatt and McDougall, 1995) and performance effects of new venture internationalization (Reuber and Fischer, 2002; McDougall and Oviatt, 1996; Oviatt and McDougall, 1997). However, there is a lack of research that analyzes the role of new venture internationalization on survival and exit strategies (Jones and Coviello, 2005; Zahra and George, 2002). In this paper I fill that significant gap in the literature.

I conceptualize internationalization in terms of international alliances for two main reasons. First, McDougall and Oviatt (2000), the pioneers of research dealing with new venture internationalization, included alliances as one of the key topics within the field. Second, prior research has shown that internationalization via alliances is one of the most important drivers of the new venture internationalization process due to their liabilities of smallness and newness (Al-Laham and Souitaris, 2008; Johanson and Vahlne, 2009). International alliances provide advantages to new ventures (Baum and Silverman, 2004), primarily associated with the access to and acquisition of knowledge (Grant and Baden-Fuller, 2004; Liebeskind *et al.*, 1996). Engaging in

alliances assists new ventures to overcome their knowledge constraints and to internationalize in a manner not possible for an isolated new venture (Al-Laham and Souitaris, 2008; Zahra, Ireland, and Hitt, 2000). I argue that internationalization via international partners initiates learning processes that can be used to acquire additional knowledge stocks (Zahra and George, 2002). I believe that such knowledge and capabilities influences new ventures' exit strategies.

5.3 Development of hypotheses

5.3.1 Influence of business model design on new ventures' exit strategies

5.3.1.1 Influence of business model exploration (i.e. R&D alliances) on new ventures' exit strategies

Building simultaneous R&D partnerships assists new ventures pursuing an explorative business model to acquire technological knowledge and generate innovation. This can be explained with regard to the mechanisms inherent to R&D alliances. Partnering leads to the generation of trust between collaborating firms (Liebeskind, 1996; Granovetter, 1992). Subsequently, such trust enables the exchange of knowledge (Levin and Cross, 2004), opens alternative views on common research problems (Powell, Koput, and Smith-Doerr, 1996; Dyer and Singh, 1998), and helps to locate new knowledge (Dyer and Nobeoka, 2000). Consequently, knowledge exchange and acquisition result in innovation through the recombination of existing and new knowledge (Grant, 1996; Kogut and Zander, 1992). As an example, in the biotechnology industry R&D partnerships are built to acquire basic knowledge that can be used to create innovativeness in the form of novel molecular entities which are then patented, and developed (Rothaermel and Deeds, 2004: 202). In fact, prior empirical research has shown that R&D alliances strengthen innovativeness in terms of various indicators, such as patenting (Shan *et al.*, 1994; Baum *et al.*, 2000; Al-Laham and Amburgey, 2011), product innovativeness (Kotabe and Swan, 1995), and product development

(Deeds and Hill, 1996). Thereby, I acknowledge that new ventures seek predominantly local knowledge through local search (March and Simon, 1958; Nelson and Winter, 1982). The latter refers to searching for new knowledge in the neighborhood of the current knowledge base (Stuart and Podolny, 1996). Involvement in local search results in expertise in the current technological domain and, as a result, leads to increasing incremental innovation (Rosenkopf and Nerkar, 2001). I argue that such increasing innovativeness stemming from R&D alliances affect new ventures' exit strategies. In particular, I state that with increasing innovativeness new ventures tend to stay in the market, as innovative firms tend to demonstrate higher profitability, greater market value, and superior credit ratings (Czarnitzki and Kraft, 2004). Hence, new ventures pursuing an explorative business model reflected by R&D alliances can avoid to exit by dissolution.

As the new venture benefits from increasing incremental innovativeness, which results from low and moderate levels of explorative business models, it does not aim to sell-off its operations. In addition, potential buyers might not be even willing to take over the new venture. Building on my conceptual framework, I argue that the tendency toward sell-off depends on their willingness to access the new venture's knowledge stocks acquired through R&D alliances. In this regard, I presume that incremental innovation stemming from a local search for knowledge signals hardly any attractiveness to potential buyers (Rosenkopf and Almeida, 2003). I argue that large mature firms do dispose of enough technological expertise and R&D budget to generate such incremental innovation themselves (Santarelli and Sterlacchini, 1990; Henderson and Clark, 1990). Thus, I conclude that they do not thrive toward M&A, as they are able to build those innovations in-house. Given the restricted signalized value and the un-specificity of knowledge provided by new ventures with moderate explorative business models, I acknowledge that large firms are rather supposed to engage in strategic alliances with those new ventures than in M&A activities (Williamson, 1975; Kogut and Zander, 1992). Thus, an explorative business model design characterized by an

engagement in a low and moderate number of R&D alliances results in a decreased sell-off rate due to the limited signaled value of the new venture's knowledge stocks.

However, the derived theoretical rationale only holds true up to a certain degree of business model exploration reflected by a certain number of R&D alliances in which the new venture is engaged. I assume that the new ventures' limited cognitive capacity (Cyert and March, 1963) results in a limited absorptive capacity (Cohen and Levinthal, 1990). The latter, which is emphasized to be a powerful knowledge management capacity (Argote, McEvily, and Reagans, 2003; Lichtenthaler and Lichtenthaler, 2009), refers to the "ability to identify, assimilate, and exploit knowledge from the environment" (Cohen and Levinthal, 1989: 589). Thus, the assumed limited absorptive capacity implies that new ventures can only acquire a certain and quite restricted amount of knowledge. Consequently, their innovative potential that they might leverage from their R&D alliances is restricted as well. Moreover, knowledge acquisition and the generation of innovation involve reconfiguring and recombining capabilities (Kogut and Zander, 1992). The latter, however, represents a challenging task, as it requires changes in the way how components of innovation are assembled (Henderson and Clark, 1990). This might lead to failures in such a way that additional knowledge stocks cannot be integrated into innovative outcomes. According to Levinthal and March (1993: 105) "[eventual] failure [in the process of exploring new opportunities] leads to search and change which lead to failure which leads to even more search, and so on". Thus, I argue that at a certain degree of business model exploration characterized by a certain number of R&D alliances new ventures cannot increase their innovativeness any more. Given the mentioned drawbacks of explorative learning additional R&D alliances might even weaken a new venture's innovativeness. Thus, I conclude that new ventures pursuing business model exploration with a massive number of R&D alliances tend to have an increased tendency toward dissolution.

