

**MANAGING PORTFOLIOS OF STRATEGIC ALLIANCES:
THE EFFECT OF ALLIANCE MECHANISMS ON ALLIANCE
PORTFOLIO PERFORMANCE**

Koen Heimeriks*
Copenhagen Business School

December 2005

ABSTRACT

In this study alliance mechanisms are investigated to explain why some firms extract superior rents from their alliance portfolios. First, I examine the relationship between alliance experience and the use of alliance mechanisms. Second, I investigate the impact of mechanisms on the firm's ability to manage alliance portfolios. Third, the moderating effect of alliance type is expanded upon by examining the degree to which the compositions of a firm's alliance portfolios (equity versus non-equity) influences the effect of alliance mechanisms. The results are based on a detailed survey among 192 alliance managers and Vice-Presidents reporting on over 3400 alliances initiated over the period 1997-2001. The findings reveal what mechanisms contribute to manage alliance portfolios successfully and empirically validate *how* lessons from prior alliances create learning effects that can be leveraged across a firm's entire alliance portfolio. Moreover, the results show that the effect of mechanisms on alliance portfolio performance is stronger for alliance portfolios that mainly consist of non-equity alliances.

*Key words: Alliance portfolio, alliance mechanisms, knowledge transfer,
alliance capabilities, alliance performance.*

PLEASE DO NOT CIRCULATE OR CITE WITHOUT PERMISSION

*Correspondence to: Center for Strategic Management and Globalization, Porcelænshave 24, DK-2000 Frederiksberg, Denmark, Heimeriks@cbs.dk. The author has greatly benefited from the help and insightful comments of Geert Duysters, Nicolai Foss, Ha Hoang, Jeff Reuer, Wim Vanhaverbeke, Martin Wetzels, the participants and reviewers of the Organization Science Winter Conference 2003, the INFORMS College on Organization Science Conference 2005, and the executives of various firms for their contributions to the interviews.

**MANAGING PORTFOLIOS OF STRATEGIC ALLIANCES:
THE EFFECT OF ALLIANCE MECHANISMS ON ALLIANCE
PORTFOLIO PERFORMANCE**

INTRODUCTION

In spite of the unprecedented growth in alliance activity over the last decades (Hergert and Morris, 1988; Khanna et al., 1998), there is mounting evidence that alliance performance has remained weak (Park and Ungson, 2001). Although reported failure rates range between 40 to 60% (Porter, 1987; Harrigan, 1988; Dacin et al., 1997), some firms seem to consistently enjoy better alliance performance than others (Kale et al., 2002). Strikingly, little is known about the mechanisms firms use to manage their stock of alliances and the effect of such mechanisms on alliance portfolio performance. This study aims to examine how successful firms manage their alliance portfolio in order to yield high and consistent returns. Therefore, I investigate the influence of alliance mechanisms on alliance portfolio performance.

In recent academic literature two groups of studies can be identified which are suggested to enhance alliance performance. The first group examines the effect of behavioral factors such as trust and commitment on alliance performance (e.g. Lorange and Roos, 1990; Kanter, 1994; Arino and De la Torre, 1998; Young-Ybarra and Wierseman, 1999). These factors are collectively referred to as relational advantages (Dyer and Singh, 1998). In particular, collaboration-specific rents (Madhok and Tallman, 1998), relational rents (Lane and Lubatkin, 1998), common benefits (Khanna et al., 1998) and relational capital (Kale et al., 2000) result from these advantages. The second and more recent group of studies has looked at firm-specific or structural factors, i.e. firms' assets or resources that aid in managing alliance portfolios over a longer period of time and are not alliance-specific.

These studies refer to the need to create collaborative advantage (Kanter, 1994; Dyer, 2000) or alliance capabilities (Kale and Singh, 1999; Kale et al., 2002). These studies suggest that dedicated assets and mechanisms, e.g. the use of an “alliance function or department”, have a positive effect on alliance performance. The basic purpose of these studies is not merely to explain rent optimization in individual alliances, but to uncover alliance capabilities that improve the performance of the entire firm’s alliance portfolio. Despite some recent studies (Parise and Casher, 2003; Sarkar et al., 2004) little is known about the potential effects of alliance mechanisms that firms employ to accumulate and transfer knowledge critical to managing alliance portfolios. As alliances are reported to generate a growing share of revenues for many firms (Harbison and Pekar, 1997; Margulis and Pekar, 2001), it becomes increasingly important for firms to understand what mechanisms are critical to enhance alliance portfolio performance. In this way, such mechanisms can not only help to leverage a firm’s revenues that come from alliances, but can also play an essential role in building and sustaining a firm’s competitive advantage.

RESEARCH ON ALLIANCE PERFORMANCE

As the value of inter-organizational relationships has grown into a significant percentage of a firm’s value (Dyer and Singh, 1998), alliance performance and its antecedents have become an important area of research. Initially, research on alliance performance was primarily conducted on basis of transaction cost economics (e.g. Hennart, 1988; Hill, 1990; Argyres and Liebeskind, 1999), agency and real options theory (e.g. Axelrod, 1984; Kogut, 1991; Parke, 1993; Chi and McGuire, 1996) and traditional industrial organization perspective (e.g. Porter and Fuller, 1986; Ohmae, 1989). Such theories examine the role firms play in ‘hybrid organizations’ or networks and the factors influencing exchanges between firms in these networks, i.e. minimization of production and transaction

costs (Hennart, 1988; Williamson, 1975, 1991). The insights generated in such studies either refer to the role of bargaining, opportunism and unilateral gains in alliances or investigate critical aspects in dyadic relationships. For instance, choice of governance structure (Williamson, 1985; Pisano, 1989) and partner fit (Geringer, 1991; Medcof, 1997) prove to be critical antecedents of the performance of individual alliances.

