Copenhagen
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HANDELSHØJSKOLEN

INTERNATIONAL STRATEGIC ALLIANCES: ALLIANCE PORTFOLIO CONFIGURATION AND FIRM PERFORMANCE

Master´s Thesis, BLC Leadership and Management Studies
Copenhagen Business School

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Number of taps: **97.857**

September 2012

Executive Summary

International strategic alliances are gaining importance as a tool of corporate strategy. This ubiquity of alliances in business practice is reflected in a growing number of studies on that matter. Scholars traditionally focus on either of two major research streams. The first one analyzes the causes for alliance formation, the latter the consequences of it.

However, many large corporations maintain alliances with multiple partners simultaneously. This requires managers and researchers to shift the focus from a single alliance dyad to the alliance portfolio as a whole. A major challenge that stems from this alteration is the question of how to configure such a portfolio. Manifold opportunities concerning the portfolio´s size, diversity, and density exist. Furthermore, scholars' opinions on the ideal alliance portfolio structure vary, due to opposing findings.

This paper aims at shedding more light onto the discussion whether portfolio size has an influence on firm performance. In addition, the study at hand targets to derive further insights on a beneficial degree of density within a portfolio. A multilevel analysis is applied in order to account for the hierarchical structure of the data. Yet, the proposed method fails to present statistically significant results.

Acknowledgments

I would like to express my sincere gratitude to my supervisor Bo Bernhard Nielsen for guiding and supporting me throughout the whole research process. His supervising style allowed me to set an individual focus, and let me work self-directed.

Furthermore, I like to thank Steven Moore, from Queen´s School of Business in Kingston, Ontario, for advising me on technical issues, concerning correct referencing.

In addition, I express thanks to my friends Rasmus Termansen and Thomas Gadeberg for valuable thoughts and ideas on this paper.

Last but not least, I thank my parents Johanna and Wolf- Joachim Rödiger, for their infinite support throughout my whole life. Achieving two Master-titles at the same time would not have been possible without you.

Axel Rödiger

Wiesbaden, September 26, 2012

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Abbreviations

API	Alliance portfolio internationalization
CEO	Chief executive officer
GDP	Gross domestic product
IPO	Initial public offering
LISREL	Linear structural relationship model
M&A	Mergers and acquisitions
MLA	Multilevel analysis
MNE	Multinational enterprise
R&D	Research and development
ROA	Return on assets
SDC	Securities data company
SEC	U. S. Securities and exchange commission
SEM	Structural equation modeling
SIC	Standard industrial classification code

1 Introduction

1.1 Opening

Contemporary business environment, characterized by a global market place and fierce competition, accentuates the importance of valuable business partner affiliations (Parise and Casher, 2003). Yet, many organizations fail to manage "their key partner relationships for long-term value creation" (p. 25). International strategic alliances, aiming at overcoming this deficiency, are a growing practice to organize commercial transactions across institutional and public borders (Nielsen, 2007). This omnipresence of alliances in business practices is reflected in an ever growing stream of research (Gulati, 1998). Traditionally focusing on the dyad (Wassmer, 2010), scholars analyze the causes for and consequences of alliance formation. Though, alliances compete with each other for scarce resources (Parise and Casher, 2003). Thus, the ramifications of a single dyad should not be seen isolated when organizations maintain several alliances simultaneously. For practitioners and researchers alike the focus on the alliance portfolio as the unit of analysis raises vital concerns to consider (Wassmer, 2010). Indeed, allying with different partners bears several opportunities. Organizational learning, creation of synergies through pooling of complementary skills, and access to best practices are amongst them (Inkpen, 2005). However, portfolios are difficult to manage, due to the discrepancies in aspirations of independent organizations (Nielsen, 2007). Therefore, many alliance portfolios are beset with instabilities and experience subpar performance (Beamish and Delois, 1997; Harrigan, 1985 cited in Nielsen, 2007, p. 338).

One of the major challenges in managing an entire portfolio is its configuration. Multitudinous alternatives exist concerning the portfolio´s size, density, and diversification. Aggravating the decisions, which need to made, is that scholars opinions differ, due to controversial findings. The

present study aims at contributing to the question which alliance portfolio configuration can be seen as advantageous.

1.2 Research questions

The following research questions guide this thesis.

1. How does an international alliance portfolio´s size impact firm performance?
2. What degree of an international alliance portfolio´s density is more beneficial towards firm performance?

1.3 Expected contribution

International strategic alliances are of growing importance for corporate strategies. This is well reflected in an increasing field of research. However, scholars defend opposing views on what benefits can be derived from alliances. This master thesis is expected to make certain valuable contributions to contemporary strategic alliance research.

First, the study aims at providing additional evidence on the influences of alliance portfolio size on firm performance. Second, the present paper is expected to take a stand for either perspective in the discussion about alliance portfolio density. Furthermore, an objective standpoint derives due to the application of reliable secondary data.

Through a thorough presentation of the most important discoveries of the field, the present study serves as a source of information for interested, yet, uninformed readers. This can encourage future (master) students to explore this interesting field of research, which covers strategy, supply chain management, project management, finance, culture, and internationalization. But not only scholars and students profit from reading. Managers, who need to make important decisions when setting up an alliance portfolio, can draw conclusions from the findings.

Traditionally strategic alliance research has been conducted in the pharmaceutical/biotech or software industries. The paper in hand applies knowledge on and aims at drawing it from the manufacturing industry, which is an important pillar to almost every economy worldwide.

Finally, potential future research opportunities are identified and presented in order to contribute to the further development of the field.

1.4 Structure of the thesis

This paragraph provides a general idea about the structure of this thesis. Each chapter is summarized in brief to give the reader an idea what can be expected.

Chapter 1 Introduction: The introduction sets the stage for the following analysis. It provides an initial insight into international strategic alliance research. Furthermore, the guiding research questions and the expected contribution of this paper to the field of strategic alliance research are stated here. The chapter concludes by summarizing the structure of the present paper.

Chapter 2 Literature review: The literature review summarizes and presents contemporary strategic alliance research. Besides, it introduces the two major streams of research in the field.

The first focuses on the causes for alliance formation, the second on how alliance portfolios are configured in the most appropriate way. Opposing views of ideal alliance portfolio configuration are presented.

Chapter 3 Method: The topic of chapter three is the applied method. First, the process of data collection is explained. Second, the different variables are introduced and their operationalization is elucidated. Third, the most adequate statistical model is presented and legitimated against alternative approaches.

Chapter 4 Results: Chapter four describes the results of descriptive and inductive statistics. The results of a frequency distribution and a multiple regression analysis are provided to get an initial idea about consistencies within the data. Yet, the most suitable method of statistical analysis is the multilevel analysis. The results of the multilevel analysis (model 1) are presented in this chapter. The results for model two, which serves as a robustness test, can be found in the appendix.

Chapter 5 Conclusion and discussion: The final chapter attempts to make sense of the results. In order to explain why the results are as they show, and what that means for the strategic alliance research. However, the interpretation is based on findings of prior studies due to statistically not relevant results. Furthermore, paragraphs about the limitations of this paper and their classification into the respective field of research, as well as an identification of possible future research opportunities are presented.

2 Literature Review

The purpose of this chapter is to provide a general idea of the existing research stream on strategic alliances. The most important studies and their findings are presented, which will help the reader to get an understanding of the current knowledge and about contemporary discussions amongst academics. Furthermore, this chapter establishes a vocabulary which is crucial to understand the following analysis. After presenting different definitions of alliance and alliance portfolio, the two major streams of research of the field are introduced. The first one focuses on why organizations form alliances, the latter on how they do it and what benefits arise.

2.1 Definition: Alliance Portfolio

Strategic alliances are nowadays an ubiquitous occurrence (Gulati, 1998; Bamford and Ernst, 2002). Establishing, managing, and exploiting alliances has become a task that is crucial to an organization´s strategic efforts. Indeed, many large firms maintain hundreds of them at the same time (Anand and Khanna, 2000). As a result these firms face the challenge to manage not only one alliance but an entire alliance portfolio (Hoffmann, 2005, 2007). However, before introducing the major streams of research it is necessary to establish a common understanding of what a strategic alliance and an alliance portfolio is.

In general scholars´ definition of strategic alliances are comparable. Gulati (1998) defines them as “voluntary arrangements between firms involving exchange, sharing, or codevelopment of products, technologies, or services” (p. 293). This definition will be applied throughout the following study. Bamford and Ernst (2002) provide a similar definition. For them “[…] the term "alliances" refers to a broad range of collaborative arrangements involving shared objectives; shared risk, reward, or both; and a significant degree of coordination or integration. Alliances

involve more shared decision making than do arm's-length contracts and lack the full control and integration of mergers and acquisitions" (p. 29).

On the contrary, definitions of alliance portfolio differ, depending on the theoretical lens researchers apply when analyzing alliance networks (Wassmer, 2010). The approach, probably the widest spread, to define an alliance portfolio is the ancillary angle, which means "viewing an alliance portfolio as the aggregate of all strategic alliances of a focal firm" (Wassmer, 2012, p. 142). Hoffmann (2007) follows this approach and considers "[…] all the alliances that the observed company has" (p. 828) in his study. Marino et. al. (2002) use the same approach and focus on "multiple strategic alliances" (p. 145). So do Ozcan and Eisenhardt (2009), who contemplate "a set of direct ties" as definition for a focal firm´s "egocentric network" (p. 246).

Scholars who focus on organizational learning through alliances usually either include past alliances or solely focus on them. Simonin (1997) is an example for the prior. He uses "[…] current (at least one year old) or the past but recent (terminated less than three years ago) international strategic alliances" (p. 1160). Hoang and Rothaermel (2005) as well as Anand and Khanna (2000) are examples for the latter. Both papers focus on alliances, which, at the time of the study, were built and managed in the past.

Furthermore, the way an alliance portfolio definition is operationalized impacts the study´s explanatory power. Including or excluding certain types of relationships may create a biased sample. Reuer and Ragozzino (2006) for example only include equity joint ventures of US firms with foreign partners. Thus, they exclude domestic alliances and those that have a different governance structure.

Moreover, in order to clearly define an alliance portfolio, it is necessary to define the level of analysis. Does a network include all alliances of a business unit or of the corporation as a whole? Hoffmann (2007) for example analyses two business units of Siemens in order to test his hypotheses. Contrary, Gulati and Gargiulo (1999) try to find out what triggers organizations to form alliances. Hence, the level of analysis is the corporation as a whole.

In addition, there is no consistent vocabulary amongst strategic alliance researchers. Some use the term alliance portfolio (Lavie, 2007), whereas others use different terms. Gomes-Casseres (1994) calls them networks or alliance groups, and Vanhaverbeke and Noorderhaven (2001) call them alliance blocks. In the following the terms will be used interchangeably if not otherwise noted.

2.2 Reasons for Alliance Portfolio formation

One major stream of studies in the field of international strategic alliances tries to identify the reasons why firms establish relationships with other organizations. The motivations, which are presented in several studies, are manifold. Reasons like gaining access to resources (Ahuja, 2000b; Das and Teng, 2000), the reduction of transaction costs (Kogut, 1988), organizational learning (Lorenzoni and Lipparini, 1999; Inkpen, 2000), improving the focal firm´s competitive position (Lavie 2006; Nielsen, 2003), or the position within an existing network (Gulati, 1995; 1999) are amongst them and will be introduced in the following sections.