At the same time, the new venture's massive amount of knowledge signals value to potential acquirers. In particular, potential buyers develop a willingness to acquire the dedicated knowledge-

based expertise that new ventures build through an intensive focus on local search (Rosenkopf and Nerkar, 2001). In addition, I argue that – in contrast to new ventures – potential buyers, which are large and mature firms, are able to assimilate the massive amount of knowledge and transfer them to innovation for two reasons: higher absorptive capacity and more recombining capabilities than new ventures. On the one hand, it is established that that new ventures suffer from a more limited cognitive capacity than large firms that arises from their liabilities of smallness (Stinchcombe, 1965, Carroll and Hannan, 2000; Wiklund, Baker, and Shepherd, 2010). Thus, large firms have a higher absorptive capacity than new ventures that assists them – in case of a M&A – to leverage the large amounts of knowledge provided by those new ventures’ R&D alliances. On the other hand, it is established that new ventures do have less reconfiguring or combining capabilities than mature firms due to the fact such capabilities result from learning and experience inherent to more mature firms (Cyert and March, 1963; Levitt and March, 1988; Martin and Salomon; 2003; Nelson and Winter, 1982). Whereas new ventures tend to suffer from a decreased innovativeness as a result of intensive business model exploration, large mature firms are able to benefit from it, thereby creating knowledge-based advantages (McEvily and Chakravarthy, 2002). Building on my conceptual framework, I conclude that new ventures pursuing business model exploration with a massive number of R&D alliances tend to have an increased propinquity toward sell-off. Hence, I can derive the following set of hypotheses:

HYPOTHESIS (1A): The relationship between business model exploration (i.e. R&D alliances) and exit via dissolution is curvilinear. The slope is negative at low and moderate levels of R&D alliances and is positive at high levels of R&D alliances indicating a u-shaped link.

HYPOTHESIS (1B): The relationship between business model exploration (i.e. R&D alliances) and exit via sell-off is curvilinear. The slope is negative at low and moderate levels of R&D alliances and is positive at high levels of R&D alliances indicating a u-shaped link.

5.3.1.2 Influence of business model exploitation (i.e. MD&L alliances) on new ventures' exit strategies

Like their R&D alliance counterparts, MD&L alliances represent an important way to exchange knowledge in pursuit of an exploitative business model (Chen and Huang, 2004; Larson, 1992; Yu, Gilbert, and Oviatt, 2011). In particular, knowledge from marketing alliances assist new ventures to develop new product capabilities, attract new customers, and tap into unexplored markets (Lechner and Dowling, 2003; Lu and Beamish, 2001). Distribution alliances provide knowledge in terms of the overall sales infrastructure. Licensing alliances offer knowledge with regard to technology and production facilities and expertise in exploiting clinical trials (Pisano, 1990; Baum, Calabrese, and Silverman, 2000). In particular, biotechnology new ventures can accumulate these valuable knowledge stocks from downstream partnerships with large and experienced pharmaceutical and chemical firms (Baum *et al.*, 2000). These established pharmaceutical and chemical firms have the routines and competencies to manage a new drug to the regulatory process (Rothaermel and Deeds, 2004). As an example, the biotechnology firm Biogen is engaged with the pharmaceutical company Schering-Plough that took responsibility for the clinical trials and the regulatory activities (Rothaermel and Deeds, 2004). In addition, whereas these large pharmaceutical and chemical firms often lack capabilities in emerging technologies, they have great competencies in advantage-seeking referring to the creation of competitive advantages and effective commercialization (Ireland, Hitt, and Simon, 2003). Indeed, prior empirical literature has emphasized that MD&L alliances assist new ventures to improve the commercialization of their product/service offerings (Lavie and Rosenkopf, 2006). I assume that such an increased commercialization capability stemming from business model exploitation reflected by MD&L alliances affect new ventures' exit strategies. In particular, I argue that new ventures that are effective in commercializing their offerings stay in the market, thereby avoiding dissolution. In turn, I argue that these commercializing champions are not attractive as take-over targets, as potential buyers are those

established pharmaceutical and chemical firms that provide the commercializing knowledge to the new ventures. Hence, commercializing knowledge stemming from an increasing number of MD&L alliances tends to result in a lower sell-off rate, as potential acquirers might not be interested in re-acquiring their own knowledge, which they brought to the alliances, through an M&A.

However, also this theoretical rationale only holds true up to a certain degree of business model exploitation characterized by a certain number of MD&L partnerships. As in the case of R&D alliances the assumed limited absorptive capacity of new ventures implies that they can only acquire a certain amount of knowledge. Thus, their commercializing potential which they might leverage from their MD&L alliances is limited as well. Moreover, I argue that the commercializing potential is restricted due to the downside of exploitative learning inherent to the great engagement in MD&L alliances (Lavie and Rosenkopf, 2006). In fact, firms that engage in excessive business model exploitation tend to suffer from obsolescence due to technological progress or changes in customer preferences (Levinthal and March, 1993). Further, as firms that develop a competence in a certain area tend to engage in that activity more frequently, they further enhance their specific competencies (Levinthal and March, 1993). Firms that commit themselves to existing technologies and competencies are less likely to explore new opportunities through their alliances (Lavie and Rosenkopf, 2006). As these competencies can turn into core rigidities, firms can become trapped by their competencies with self-destructive consequences (Leonard-Barton, 1992; Levitt and March, 1988). I can illustrate these theoretical considerations by means of a focal new venture that pursues a dedicated exploitative business model. That new venture heavily relies on selling technologies and services to their MD&L partners. In order to improve its business, the new venture tries hard to enhance its commercializing competencies in order to continuously improve its technologies and services. While trying to bring its current business model to perfection, its customers' preferences might change or technologies might progress. Such developments might make the focal new ventures obsolete in the market, as emerging new ventures that take on the mentioned developments

might outperform it. It becomes clear that business model exploitation might have self-destructive consequences. However, for established pharmaceutical and chemical firms a new venture's highly exploitative business model signals value. In fact, those incumbents might find an M&A valuable to avoid that commercializing knowledge that they brought to the MD&L alliances falls in the hands of their competitors. Hence, as with business model exploration (i.e. R&D alliances), I can derive two u-shaped relationships between business model exploitation (i.e. MD&L alliances) and new venture exit strategies reflected by the following set of hypotheses:

HYPOTHESIS (2A): The relationship between business model exploitation (i.e. MD&L alliances) and exit via dissolution is curvilinear. The slope is negative at low and moderate levels of R&D alliances and is positive at high levels of MD&L alliances indicating a u-shaped link.

HYPOTHESIS (2B): The relationship between business model exploitation (i.e. MD&L alliances) and exit via sell-off is curvilinear. The slope is negative at low and moderate levels of MD&L alliances and is positive at high levels of MD&L alliances indicating a u-shaped link.

5.3.2 Influence of internationalization on new ventures' exit strategies

Internationalization that I conceptualize as international alliances assists new ventures in acquiring additional knowledge stocks (e. g. Al-Laham and Souitaris, 2008). In particular, from the theoretical lenses of the knowledge-based view, I assume that international alliances play two distinctive roles with respect to knowledge acquisition: a direct and a moderating role. On the one hand, international partnering increases the variety of ideas to which a new venture is exposed which results in a more extensive knowledge base (Huber, 1991; March, 1991; Barkema and Vermeulen 1998). I assume that this knowledge directly influences new ventures' exit strategies.