Simultaneously, a theory of ‘capabilities’ started to emerge (Richardson, 1972). Even though Penrose’s (1959) early work also discusses processes inside the firm, Richardson’s early work linked capabilities to inter-firm processes. While the foundations underlying these theories have gained great momentum over the past decades (Hoopes et al., 2003), so far little attention has been devoted to intra-firm factors that determine performance across a portfolio of alliances (Kale and Singh, 1999; Hoffmann, *forthcoming*). Other theoretical viewpoints have proven to complement these theories, such as among others, evolutionary economics (Nelson and Winter, 1982), organizational learning and knowledge-based theory (Conner and Prahalad, 1996; Grant, 1996; Lei et al., 1997; Argote and Ingram, 2000), resource-based theory (Wernerfelt, 1984; Barney, 1991; Peteraf, 1993) and the dynamic capability view (Teece et al., 1997; Eisenhardt and Martin, 2000). In line with Richardson’s (1972) logic, these theories point to organizational capabilities rather than to dyadic and relational characteristics to explain persistent performance differentials among firms. This specific area of alliance research pays attention to a firm’s internal features that are often difficult to buy or imitate, such as managerial processes, tools and routines and learning abilities (Dierickx and Cool, 1989; Khanna et al., 1998; Lane and Lubatkin, 1998). For instance, some recent studies advance current understanding of the link between experience and learning curves and gains and rent generation (Dutton and Thomas, 1984). Similarly, several researchers have pointed to alliance experience as an important explanatory variable for alliance performance (Reuer et al., 2002b; Hoang and Rothaermel, 2005). Alliance experience is elementary to

nurture the learning process, as contingencies can be better anticipated and responded to (Anand and Khanna, 2000; Mayer and Argyres, 2004). In spite of the fact that accumulated experience (i.e. prior trials and tribulations) positively influences learning, learning curves vary significantly among firms and therefore provide some explanation why persistent alliance performance differentials are observed (Anand and Khanna, 2000; Pisano et al., 2001). Other scholars have confirmed the positive relationship between alliance capabilities and alliance performance, thereby pointing to a mixture of behaviors, attitudes and organizational elements that foster alliance performance. Their positive relationship is caused by relational qualities, alliance knowledge transfer or a combination of these two aspects as means to improve alliance performance (e.g. Powell et al., 1996; Simonin, 1997; Anand and Khanna, 2000; Sivadas and Dwyer, 2000; Arino et al., 2001; Lambe et al., 2002). While various studies examined the effect of alliance capabilities on value creation in alliances by for instance measuring the effect of an alliance department or function (Kale et al., 2002), empirical evidence on specific mechanisms fostering alliance portfolio performance remains scarce. Moreover, even though such insights have progressed our understanding, they are unlikely to reflect the full artillery firms deploy to prevent they fall victim to conventional alliance failure. In other words, the complexity involved in managing alliances is unlikely to be captured by one dimension (Axelrod, 1997). Hence, I posit that –in line with Dyer et al. (2001) and Parise and Casher (2003)- there are other mechanisms such as alliance performance metrics and partner selection procedures that help firms improve alliance portfolio performance. This study intends to fill this void by investigating the mechanisms that help improve a firm’s alliance portfolio performance.

In order to better understand how firms can optimize rents from their alliance portfolio, it is essential to clearly define the different concepts.¹ In this study, I define an alliance portfolio as the number of a firm's strategic alliances. Strategic alliances (also referred to as 'alliances') are defined as temporary cooperative agreements in which two or more firms share reciprocal inputs to realize improved competitive positions for the partners involved, while maintaining their own corporate identities (Contractor and Lorange, 1988; Parkhe, 1993). Alliance mechanisms are defined as organizational attributes that create repeatable patterns of action such as selecting potential partners and evaluating performance in alliances. Alliance mechanisms enable firms to become more successful at managing alliance portfolios as they facilitate the transfer of critical knowledge and practices which become embedded in routines thereby creating alliance capabilities (Collis, 1994; Kale and Singh, 1999; Eisenhardt and Martin, 2000; Winter, 2003). Miller (2003: 969) notes that such mechanisms not only help "*share knowledge across different parts of the organization ... [but also contain] routines [which] institutionalize knowledge*". In line with the logic of Hunt and Morgan (1996) and Helfat and Peteraf (2003), I define alliance capabilities as a higher-order resource constituted by the firm's set of alliance mechanisms which aims to optimize the ex ante resource deployment and asset commitments in its alliance portfolio. Higher-order resources can be called 'capabilities' (Amit and Schoemaker, 1993) and are said to determine the way in which firms manage their resources (Teece et al., 1997). Makadok (2001) defined a capability as a special type of resource which is organizationally embedded and nontransferable and improves the productivity of other resources possessed by the firm. This definition explicitly suggests capabilities should be built to enable resources to be efficiently deployed.

1. As it is not our intention to provide an extensive overview of the vast amounts of literature on e.g. RBV and DCV, I refer to other papers for more elaborated reviews (Peteraf, 1993; Foss, 1997; Teece et al., 1997; Dosi et al., 2000; Fujimoto, 2000).

The next sections will define the hypotheses and analyze and discuss the findings.

HYPOTHESES

While the topic of ‘alliances’ has been extensively analyzed over the past decades, surprisingly little attention has been paid to the specific problems and tasks of managing alliance portfolios (Hoffmann, 2005). Nor has the effect of alliance mechanisms on alliance performance been extensively analyzed (Simonin, 1997). Given that alliances are generating an increasing percentage of firm sales (Margulis and Pekar, 2001) it becomes ever more critical for firms to be aware of practices that allow some firms to enhance their alliance portfolio performance. There are a number of reasons to expect that firms with greater alliance experience make more use of alliance mechanisms to manage their alliance portfolio. First, it is important for firms to ensure proper use of invested resources and use of partner resources. Within Amit and Schoemaker’s (1993) and Makadok’s (2001) framing of the resource-capability relationship, alliance mechanisms can be seen as organizational attributes that allow firms to effectively deploy resources invested in the alliance to for instance explain differential learning in alliances (Kumar and Nti, 1998). So, firms that have greater experience in managing alliances have more prior knowledge which –in order to be optimally leveraged- should be dispersed using alliance mechanisms (Simonin, 1997, Kale et al, 2002).