2.2.1 Access to resources

Eisenhardt and Schoonhoven (1996) argue that firms in strategic vulnerable positions, such as operating in highly competitive markets, following an innovative strategy, or being faced to emergent-stage markets, tend to form alliances at higher rates than those which are not. This is probably due to the fact that in such situations additional resources, e.g. technical know-how, cash, and legitimacy, would provide a competitive advantage. In addition, the findings reveal that sample firms, which maintain only few alliances, have only few resources. The authors assume that this is either due to a lack of interest in the formation of alliances, or a reduced attractiveness to potential partners. The latter leads to the assumption, that it requires resources to get access to new ones. However, Eisenhardt and Schoonhoven (1996) also suggest that alliance formation is not only a result of rational calculus. Social aspects like skills, status, and past relationships of the top-management team also play a vital role. Hence, organizations with large top-management teams, which are experienced and well connected, tend to form alliances at higher rates.

Das and Teng (2000) support the argument that pooling resources together produces a value creation potential. Many resources, tangible and intangible assets, a firm possesses, are neither perfectly mobile nor imitable, thus they are firm-specific. Every firm´s competitive position is determined by the set of unique resources and relationships it owns. In other words, what a firm will accomplish is strongly influenced by its resources. Hence, a firm can enhance its performance through access to diverse resources.

Additional advocates for the argument that rather firm internal resources drive alliance formation are Chung, Singh, and Lee (2000). In their study they analyze the factors, which influence U.S. investment banks to form strategic alliances. Three arguments could be verified to have a significant impact: resource complementarity, status similarity, and social capital. Regarding

resource complementarity the results indicate that leading investment banks prefer to ally with partners who can balance their weaknesses. By pooling resources together synergies can be generated, this opportunity, in turn, enhances the likelihood of alliance formation. Status similarity leads to higher rates of alliance formation because status is seen as a signaling role in interorganizational interactions (Podolny, 1994 cited in Chung, Singh, and Lee, 2000, p. 19). Furthermore, a similar status shows investment banks that operating mechanisms are compatible and reduces free-riding problems. Finally, "[…] social capital explained a substantial amount of the variance in the chances of alliance formation. Organizations tend to reciprocate what they have received in the past and rely on their social capital for handling market uncertainty" (Chung, Singh, and Lee, 2000, p. 19). These results show that firm´s tangible and intangible assets play an important role in the development of alliances. Furthermore, the importance of intangible assets (status and social capital) increases with increasing market uncertainty.

A firm´s set of assets as described above aims at a characteristic, which Ahuja (2000b) analyses as well, namely organization´s attractiveness on the alliance partner market. Ahuja (2000b) argues that how interesting a firm for potential partners is, is determined by what it can bring to an alliance. In case a firm can only provide tradable factors in exchange for access to resources the partner is unlikely to accept the terms. Organizations rather form alliances if they get access to a resource that cannot be obtained from the market. The reason is that firms, which offer access to resources would be sharing their "supernormal profit-generating asset in turn for one whose current market value captures its entire future return" (p. 338). Hence, prior accumulated resources (through alliances) constrain a firm´s future partnering opportunities.

2.2.2 Reduction of transaction costs

Transaction costs refer to costs that arise when firms interact with other organizations. Williamson (1975; 1985 cited in Kogut, 1988, p. 320) subsumes under this term expenses, which incur for setting up contracts, negotiating its terms and enforcing rights, determination of optimal investments in order to minimize dependence on partners, and stabilizing relationships. Kogut (1988) suggests that international strategic alliances are means by which large organizations increase control over smaller companies and over each other. In other words, organizational coordination replaces markets. Thus, with increasing coordination transaction costs drop.

2.2.3 Organizational Learning

Lorenzoni and Lipparini (1999) suggest that firms enter into strategic alliances in order to get access to complementary competencies, rather than to physical assets. They argue that it is the transfer of knowledge that enables organizations to keep up with technological development. Because proficiency is not only located internally but also externally, partners within a network are seen as some sort of intelligence unit that can be drawn of through alliances. Establishing relationships in order to access external expertise does not only foster learning, it further makes it harder for unconnected competitors to imitate products and services.

George et. al. (2001) are in support for above mentioned argument. They too see the necessity of firms for constant innovation in order to remain competitive. This is especially the case for players in the high-technology industry. However, the ability to innovate depends on a firm´s capability to assimilate and exploit diverse types of knowledge. George et. al. (2001) recommend strategic alliances as an effective way to achieve this objective. Kogut (1991) provides a similar

recommendation. He argues that, in a world of uncertainty, joint ventures should be used as platforms for potential future developments.

Despite all arguments, which highlight the advantages of enhancing a firm´s skill set and expertise via alliances, Inkpen (2000) points towards some limitations. For him it is crucial that organizational learning is constraint by managers´ ability to understand the consequences of newly acquired knowledge. That means that the focal firm needs to be able to exploit knowledge in a way that it leads to an improved strategy and operations (Cohen and Levinthal, 1990 cited in Inkpen, 2000, p. 1035). Consequently, in order to make alliances successful, the engaging firms need to be able to acquire and transform knowledge.

2.2.4 Improve the competitive position

Organizations can diversify the risk they are opposed to by operating in different marketplaces. International strategic alliances serve as means to increase own competitive position in foreign markets. Not surprisingly, the Danish firms in Nielsen´s (2003) study see market development as one of the major reasons to form international alliances. This is in line with prior findings on that matter made by Glaister and Buckley (1996 cited in Nielsen, 2003, p. 319). When establishing international strategic alliances the agendas of Nielsen´s (2003) sample firms vary with the national origin of a partner firm. When allying with European partners relational embeddedness (access to distribution channels and links with major suppliers/customers) and legitimacy (partner reputation/trust between top management) are crucial. When partnering with US firms the most important task-related criteria are scale economies and complementarity (access to technology and relatedness of partners´ business). For partners from the rest of the world, including Asia, access to local cultural knowledge prevails.

Elaborating on Barney´s (2001, cited in Lavie, 2006, p. 649) argument that firm´s need to enable themselves to exploit their competitive advantage, Lavie (2006) states that this is not only a matter of internal organization. It is rather beneficial when firms get access to complementary resources via alliances than building them up internally. Hence, an organization´s ability to achieve and preserve competitive advantages depends on "[…] their capacity to form and maintain valuable interactive relationships with alliance partners" (Lavie, 2006, p. 650).

Yet, a firm´s competitive advantage is not only influenced by its own actions. Indeed, Park and Zhou (2005) and Gimeno (2004) argue that alliances are built in order to reduce losses and react towards rival´s networks. Gimeno (2004) argues that firms respond to rivals´ alliances by either allying with rivals´ partners, thus forming intra-network competition, or by establishing countervailing alliances, which creates internetwork competition. Intra-network competition favors open networks with structural holes (see chapter 2.3.4) and is favored when rivals´ alliances involve low levels of co-specialization. In cases of high co-specialization internetwork competition is the preferred answer. In this event dense networks that lock out competitors are emphasized.

2.2.5 Network position

Gulati (1995; 1999) argues that the likelihood that organizations establish alliances is strongly influenced by their existing network. His results show that the position a firm holds within its network has a significant impact on the frequency with which the focal firm establishes new networks (Gulati, 1999). He argues further that "[…] the extent of capabilities firms accumulated with forming alliances also positively affected the frequency with which they entered new

alliances" (Gulati, 1999, p. 413). This indicates that prior alliance success coagulates the organization´s willingness to invest into alliances. Furthermore, already existing relationships provide information about partners, such as the partner´s trustworthiness as a partner, its operations, and potential synergy effects (Gulati, 1995). As a result trust increases and new alliance opportunities arise. Even though this positively affects new alliance formation, this happens only up to a certain point. Beyond that point additional alliances lead to a falling likelihood of new alliance formation. The reason is probably the risk of overdependence and that there are limits to the amount of alliances one firm can maintain (Baum and Oliver, 1992 cited in Gulati, 1995, p. 644).

2.3 Alliance portfolio configuration

The second major stream of research in the field of strategic alliances focuses on characteristics and outcomes of alliance activities (Nielsen, 2007). Scholars who subscribe to this field of studies analyze how specific alliance portfolio arrangements impact firm performance. Alliance portfolio size, diversity, and density are the most important configurations and will be introduced in the following. Yet, beforehand it is necessary to understand that performance can be measured in different ways. The major ways how researchers define performance are presented next.

2.3.1 Performance measures

The existing literature on international strategic alliances covers a vast range of different approaches towards measuring alliance performance. While some scholars focus on financial and economic measures, such as return on assets (ROA) or productivity (Goerzen and Beamish, 2005; Koka and Prescott, 2008), others emphasis non-accounting criteria, such as innovation (Shan, Walker, and Kogut, 1994; Deeds and Hill, 1996).

Goerzen and Beamish (2005) argue that even though firms pursue multidimensional goals economic results dominate their interests. This dominance of economic success measures is also reflected in the literature on strategic alliances. Screening over 70 studies, they find that three measures are generally accepted, namely ROA, return on sales, and return on capital. However, in order to avoid bias due to distinctive asset valuation and local tax treatment Goerzen and Beamish (2005) base return on sales and return on capital on operational profits and not on net, after tax returns.

Lavie (2007) uses the focal firm´s market performance, defined as the annual change in the market value of the firm´s common shares as a measure of alliances success. This dependent variable is operationalized by multiplying the number of common shares outstanding by the firm´s stock price. However, the firm´s market value is a very volatile performance measure. In order to tackle the volatility issue Lavie (2007) averages the end-of-month daily values of the relevant year. He argues that accounting measures have certain limitations that make them not optimal to determine alliance success. First, they discount firm´s intangible assets. Second, firm level factors intervene and confound alliance success (Berg et. al., 1982; Hagedoorn, 1993 cited in Lavie, 2007, p. 1198).

A similar approach to investigate international strategic alliances performance from a financial standpoint is by focusing on changes in the focal firm´s stock market value following alliance announcements (Kale, Dyer, and Singh, 2002).

Further critique on using accounting measures is offered by Koka and Prescott (2008). Their sample firms come from a variety of countries, which use different accounting principles. Thus, the required comparability is not given. Instead Koka and Prescott (2008) use productivity (sales per employee) as a performance measure. A further advantage this approach offers is that productivity provides insights about efficiency as well. Efficiency has been the driving force in the steel industry, which is the industry of interest in this study. Hence, productivity reflects the business´ competitive dynamics in a better way.

Yet, researchers do not focus on financial results solely. Powell et. al. (1996) assume alliances success would be reflected in a firm´s growth. Hence, they use the reported number of employees to measure alliance success. Silverman and Baum (2002) measure a firm´s probability to fail when industry rivals form alliances.

The question how international strategic alliances impact an organization´s ability to innovate is the leading question of several studies (Shan, Walker, and Kogut, 1994; Zaheer and Bell, 2005; Deeds and Hill, 1996). Shan, Walker, and Kogut (1994) measure this by looking at the firm´s innovative outputs. This is operationalized by counting the focal firm´s number of biopharmaceutical patents.

Deeds and Hill (1996) rather focus on the rate of new product development. They do not use patents because they do not see a one-to-one correspondence between patents and products. They further refer to Mansfield (1977 cited in Deeds and Hill, 1996, p. 48) and Pakes (1985 cited in

Deeds and Hill, 1996, p. 48) who find that patents should be seen as an innovation input and not as an output. Thus, Deeds and Hill (1996) calculate the number of new products produced since the organization´s foundation.