On the other hand, new venture internationalization triggers a process of learning (Lu and Beamish, 2001). In particular, I presume that the more a new venture internationalizes through forming alliances with foreign partners, the more deeply imprinted its learning routines in the form

of dynamic capabilities (Sapienza *et al.*, 2006). The imprinting research emphasizes the impact of prior history on subsequent organizational outcomes (Stinchcombe, 1965; Milanov and Fernhaber, 2009). Prior imprinting research (e.g. Milanov and Fernhaber, 2009) has emphasized the lasting impact of a new venture's initial financial capital (Bamford, Dean, and McDougall, 2000), competitive intensity (Swaminathan, 1996) and strategy (Boeker, 1989) on subsequent new venture behavior (Boeker, 1989), growth (Eisenhardt and Schoonhoven, 1990), profitability (Bamford *et al.*, 2000) and mortality (Swaminathan, 1996). In this paper, I argue that early internationalization in terms of international alliances has a lasting impact on the creation of dynamic capabilities. The latter refer to “the firm’s ability to integrate, build and reconfigure internal and external competencies to address rapidly changing environments” (Teece, Pisano, and Shuen, 1997: 516). As such, they imply the firm’s ability to maintain organizational fitness (O’Reilly and Tushman, 2008) and develop new skills needed to address emerging threats and opportunities (Eisenhardt and Martin, 2000; Teece *et al.*, 1997; Winter, 2003). I conclude that dynamic capabilities are best suited to positively moderate the relationships between business model design and new ventures’ exit strategies.

5.3.2.1 Direct influence of international alliances on new ventures’ exit strategies

International partners from various home countries differ in terms of their resource endowments (Lavie and Miller, 2008). In particular, from a knowledge-based perspective, ties with international partners provide a fruitful learning arena to strengthen innovation and commercialization due to the diversity of their knowledge bases (Lane and Lubatkin, 1998). On the one hand, international partners increase the variety of technologies and ideas to which a new venture is exposed that could be limited in its home country (Barkema and Vermeulen, 1998; Eisenhardt and Schoonhoven, 1996; Hagedoorn, 1993; Huber, 1991). As such, international partners might provide the chance to overcome a new venture’s tendency towards local search which restricts the possibilities for

innovation through the recombination of knowledge. Indeed, new ventures tend to search for new knowledge in the neighborhood of their current technological knowledge domain (Nelson and Winter, 1982). Such behavior restricts the acquisition of novel, more distant knowledge (Leonard-Barton, 1995; Levitt and March, 1988). By contrast, the existence of heterogeneous knowledge provided by international partners enriches the possibility of new combinations and enhances the likelihood for innovation (Henderson and Cockburn, 1996). On the other hand, international partners provide global market knowledge that can help to bridge national boundaries and leverage firm's competitive advantage in foreign markets (Lavie and Miller, 2008). Thus, international ties enhance the new venture's responsiveness to global market conditions, thereby improving commercialization. I argue that the emergent innovativeness and commercialization have a significant impact on new ventures' exit strategies. In particular, I state that increased innovative and commercial capabilities assist new ventures to avoid dissolution. Also, I presume that the higher the innovativeness and commercialization stemming from distant knowledge, the higher the attractiveness of a new venture to a potential acquirer reflected by an increased tendency toward sell-off.

However, new ventures tied to a massive number of international partners also face conflicts (Madhok and Tallman, 1998; Park and Zhou, 2005; White and Lui, 2005) resulting from cultural divergence and their limited cognitive capacity (Cyert and March, 1963). Cultural differences between the focal new venture and its foreign alliance partners restrict the extent of shared values and goals that are needed to absorb and transfer knowledge in alliances (Parkhe, 1991). Differences in norms and values of culturally distant alliance partners tend to create divergent expectations that result in the lack of commitment and, ultimately, irresolvable conflicts (Lane and Beamish, 1990). Overall, these liabilities reduce the effectiveness of collaboration with foreign partners (Kumar and Nti, 1998) and weaken the new venture's ability to leverage knowledge from their pool of international partners (Powell *et al.*, 1996). As this endangers the overall ability to leverage

innovation and commercialization, it also affects new ventures' exit strategies. I conclude that with increasing international alliances new ventures risk to be forced toward dissolution due to restricted innovation and commercial potentials.

In addition, high levels of internationalization reduce the attractiveness of new ventures as M&A targets, as the tacit nature of internationalization knowledge stocks impedes the transfer of those knowledge stocks from the new venture to the potential acquirer (Lam, 1997). I argue that at low and medium levels of internationalization potential acquirers can still deal with the tacit characteristics offered by the internationalization knowledge that they acquire from new ventures. However, with ever increasing tacit knowledge its transfer becomes ever more difficult (Nonaka and Takeuchi, 1995; Ranft and Lord, 2002; Simonin, 1999). As a consequence, potential buyers are not able to transfer the internationalization knowledge in order to create innovativeness and commercialization from it. As in an acquisition potential buyers are attracted by assets that are expected to have a great impact on the productivity and competitive advantage of the acquiring firm (Caves, 1998), massive internationalization weakens the attractiveness of new ventures as M&A targets. This, in turn, reduces the probability of sell-off. Hence, I conclude the following set of hypotheses.

HYPOTHESIS (3A): The relationship between international alliances and exit via dissolution is curvilinear. The slope is negative at low and moderate levels of international alliances and is positive at high levels of international alliances indicating a u-shaped link.

HYPOTHESIS (3B): The relationship between international alliances and exit via sell-off is curvilinear. The slope is positive at low and moderate levels of international alliances and is negative at high levels of international alliances indicating an inverted u-shaped link.

5.3.2.2 Moderating influence of international alliances on the relationships between business model design and new ventures' exit strategies

As conceptualized, I argue that internationalization enables new ventures to develop and maintain dynamic capabilities through a process of imprinting (e. g. Milanov and Fernhaber, 2009). Teece *et al.* (1997) and Eisenhardt and Martin (2000) highlight that dynamic capabilities are embedded in organizational processes and assist firms to deal with rapidly changing environments. As such, they are directed toward enabling organizational change and evolution (Zott, 2003). With regard to knowledge management Zahra and George (2002) argue that absorptive capacity is an important part of dynamic capabilities. Thus, international alliances assist new ventures to improve knowledge creation and utilization that enhances their ability to gain and sustain innovation through the recombination of knowledge stemming from R&D alliances. Moreover, dynamic capabilities strengthen new ventures' architectural competence (Henderson and Cockburn 1994) or combinative capability (Kogut and Zander 1992). Both concepts refer to the ability to recombine external and internal knowledge and, in turn, foster innovation. Finally, I assume that dynamic capabilities stemming from the engagement in international alliances aid new ventures learn from failed innovation initiatives, thereby to avoid learning traps underlying business model exploration. I conclude that dynamic capabilities assist new ventures in leveraging more knowledge from their R&D alliances characterizing for the explorative business model design. Also, I believe that they are better able to integrate such knowledge to achieve a higher innovativeness. Based on my conceptual framework, I conclude that such enhanced innovativeness decreases the dissolution rate. In contrast, I conclude that it signals attractiveness to potential acquirers. Hence, I can hypothesize that international alliances augment the propinquity toward sell-off.

HYPOTHESIS (4A): International alliances negatively moderate the relationship between business model exploration (i.e. R&D alliances) and exit via dissolution.

HYPOTHESIS (4B): International alliances positively moderate the relationship between business model exploration (i.e. R&D alliances) and exit via sell-off.