Second, more and more firms start to compete using networks of partners (Gomes-Casseres, 1994; Gulati, 1998). Instead of focusing on realizing success in single alliances, firms are confronted with the need to manage set of alliances which are elementary to driving a firm’s overall performance (*Financial Times*, 2000; *Forbes Magazine*, 2001; Dyer and Hatch, 2004). Although in some firms individual managers are responsible for managing and coordinating a (number of) certain alliance(s), firms that

have large alliance portfolios can lose sight over their set of alliances (Yoshino and Rangan, 1995; Hoffmann, 2005). This can create a lack of alliance strategy which decreases the chances that a firm knows what alliances are critical for what reasons (Bamford et al., 2003). Therefore, alliance mechanisms can be used to increase the coordinative capacity of the firm (Teece and Pisano, 1994; Kale and Singh, 1999; Nault and Tyagi, 2001).

Third, as a firm's alliance experience and the number of alliances it manages increases, it will require a more sophisticated set of alliance mechanisms. In case a firm only manages a few alliances relatively rudimentary forms of knowledge exchange may suffice to share important insights. However, when a firm's alliance portfolio has gained a substantial size, it takes other alliance mechanisms to ensure optimal use of gained experiences and to yield maximum gains (Bamford and Ernst, 2002; Ernst and Bamford, 2005). For instance, informal and unstructured knowledge sharing or meeting between executives may suffice to inform others of the new lessons and skills gained when there are only a few alliances a firm needs to manage. But when the firm's alliance experience increases, the potential of the lessons learned also increases. It therefore becomes more relevant to install more formal means such as for instance an alliance database to ensure the knowledge gained is captured. Hence, extant literature has suggested that firms use alliance mechanisms manage their alliance portfolio and disperse alliance experience (e.g. Parise and Casher, 2003; Goerzen, 2005; Hoang and Rothaermel, 2005). For these reasons, I posit:

Hypothesis 1: There is a positive relationship between the firm's alliance experience and the number of alliance mechanisms it has in place.

While some studies find positive relationships between alliance portfolios and alliance performance (Stuart et al., 1999; Baum et al., 2000), little is

known about internal drivers that foster value creation in alliance portfolios (Sarkar et al., 2004). Again other studies have pointed to the role alliance experience and capabilities play in explaining persistent performance differences (Anand and Khanna, 2000; Kale et al., 2002; Hoang and Rothaermel, 2005; Rothaermel and Deeds, 2005). In order to ensure that maximum amount of value is extracted from their alliances, firms will have to leverage prior knowledge to their advantages by sharing successes and failures (Goerzen, 2005). In spite of the increasing attention paid to alliance capabilities, empirical evidence of relevant dependent variables (i.e. alliance experience and capabilities) on alliance portfolio performance is scarce.

In order to understand *how* firms learn from previous experiences and develop alliance capabilities, it becomes relevant to understand what alliance mechanisms can be used to manage alliance portfolios (Simonin, 1997). Explicating how mechanisms help transfer knowledge by analyzing the underlying learning processes is critical to foster a genuine of firm's learn to manage their alliance portfolio. Unfortunately, while learning in general has received extensive scholarly attention (e.g. Cohen and Sproull, 1996; Paulus and Yang, 2000; Szulanski, 2000; Easterby-Smith and Lyles, 2003), how firms have organized to share knowledge on their alliance portfolios has received little attention.

Although some empirical evidence has been found linking alliance experience and performance, most studies fall short of explicating what building blocks are used to develop alliance capability, or the ability to manage alliance portfolios. Alliance mechanisms help increase a firm's alliance portfolio performance in a number of ways. First, alliance mechanisms help transfer knowledge. Value creation in alliances will only become effective if knowledge is both transferred and integrated (Almeida et al., 2002). As Kale et al.'s (2002) study suggested using e.g. an alliance function or department helps to *structurally* coordinate alliance knowledge in the firm (Kale et al., 2002). In this way, it can act as a central coordination mechanism (Harbison and Pekar, 1998a) or coordinative

capacity (Teece and Pisano, 1994; Kale and Singh, 1999; Nault and Tyagi, 2001). Moreover, mechanisms such as alliance training can stimulate knowledge sharing and the dispersion of lessons from prior experiences thereby fostering the body of knowledge in a firm (Oliver, 2001). As a firm's absorptive capacity is constituted by its prior related knowledge, sharing experiences will enable it to recognize the value of new information and to assimilate and apply it to commercial ends (Cohen and Levinthal, 1990).

Second, by stimulating dispersion of individual experiences and knowledge in general, the collective competence of the firm is nurtured (Zollo and Winter, 2002). It is important to leverage knowledge across a firm's alliances by considering alliances as a portfolio rather than a separate activity (Lorenzoni and Baden Fuller, 1995). Isolation of an alliance by considering it as a stand-alone activity would unnecessarily limit the firm's learning abilities (Khanna et al., 1998). In this context it is critical that acknowledge that acquired knowledge is only valuable after its diffusion (Hamel et al., 1989) and that the most effective manner to exchange knowledge is from peer to peer (Alliance Analyst, 1999). For instance, knowledge exchange between alliance managers can be an effective means to formalize communication channels through which valuable knowledge can be transmitted. Moreover, the use of an alliance trainings can prove a structural means through which information on alliance progress is dispersed throughout the firm and codification stimulated (Harbison and Pekar, 1998). Even cultural sensitivity, which can be fostered by cultural trainings, can enhance alliance performance (Johnson et al., 1996).

Third, alliance mechanisms are likely to stimulate the definition and execution of an alliance strategy (Bamford et al., 2003). Using a central (staff) position by either installing a single position or by creating an entire department has the potential to create an overview of the entire portfolio of alliances and the strategy behind each of these alliances (Hoffmann, 2005).

Fourth, the use of alliance mechanisms gives a firm-wide sign that alliances are considered important reflect management commitment to both

internal and external knowledge exchange (Inkpen, 1998). For instance, using sophisticated incentive systems not only helps employees to share in an alliance, but it can also increase employee involvement (Aldrich, 1999). Alliance metrics and rewards and bonuses can prove a useful means to this end. This can positively influence the continuity among personnel, which in turn greatly affects the success of knowledge absorption in the alliance (Leonard-Barton, 1995).

Fifth, alliance mechanisms can help firms manage a number of critical tasks for a firm with respect to its alliances. They aid in the process of day-to-day management of alliances by increasing know-how of particular stages of the alliance life-cycle or by raising alliance know-how throughout the firm. As they help to disseminate knowledge by either codification (e.g. best practices or alliance database) or verbalization (e.g. alliance training) they improve chances of resolving conflict situations and aid in joint problem solving activities (Mohr and Spekman, 1994; Kale et al., 2000).