Zaheer and Bell (2005) determine innovativeness by using industry expert assessments. These experts evaluate the extent to which the sample firm´s tend to lead the industry in presenting products and services and adopting new technologies.

Focusing on single performance measures excludes other benefits international strategic alliances might bring. Nielsen (2007) overcomes this shortcoming by using a multidimensional approach, which covers four different aspects of alliance performance, namely, relational equity, financial performance, organizational learning, and efficiency. Nielsen (2007) asks key-decision makers like alliance managers and general managers to evaluate the alliance results versus expectations prior to the formation. Relational equity refers to the relationships with external players, e.g. customers, partners, suppliers, and investors. Financial performance includes sales, market share, and profitability. Organizational learning addresses the level of knowledge transfer and the creation of new knowledge. Efficiency measures how an alliance causes more efficient procedures and lower operation costs.

2.3.2 Alliance Portfolio size and firm performance

One stream of alliance portfolio configuration analysis aims at understanding how the size of a focal firm´s portfolio affects firm performance (Shan, Walker, and Kogut, 1994; Capaldo, 2007; Ahuja, 2000a; Deeds and Hill, 1996; Stuart, Hoang, and Hybels, 1999). Different findings and interpretations face each other. Whereas Shan, Walker, and Kogut (1994) find a positive correlation between alliance portfolio size and firm performance, Lavie (2007) and Dyer, Singh,

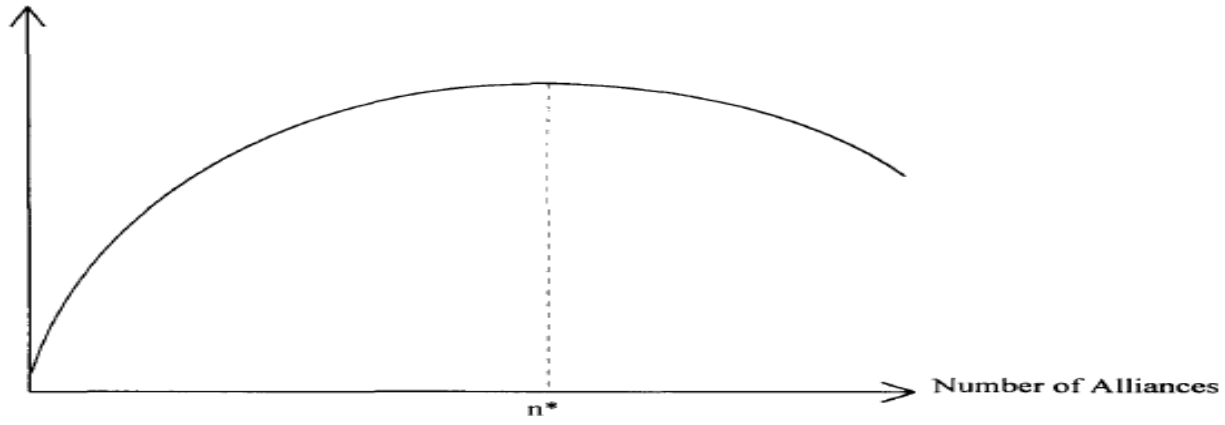
and Kale (2008) point out that not only value creation but rather its appropriation within a partnership is important. Stuart, Hoang, and Hybels (1999) argue that it is more important with whom a company allies than the sheer number of ties a firm maintains.

Shan, Walker, and Kogut (1994) find in their study of startups in the biotechnology industry, that the number of alliances positively influences innovation output. They refer to March and Simon (1958, Chapter 6 cited in Shan, Walker, and Kogut, 1994, p. 388) when they suggest that a startup is able to focus intensely on research and product development when their partner firm takes responsibility for the commercialization process. This specialization leads to a higher likelihood of successful innovative efforts. This finding is supported by the falsification of their second hypothesis, which is that "a startup´s amount of innovative output explains the number of its relationships" (Shan, Walker, and Kogut, 1994, p. 388). Hence, they prove that alliance portfolio size positively influences innovative output, not vice versa.

Further backing for the argument that alliance portfolio size positively influences firm performance is given by Capaldo (2007). He argues that, when a focal firm increases its network size its bargaining power within each dyad increases. This is due to the decreasing vulnerability to external resources such as partners leaving the network or failing innovation attempts. Furthermore, a larger network increases the networks diversity. Such a diverse and open network has a positive impact on the firm´s innovative capabilities.

Deeds and Hill (1996) contribute further to this proposition. Their findings show that alliances are a viable way for companies to assemble complementary assets, which are needed to increase the rate of new product development. However, the results also suggest that, if a company enters into too many alliances diminishing and ultimately negative returns set in, leading to an inverted U-shaped relationship (figure 1).

Figure 1: Rate of new product development



Source: Deeds and Hill, 1996, p. 45.

In order to develop new high-technological products a company needs to assemble a number of complementary assets (Deeds and Hill, 1996). Due to constraints in time and financial resources, a firm cannot develop all matching skills on their own, turn them into a commercially feasible product, and achieve all this while still profiting from first-mover advantages. Yet, Deeds and Hill (1996) refer to Schoonhoven, Eisenhardt, and Lyman (1990 cited in Deeds and Hill, 1996, p. 42), who state that these first-mover advantages, such as generating early cash-flows, external visibility and legitimacy, and early market share are necessary to increase the own chances for success. Alliances are an elegant way of achieving all afore mentioned benefits and giving the additional advantage that costs associated with the development can be shared by alliance partners. Nevertheless, the relationship between the number of alliances and product development is not linear. Deeds and Hill (1996) offer two major reasons to support this argument. First, not all alliances contribute equally to the rate of new product development leading to diminishing returns from additional alliances. They refer to Mowery and Rosenberg (1989 cited in Deeds and Hill, 1996) and Rosenberg (1982 cited in Deeds and Hill, 1996) who argue that "increasing complexity and specificity of the knowledge required in the product development process are not

only forcing firms into strategic alliances, but also make partner selection critical" (Deeds and Hill, 1996, p. 44). Hence, the "law" of diminishing returns comes to play: the more alliances a company enters into, the more likely it is that some partner´s contribution will be marginal. Furthermore, learning is limited and returns from additional alliances diminish. Second, bounded rationality will lead to negative returns. Beyond a certain number of alliances the burden on management to properly screen partners and ensure their contribution to value creation is overloaded. As a result, partners who behave opportunistically or whose knowledge cannot be transferred enter the network, which leads to negative returns.

Reasons, which lead to diminishing and negative returns can be understood as costs of alliance formation and maintenance. White and Lui (2005) contribute to the understanding of such costs with their study on contractual alliances between architects and general contractors in the Hong Kong construction industry. They suggest that costs are conceptually and empirically distinct and identify two classes, namely cooperation costs and transaction costs. Their definition of the term "transaction costs" describes expenses, which occur due to the threat of an alliance partner acting opportunistically. However, the concept of transaction costs neglects the fundamental reasons why firms enter into alliances, such as organizational learning, creating synergies, and joint creation of tangible and intangible assets. This is achieved through pooling, swapping, and division of resources. "Even when the partners in such an alliance completely trust each other (i.e., the threat of opportunistic behavior is zero) and other appropriation concerns are absent, cooperating to achieve these benefits can be costly in terms of coordination, adjustment to a partner, and mechanisms to smooth communication and integrate activities. We [White and Lui] have used the term "cooperation costs" to capture these costs" (White and Lui, 2005, p. 926).

A further limitation to increasing value with increasing size of an alliance portfolio is given by Stuart et. al. (1999). Although they agree with Deeds and Hill (1996) that alliances are respected ways for firms to acquire the resources needed to succeed, they specify that it is rather important with whom a company allies than the sheer number of alliances. Thus, careful partner selection is critical for alliance success. More insights on Stuart et. al. will follow in chapter 2.3.3 Alliance portfolio diversity and performance.

To other scholars it is not only important whether an alliance portfolio is able to create value beyond the associated costs, but also its apportionment. Dyer, Singh, and Kale (2008) argue that simple participation in alliances does not create benefits by itself. Thus, companies, which want to get most out of alliance efforts, need to understand what factors determine the capacity to annex the greatest gains. They point out four generic ways how firms can enhance their appropriation capabilities. This can be achieved by:

• Contributing more critical and scarce resources to the alliance;

• Having more "synergy sensitive" resources - that is, resources that are common with the benefits realized through the alliance;

• Holding a brokerage position within a network with many structural holes; and/or

• Using such a position to gather the required knowledge in order to build up internal resources or future alliances.

This argument is in line with Lavie´s (2007) study on value appropriation in the U.S. software industry. He finds that, contrary to prior research partners with the most valuable resources are not necessarily the best allies, which is clearly a contrasting view to Stuart´s (2000) argument. They might enhance joint value creation but affect performance adversely by unproportional

value appropriation. The relative bargaining power of a partner towards the focal firm is determined by higher profit margins and access to alternative alliances, which pursue similar objectives. The focal firm itself can enhance its bargaining power by increasing multilateral competition among its partners. "This outcome is ascribed to the firm´s ability to arbitrage among competing partner´s and control resource allocation decisions, which improve its appropriation capacity" (Lavie, 2007, p. 1207). As a result it is important for scholars and managers alike to distinguish between value creation and value appropriation processes when evaluating alliance portfolios.

2.3.3 Alliance Portfolio diversity and firm performance

Another aspect of alliance portfolio configuration is its diversity. Several scholars have focused on the impact of alliance portfolio diversification on firm performance (Stuart, 2000; Goerzen and Beamish, 2005; Lavie and Miller, 2008). Lavie and Miller (2008) state that increasing alliance portfolio internationalization (API) has a sigmoid impact on firm performance. With growing API performance first declines, then increases, and ultimately declines again. Contrary findings are offered by Goerzen and Beamish (2005). They suggest that firms should either focus on homogeneous networks or very diverse forms, being "stuck in the middle" leads to subordinate performance. Last but not least, Stuart (2000) and Gulati and Higgins (2003) suggest that specific partner attributes are crucial to achieve alliance success.

Lavie and Miller define alliance portfolio internationalization as "[…] the degree of foreignness of partners in a firm´s alliance portfolio as defined by the cross-national differences between the firm´s home country and its partners´ countries of origins" (Lavie and Miller, 2008, p. 4). They

refer to Ghemawat (2001 cited in Lavie and Miller, 2008, p. 4), who shows that such differences include dissimilarities in culture, institutions, levels of economic development, and geographical distance. When API increases, performance initially declines. This downturn is due to national differences between the firm and its partners. These differences are too subtle to be recognized but do hinder the successful adaptation of collaborative routines. At moderate levels of API the overlapping of national profiles leads to a better understanding of partner´s backgrounds, efficient implementation of collaborative procedures, and access to partner´s markets and assets. Hence, performance improves. Finally, "[…] at high levels of API, internationalization precludes successful adaptation to nationally distant partners, because the firm´s collaborative routines are ineffective in bridging geographical, cultural, institutional, and economic differences" (Lavie and Miller, 2008, p. 27). However, the performance of over-internationalized portfolios is still likely to be higher than that of purely domestic alliance networks. Worth mentioning is also their finding that liabilities associated with API can be mitigated by increasing experience in managing cross-national alliances. This means that, with increasing experience in managing internationally diverse networks the associated costs decline, hence performance increases.