The increase of absorptive capacity as a result of dynamic capabilities stemming from internationalization also affects commercialization. In fact, the more absorptive capacity a new venture has, the more knowledge it can acquire from MD&L alliances inherent to business model exploitation in order to improve its commercialization capabilities. In addition, dynamic capabilities also have an effect on the exploitative learning traps inherent to the engagement in MD&L alliances. In fact, dynamic capabilities explain how firms evolve along constrained trajectories and deal with rigidities created by path dependencies (Helfat and Peteraf, 2003; Teece *et al.*, 1997; Zahra, Sapienza, and Davidsson, 2006). Basically, this research argues that dynamic capabilities are able to break path dependencies and overcome core rigidities. In fact, a dynamic capability represents a higher-order ability to sense and address a need for change in a firm's competence base (Teece, 2007) threatened by persisting rigidities (Schreyögg and Kliesch-Eberl, 2007). Through sensing and reconfiguring dynamic capabilities provide firms with a new set of knowledge-related tasks which have the potential to impact exit strategies. To illustrate these theoretical thoughts, I point back to my example of the focal new venture whose exploitative business model might have self-destructive consequences. In this context, dynamic capabilities assist the new venture to adapt to the changing developments. Dynamic capabilities aid the focal new venture to acquire the knowledge stocks needed to consider customer preferences and technological changes. Thus, I argue that, collectively combined, dynamic capabilities enhance commercialization which, in turn, affects exit strategies. I conclude that increased commercialization decreases the propinquity toward dissolution, while it increases the tendency toward sell-off due to the signaling value to potential buyers.

HYPOTHESIS (5A): International alliances negatively moderate the relationship between business model exploitation (i.e. MD&L alliances) and exit via dissolution.

HYPOTHESIS (5B): International alliances positively moderate the relationship between business model exploitation (i.e. MD&L alliances) and exit via sell-off.

The figure below summarizes the conceptual framework and illustrates the hypotheses.

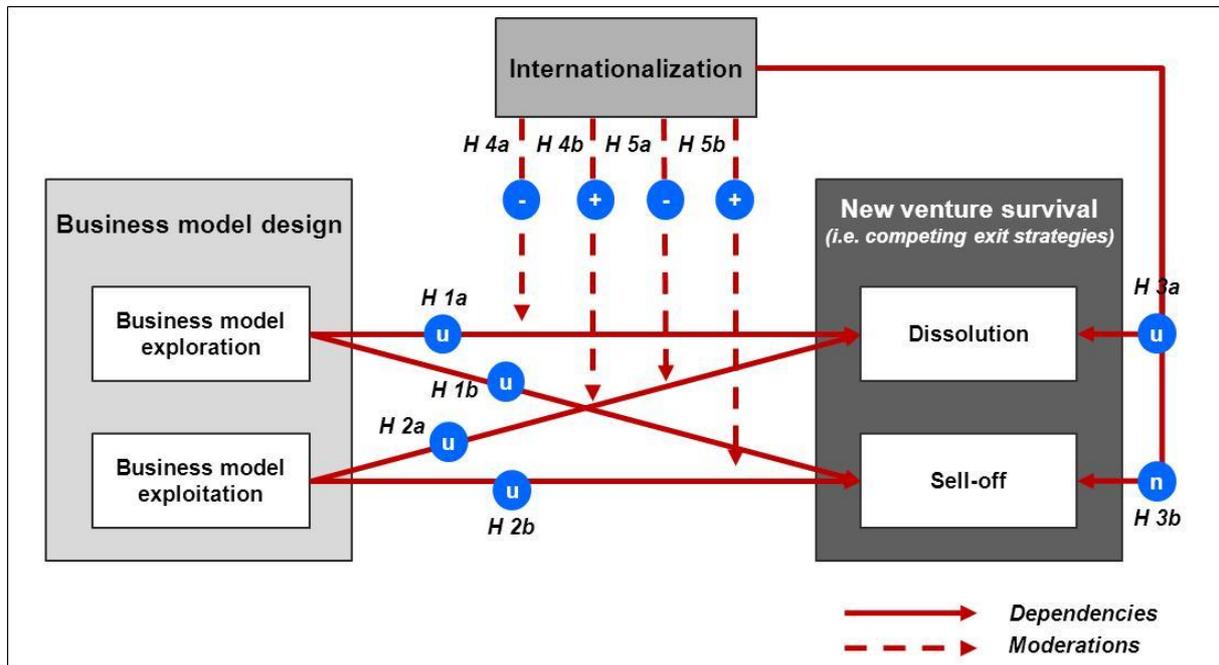


Figure 9: Conceptual framework and hypotheses of the third research study.

5.4 Methodology

5.4.1 Research setting: the German biotechnology industry

The setting used for the purpose of this study is composed of the entire population of German biotechnology firms (in total 1,167 firms) founded in 1996 or thereafter. I examine this setting until 2009, when 528 German biotechnology firms were still existent. Compared to the U.S., the German biotechnology industry did not exist prior to the mid-1990s (Casper, 2000). This was due to a hostile regulatory environment for genetic research throughout the 1980s and early 1990s. However, in the mid-1990s, the German government introduced a series of new technology policies designed to organize the development of innovative technologies and start-ups (Al-Laham and Amburgey, 2011). As a result, in 1997, a new stock exchange (“Neuer Markt”) was created that favored young start-ups by applying substantial lower listing requirements than those existing for the main stock market. Collectively combined, those institutional changes have led to a dramatic increase in the numbers of German biotech start-ups, most of which are located in regional clusters (“Bio-Regio”) around universities and public research institutes (Al-Laham and Souitaris, 2008). Thus, it is obvious that my sample is composed of new ventures, as the bulk of firms in my sample represent young and small start-ups thriving for innovative offerings.

Firms operating in biotechnology rely on knowledge extensive capabilities transforming scientific know-how in products (Powell *et al.*, 1996; Hagedoorn, 2002). Thus, commercialization heavily depends on core competencies dealing with scientific discoveries (Amburgey *et al.*, 2008). For such a business model to be successful, partnering is indispensable in order to source specialized knowledge from external institutions, such as universities. As a result, by today, biotechnology firms are engaged in multiple simultaneous exploration and exploitation alliances with local and international partners (Amburgey *et al.*, 2008). In fact, biotechnology has been identified as the industry with the greatest partnering affinity among several industries characterized

by high alliance activity (Hagedoorn, 2002). As such, the setting is best suitable to analyze the impact of business model design and internationalization conceptualized as different types of strategic alliances on new ventures' exit strategies.

5.4.2 Data

I use the following primary sources to compile the sample. The first data source is the daily (de)registration records of the German Commercial Register ("Bundeszentralregister") in Berlin. In addition, I use the "Yearbooks of the German Biotechnology Industry" published yearly by the German company Biocom AG. The "Yearbook of the German Biotechnology Industry" is a collection of firm-specific information gathered from an annual survey of all organizations in the field of biotechnology. The addresses from this source were used to identify the geographic location of the firms, their age as well as the number of employees. The third source is archival data coded from the monthly TRANSCRIPT newsmagazine that reports on the German biotech industry. Prior research on this data base has been published already (Al-Laham and Souitaris, 2008; Al-Laham and Amburgey, 2009; Al-Laham and Amburgey, 2010; Al-Laham and Amburgey, 2011).