Last, as Kor and Mahoney (2005) underline, investments made to improve alliance portfolio management constitute tangible efforts to build capabilities. Such investments represent a commitment to learn and allow for specific processes and routines to evolve and ultimately to engender superior performance (Hamel, 1991; Zollo and Winter, 2002).

Hypothesis 2: Alliance mechanisms have a positive impact on a firm's alliance portfolio performance.

In addition to the direct effect of alliance mechanisms on alliance portfolio performance, it is interesting to investigate this effect holds for different types of alliances. Previous studies have looked at such issues as the differential effect of alliance experience on different alliance types (Anand and Khanna, 2000) or focused on alliance portfolio characteristics (e.g. George et al., 2001; Rothaermel and Deeds, 2005). However, little is known

about whether different types of alliances equally benefit from alliance mechanisms.

There are a number of reasons for this. First, equity alliances tend to carry more characteristics of a hierarchy (Williamson, 1975). Under this assumption it seems reasonable to expect that a firm's alliance experience will have a relatively greater impact on types of alliances the firm as an organization has little resemblance with. Second, conventional management principles that apply do not apply in alliances and partners need to need to rely on principles of cooperation rather than command and control. This is particularly evident for non-equity alliances which tend to be of a more fluid and informal nature. In contrast, equity alliances involve shareholdings which by definition provide the equity holder with control to ensure influence on outcomes. Third, besides the surge in non-equity alliances in different sectors, a marked trend is the decrease in the use of joint venture as a mode of cooperation (Hagedoorn, 2002). Given this increasing importance of non-equity forms of alliances, firms tend to gain experience in this particular form, leading to improved performance in these types of alliances. Hence, the traditional principle of learning from alliance experience in this respect is expected to hold. For these reasons, I posit that:

Hypothesis 3: The impact of alliance mechanisms will be greater for alliance portfolios that are dominated by equity alliances rather than non-equity alliances.

The next section discusses the design and data collection of this study.

DESIGN, DATA AND METHODOLOGY

In order to test the hypotheses defined, a survey was sent out to alliance managers and Vice-Presidents who were responsible for managing and overseeing the firm's alliance portfolio. In addition, semi-structured

interviews were used to interview twelve experts in the field of alliance management which allowed me to interpret the findings.

Survey

All survey questions referred to a firm's entire alliance portfolio and most were closed using a 5-point Likert-type scale (see appendix 4). The primary data sources were the database of the Association of Strategic Alliance Professionals and the Dutch internet society. These databases allowed me to address the mailing to VP's of alliances or – in absence of this function- to top managers in charge of corporate alliance management. This ensured that I approached those people in the organization that were sufficiently knowledgeable about the organization's mechanisms and performance levels. The survey was conducted among 650 alliance managers and Vice-Presidents.² It was sent out to the respondents, where after I sent out a reminding message in order to maximize the response rate (Dillman, 1978). Having received 206 responses the response rate was 31.7%, which is good in comparison to most research in strategic management (Snow and Thomas, 1994) and comparable to most prior studies on alliances (e.g. Kale et al., 2002; Reuer et al., 2002a; Zollo et al., 2002). However, after data screening to delete invalid cases and remove outliers, a sample of 192 respondents resulted. In total, the 192 firms report on approximately 3477 alliances.³ The average alliance portfolio of the respondents contained 18.11 alliances. The next table shows the distribution of the categories.

-- insert table 1 about here --

2. The dataset was gathered during two periods: the first group of respondents filled out the questionnaire at the end of 2001 and the second group at the beginning of 2004. The key variables were comparable between the groups and not deviate in any substantial way.

3. The variable measuring the number of alliances consists of five categories (0-5, 6-15, 16-25, 25-40 and >40 alliances). For the last category (>40 alliances), the average was set at 50 alliances. Hence, the total number of alliances is therefore an estimate of 3477 alliances.

Another issue respondents reported on concerned the market value (i.e. share price times number of shares) generated via alliances. Whereas in 2001 an average of 38% of the respondents' market value is generated via alliances, they expect 51% to be generated via alliances in 2006. The next table shows the results.

-- insert table 2 about here--

The dataset provided cases from various industries: 3% chemicals, 17% ICT, 26% ICT services, 5% financial services, 30% other services (e.g. consultancies), 3% pharmaceuticals and biotechnology, 10% other manufacturing and 4% public sector (e.g. education and non-profit organizations), and 2% is missing data. This means that 82% of the respondents are active in ICT and service sectors. Furthermore, firm sizes in terms of yearly sales revenues also showed divergence. The largest amount of respondents, namely 35%, is found in the category of US\$ 1b to US\$ 50b. The rest is found in: 24% below \$1m, 23% between \$1-100m, 13% between \$100m-\$1b, 4% larger than \$50b, and 1% was missing data. The sample diversity should not hamper the validity of this study's result, as alliance mechanisms should equally influence alliance performance independent of the specific firm or alliance (Day, 1995).

To ensure that the dataset was not biased as a result of non-response, the data was screened to compare a number of respondent characteristics. These characteristics were investigated to understand if the sample was a good representation of the population. First of all, an analysis was performed to verify if any non-response bias was apparent using three variables to compare early versus late respondents. The three variables were: firm size measured as the number of employees of the parent company, firm size as measured by total worldwide sales revenues and alliance performance. Chi-square tests for each of these measures show that

there is no difference between the different categories.⁴ This demonstrates that there is a relatively equal division between small to medium-sized and large firms in terms of both the number of employees and sales revenues as well as alliance performance level when comparing early and late respondents. As late respondents can assumed to be comparable to non-respondents, this indicates that there was no significant non-response bias in the dataset (Armstrong and Overton, 1977). Second, the average alliance performance of the sample was 52%, which is comparable to other studies on alliance performance (Park and Ungson, 2001). These results suggest that the sample is not skewed in terms of firm size or in terms of alliance performance, which implies that the validity of the dataset was not influenced as a consequence of non-response bias.