The conclusion that firms profit from engaging in international alliances is one which Goerzen and Beamish (2005) do not share. The majority of their sample firms, all Japanese multinational enterprises (MNE), which maintain operations in six or more countries (Stopford and Wells, 1972 cited in Goerzen and Beamish, 2005, p. 339), registered the actual costs, but not the paybacks of internationally diverse alliance portfolios. The statistical relationships found in their study suggest that either focused homogeneous networks or very diverse ones lead to superior performance. However, the great majority experiences subordinate merits. Goerzen and Beamish (2005) denominate this group as being "stuck in the middle" (p. 348). This is probably due to the fact that more diverse inter-organizational alliances are harder to integrate. They refer to Roth

and O´Donnell (1996 cited in Goerzen and Beamish, 2005, p. 349) who argue that management capabilities in running a network of alliances may get overwhelmed as cultural distance increases. Hence, cultural variances, agency problems, and challenges of knowledge appropriation hinder the creation and exploitation of synergies. Despite these findings, Goerzen and Beamish (2005) state that alliances may still offer competitive advantages, which are of a non-economic nature. Goerzen and Beamish (2005) operationalize performance through ROA, return on sales, and return on capital (see chapter 2.3.1).

This focus on merely economic performance neglects other measures such as access to information, organizational learning, and the ability to acquire the required resources for survival and growth. The latter is a topic that Stuart et. al. (1999) address. Their study focuses on new ventures, which need to obtain manifold resources to become viable enterprises. Here network diversity refers to different associates, such as equity partners and investment banks. These new ventures face the problem that the market cannot evaluate these unproven companies in order to decide whether to contribute to them or not. Because they cannot conduct a due diligence, potential partners turn to the social structure of business relationships of the focal firm. The prominence of sponsors and affiliated companies becomes a crucial criterion for whether new ventures will get access to the required resources or not. Stuart et. al. (1999) suspect that new ventures that maintain relationships to prominent business partners tend to do so across the board. More precisely, a firm which is sponsored by a well-known equity partner is more likely to have prominent alliance partners and investment banks. This finding is not very surprising as partners serve as allies, who introduce the focal firm to their own network. Stuart et. al. (1999) refer to Bygrave and Timmons (1992 cited in Stuart et. al., 1999) who "[…] noted that high-status venture capital firms tended to secure prestigious investment banks to syndicate their [the new ventures] IPOs" (p. 345). Moreover, being affiliated with prominent partners creates attention and

recognition for a new venture. This momentum can be leveraged in order to acquire additional exchange partners, leading to a cycle of advantage. As a result Stuart et. al. (1999) suggest that "sponsorship has the capacity to substitute for accomplishment and experience as a basis for the success of young companies" (p. 344). These findings lead to the conclusion that it is rather important with whom a company allies, than the level of diversification of an alliance portfolio.

Because the choice of a partner is dependent on the strategic direction of alliances, this is a result which Hagedoorn and Schakenraad (1994) confirm. They show that technological oriented companies (information technology, mechanical engineering, and oil- and chemical corporations), which maintain R&D oriented strategic alliances, experience higher rates of profit than those companies, which run dominantly market oriented partnerships. Hence, the choice of partners should reflect that.

Further support to Stuart et. al. (1999) conclusion is given by Stuart (2000). His study provides additional evidence that strategic alliances can improve performance. However, his results show that the important factors, which determine alliance success, are the partner´s attributes and not mere affiliation. He suggests that from both, a resource access and a reputation standpoint, large and innovative firms are the most prized partners. This is in contrast to Lavie´s (2007) finding that partners with the most valuable resources might use their bargaining power in order to appropriate disproportional shares of the value created through the alliance (see chapter 2.3.2). Stuart (2000) believes that gaining an alliance partner is a positive signal to the focal firm´s market. It will create public assurance and help to attract risk adverse customers. Furthermore, "[…] alliances can be highly advantageous even when they fail to achieve the strategic objectives that led to their formation. The reason for this is that a focal organization´s reputation may be upgraded simply because it has survived the due diligence of a prominent strategic partner,

particularly if the focal organization is young and small" (Stuart, 2000, p. 808). Further elaboration is given by Gulati and Higgins (2003). Following their study not only the partner´s reputation is important, but also the market conditions at a given time. Since network benefits are not uniform having prestigious partners effects performance differently under certain market conditions. When equity markets are relatively cold for new issues, young enterprises profit from alliances with prestigious venture capitalists. When markets are relatively hot partnerships with respected investment banks are beneficial.

Another way an organization can diversify its alliance portfolio is by establishing relationships along the value chain. Upstream, e.g. joint R&D, downstream, e.g. licensing, and alliances with industry rivals within the biotechnology industry is the focus of Silverman and Baum (2002). The object of interest of their study is not the firm, which entered into alliances, but the influence, which alliances of competitors have on the focal firm. They find that alliances between industry rivals unambiguously raise the focal firm´s chances for failure. Upstream alliances show mixed results. While rivals alliances with Universities are negatively related with exit rates, relationships with hospitals and industry associations, as well as alliances with research institutions and governmental labs have a positive impact. Silverman and Baum (2002) suggest that firms should establish own alliances with Universities, pharmaceutical and chemical companies in order to mitigate the risks that arise when competitors build alliances.

Baum, Calabrese, and Silverman (2000) present similar findings. They suggest that startups, which form upstream and downstream alliances and arrange them to provide access to diverse information and capabilities experience stronger initial performance on average. On the other hand, startups, which form alliances with established industry rivals tend to experience weaker performance. Nevertheless, these alliances are not generally destructive, varying with the rival´s

relative scope and innovativeness. Hence, the findings show that variation in startups alliance network composition rapidly produces significant differences in their performance.

Goerzen (2007) focuses on yet another form of alliance portfolio diversification and firm performance. He analyzes whether repeated equity-based partnerships are beneficial to the focal firm´s economic performance. Thus, the reverse argument is that not-repeated partnerships are a form of diversity. His findings show that repetitive equity-based alliances have a negative impact on performance. This is probably due to the fact that allying with the same partners recurrently hinders newcomers to enter into the network. Hence, the alliance portfolio locks out partners that could contribute needed cutting-edge technologies. Although established relationships and alliance management procedures contribute to the reduction of transaction costs, too much focus on the efficiency of managing the alliance hurts the firm on the corporate level. More precisely, "firms, by focusing primarily on achieving improved coordination across alliances, may be reducing the opportunities for novel systems, procedures, or perspectives to enter into their network (Goerzen, 2005a)" (Goerzen, 2007, p. 503).

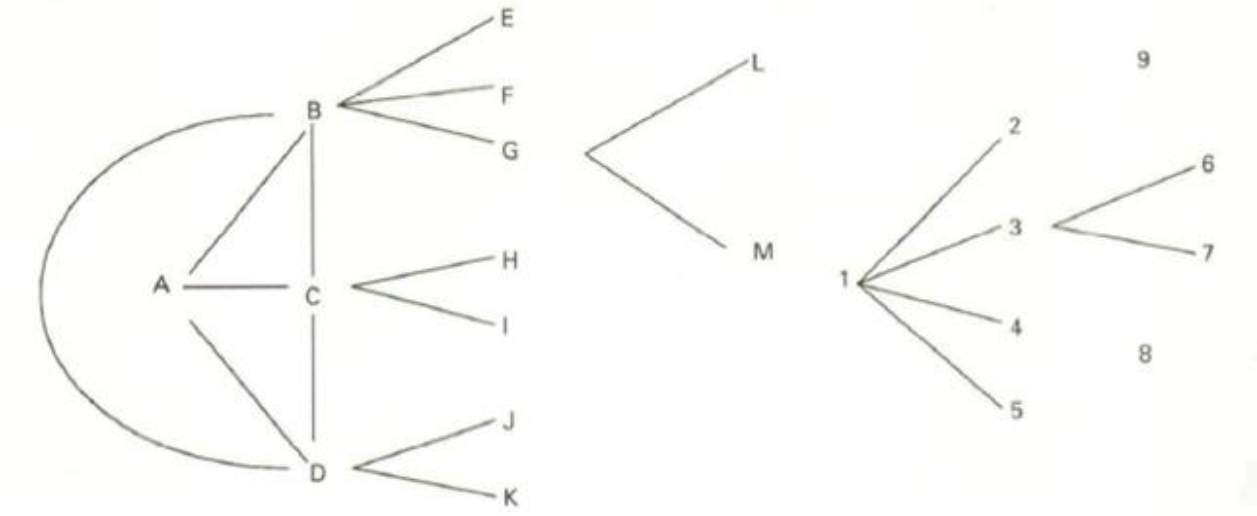
2.3.4 Alliance Portfolio density and firm performance

The term alliance portfolio density refers to the position a firm holds within its network. Two opposing perspectives exist among scholars who focus on this particular stream of research. First, closed networks with many connections linking the focal firm to its partners are seen as advantageous (Coleman, 1988 cited in Ahuja, 2000a, p. 425). In such a dense network, ties to associates are characterized as strong and partners are interconnected. The divergent view is that a firm should establish and maintain many rather weak relationships to disconnected partners in

order to obtain diverse information and control advantages over others (Burt, 1992 cited in Ahuja, 2000a, p. 425). The resulting benefits through this brokerage position are often described as "Burt-rent". Partners not being connected to each other create structural holes.

Figure 2 illustrates aforementioned network configurations (Ahuja, 2000a). The first alliance portfolio (A to M) is an example for a closed network. Firm A holds three direct ties and nine indirect ties through their partners. In addition, firms B, C, and D are interconnected leading to a closed network without structural holes. The second alliance portfolio is an example for an open network including structural holes. Firm 1 maintains four direct ties and two indirect ties. Firms 2, 3, 4, and 5 are not related to each other, thus creating structural holes.

Figure 2: Illustration of direct ties, indirect ties, and structural holes in two networks



Source: Ahuja, 2000a, p. 428.

Ahuja (2000a) describes the benefits of such networks as follows. "First, they can provide the benefit of resource sharing, allowing firms to combine knowledge, skills, and physical assets. Second, collaborative linkages can provide access to knowledge spillovers, serving as

information conduits through which news of technical breakthroughs, new insights to problems, or failed approaches travels from one firm to another" (Ahuja, 2000a, p. 427-428). Resource-sharing mainly relates to the pooling of know-how and physical assets, whereas knowledge spillover refers to the circulation of information. Ahuja (2000a) refers to Kogut and Zander (1992 cited in Ahuja, 2000a, p. 428) and Szulanksi (1996 cited in Ahuja, 2000a, p.428) who define frameworks to distinguish between know-how and information. Accordingly "know-how entails accumulated skills and expertise in some activity and is likely to include a significant tacit or noncodifiable dimension. Information refers primarily to facts, discrete quanta of information that can be transmitted through simple communication in relatively complete form and without loss of integrity" (Ahuja, 2000a, p.428). Furthermore, Ahuja (2000a) analyzes what impact direct ties, indirect ties, and structural holes have on a firm´s innovative capability. He finds that direct and indirect ties positively influence the innovative output. The magnitude of indirect ties however, is moderated by the firm´s level of direct ties. Thus the optimal configuration depends on the firm´s incentives. When a cooperative environment and the minimization of opportunistic behavior are crucial to success, closed networks are likely to be efficient. When the focal firm needs quick access to diverse information structural holes are likely to be beneficial.

In addition, not only the difference between direct tie and indirect tie has an influence on the alliance output. Researchers also distinguish between two different types of direct ties, namely strong and weak ties. Koka and Prescott (2008) argue that strong and weak ties offer different benefits, which is why they are likely to impact performance differently under different contexts. However, there is no mutual understanding what relationships are seen as strong ties or weak ties. The following two chapters will introduce researcher´s findings on the influences of weak and strong ties.