These data were used to construct an event history for each company. Event histories are data structures that include information on the number, timing and sequence of the events that are being examined. My variables constructed from the event histories are measured to the day. For example, my alliance variables (e. g. different types of alliances) are accurate to the day that the agreement is signed. Each firm's history began at the time of its incorporation or qualification to do business and ended at the time of an event or at the end of the month, whichever came first. The organization's second spell began on the following day and ended at the time of an event or the end of the month. This pattern continued until the firm exited (through failure or acquisition) or until the end of the observation period where spells were coded as "right censored." This procedure that has already been described in Al-Laham and Souitaris (2008) allowed time-varying covariates to be

updated throughout the firm's history at monthly intervals. In those cases where only the month and year of an event could be determined, the day was set at the midpoint of the month to minimize errors in timing.

5.4.3 Measures

5.4.3.1 Dependent variables

To study competing exit strategies I employ a hazard model where I consider the time until the two types of exit as a nonnegative random variable t . A basic concept for this analysis is the hazard rate $\lambda(t)$. The rate is defined as

$$\lambda(t) = \lim_{\Delta t \rightarrow 0} [q(t, t+\Delta t)/\Delta t]$$

where q is the discrete probability of the firm dissolving the business or selling it off between t and $(t+\Delta t)$, conditional on the history of the process up to time t . This rate summarizes the information on the intervals of time between successive events, with higher values of the rate corresponding to shorter times between events and vice versa. In line with prior research I measure dissolution as closure as a consequence of bankruptcy (Decker and Mellewigt, 2007; Cefis and Marsili, 2012), while I measure sell-off as M&A (Decker and Mellewigt, 2007; Cefis and Marsili, 2012).

I am interested in the factors that influence dissolution or sell-off because there are important economic differences between different forms of exit (Scharf, 1991). I model this event series as a stochastic point process (Amburgey, 1986). The rates $\lambda(t)$ were each specified as an exponential function of the independent variables and a set of parameters capturing the effects of the variables on the rate of events such that:

$$\lambda(t) = \exp(\beta X_t)$$

In particular, I estimate a competing risks model that enables the pursuit of two aims: (1) to analyze the factors that influence the probability of an event occurring (in my case the event is firm exit);

(2) to distinguish the effects of these factors on the event resulting from different modalities (dissolution vs. sell-off) (Cefis and Marsili, 2012).

Parameters were estimated using maximum likelihood with the STATA 12 program. The estimation procedure clustered observations by firm to reduce the impact of unobserved firm-specific effects (White, 1982). The significance levels of the parameters were evaluated by examination of t-ratios, whereas the goodness-of-fit of the different models was evaluated by examination of likelihood ratio statistics.

5.4.3.2 Independent and moderating variables

I regard business model exploration and exploitation as two distinct dimensions implying differing learning behaviors, rather than as two ends of a continuum (He and Wong, 2004; Katila and Ahuja, 2002). Given the significance of strategic alliances for high technology new ventures' business model, I measure the extent to which firms pursue business model exploration as the cumulative count of R&D alliances. In turn, I measure business model exploitation as the cumulative count of MD&L alliances.

In addition, as I conceptualize new venture internationalization as international embeddedness (see e.g. Al-Laham and Souitaris, 2008), I measure it as the cumulative count of all ties with foreign partners.

5.4.3.3 Control variables

I include as controls a number of variables known or expected to affect the likelihood of exits but not included in my hypotheses. These compose of attributes that take effect at both the industry- and the firm-level. My single industry study design helps us to control for environmental variances. I include traditional predictors of new venture survival like size, age, research and development expenses and the time variable quarter to account for time variance in my analysis.

5.5 Results

Concerning my independent variables, overall the collected data contain 1,750 strategic alliances ranging from research and development alliances, over marketing and distribution alliances, to licensing and production alliances. Out of the 1,750 strategic alliances, I find 880 research and development alliances and 521 marketing and distribution alliances, with 901 alliances having at least one international partner. With regard to my depended variable, I found 195 dissolution and 373 sell-off events.

Table 1 reports descriptive statistics including means, standard deviations, minimum and maximum values for all variables. Table 2 provides Spearman’s rank correlation coefficients for all variables.

Variable	Observation	Mean	Std. Dev.	Min.	Max.
Age firms	54741	19.6972	22.32226	0	341
Size	54741	49.73	321.43	0	13,139
R&D expenses	54741	673056.4	2.91e+07	0	5.00e+09
Quarter	54741	87.47582	14.59453	0	115
R&D Alliances	54741	.0825707	1.116512	0	45
M&D Alliances	54741	.0337772	.5372589	0	25
Intern. Partners	54741	.1925065	2.371188	0	74

Table 9: Descriptive statistics of the third research study.

	Age firms	Size	R&D expenses	Quarter	R&D Alliances	M&D Alliances	Intern. Partners
Age firms	1.0000						
Size	0.1599*	1.0000					
R&D expenses	-0.0541*	0.1624*	1.0000				
Quarter	-0.1719*	-0.3203*	-0.2688*	1.0000			
R&D Alliances	-0.0555*	0.0524*	0.0191*	-0.0229*	1.0000		
M&D Alliances	-0.0363*	0.0227*	0.0148	0.0230*	-0.0198*	1.0000	
Intern. Partners	-0.0434*	0.0597*	0.0180	0.0188*	0.3539*	0.4139*	1.0000

Table 10: Correlation matrix (*p<0.05) of the third research study.

Table 3 provides the results of my competing risk model to explain new ventures' competing exit strategies. Herein model 2 is the full model – including controls, independent variables, and moderating variables – that analyzes exit by dissolution. Model 4 is the full model that tests the effects on exit by sell-off. I test my hypotheses on both full models.

Model 2 shows that with increasing size in terms of employees new ventures tend to survive indicated by a decreased dissolution rate ($\beta = -0.043$, *** $p < 0.001$). Also, it shows that new ventures' tendency towards dissolution declines with increasing age ($\beta = -0.231$, ** $p < 0.01$). Model 4 shows that new ventures' sell-off rate decreases with increasing size ($\beta = -0.001$, * $p < 0.05$) and age ($\beta = -0.043$, *** $p < 0.001$).

Apart from these general results, I can report findings that concern the derived hypotheses. With regard to exit by dissolution, data show that the root term for R&D alliances is highly significant and negative ($\beta = -15.77$, *** $p < 0.001$), while the squared term is highly significant and positive ($\beta = 0.43$, *** $p < 0.001$) indicating a u-shaped link. Thus, hypothesis (1A) is supported by the data. Findings also show that MD&L alliances have an impact on new venture's exit by dissolution indicated by a negative and highly significant root term ($\beta = -16.26$, *** $p < 0.001$) and a positive and highly significant squared term ($\beta = 0.63$, *** $p < 0.001$). Thus, I can confirm hypothesis (2A) assuming a u-shaped relationship. In addition, the root term for international alliances is highly significant and negative ($\beta = -14.38$, *** $p < 0.001$), while the squared term is highly significant and positive ($\beta = 0.24$, *** $p < 0.001$) indicating a u-shaped relationship. Hence, I can confirm hypothesis (3A). It is obvious from the data that international alliances negatively affects the relationship between MD&L alliances and a new venture's tendency towards dissolution ($\beta = -0.03$, *** $p < 0.001$) which confirms my hypothesis (4A). My hypothesis (5A) assumed a negative moderating effect of international alliances on the relationship between MD&L alliances and new venture's exit by dissolution. Based on the empirical evidence of my data, I have to reject this hypothesis. The linear interaction term is highly significant and positive ($\beta = 0.37$, *** $p < 0.001$).