Expert interviews

In addition to the survey, in-depth expert interviews were conducted. For these interviews, twelve experts in the field of alliances and capability development were selected worldwide. Within the group of experts, there was a sound division between practitioners (seven in number) and academics (five in number). However, some of the experts were active in both academia and business. The experts interviewed were selected on basis of their established reputation in the field and ability to sufficiently contribute to the goal of these interviews on basis of their prior experience and related knowledge.

The interviews served two purposes. On the one hand, they allowed for a verification of the empirical findings. On the other hand, the interviews were aimed at validating and extending the argumentations for expected and unexpected results and the reasons why the study's findings

4 . None of the three variables was significant at the 5% level. The chi-square statistic shows a χ^2 -value of 2.386 (p-value is 0.122) for number of employees, a χ^2 -value of 1.947 (p-value is 0.163) for sales revenues and a χ^2 -value of 3.133 (p-value is 0.077) for alliance performance. Therefore, no significant correlations were found between item scores and survey response time.

were appropriate. Mirroring the findings against the opinion and insights of practitioners and academics should nurture stronger and more reliable results. The interviews were semi-structured and lasted between sixty and ninety minutes (see appendix 5). The interview questions were partly exploratory and mostly open-ended (Greer et al., 2000). Before interviewing the envisioned experts, a panel of interviewees allowed for informal pre-testing of the questionnaire (Churchill and Iacobucci 2001). After the pre-tests, the interviews were recorded with consent of the interviewees and thereafter transcribed to allow for comparison of the different interviews. Moreover, the results were summarized during the interview in order to ensure an adequate representation of the expert's answers. Hence, the results of these interviews were used to verify the findings. Analyses of the results were done by comparing individual arguments and comments of the interviewees to the findings and categorize any arguments given to provide additional support for empirical findings.

Explanatory variables

Given the infancy of the field of research, measurement of intra-firm mechanisms and antecedents of alliance portfolio performance in general is an emerging and challenging area. I used a number of explanatory variables to examine the hypotheses. First, alliance mechanisms were operationalized using expert input and in line with earlier studies (Bamford and Ernst, 2003; Draulans et al., 2003). This helped me define twenty-nine intra-firm mechanisms that are critical to the performance of alliance portfolios. From a managerial viewpoint, the alliance mechanisms analyzed in this study can be divided into four categories: functions, tools, control and management processes and external parties (see appendix 3 for an overview). In line with the logic followed by Gittell (2002) and Miller (2003), these mechanisms reflect the way in which firms develop alliance capabilities. They essentially function as organizational attributes aimed at enhancing alliance performance. Following Afuah (2000) and Kale et al. (2002), the

investigation of these twenty-nine key variables of alliance capability are all represented by single-item dummy variables. Despite the fact that it suffers from limitations such as the assumption that all mechanisms are equally important, I use it for a number of reasons. First of all, using binary variables to measure whether a firm deploys a certain intra-firm mechanism provides an objective way to measure the issue under investigation. For instance, asking a respondent whether his firm has an alliance department can be answered straightforwardly by responding 'yes' or 'no'. In doing so, I follow a recent study by Knott (2003), who investigates the effect of franchise routines on franchise performance. Second, using alternative scales such as a Likert scale would seriously complicate the comparison and summing up of the individual mechanisms. Given the different nature of the mechanisms, it would have been practically impossible to use one definition of a Likert scale for all mechanisms (e.g. the use of intranet could be quantified by for instance daily or weekly use, the contribution of a Vice-President would have to be measured differently). This would have resulted in difficult to interpret results and substantial loss of information. Third, as this study seeks to examine the use of mechanisms aimed at alliance portfolio management, it is also important to take into account the unruly nature of practice. Adding a third option to the 0-1 scale, for instance the option 'don't know' or 'no opinion', is not likely to improve the quality of the results as there is little ambivalence in having or not having a mechanism in place. Moreover, adding such a category makes people more prone to opt for the alternative 'no opinion' (DeVellis, 1991; Baarda and De Goede, 1995). The option of ascribing different weights to different mechanisms was not considered appropriate, because of the different nature of the mechanisms and a lack of insight into the specific (quantitative) contribution each mechanism makes. Hence, given these arguments, I conclude that the use of a binominal semantic differential scale suits the purposes of this study, as it allows me to examine the extent to which firms make use of internal mechanisms to develop alliance capabilities.

The second explanatory variable is the percentage of equity alliances in a firm's alliance portfolio ('equity percentage'). This variable was measured using a 5-point Likert scale with 20% intervals (i.e. 0-20%, ... 81-100%).

Control variables

In the analyses, I control for a number of variables: alliance experience, firm size and industry effects. First, in line with earlier studies (e.g. Kale et al., 2002; Li and Rowley, 2002; Tsang, 2002b), alliance experience was measured as the number of alliances formed over the period 1997-2001. Second, firm size was measured as the firm's annual sales revenues in the year 2000 and was added as large firms are more likely to enter into a larger number of alliances. Last, two industry-related control variables were used: ICT-related and service-related sectors. ICT-related sectors consist of ICT and ICT-service sectors (43% of the total sample) and service-related sectors were defined as ICT-services, financial services, other services and public sectors (65% of the sample).

Dependent variable

So far, in spite of some notable exceptions (e.g. Sarkar et al., 2004), most empirical investigations analyze individual alliance performance rather than the performance of a firm's entire alliance portfolio. In general, three groups of measures are used: financial, operational and organizational effectiveness performance (Venkatraman and Ramanujam, 1986). The first group includes measures such as profitability and growth (e.g. Parkhe, 1993; Hagedoorn and Schakenraad, 1994; Aulakh et al., 1996; Combs and Ketchen, 1999; Sarkar et al., 2001). Longevity, survival and duration are part of the second group and are therefore examples of operational performance measures (e.g. Killing, 1983; Harrigan, 1988a; Kogut, 1988). The third and most common way to measure alliance performance is to use organizational effectiveness measures. These measures determine the

overall satisfaction with the alliance or the extent to which objectives have been met (e.g. Geringer and Hebert, 1991; Mohr and Spekman, 1994). Whereas the former two groups of measures are objective, the third group is more subjective.