2.3.4.1 Weak ties and firm performance

Zaheer and Bell (2005) find in their study that firms, which are embedded in an open network, which provides access to diverse information through structural holes, tend to perform better than firms that engage in a closed network. This is especially the case for firms whose competitive environment requires them to develop product innovations swiftly and respond quickly to changes in the market. In such a situation new information acquired through partners can be transformed into new products and services, which will enhance the focal firm´s performance. Zaheer and Bell (2005) call the benefits of this process of enhancing internal competences through a superior network position as "network-enabled capabilities" (p.820). However, they acknowledge that a greater network position does not automatically generate benefits. The actor´s characteristics, here the ability to innovate, need to be considered as well. Thus, "innovative firms embedded in structurally beneficial networks will perform better than firms with either (but not both) characteristics" (Zaheer and Bell, 2005, p. 821).

Support for the argument that a brokerage position within a network is the superior configuration is given by Rowley et. al. (2000). According to their findings weak ties are beneficial, especially in an environment characterized by uncertainty. In such a setting firms need to be more explorative oriented in order to develop innovations and alternate strategic directions. For such purposes access to diverse information is needed. An open network with structural holes can provide such information. Furthermore, their findings show a negative impact of strong ties on firm performance. Rowley et. al. (2005) explain this by referring to the costs associated to the care of ties. The formation and maintenance, especially of strong ties, requires committing resources to it, which then cannot be used otherwise. In addition, strong ties serve as alternate

social control mechanisms, which do only provide little additional profits. Hence, the costs outweigh the benefits.

Although Bae and Gargiulo (2004) show that firms in a brokerage position perform better, on average, than firms which are embedded in a dense, closed network, they refer to certain limitations of such an alliance portfolio configuration. Limitations derive from a firm´s ability to substitute network partners. Bae and Gargiulo (2004) suggest that a firm is able to retrieve benefits from an alliance, if it manages to ally with resource rich partners. Yet, it is often the case that such partners, due to their competitive strength, have the ability to appropriate a disproportionate share of the value created through the alliance. The focal firm can overcome such constrains if it is able to exchange partners while maintaining access to the required resources. Hence, the focal firm needs to leverage its brokerage position by promoting and exploiting competition between network partners. In a situation where partners cannot be exchanged strong ties are found to be beneficial. Therefore, "[…] the benefits of brokerage seem to be incompatible with having nonsubstituable partners" (Bae and Gargiulo, 2004, p. 856).

2.3.4.2 Strong ties and firm performance

Capaldo (2007) describes the strengths of strong ties -mutual knowledge, social contents (interpersonal relationships), and relational-specific investments- as being beneficial for the focal firm´s ability to innovate continually. Referring to Uzzi (1997 cited in Capaldo, 2007, p. 601), Dyer (1996 cited in Capaldo, 2007, p. 601), and Blankenburg Holm, Eriksson, and Johanson (1999 cited in Capaldo, 2007, p. 601) he describes a situation where these strengths not only work individually, but reinforce themselves, leading to a virtuous circle (Capaldo, 2007). Accordingly, in strategic alliances mutual knowledge needs to be existent for social contents and

joint investments to develop. Through the development and strengthening of social aspects between participants, shared knowledge enhances by what Uzzi (1997 cited in Capaldo, 2007, p. 601) calls a "fine-grained information transfer". It further encourages the participating organizations to deepen their collaboration by investing in relation-specific assets. Growing investments increase the participant´s economic interests, which validates mutual commitment. This strengthens the fundament for the development of further social content and mutual knowledge. Capaldo (2007) supposes that the result of this self-enhancing process is a network characterized by an atmosphere of trust and exclusive agreements whose scope is narrow and well defined. This in turn stimulates innovative performance. The aforementioned advantages however, come at cost. Firms in a dense and closed network run the risk "[…] of being locked in a narrow circle of strong ties and […] becoming unable to face technological discontinuities or profit from new opportunities –whether they spring from heterophilous relationships or new market trends […]" (Capaldo, 2007, p. 603).

Dyer and Nobeoka (2000) contribute similar results. They suggest that strong ties are favorable when it comes to exploiting the diversity which resides in networks. Furthermore, strong ties are better suited to transfer tacit knowledge. The redundant ties make it easier to locate potentially valuable knowledge and enhance trust that facilitates the transfer of knowledge. This argument is further supported by Tiwana (2008). The costs of strong ties are that firms are very much inward focused, which limits their ability to create new knowledge (Dyer and Nobeoka, 2000).

In order to appropriate above-mentioned benefits Kale et. al. (2002) recommend that firms invest in a dedicated alliance function. Such a function can enhance the process of identifying the right partners, screen them more adequately, and even attract stronger and more compatible associates. Furthermore, it presents and positions the alliance better to customers, competitors, and investors.

Thus, a company can enhance its chance for success through such a function. A dedicated alliance function does have even more influence on strategic alliance success than experience in managing alliances. Even though experience is positively related to alliance success, its influence is strongest if it leads to the creation of a dedicated structure to coordinate and leverage that experience efficiently.

Investing resources into the management of alliances is a counsel Madhok and Tallman (1998) support. However, their suggestion is to rather invest into relationship building efforts than into physical assets. Without such determinations the gap between potential and realized synergies cannot be closed.

3 Method

The following chapter introduces the method, which is applied in order to find answers to the guiding research questions. First, the process that leads to the final dataset is described. Second, all variables are presented. Third, an appropriate statistical model to analyze the dataset at hand is introduced.

3.1 Data collection

The original dataset, as collected by Nielsen based on Securities Data Company (SDC), includes 1.864 alliances in the high-technology industry that were announced from January 1st, 1988 until December 31st, 2007. It provides the names of participating enterprises, a description of their business, as well as their standard industrial classification code (SIC), and their nationality. In the

case an alliances has been formed on the business unit level, name, SIC, and nation of the ultimate parent company is given. Furthermore, the dataset includes information about the alliances itself, such as deal name, SIC, nation, and a deal synopsis. The synopsis provides general information about what the alliances aims at. In addition, information about the ownership structure is given. SDC, a division of Thomson Financial, is the alliance database most commonly used in strategic alliance research (Schilling, 2009). The database covers next to alliance data, e.g. mergers and acquisitions, information about a variety of financial transactions (Easterby-Smith, Thorpe, and Jackson, 2008). "SDC collects data from the U. S. Securities and Exchange Commission (SEC) filings (and their international counterparts), trade publications, wires, and news sources. SDC tracks a very wide range of agreement types, including joint ventures, strategic alliances, research and development (R&D) agreements, sales and marketing agreements, manufacturing agreements, supply agreements, and licensing and distribution pacts" (Schilling, 2009, p. 235).

Due to the interest and limitations of this study the initial dataset needs to be refined. Because this study focuses on the impact of international strategic alliances on corporate financial success, the decision whether an alliance is included into the sample is based on the characteristics of the ultimate parent companies of each alliance partner.

In order to be as actual as possible the time frame of this study spans the years 1997 until 2007. Historical alliances are traced back until 1992. This five year lag is applied in order to include active alliances, which were formed before 1997 (Stuart, 2000; Lavie and Miller, 2008).

The setting of this study is the manufacturing industry. The focus on a single industry prevents from incorporating bias, which is based on different alliance formation patterns and industry specific competitive dynamics. Hence, this approach is widely used in strategic alliance research,

e.g. Lavie (2007), and Deeds and Hill (1996). Whether a firm belongs to the industry of interest is determined by the SIC code of the ultimate parent company. The manufacturing industry covers the SIC codes 2000 – 3900 (siccode.com, 2012). However, the interest of this paper is on alliances formed in the high-technology field of the manufacturing industry. This is due to the assumption that the more technologically advanced the products get, the more resources, in both, quality and quantity, are needed. According to the literature, strategic alliances are a tool to acquire access to such diverse resources. The SIC codes 2000 – 2900 include the production of textile, lumber and wood, furniture and paper products and are excluded from the sample, leaving only alliances where at least one partner firm belongs to the SIC codes 3000 – 3900.

Furthermore, this study aims at identifying the impact of international strategic alliances. Here, "international" is defined as involving alliance partners from different nationalities. Thus, in the case that all ultimate parent companies from alliances partners have the same nationality, the alliance is deemed to be local, and as such excluded from the sample. This simplistic approach to define the term international neglects the fact that differences between countries vary in several dimensions, e.g. culturally, institutional, and the level of economic development (Ghemawat, 2001 cited in Lavie and Miller, 2008), and could influence the success of alliances in different ways. However, the limitations of this paper do not allow for further specification, as this would be a research topic on its own.

Financial data is applied in order to operationalize some of the variables, which will be described in the following. The numbers used are derived from balance sheets, cash flows, and profit and loss statements of the sample firms. Because different countries use different accounting principles and currencies, the comparability of such data and the obtained results based on such data is questionable. To avoid such bias, only U.S. based companies are included in the sample.

Due to the longitudinal nature of this analysis sample firms need to show complete information for at least five years (Lavie, 2007). Hence, companies that show less than five annual records are excluded from the final sample.

Following the described alteration of the initial dataset the final sample includes U.S. based manufacturing companies (SIC 3000 – 3900), that maintain at least one international alliance between the years 1997 – 2007. Further completion of the dataset, e.g. the variables as described in the following, leaves 65 companies with a total of 416 company-year entries. The sample includes prominent corporations such as Boeing, Caterpillar, Ford, GE, and Texas Instruments (see appendix 6.1 for a list of all sample firms).

3.2 Variables

3.2.1 Dependent variable – Firm performance

The dependent variable, which reflects the success of international strategic alliances, is operationalized through the profitability ratio: return on assets. ROA is mathematical defined by dividing net income by total assets (Investopedia, 2012). "ROA simply shows how effective the company is using [those] assets to generate profit. It is a measure that can be used in any given industry to compare the performance of companies of different size" (Berman and Knight, 2006, p. 154). Despite the fact that corporations pursue multidimensional goals, the principal opinion in strategy research is that financial results are of fundamental concern to firms and is thus reflected in manifold research papers (Goerzen and Beamish, 2005). The numbers for total assets from the companies´ balance sheets and those for net income from the profit and loss statements are derived from Compustat. The database provides access to balance sheets, income, and cash flow

statements for North American companies (Easterby-Smith, Thorpe, and Jackson, 2008). Several scholars use Compustat as a highly reliable source for financial data (Lavie and Miller, 2008; Lavie, 2007; Bae and Gargiulo, 2004; Ahuja, 2000a).

3.2.2 Independent Variables

3.2.2.1 Alliance portfolio size

One independent variable is the size of a focal firm´s international alliance portfolio (Alliances). In other words the number of international strategic alliances a focal firm maintains at each year of interest. However, an alliance that is formed in any given year (t) is unlikely to impact financial results in the same year (t). ROA is rather affected by all alliances the company operated in the year before (t-1). Hence, the independent variable that influences ROA in (t) is the number of accumulated international strategic alliances in (t-1). As mentioned above the interest of this study is the impact of international alliances only. Hence, only alliances with non U.S. based partners are computed. E.g. in the case that a focal company entered into an alliance with three partners from foreign countries, all three dyads are counted. However, in the case where two U.S. based manufacturing companies formed an alliance with three partners from abroad, each U.S. firm´s alliance count augments by three. The dyad to the local partner does not count. Furthermore, the variable is operationalized by the number of "accumulated" alliances, because, in general, alliances last for more than one year. Yet, it is not possible to specify every ending date for all alliances. In order to operationalize alliance life-time an average of five years is used (Stuart, 2000). In other words, five years after its announcement the alliance is deemed to have ended and does not increase the alliance count of year six. To incorporate alliances, which have been formed before 1997, an in alliance research commonly used five-year lag is applied

(Stuart, 2000; Lavie and Miller, 2008). Put differently, for every company that shows an alliance entry throughout the period 1997 – 2007, alliance announcements were tracked back until 1992. E.g. Texas Instruments´ ROA in 1997 is influenced by all international alliances the company announced from January 1st, 1992 to December 31st, 1996.