Concerning exit by sell-off, data show that the root term for R&D alliances is highly significant and negative ($\beta = -29.45$, $***p < 0.001$), while the squared term is highly significant and positive ($\beta = 0.80$, $***p < 0.001$) indicating a u-shaped link. Thus, hypothesis (1B) is supported by the data. The findings also show that MD&L alliances have an impact on new venture's exit by sell-off indicated by a negative and highly significant root term ($\beta = -32.80$, $***p < 0.001$) and a positive and highly significant squared term ($\beta = 1.05$, $***p < 0.001$). Thus, I can confirm hypothesis (2B) assuming a u-shaped relationship. In addition, the root term for international alliances is highly significant and positive ($\beta = -1.24$, $***p < 0.001$), while the squared term is highly significant and negative ($\beta = -0.77$, $***p < 0.001$) indicating an inverted u-shaped relationship. Hence, I can confirm hypothesis (3B). It is obvious from the data that I have to reject hypothesis (4B) due to a positive, yet insignificant moderating effect of international alliances. My hypothesis (5B) assumed a positive moderating effect of international alliances on the relationship between MD&L alliances and new venture's exit by dissolution. Based on the empirical evidence of my data, I can confirm this hypothesis. The linear interaction term is highly significant and positive ($\beta = 0.29$, $***p < 0.001$). I discuss my findings and their implications below.

RESEARCH STUDY III: BUSINESS MODEL DESIGN, INTERNATIONALIZATION, AND COMPETING EXIT STRATEGIES

	Model 1	Model2 (Exit dissolution) by	Model3	Model4 (Exit by sell- off)	Model5 (pooled)
Age firms	-.02170228**	-.02314039**	-.04616034***	-.04422346***	-.04384677***
	.00793088	.00810264	.00978123	.01071721	.00715923
Size	-.00478056***	-.00427162***	-.00020211	-.00097823*	-.00340645***
	.00137783	.00128807	.00022411	.00045097	.00100887
R&D expenses	1.567e-09	1.552e-09	4.239e-10	6.887e-10	-4.415e-08
	1.403e-09	1.041e-09	1.729e-09	1.667e-09	3.433e-08
Quarter	-.04320256***	-.04273099***	-.04136608***	-.04360604***	.00862311
	.00192255	.00191043	.00220479	.00225089	.00411779
R&D Alliances		-15.770249***		-29.454207***	-15.214625
		.14253951		.32546229	644.41199
R&D Alliances sward		.4280076***		.80225803***	.41612908
		.00406157		.00903684	17.934023
M&D Alliances		-16.255239***		-32.796177***	-17.326776
		.16942424		.64027707	1204.1771
M&D Alliances sward		.62604631***		1.0467901***	.52106106
		.00694364		.02600875	100.64508
Intern. Partners		-14.377784***		1.2449298***	.8800933***
		.17185413		.18090716	.08403123
Intern. Partners sward		.23947975***		-.07744583***	-.05431803***
		.00292264		.02311442	.00942185
Interaction R&D x Intern.		-.03052424***		-.02519345	-.00179049
		.00102793		.02523129	2.5518075
Interaction M&D x Intern.		.03745569***		.28747055***	.1836057
		.00143881		.05227183	72.990113
Constant					-13.876927***
					.41489069
Statistics					
chi2	521.21924	23637.775	365.88999	20351.816	301.34098
df	4	12	4	12	12
N	29032	29032	29032	29032	29032
aic	5131.9914	5118.046	2782.6285	2580.2508	4393807
bic	5165.0961	5217.3599	2815.7331	2679.5646	4501.397

*Legend: coefficient / (standard error); * p<0.05; ** p<0.01; *** p<0.001*

Table 11: Competing risk model of new venture exit.

5.6 Discussion and conclusion

5.6.1 Discussion and theoretical implications

5.6.1.1 Influence of business model design on new ventures' exit strategies

Empirical evidence indicates that business model design, which I conceptualize in terms strategic alliances, affect new ventures' exit strategies. I conceptually link business model design to the exploration-exploitation framework (March, 1991). I show that the two different business model designs that a new venture can pursue – explorative and exploitative business models – impact exit by dissolution and exit by sell-off. In fact, data illuminate that at low and moderate levels of explorative and exploitative business models the new ventures' tendency toward dissolution and sell-off decreases, whereas at high levels their propensity increases. I explain these findings below, thereby referring to my conceptual framework drawn on the knowledge-based view.

I argue that new ventures that are able to acquire additional technological and commercial knowledge stocks through learning from their external R&D and MD&L partners are able to generate innovation and commercialization. As a result, they are able to survive indicated by a decreasing dissolution rate. However, my results also point toward the downside of knowledge acquisition through learning. In fact, it is obvious from the data that too much emphasis on knowledge acquisition results in detrimental effects on innovation, commercialization, and survival chances. Due to their limited cognitive capacity new ventures are not able to assimilate and absorb massive amount of knowledge from external partners. Thus, at intensively high levels of explorative and exploitative business models they tend toward exit by dissolution.

In addition, I ascribe the u-shaped impact of explorative and exploitative business models on exit by sell-off to the value the new ventures' knowledge base signals to potential acquirers. I argue that only if knowledge is aimed to be accessed by the acquiring firm and is able be transferred from the new venture to the acquiring firm, new ventures that are signaling knowledge are likely to

become M&A targets (Coff, 1999; Ahuja and Katila, 2001; Ranft and Lord, 2002; Capron and Mitchell, 2004). In this regard, I assume and show that low and moderate levels of explorative and exploitative business models generate only local technological and commercial knowledge. The latter do not signal enough attractiveness for new ventures to being acquired by potential buyers (i.e. decreasing sell-off rate). However, with ever increasing knowledge flows the new venture becomes ever more important as M&A target indicated by an increase of the sell-off rate.

5.6.1.2 Direct influence of internationalization on new ventures' exit strategies

Moreover, my results indicate that internationalization, which I conceptualize in terms of international strategic alliances, affect new ventures' exit strategies. On the one hand, empirical evidence shows that at low and moderate levels of internationalization new ventures' tendency toward dissolution decreases, while it increases at high levels of internationalization. Theoretically, I ascribe this to the interplay of knowledge-related opportunities and challenges of international partners. At low levels of internationalization the existence of heterogeneous knowledge enriches the possibility of new knowledge combinations and enhances innovation and commercialization. This, in turn, assists new ventures to survive indicated by a decreasing dissolution rate. In contrast, at high levels of internationalization cultural differences restrict the ability of new ventures to access and assimilate knowledge and to leverage innovation and commercialization. As a consequence, the latter result in an increasing dissolution rate.