Various studies have investigated the need to use objective, subjective or a composite index to measure alliance performance (e.g. Arino, 2003). Geringer and Hebert (1991) have shown that objective and subjective measures tend to be highly correlated. In spite of early criticism on the use managerial assessments as a measure for alliance performance, there is an emerging consensus that managerial assessments of performance provide a sound reflection of alliance performance (Kale et al., 2002). In this study, I measured alliance performance as a composite measure reflecting the performance of a firm's alliance portfolio over the period 1997 to 2001. It therefore reflects the percentage of a firm's alliances in its alliance portfolio that was considered successful, i.e. the percentage of alliances where the firm's initial goals were reached (Hamel et al., 1989; Hamel, 1991; Zollo et al., 2002), over five consecutive years. Given the fact that firms form alliances for specific reasons, asking alliance managers to what extent the stated alliance objectives were achieved is an effective and scientifically established manner to assess the success of an alliance (Tuchi, 1995; Kale and Singh, 1999). Also, it can be seen as an indicator of overall performance satisfaction (Arino, 2003). Moreover, it would be irrelevant to investigate additional performance items such as learning or relationship quality given the fact that I investigate the performance of a firm's alliance portfolio. These items in general relate to performance in individual alliances.

ANALYSIS & RESULTS

A number of tests were performed in order to the hypotheses. A first analysis showed that the independent variables seemed to have high correlations. In order to solve problems associated with multicollinearity,

the data were mean centered (Aiken and West, 1991). Doing this helps to reduce the correlation between the variables and to render more meaningful results (Long, 1997; Cohen et al., 2003). The descriptive statistics and correlations for the variables are shown table 3.

-- insert table 3 about here--

First, I used ordinary linear regression to test whether firms use more alliance mechanisms as their alliance experience increases.

-- insert table 4 about here--

The findings provide support for hypothesis 1 as indeed the number of alliance mechanisms is positively and significantly ($B=.386$, $p<0.001$) related to the firm's alliance experience. Of the three control variables included in the model (i.e. firm size, ICT and service sector), firm size ($B=.201$, $p<.01$) and ICT sector ($B=.134$, $P<.05$) are significantly and positively related with the size of a firm's alliance portfolio.⁵

Second, in order to examine whether alliance mechanisms have a positive effect on alliance portfolio performance (hypothesis 2) I applied two techniques: discriminant analysis and ordinary logistic regression. First, discriminant function analysis was used to compare practices between low and high-performing firms. This technique derives the maximum discrimination among the two groups using alliance performance group membership as a categorical, dependent variable (Hair et al., 1998; Klecka, 1980). Low-performing firms were defined as having an alliance performance level between 0 and 40% and high-performing firms between 61-100%. Firms having a performance level between 41 and 60% were left out of this particular analysis because extant literature suggests that on

average success rates of companies vary from 40-60% (Park and Ungson, 2001). If significant differences were found between low and high performing firms, this would indicate that alliance mechanisms play a critical role in enhancing a firm's alliance portfolio performance.⁶ The results indeed show that alliance mechanisms discriminate between low and high-performing firms.⁷ In order to verify the discriminatory power of the model tested, I assessed the discriminatory power of the total set of variables. I will consider the 'goodness' of the discriminant functions as is reflected in various indicators presented in the next two tables.

--insert table 5 about here--

--insert table 6 about here--

The first indicator is the eigenvalue which represents the relationship of the between group and the within group sum of squares. Higher eigenvalues can be associated with more discriminating functions. In this case, the function seems to have moderate to strong discriminating power. Other important statistics include the canonical correlation, which represents the proportion of total variance that is accounted for by differences among low and high-performing firms. A chi-square value of 39.959 and a corresponding significance of 0.085 imply that the hypothesis, that the mean scores on the various variables for the different groups are equal, is moderately supported. A number of robustness checks –i.e. classification matrix (see table 7), Box's M test- were performed. The outcomes of these

5. Interestingly, I also found that there is a significant correlation to the market value firms expect to generate via alliances in 2006 and the amount of mechanisms they use (B=.159, p<.05, F-value= 4.95, R²=.025).

6. Please note that for this analysis, N=139 due to the fact that the average performance group (41-60%) was left out.

7. Please refer to appendix 1 for the ANOVA table. The mean values of fifteen variables differ significantly between the two groups. I also investigated the structure matrix which is presented in appendix 2 (Klecka, 1980). Moreover, in order to ensure the robustness of

tests confirm the robustness of the test and suggest a relatively large degree of divergence among firms from the two success categories.

-insert table 7 about here--

Although these results provide preliminary and moderate support for the positive effect of alliance mechanisms on alliance portfolio performance (hypothesis 2), it is also interesting to examine whether there are latent dimensions which link individual mechanisms and that underlie successful alliance portfolio management (Gorsuch, 1983; Hair et al., 1998). In order to analyze the effect of alliance mechanisms at a scale-level, I apply exploratory factor analysis for dichotomous independents (Muthen and Christoffersson, 1981). The goal of EFA is to derive the smallest number of interpretable factors so as to adequately explain the apparent correlations among the variables used. Given that applying the conventional factor analysis procedures with dichotomous items often produces uninterpretable results (Bernstein and Teng, 1989), Mplus was used to perform the factor analysis (Bartholomew, 1987; Agresti, 1990).⁸ Since I do expect the mechanisms to be correlated, a rotational method called oblique or PROMAX rather than an orthogonal method or VARIMAX was used (Tucker and MacCallum, 1997). The results for the multi-item measures are presented in the next table. With a sample size of approximately 200 cases, the factor loadings should be .40 or higher in order to be significant at the 5% level (Hair et al., 1998: 112). The coefficient alpha is calculated to measure the internal consistency of the items used and are allowed to decrease to the .70 level (Nunally and Bernstein, 1994).

-- insert table 8 about here--

the model tested, I performed logistic regression analyses (Press and Wilson, 1978); the results confirmed our findings.