3.2.2.2. Number of weak ties, number of strong ties, and strong tie ratio

According to prior studies, strong and weak relationships to alliance partners influence alliance success in different ways. In order to contribute to the discussion whether strong ties or weak ties are more beneficial the second independent variable distinguishes between both. Following Rowley, Behrens, and Krackhardt´s (2000) framework each dyad is assigned to either group. "[…] equity alliances, joint ventures, and nonequity cooperative (R&D) ventures are categorized as strong ties, and weak ties are operationalized as marketing agreements, and licensing and patent agreements" (Rowley, Behrens, and Krackhardt, 2000, p. 377). The underlying reasoning for this separation is based on resource commitment to the alliance. Strong tie alliances as described above often require up front investments in both, financial and non-financial resources. Weak tie alliances on the other hand require less resource commitment, less coordination of activities, and less interactions with the partner. However, many of the sample firms maintain strong (Strong) and weak (Weak) ties at the same time. The strong tie ratio (Ratio) is used in order to set the number of strong and weak ties in relation to the number of total alliances. By dividing the number of strong tie alliances by the number of total alliances for each year, a ratio is generated, which states to what extend strong ties or weak ties dominate the individual portfolio. In the case that the ratio is exactly one, the focal firm´s portfolio consists of exclusively strong tie alliances. Due to the fact that the strong tie ratio is a variable which is derived out of

the number of strong ties and the number of total alliances it can be expected that multicollinearity between those variables will occur. Hence, they are not used all at the same time, but in different models.

3.2.3 Control Variables

3.2.3.1 Firm size

Consistent with prior strategic alliance research firm size is included as a control variable (Gulati and Higgins, 2003; Hagedoorn and Schakenraad, 1994; Goerzen and Beamish, 2005; Nielsen, 2007). Chang and Thomas (1989, cited in Goerzen and Beamish, 2005, p. 341) prove that larger firms have easier access to lower cost of capital and are exposed to lower risk. This in turn boosts performance. Therefore, it is crucial to control for this variable. Following the conventional approach, firm size is operationalized by the number of employees. The data is derived from Compustat. The raw number of employees is then divided by 1000 in order to avoid a regression coefficient, which is too small (employees1000).

3.2.3.2 Capital structure

Capital structure influences firm performance (Jensen, 1989, cited in Goerzen and Beamish, 2005, p. 341), thus needs to be controlled for. Following Goerzen and Beamish (2005) capital structure is operationalized by the debt-to-equity ratio (DtE). The debt-to-equity ratio specifies how the focal firm finances its assets (Investopedia, 2012). A high number for this ratio generally shows that the company achieves increased operations by accepting higher debt burdens. In other words, a high debt-to-equity ratio indicates that the firm finances its asset base by debt. Thus,

more assets can be used than it would be possible without outside financing. These assets are then used to generate sales. Hence, the debt-to-equity ratio affects both, numerator and denominator of the ROA ratio. The Compustat database is the source for the needed financial data.

3.2.3.3 Industry growth

It is comprehensible that in times of economic growth, financial performance of individual companies grows, too. On the other hand, during economic downturns financial performance is likely to be effected as well. In order to correct for these macroeconomic influences industry growth is included (IndGrowth) as a control variable. The U.S. Department of Commerce – Bureau of Economic Analysis (bea.gov, 2012) offers the data needed to operationalize this variable. It provides the numbers for the overall development of the U.S. GDP for all years of interest, as well as the contribution, or value added, for individual industries. The industry trend is calculated based on the numbers for value added by the manufacturing industry.

3.2.3.4 Industry Profitability

Stimpert and Duhaime (1997, cited in Goerzen and Beamish, 2005, p. 341) show that industry profitability (IndProf) influences performance. The variable is operationalized by using the industry average ROA (Goerzen and Beamish, 2005). The basis for this variable is the sample. For each year of the analyzed period an average ROA is calculated.

3.2.3.5 Investment Intensity

Companies reinvest resources into R&D and their asset base in order to ensure future competitiveness. Therefore, Lavie (2007) controls for the firm´s "[..] R&D intensity, measured as the firm´s R&D investments divided by its net sales" (p. 1201). However, as this paper´s interest is the impact of international strategic alliances on ROA this control variable needs to be refined. Return, or sales, is not solely dependent on a firm´s investment in its R&D efforts. Especially in the case of manufacturing companies´ property, plant, and equipment, efficient marketing and sales, as well as sourcing processes are crucial to performance. Thus, total investment activities seem to be the preferable number to look at. The raw amount of dollars invested is set in relation to the focal firm´s size by dividing investing activities by net sales. The resulting variable is named investment intensity (InvInt). The data is derived from Compustat.

3.3 Statistical model

A multilevel analysis is the statistical model that is most suitable for the dataset at hand. Prior to running the model, however, the data is visualized and regrouped in order to get a better understanding of the present situation.

The first scatterplot, using the average ROA and the average number of alliances for each firm (see figure 3) reveals that the company "National Scientific" is an outlier. This is further supported by comparing the arithmetic means and the standard deviations for the cases including "National Scientific" and excluding it (see Table 1). Including an outlier like this would bias the results. Hence, "National Scientific" is excluded from all further calculations and interpretations.

Figure 3: Scatterplot - All companies

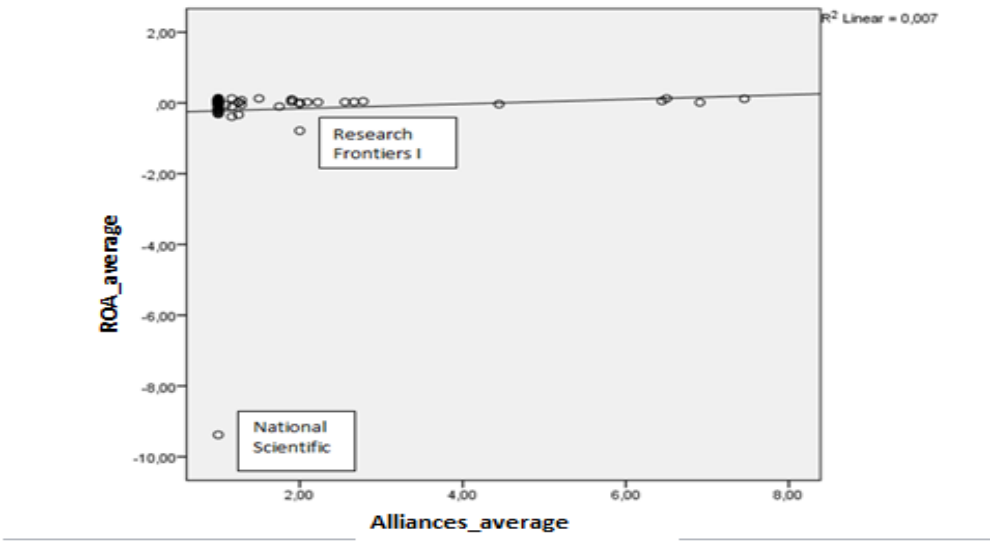


Table 1: Comparison - Arithmetic mean and standard deviation

Variable „ROA“	Arithmetic Mean	Standard Deviation
All Companies	-0,1371	1,4478
Exclusion of „National Scientific“	-0,0365	0,1566

Figure 4: Scatterplot - Exclusion of "National Scientific"

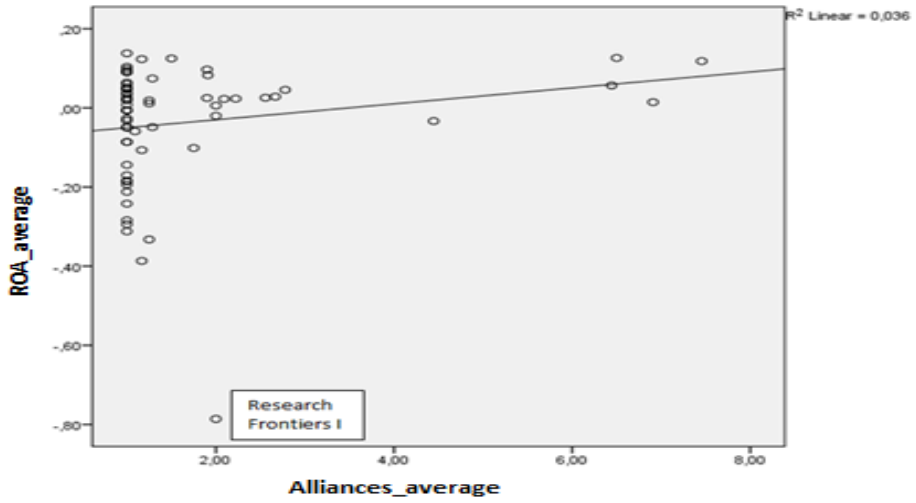
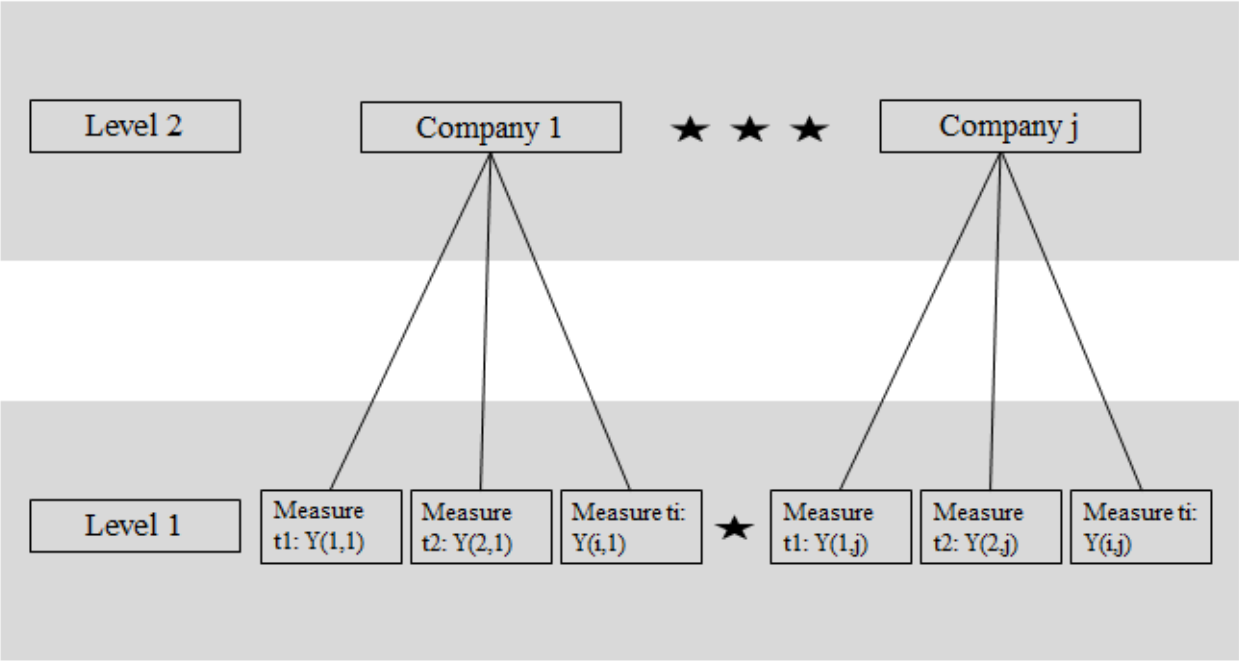


Figure 4 shows that after excluding "National Scientific" another outlier ("Research Frontiers I") can be identified. However, "Research Frontiers I" can be seen as belonging to the majority of data entries (see figure 3), thus, is included in the following analysis.