On the other hand, data indicate that at low and moderate levels of internationalization new ventures' tendency toward sell-off increases, while it decreases at high levels of internationalization. I ascribe this to the distant and tacit nature of internationalization knowledge that new ventures acquire from their international partners. As internationalization knowledge assist new ventures to overcome local search for innovation and commercialization, they signalize knowledge-based value to acquirers. As internationalization knowledge is difficult to transfer due to

its tacitness, such signaled knowledge-related value is restricted to a certain amount of internationalization knowledge. Thus, I can explain the inverted u-shaped relationship between internationalization and exit by sell-off.

5.6.1.3 Moderating influence of internationalization on new ventures' exit strategies

Finally, data confirm the importance of internationalization as moderating the relationships between business model design and new ventures' exit strategies. Dynamic capabilities that I conceptualize as a byproduct of early internationalization assist new ventures, which pursue an explorative business model, in leveraging more knowledge and subsequent innovation from their R&D alliances. This results in higher survival chances indicated by a lower dissolution rate. However, the positive effects of dynamic capabilities do not hold for new ventures pursuing an exploitative business model. Data show that dynamic capabilities positively moderate the relationship between MD&L alliances and dissolution. This implies that the more commercialization new ventures leverage from their MD&L alliances the lower their survival chances. In explaining this finding, I argue that new ventures operating in high technology industries such as biotechnology do not benefit from exclusively focusing on downstream activities, thereby leaving aside their traditional core competencies being in upstream activities, in particular in R&D (Rothaermel and Deeds, 2004).

Opposed to my hypothesis (4B), empirical evidence does not show a positive moderating effect of dynamic capabilities on the relationship between R&D alliances and the sell-off rate. By contrast, there is a negative, yet not significant effect. Evidently, dynamic capabilities do not signalize value to acquirers, but rather deter them from buying the new venture. I argue that this is due to the fact that dynamic capabilities are tacit knowledge-related tasks that are difficult to formalize and communicate, and can only be acquired through practical experience in the relevant context, i.e. 'learning-by-doing' (Lam, 2000). As such, they do not add any value to potential

acquirers. Thus, I can explain the negative moderating effect on the R&D – sell-off link. As potential buyers are large pharmaceutical and chemical incumbents, they have practical experience in commercialization. As a consequence, they know how to deal with tacit dynamic capabilities that aim to leverage commercialization knowledge from MD&L alliances. Thus, empirical evidence confirms hypothesis (5B) assuming a positive moderating effect on the MD&L – sell-off rate.

5.6.2 Managerial implications

This paper has implications for entrepreneurs and managers of new ventures aiming at generating performance and increasing market success. In this regard, new ventures can generate success, by avoiding dissolution or by selling off their operations to an acquirer (Freeman, Carroll, and Hannan, 1983; Headd, 2003). Based on the empirical evidence of this study I can recommend entrepreneurs and managers how they should design their business models and pursue their internationalization activities in order to be successful. On the one hand, empirical evidence indicates that new ventures should pursue moderate levels of explorative and exploitative business models. New ventures should form strategic alliances with a moderate number of R&D, MD&L, and internal partners. I have shown that such a moderate configuration provides the most promising survival chances. By contrast, with ever increasing numbers of partnerships new ventures' tendency toward dissolution ever increases. On the other hand, empirical evidence shows that with increasing specialization of their business model new ventures can enhance their attractiveness as M&A targets. However, this results in lower survival chances. When considering both exit strategies simultaneously, I recommend new ventures to have balanced business model designs (i.e. moderate level of exploration/exploitation) and pursue a moderate internationalization. Such a configuration creates combinations of business and internationalization knowledge that has the best chances for generating success, by avoiding dissolution or by selling off their operations.

5.6.3 Limitations and avenues for further research

There are two limitations of my study that need to be emphasized. First, I did not take into account restructuring as a potential third type of exit strategies proposed in prior research (Cefis and Marsili, 2012). However, I wanted to contrast the two main important exit strategies suggested in extant literature (Decker and Mellewingt, 2007). In addition, the generalizability of my results could also be challenged, as the sample represents a single industry (biotechnology) in one country (Germany). However, there is prior evidence that research results from the biotechnology industry are generalizable to other high-technology industries such as semiconductors (Almeida, 1996; Coombs *et al.*, 2006).

Further research should take on the effort and analyze the determinants of different exit strategies. Sticking to a homogeneous picture of exit is not realistic. As I live in a business world which is ever increasing in complexity, research should further investigate the determinants that drive different exit strategies.

6 CONCLUSION

The following chapter will complete this dissertation. To that end, section 6.1 will provide a short summary of the findings. Additionally, in section 6.2, I will present the theoretical contributions of this piece of work, followed by its managerial implications provided in section 6.3. Finally, section 6.4 will report on the limitations and identify some avenues for further research.

6.1 Summary of findings

Overall, this dissertation examines how firms can strategically restructure 1) through engaging in alliances, alliance portfolios, and networks; 2) through business model design; and 3) through developing dynamic capabilities to improve their strategic performance in terms of innovation, vertical integration, and survival. Empirical evidence is derived from a longitudinal analysis of the entire population of the German biotechnology industry between 1996 and 2009. In order to answer that overall research question, I have conducted three individual research studies.

The first research paper aims to explain how alliance portfolio configurations and alliance portfolio capabilities impact new venture innovation performance. I am able to show that for new ventures homogeneous alliance portfolio configurations enhance innovation. Also, I find that portfolio capabilities per se do not certainly assist new ventures in enhancing innovation, as increasing portfolio capabilities also increase complexity. Furthermore, I surprisingly do not find an interaction effect between configuration and capabilities on innovativeness. Thus, I can emphasize the importance of alliance portfolio configurations and capabilities per se.

The second research paper examines how multi-level network partner configurations and absorptive capacity influence the expansion of vertical integration. I am able to show that the expansion of vertical integration is a firm's purposeful strategy to access knowledge in the light of unfavorable multi-level network partner configurations. In fact, I find that ego-network partners' international diversity and regional network partners' research munificence negatively affects the

expansion of vertical integration. In addition, I show the significance of absorptive capacity per se and as moderating effect for the expansion of vertical integration.

The third research paper aims to explain how business model design and internationalization impact new ventures' competing exit strategies. I am able to show that knowledge stocks acquired through organizational learning triggered by business model design and internationalization affect new ventures' decision over whether to dissolve a business or sell it off to another company.

6.2 Theoretical contributions

In the following, I will outline the main contributions of the overall dissertation and its three research studies. Overall, I have established a new angle of restructuring that overcomes the weaknesses of existing restructuring research. Although the financial focus of prior restructuring research has enriched our understanding of how firms can strengthen their operational effectiveness, every solely financial approach overlooks central aspects of value creation at the business unit level (Chakravarthy, 1986) and is inadequate to account for strategic positioning and competitive advantage. Strategic restructuring takes the competitive strategy perspective that single-business firms and business units can apply for improving their strategic positioning and achieving competitive advantage. As such it represents a new and so far neglected perspective of restructuring. Additionally, from a theoretical perspective, strategic restructuring is important, as it integrates constructs that have been emphasized recently in the strategic management literature (Lavie, 2007; Zott and Amit, 2008; Teece, 2007).