Whereas the second factor is slightly below the recommended level (0.63), the first factor is substantially higher (0.82) which are levels that are tolerable in exploratory settings (Robinson et al., 1991). The table also shows the eigenvalues of the factors, which is a criterion for the number of factors to extract from the analysis. As the values of the latent root or eigenvalues are all greater than 1, they are all above the cut-off level of 1 (Hair et al., 1998: 103). This indicates that these factors explain more than the variance of a single variable and hence they can be included. The root mean square residual is 0.0707, which is an acceptable level (Hair et al., 1998). The factor correlation is .551, which is a moderate level of intercorrelation, suggesting that the factors overlap to some degree but also represent conceptually distinct measures. In addition, factor analysis of tetrachoric correlations revealed the same factor structure.

The first factor is interpreted as structures and processes aimed at knowledge exchange at an organizational level (e.g. alliance manager or database) while the second is aimed at dispersing knowledge on alliance portfolio management at a group level (using e.g. different types of training and best practices).⁹ The expert interviews confirm this interpretation, i.e. there are two types of organizational attributes to improve alliance portfolio performance: attributes that create processes and structures to coordinate and control alliance activities and (e.g. alliance managers) and knowledge sharing attributes by having employees share exchange prior experiences (e.g. best practices).

The next table shows the results of the ordinal logistic regression which was used to examine effects of these two factors on alliance portfolio

8 . For a more elaborate discussion on critical issues in exploratory factor analysis with dichotomous items, I refer to Bernstein et al. (1988), Nunally and Bernstein (1994) and McLeod et al. (2001).

9. Crossan et al. (1999) also refer to group level learning as 'integrating' mechanisms and to organization level learning mechanisms as 'institutionalizing' mechanisms which help firms to embed practices and routines.

performance (Hosmer and Lemeshow, 2000).¹⁰ Using a hierarchical approach, I begin with a baseline model that only includes control variables. I include firm size, alliance experience (calculated as the number of alliances formed over the last 5 years), and two sector-specific variables for the ICT and service sector as controls.

-- insert table 9 about here--

Model I shows the results of the baseline model. The outcomes indicate that only alliance experience ($B=.446$, $p<.001$) is a significant control variable. Model II shows the results when the independent variables are included. It shows that alliance experience ($B=.483$, $P<.05$) and group level mechanisms ($B=.411$, $p<.01$) have a positive and significant effect on alliance portfolio performance. Except for alliance portfolio size, none of the control variable has a significant effect on alliance portfolio performance. The results remained identical even I changed or eliminated individual items from the factors. The results were similar in case I used alternative statistical techniques such as ordered logit or probit. These results provide convincing support for the positive effect of group level learning mechanisms on alliance portfolio performance (hypothesis 2).

In order to test whether different types of alliances benefit equally from the use of alliance mechanisms, a number of models were defined. To test for a moderating of the variable 'equity percentage' (i.e. the percentage of alliances in a firm's alliance portfolio that is equity-based), three models were tested (Sharma et al., 1981; Cohen et al., 2003). The following table shows the results.

--insert table 10 about here--

10. Please note that for this analysis $N=166$ because of missing variables.

Model I again shows the main effects of group and organizational level mechanisms as well as the controls (these results are similar to the ones presented in model II of table 9). Model II shows the results when interaction effects of the independent variable 'equity percentage' are included as well. Model III shows the results in case 'equity percentage' is added as separate independent (Jaccard, 2001).¹¹ Moreover, the increase in R^2 confirms the moderating effect for these models (Cote, 2001). Model IV follows Sharma et al.'s (1981) suggestion to also test for a potential main effect of 'equity percentage'; as model IV shows, there is no such main effect of equity percentage on alliance portfolio performance. The results show that percentage equity is a moderating variable in the models tested. In other words, alliance portfolios which predominantly consist of equity alliances benefit less from the firm's alliance mechanisms than alliance portfolios which consist primarily of non-equity alliances.

DISCUSSION & CONCLUSION

The findings of this study provide a number of new insights based on the analyses of 192 firms that have a total alliance portfolio of 3477 alliances. The results of the empirical analysis reveal some important findings about the use and effect of alliance mechanisms on alliance portfolio performance. First of all, I find a positive significant relationship between alliance experience and the use of alliance mechanisms ($B=.39$, $p<.001$). This implies that the greater a firm's alliance experience, the more alliance mechanisms it uses to manage its alliance portfolio. The positive effect was confirmed during many of the expert interviews. One expert mentioned: *"They [the mechanisms] are building blocks and can almost be called artifacts. ...I don't think you can learn very well if you don't have them"*. In order for firms to be

¹¹ . Please note that multicollinearity is not an issue in moderating models unless extremely high levels of correlation ($>.98$) between independent variables occur which is not the case (Jaccard, 2001).

able to capture the value inherent in prior experiences, it is important to use alliance mechanisms to disperse these lessons. More specifically, the need for firms to use alliance mechanisms to ensure dispersion of prior experiences becomes more imminent when the number of alliances it has to manage and oversee increases.

Second, in trying to fill the empirical lack of evidence on the role building blocks underlying the superior ability of some firms to manage alliance portfolios, I investigated the effect of alliance mechanisms on alliance portfolio performance. These results suggest that, in line with previous research on alliance capabilities (Anand and Khanna, 2000; Sivadas and Dwyer, 2000; Kale et al., 2002; Lambe et al., 2002), high-performing firms employ a significantly larger number of alliance mechanisms than low-performing firms. This finding was supported in a multivariate setting and provides convincing support for hypothesis 1. These findings extend current literature as they reveal *how* firms manage their alliance portfolios and to what extent specific organizational attributes explain consistent performance differentials between firms when it comes to alliance management.