Further initial treatment of the data includes a frequency distribution, and a multiple regression analysis, which is based on the mean values for each company over the years. However, multiple regression analysis is only applied in order to provide an idea about coherences in the data. It cannot be seen as the correct statistical model, because it neglects the fact that values for all variables and all companies vary over time. Laird and Ware (1982 cited in Langer, 2009, p. 223) show in their study that the multilevel analysis (MLA) is the most adequate approach to analyze repeated measurements. Compared to classical structural equation modeling (SEM) the hierarchical structure of MLA (Figure 5) allows analyzing variable variations on the (company) individual level. Linear structural relationship model (LISREL), on the other hand, which is one of the best known SEM (Easterby-Smith, Thorpe, and Jackson, 2008), computes this alteration

only on the sample level (Langer, 2009). Hence, MLA allows for company individual influences of independent variables on the dependent variable (see appendix 6.2 for visualization).

Figure 5: Hierarchical structure of MLA



Source: Adapted from Langer, 2009, p. 223.

Furthermore, MLA is able to analyze an unbalanced panel (Bryk and Raudenbush, 1992 cited in Langer, 2009, p. 226), which is the case for the dataset at hand. In addition, MLA allows incorporating measures, which vary over time. Hence, the variable year is included. Year 1997 is zeroed in as the starting point of the period (Year1997). In addition, in order to control for time constant confounding variables, firm fixed effects transformation is included (Giesselmann and Windzio, 2012).

Two models are run, which only differ in the independent variables applied. The first model uses the accumulated number of alliances (X1=”alliances”) and the strong tie ratio (X2=“ratio”) as

independent variables. The second is run as a robustness test and uses the total number of weak and strong ties (X1=”Weak”; X2=”Strong”) as independent variables. The dependent variable in both cases is ROA (Y=ROA). In addition, all control variables remain the same. All variables are described above.

4. Results

Chapter four presents the results, which are derived from the frequency distribution, multiple regression analysis, and MLA. For inductive statistics only the results for model one are presented, due to the limitations of the paper. The results of model two, for multiple regression analysis and MLA, do not differ from the results of model one. However, model two can be found in the appendices.

4.1. Descriptive statistics

Figure 6 shows the results of the frequency distribution for all ROA values. ROA class “-0,1 to 0,1” is the mode for the distribution with 65,2% of all values ranging in this class. This finding together with the relatively low standard deviation (s=0,1566; see table 1) indicates that it might be problematic to explain variances with a form of statistical regression analysis.

Figure 6: Frequency distribution

ROA_classified

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-1,5 to -1,3	1	,2	,2	,2
	-1,1 to -0,9	2	,5	,5	,7
	-0,9 to -0,7	3	,7	,7	1,5
	-0,7 to -0,5	10	2,4	2,4	3,9
	-0,5 to -0,3	20	4,9	4,9	8,8
	-0,3 to -0,1	44	10,7	10,7	19,5
	-0,1 to 0,1	268	65,2	65,2	84,7
	0,1 to 0,3	60	14,6	14,6	99,3
	0,3 to 0,5	3	,7	,7	100,0
	Total	411	100,0	100,0	

4.2. Inductive statistics

Multiple regression analysis, which uses company specific mean values for each variable, gives an initial idea of coherences in the data. Figure 7 shows the result for the first model. At a significance level of 10% only the variables firm size (Employees_mean) and investment intensity (InvInt_mean) are statistically significant. ROA increases with an increasing number of employees and decreases when investment intensity increases. Most variables are measured in different units which makes it necessary to look at the standardized coefficients (Beta) when comparing influences of variables. Here, investment intensity has the strongest influence. Both independent variables ("alliances_mean" and "Ratio_mean") show weak positive coefficients. However, their significance level is not satisfactory. Thus, the positive influence of the number of alliances and the strong tie ratio cannot be generalized. The control variables capital structure (DtE_mean) and industry profitability (IndProf_mean) indicate a weak negative influence on ROA. Yet, again, the insufficient significance levels prohibit a generalization.

Results of the second model can be found in appendix 6.3.

Figure 7: Results - Model 1 (Multiple regression analysis)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-,159	,107		-1,478	,145
	Alliances_mean	,016	,011	,149	1,422	,160
	Ratio_mean	,060	,037	,157	1,603	,115
	Employees_mean	4,798E-007	,000	,215	1,835	,072
	DtE_mean	-,015	,010	-,181	-1,542	,129
	IndGrowth_mean	1,671	1,451	,123	1,152	,254
	IndProf_mean	-,202	,460	-,052	-,438	,663
	InvInt_mean	-,143	,023	-,600	-6,260	,000

a. Dependent Variable: ROA_mean

Figures 8 and 9 show the MLA results. The null model (Figure 8) shows the explanatory power of the proposed model (0,019855/(0,019855+0,023749)=45,5%). A fit index of 45,5% shows that the majority of ROA variance is explained by other variables than the ones which have been used in this paper.

Figure 8: MLA - Null model

Estimates of Covariance Parameters[a]

Parameter		Estimate	Std. Error	Sig.
Residual		,023749	,001808	,000
Intercept [subject = Company]	Variance	,019855	,004316	,000

a. Dependent Variable: ROA.

Figure 9: MLA - Model 1

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	Sig.
Intercept	-,043296	,032638	,190
Year1997	,000565	,004856	,909
Alliances	,004285	,006075	,482
Ratio	-,000734	,029470	,980
employees1000	,000499	,000257	,056
DtE	-,000127	,001391	,927
IndGrowth	,512162	,241170	,035
IndProf	,232749	,062197	,000
InvInt	,002251	,002843	,429

a. Dependent Variable: ROA.

Furthermore, three variables show a significant influence on ROA (Figure 9). First, firm size (employees1000) has a weak positive effect on the dependent variable at a significance level of 10%. Second, industry growth (IndGrowth) shows a moderate stimulus at a significance level of 5%. Third, industry profitability exhibits a weak positive influence at the 1% significance level. The influence of the portfolio size (Alliances) is weak and not significant, as the multiple regression analysis already indicates. The MLA shows a weak negative impact of the strong tie ratio on ROA, contrary to the findings of the multiple regression analysis. Yet, due to the deficient significance level, this finding cannot be generalized. The control variables capital structure (DtE) and investment intensity (InvInt) have weak and not significant influences on ROA, capital structure negative and investment intensity positive, respectively.

The results of the robustness test (Model 2) confirm above described findings. The outcomes are stated in appendix 6.4.

5 Conclusion and discussion

The following chapter presents the key findings of this study and provides an interpretation of them. Furthermore, every decision on how to structure a study, excludes alternative ways to analyze a situation. Thus, every research design comes with certain limitations. The limitations of this paper are a further topic of chapter five. Finally, the present study is classified into the contemporary stream of research on strategic alliances and potential future research topics are identified.

5.1 Key findings and interpretation

Although prior research shows that strategic alliances are a viable way to get access to resources and in turn achieve profits of some sort (Lavie, 2007; Deeds and Hill, 1996), the findings of this paper do not support this assumption. In fact, the sample does not provide a sole and clear answer to the disposed research questions. Hence, an assumed influence of international strategic alliances may be the case. Yet, several alternative interpretations are possible, too. The arguments, which lead to the assumption that there is coherence between alliance portfolio configuration and financial performance is sufficiently described in chapter two. Thus, the following focuses on alternative interpretations of why firms form alliances and why the expected increase in ROA fails to appear.

In the manufacturing industry arm's-length contracts and/or vertical integration are more appropriate alternatives to ensure access to the needed resources. For goods, services, and even knowledge, which are relatively easy to obtain on the respective markets, arm's-length contracts require less investment. Furthermore, a high substitutability of suppliers enhances market power, thus enables the manufacturing companies to push prices down. For those resources, which are hard to find on the markets, or, which are crucial for the focal firm´s core competencies, mergers and acquisitions (M&A) or own development are beneficial.

A good strategy alone does not guarantee the desired output (Mankins and Steele, 2005). It is rather excellent execution, which turns a good strategy into great success. Hence, simple participation in international strategic alliances is not sufficient (Dyer, Singh, and Kale, 2008). Potential alliance partners need to be screened efficiently in order to detect latent synergies (Kale, Dyer, and Singh, 2002). Furthermore, the benefits, which derive from the alliance, need to be presented and positioned in appropriate ways to customers, competitors, suppliers, and investors. In addition, whether "network-enabled capabilities" (Zaheer and Bell, 2005, p. 820), that is, internal capabilities enhanced through a superior network structure can be achieved, is dependent on execution as well. E.g. clashing corporate cultures let alliance attempts fail, which seemed to be a perfect fit from a rational standpoint (Ailon, 2007).

Prior findings suggest that firms form strategic alliances not as a proactive move to achieve potential gains, but rather as a reaction to allying competitors (Park and Zhou, 2005; Silverman and Baum, 2002; Gimeno, 2004). Thus, building a network is "[…] a defensive move to sustain a competitive balance in the market" (Park and Zhou, 2005, p. 545). Organizations try to match or neutralize competitors' advantages even though no direct achievements, like ROA, are likely.

Another possible explanation is based on Kogut´s (1988) argument that firms achieve greater control over market dynamics through strategic alliances. Hence, "[…] markets are replaced by organizational coordination" (p. 330). This leads to the assumption that there is no direct effect from maintaining alliances to financial performance. Yet, an indirect effect via intermediaries, such as reduced competition, enhanced competitiveness, and innovation, which in turn result in financial performance, is likely. The dependent variable ROA is not able to measure such performance, at least, not in the given time period. E.g. the automobile industry needs five to eight years to develop a new powertrain (Auto Alliance, 2012). An alliance that needs such an amount of time to develop a product would need additional time to turn these inventions into financial performance.

"[…] alliances can be highly advantageous even when they fail to achieve the strategic objectives that led to their formation" (Stuart, 2000, p. 808). The present study assumes that the benefits of allying with partners will be reflected in ROA. Yet, the focus on accounting measures, markdown the importance of intangible assets (Lavie, 2007), such as innovative capabilities, customers' faith, and low employee turnover rates. In addition, the appropriation issue, who is getting what part from the created value, is neglected. Hence, the ultimate focus on a single performance metric aggravates judging, whether alliances are worth the effort. Whether a strategic move turns into a success is further very much dependent on the incentives, which lead to the action in the first place. Nielsen (2003) shows, that motivations vary depending on the nationality of the alliance partner. Access to distribution and supply channels, economies of scale, as well as access to local cultural knowledge are amongst those and are very likely to aim at different performance outputs.