The first research study mainly contributes to the alliance portfolio literature. In fact, I extend the alliance portfolio literature, by merging configurational and managerial drivers of innovation in portfolios that were always analyzed separately (Wassmer, 2010). As such, I can satisfy the call for moderators in papers dealing with alliance portfolio configuration, as not all firms benefit equally from certain portfolio configurations (Schilke and Goerzen, 2010; Schilling and Phelps, 2007). In particular, I am able to contribute to current literature dealing with alliance

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portfolio configuration, by showing that the established positive relationship between alliance portfolio diversity (Baum *et al.*, 2000; Powell *et al.*, 1996; Silverman and Baum, 2002; Watson, 2007; Bruyaka and Durand, 2012; Wuyts and Dutta, 2012) and innovation performance becomes reversed for new ventures. Based on their inability to handle flows of diverse knowledge, I show that the implicit assumption according to which firms can readily assimilate incoming external knowledge does not hold for new ventures. Hence, for new ventures designing a homogeneous alliance portfolio is an innovation enhancing strategy. In addition, I can advance the literature on alliance portfolio capabilities. I show that new ventures may not have enough alliance experience for it to have a real performance impact. In addition, increasing portfolio capabilities also increases complexity and because new ventures are small they may not be able to appropriate all the knowledge co-created in the alliance portfolio.

The second research study mainly contributes to the vertical integration literature. Despite the wide incorporation of network embeddedness in strategic management (e.g. Ahuja, Polidoro, and Mitchell, 2009; Gulati, Nohria, and Zaheer, 2000; Polidoro, Ahuja, and Mitchell, 2011; Wang and Zajac, 2007), vertical integration research has widely neglected the network perspective so far. To my knowledge, there are only two exceptions in prior research which include the network-level to explain mechanisms driving firms' vertical integration decisions, in particular M&A (Lin, Peng, Yang, and Sun, 2009; McEvily and Marcus, 2005). I further develop this emerging research stream. In particular, I show that the expansion of vertical integration is a firm's purposeful strategy to access knowledge in the light of unfavorable network partner configurations. Thereby, I assist to draw a more realistic picture of vertical integration strategy being embedded in social behavior rather than being conducted in an atomistic context.

The third research study contributes to both the exit literature and the M&A literature. The bulk of existing exit studies have only focused on one exit strategy, thereby overlooking the fact that there are different exit strategies. So far there are only four studies that analyze firm exit as a heterogeneous event to account for different exit strategies (Cockburn and Wagner, 2010; Fortune

and Mitchell, 2012; Mitchell, 1994; Cefis and Marsili, 2012). My study contributes to this emerging research stream in order to provide a more realistic picture of exit strategies. In particular, I show that knowledge stocks acquired through organizational learning triggered by business model design and internationalization affect new ventures' decision over whether to dissolve a business or sell it off to another company. Both concepts have been neglected so far in extant literature dealing with different new venture exit strategies. Second, I contribute to the M&A research following the knowledge-based view of the firm that emphasizes the transfer of knowledge from the acquired to the acquiring firm as the main motivation for a takeover (Ahuja and Katila, 2001; Ranft and Lord, 2002; Capron and Mitchell, 2004). In particular, I further elaborate on the specifics of knowledge that drive M&A activities. I am able to develop further the conceptualization or systemization of knowledge offered in existing literature (Eriksson *et al.*, 1997; Polanyi, 1966). In particular, I show how the scope (i.e. local vs. distant knowledge) and nature (i.e. explicit vs. tacit knowledge) of knowledge determines M&A decisions.

6.3 Managerial implications

Overall, strategic restructuring provides single-business firms, such as new ventures, with a set of strategic tools that they can apply to enhance their performance. In particular, I show that strategic restructuring is a means to access external knowledge flows and initiate internal learning processes. The latter are of particular importance for firms operating in high-technology industries, such as biotechnology, semiconductors, or software.

The first research paper implies that new ventures should actively configure and manage their alliance portfolio to access external knowledge flows that, in turn, enhance innovation performance. Specifically, my research implies that new ventures should build a homogeneous alliance portfolio in terms of partners, relational and structural properties. In addition, empirical results show that new ventures benefit from alliance portfolio capabilities – in essence from moderate amounts of capabilities. I recommend that new ventures establish a dedicated alliance

portfolio function. Such a formalized function will be the effective organizational umbrella that supervises the routine-based alliance portfolio capabilities to strengthen knowledge integration and, in turn, innovation.

The second study implies that firms that have problems with accessing knowledge via network partners can expand vertical integration to ensure constant knowledge flows and innovation. To get there firms have to develop specific dynamic capabilities (Teece *et al.*, 1997; Teece, 2007) to manage the dynamic balance between external knowledge access and internal knowledge creation. Also, my results imply that firms should actively build up absorptive capacity to ensure constant flows of knowledge and, in turn, innovation.

The third research paper implies that new ventures have balanced business model designs (i.e. moderate level of exploration/exploitation) and pursue a moderate internationalization. Such a configuration creates combinations of business and internationalization knowledge that has the best chances for generating success, by avoiding dissolution or by selling off their operations.

6.4 Limitations and avenues for further research

Although this dissertation and its constituting research studies have been planned, designed, and implemented thoroughly, three main limitations exist that should not be neglected. First, I focus on three levers of strategic restructuring that the strategic management has greatly emphasized to be important that are 1) alliances, alliance portfolios, and networks; 2) business model design; and 3) dynamic capabilities. Nevertheless, there might be additional concepts that would be suitable as additional levers constituting strategic restructuring, such as business model innovation or strategic renewal. However, overall, I am convinced that the three chosen and examined concepts best characterize the levers of the strategic restructuring concept. However, future research studies could take on the effort and further develop the strategic restructuring concept, thereby integrating additional concepts emerging in the strategic management literature.

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Second, the generalizability of my results could be challenged, as the sample represents a single industry that is biotechnology in one country that is Germany. The biotechnology industry has several unique characteristics, including a long product development and approval cycle, reliance upon often basic research, and a resource-intensive new product development process. Despite these unique characteristics, I believe that the results of this dissertation are generalizable to other industries. In fact, there is prior evidence that research results from the biotechnology industry are generalizable to other high-technology industries, such as semiconductors or software industries (Almeida, 1996; Coombs *et al.*, 2006). However, future research could assess the validity of the examined models, by testing it in different industry settings.

This dissertation relies on a quantitative research design to examine the effects of strategic restructuring on various strategic performance measures. Although this research draws upon knowledge-based theories of the firm, whereby learning phenomena are quite central to the conceptual argumentation, I do not measure processes within the biotechnology firms. Thus, the knowledge-related processes and learning routines that I theoretically explain as being determinants of performance are not examined in-depth. Future research might apply a qualitative research design to disentangle more of the process issues that are raised by this research.

Future papers should take on the effort to continue the holistic approach of this dissertation. In combining extant concepts and constructs from different research streams in one overarching framework, important additional insights can be identified and derived that advance the strategic management field as a whole. Such interdisciplinary knowledge integration can compensate the downside of specialization the research community is encountering over the last decade.

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