5.2 Limitations

Prior findings cannot be supported empirically, due to missing statistically relevant results. Thus, the interpretations are rather based on findings from other papers than on what is presented above. Hence, whether the size of an international alliance portfolio impacts economic results positively, negatively, or not all, cannot be answered. Furthermore, no additional backing for either position in the discussion whether strong or weak ties are beneficial can be revealed.

However, limitations do not only stem from the less than desirable results, but also from the research settings. The limited focus on a single performance measure dismisses the impact alliances might have on outputs like innovation, reputation, and competitiveness (see chapters 2.2 and 2.3.1). The research design assumes that all sample firms establish alliances in order to achieve the same benefits. Yet, it is likely that the incentives to launch an R&D joint venture differ from those that lead to establishing a distribution-oriented network.

Furthermore, using only ROA might not reflect the business dynamics of the analyzed field. As Koka and Prescott (2008) describe some industries are rather concerned with efficiency than with profitability. In other cases the management focus lies on stock market valuations, market share, or yet another metric.

This study uses secondary data only, in order to achieve a large sample size with reliable data. Yet, the exclusion of primary data prohibits the incorporation of "insider knowledge". Even though the sources used to get the needed information are highly reliable, interviews and questionnaires to CEOs and alliance managers would broaden the scope of this study, thus provide additional value. Moreover, SDC as the basis for alliance specific information is only

able to trace publicly announced alliances. Consequently, effects of alliances that organizations do not publish, for whatever reasons, cannot be analyzed.

Typically for alliance research, papers focus on single industries to exclude bias, which is based on industry specific alliance formation behavior. This in turn limits the abilities to generalize findings to the respective industry, even in the case of significant results. Hence, all findings, interpretations, and newly acquired knowledge are limited to the respective industry only.

Furthermore, the focus on the impact of international alliances excludes local alliances by definition. Thus, whether and how local alliances influence firm performance cannot be answered by this paper. In addition, the applied definition of alliances does not include past alliances. Thus, through experience enhanced capabilities in managing alliance portfolios (organizational learning), is left aside.

Finally, the level of analysis bears another limitation to this paper. Alliance success in form of ROA is measured at the corporate level. This disregards that performance on the business unit or the alliance level might be measured in other ways than financially.

5.3 Future research

The limitations of this paper open up interesting topics for future research to explore. First, integration of "insider knowledge" can provide interesting insights into alliance portfolio configuration, management, incentives, and performance. A greater fit between the enticements to build an alliance portfolio and the resulting performance can be achieved by interviewing alliance managers and CEOs. A multidimensional approach (see Nielsen, 2007) seems to be an

interesting approach. This would allow distinguishing between individual alliance portfolio performance, thus representing the different aspirations organizations strive to achieve.

Especially in the field of international business or international management it is crucial to any study how the term "international" is defined and how dissimilarities between countries are accounted for. Future studies should shed more light onto the question what impact these differences have on the ideal alliance portfolio configuration, and the resulting performance. As countries differ in several ways, e.g. type of government, culturally, linguistically, the potential research settings are manifold.

"Culture" is a research topic on its own. The combination of culture and strategic alliance research is yet underdeveloped. Scholars can analyze what role corporate and national culture play in the field. Furthermore, how reasons to enter into alliances and ideal configurations vary depending on different cultural influences.

As in the interpretations suggested (see chapter 5.1) arm's-length contracts and/or vertical integration can be beneficial in the manufacturing industry. Future studies should have a closer look at exploring this supposition. Looking at the results it seems as if industry dynamics drive ROA. This in turn raises the question, what it is that drives companies to launch alliances anyways.

An almost untouched field of alliance research is the executional aspect. What skills are needed to turn participation in a network into success? What leadership methods are most suitable? And how can potential failures be turned around? Case studies on specific alliances would deepen and broaden contemporary strategic alliance literature.

6 Appendix

6.1 List of sample firms, means, and standard deviations

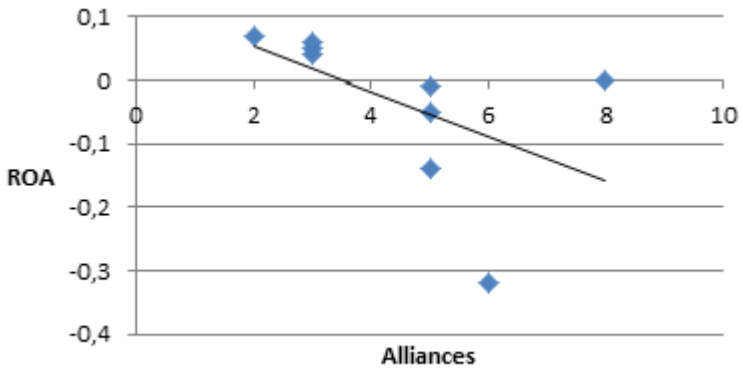
Company	N	Mean	Standard Deviation
3Com Corp.	5	-,1940	,0669
Agilent Technologies	6	,0283	,2588
American Power Conve	5	,0920	,0295
Amkor Technology Inc	9	-,0333	,1261
Applera Corp.	5	,0480	,0148
Applied Materials In	6	,0900	,0807
Boeing Co	5	,0260	,0152
Caterpillar Inc	5	,0380	,0164
CIENA Corp.	5	-,2420	,3030
Cirrus Logic Inc	5	-,0860	,3914
Conexant Systems Inc	8	-,3325	,2499
Corning Inc	6	-,1067	,1940
Dell Computer Corp.	6	,1250	,0243
Delphi Automative Sy	5	-,0860	,1299
Eastman Kodak Co	8	,0188	,0599
Eaton Corp.	5	,0480	,0192
Emerson Electric Co	11	,0827	,0276
Fedders Corp.	5	-,1860	,2930
Ford Motor Co	5	-,0060	,0251
Fuelcell Energy Inc	5	-,2940	,0838
GE	9	,0256	,0053
General Cable Corp.	5	,0200	,0308
Harman International	5	,0640	,0321
Herley Industries In	5	,0520	,0164
Hewlett-Packard Co	9	,0567	,0444
Honeywell Internatio	9	,0456	,0309
Ibis Technology Corp	5	-,2120	,2502
Image Sensing System	5	,1380	,1291
Integrated Silicon S	8	-,1013	,1549
Intel Corp.	8	,1263	,0609
Intermec Inc	5	-,0480	,1161
Iomega Corp.	5	-,0200	,1546
Itron Inc	5	-,0500	,1771
Kopin Corp.	7	-,0486	,0734
Lam Research Corp.	5	,0480	,1026
Lockheed Martin Corp	9	,0233	,0354
Microchip Technology	5	,1040	,0385
Micron Technology In	6	-,0267	,0991
Motorola Inc	11	,0145	,0712
MTS Systems Corp.	5	,0980	,0268

Company	N	Mean	Standard Deviation
National Semiconduct	6	,0200	,2620
Orbital Sciences Cor	5	,0060	,2364
OSI Systems Inc	5	,0080	,0427
Pall Corp.	5	,0600	,0292
Qualmark Corp.	5	-,1440	,3141
Ramtron Internationa	6	-,3867	,3020
Raytheon Co	11	,0227	,0382
Research Frontiers I	5	-,7860	,4196
RF Monolithics Inc	5	-,0320	,1018
Rockwell Automation	10	,0970	,0982
SanDisk Corp.	6	,0350	,1944
SEMX Corp.	5	-,1840	,2759
Sequa Corp.	5	-,0060	,0305
Silicon Storage Tech	11	-,0591	,1276
Solectron Corp.	5	-,1700	,2323
Sun Microsystems Inc	8	,0113	,1309
Texas Instruments In	11	,1182	,0978
TranSwitch Corp.	5	-,3120	,2155
Trimble Navigation L	10	,0250	,1387
United Technologies	7	,0743	,0053
Varian Semiconductor	8	,0913	,0645
Virage Logic Corp.	5	-,0060	,0219
Vitesse Semiconducto	5	-,2840	,4501
Xilinx Inc	6	,1233	,0876.

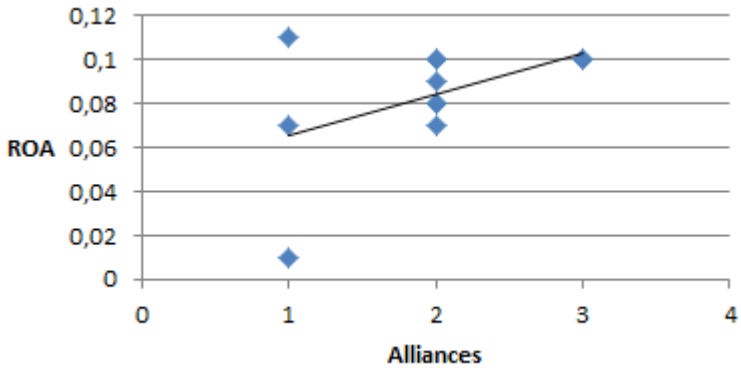
6.2 Individual influences of portfolio size on firm performance

A limitation on a bivariate observation is necessary in order to visualize the different influences of portfolio size on firm performance. Three examples are presented in the following. The visualization demonstrates that the impact of portfolio size on firm performance differs from company to company. This is principally the same for a multiple regression, yet cannot be shown in a graph.

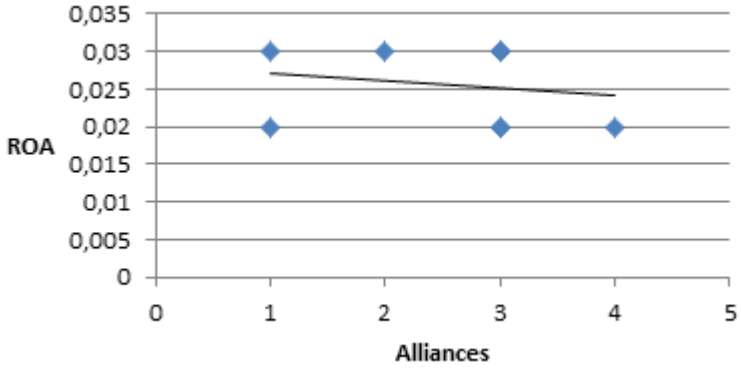
1. Amkor Technology Inc.



2. Emerson Electric Co.



3. GE



Parameters of linear regression:

Company	Intercept	Slope
Amkor Technology Inc	0,1236	-0,0353
Emerson Electric Co	0,0467	0,0189
GE	0,028	-0,0009

6.3 Multiple regression – Model 2

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-,118	,105		-1,119	,268
	Weak_mean	,006	,017	,037	,362	,719
	Strong_mean	,027	,017	,167	1,611	,113
	Employees_mean	4,666E-007	,000	,209	1,753	,085
	DtE_mean	-,014	,010	-,167	-1,407	,165
	IndGrowth_mean	1,685	1,475	,124	1,143	,258
	IndProf_mean	-,098	,460	-,025	-,214	,832
	InvInt_mean	-,143	,023	-,600	-6,131	,000

a. Dependent Variable: ROA_mean

6.4 Multilevel analysis – Model 2

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	Sig.
Intercept	-,044578	,030357	,148
Year1997	,000634	,004847	,897
Weak	,003660	,008783	,677
Strong	,006427	,009746	,513
employees1000	,000494	,000257	,058
DtE	-,000123	,001391	,930
IndGrowth	,508260	,241231	,036
IndProf	,231847	,062083	,000
InvInt	,002218	,002844	,436

a. Dependent Variable: ROA.

6.5 Dataset

See enclosed CD.

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