Third, in order to uncover latent dimensions that group individual alliance mechanisms, exploratory factor analysis and the subsequent regression analyses were used. The former revealed two dimensions: group and organization level mechanisms. While the dimension group level learning mechanisms contains five distinct mechanisms, it reflects a firm's activities to distribute alliance knowledge at a group level (i.e. 'action and reflection between group members'), organization level learning mechanisms contain ten distinct mechanisms and stimulates a firm's ability to create structures and routines among all people inside the organization (i.e. 'routines engrained in the organization's memory') (Scharmer, 1991; Cohen and Bacdayan, 1994). Whereas group level learning integrates knowledge, organization level learning institutionalizes knowledge; in other words, while 'integrating' knowledge aims to create shared understanding to

engender coherent practices within a group, ‘institutionalization’ embeds knowledge in systems, structures, routines and prescribed practices (Crossan et al., 1999: 525). A comparable argument was presented in a popular on how leading firms develop alliance capabilities: one way to improve alliance portfolio management is to use of mechanisms that codification and verbalize while another way emphasizes the use of fixed structures and processes (Alliance Analyst, 1994). The interpretation of the exploratory factor analysis was clearly supported by the results of the expert interviews. An interesting observation was made by a Director of Alliances of a Dutch airline operator: *“Initially, alliances were managed individually. At that point, we primarily relied on exchanging best practices. However, as we reckoned alliances were a major contributor to the business development of our firm, we started building alliance competences; consolidating our knowledge did this. This way, we anticipated, we could develop the discipline called alliance management. ... We set up an alliance department through which institutional learning could take shape, in which knowledge could be developed and processes could be adopted more easily.”* From this observation which describes to a period of approximately seven years, it is apparent that the lessons learned make up an essential element of how firms can successfully manage their alliance portfolios.

An intriguing finding concerns the positive and significant effect of group level mechanisms and the non-significant effect of organization level mechanisms on alliance portfolio performance. While evolutionary economics discusses the tensions inherent in variation, adaptation, and selection processes (Nelson and Winter, 1982; Bruderer and Singh, 2003) and some studies extend on this tension (e.g. Benner and Tushman, 2003; Holmqvist, 2004), empirical testing in this field is scarce and little is known as to what extent different types of learning explain performance differences in alliance portfolio management. The regression analyses clearly show that group level mechanisms explain performance differences between firms. This implies that rather than becoming inert and relying on sticky

knowledge, firms should emphasize the generation and adjustment of routines embodied in new experiences. Or as Simonin (1997: 1151) put it: “*experience must be transformed into know-how*”. The use of organization level mechanisms, which imposes prescribed practices via installed processes and structures, restrict the ability of employees involved in alliance management to implement and apply personalized and tacit knowledge. Hence, organization level mechanisms hamper the ability to leverage prior experience.

Moreover, in line with prior studies (e.g. Chan et al., 1997; Anand and Khanna, 2000; Li and Rowley, 2002; Hoang and Rothaermel, 2005), I find that the performance effects remain dependent on the number of alliances a firm employs, i.e. in addition to the effect of learning mechanisms. This finding underlines the importance of renewing and adjusting practices in order to have firms not become inert and treat alliances as homogeneous phenomena (Szulanski, 1996; Ernst and Bamford, 2005). In contrast to a study by Kale et al. (2002), who examined the effect of an alliance function on alliance performance, the findings of this study suggest that organization level learning mechanisms (e.g. a Vice-President of alliances or the use of intranet as a company-wide mechanisms to update employees on alliance issues) do not substantially impact alliance portfolio performance. In line with Simonin (1997), the results suggest that the prior experiences and alliance knowledge becomes truly valuable when they are dispersed using preferably group level learning mechanisms as their impact on performance is largest (i.e. in comparison to the effect of organization level learning mechanisms on alliance portfolio performance).

The moderating effect caused by the degree to which a firm’s alliance portfolio consists of equity-based alliances provides insight into the effect of alliance mechanisms on learning in different types of alliances. First, this finding is related to and confirms early work that suggests firms learn to contract (Mayer and Argyres, 2004). In line with Mayer and Argyres (2004) finding, I interpret the moderating effect that contractual issues become

more important in non-equity alliances given the fact that such alliances are more prone to opportunistic hazards given the difficulty to fall back on hierarchical controls. Second, the managerial complexity tends to be higher for non-equity alliances and coordination and agency cost are higher (Park and Ungson, 2001). In other words, given the inherent complexity learning to successfully manage non-equity alliances tends to be more demanding as a consequence of which the effect of alliance mechanisms to disperse this experience is stronger for non-equity alliances in comparison with equity alliances. For these reasons, the learning effects of alliance mechanisms on alliance portfolio performance is greater if the firm's alliance portfolio consists of relatively more non-equity alliances.

Limitations and future research

Despite the fact that the findings of this study extend the current understanding of how firms learn to manage alliance portfolios by using alliance mechanisms, thereby relying on the notion that learning builds on prior experience (Cyert and March, 1963; Levinthal and March, 1993), it suffers from a number of limitations. First, in line with Grant (1995), Simonin (1997) and Tsang (2002b), having certain mechanisms in place does not guarantee dissemination of knowledge. In the same light, Pfeffer and Sutton (1999) argue that there is a difference between having knowledge in-house and making effective use of it. Second, as does Simonin's (1997) study, I did not examine the impact of non-experiential learning. As Pfeffer and Sutton (1999: 95) underline: "*the fact that knowledge is acquired through experience and is often intangible and tacit produces a ... problem in turning knowledge into action*". Future research could seek to unravel the impact of non-experiential learning or compare learning effects of inter-firm experiences. Last, distinctive competitive advantage cannot be distilled from the mere possession of a certain mechanism. This requires the development of managerial capabilities as well as the difficult-to-imitate combinations of organizational, functional and technological skills (Teece et al., 1997).

Research that longitudinally examines the effect and interactions between alliance mechanisms and the actual use of such mechanisms could extend the insights gained in this study and certainly holds great potential.

REFERENCES

- Agresti A. 1990. *Categorical Data Analysis*. John Wiley: New York.
- Aiken LS, West SG. 1991. *Multiple regression: Testing and interpreting interactions*. Sage: Newbury Park, CA.
- Aldrich HE. 1999. *Organizations Evolving*. Sage Publications: London.
- Alliance Analyst*. 1994. Two grandmasters at the extremes. November 1994. NewCap Communications: Philadelphia, PA.
- Alliance Analyst*. 1996a. Arguing the collaborative core. April 1996. NewCap Communications: Philadelphia, PA.
- Alliance Analyst*. 1996b. Outsider in the middle. July 1996. NewCap Communications: Philadelphia, PA.
- Alliance Analyst*. 1996c. Managing alliances- skills for the modern era. March 1996. NewCap Communications: Philadelphia, PA.
- Alliance Analyst*. 1999. Welshing the Knowledge Rabbit. May 1999. NewCap Communications: Philadelphia, PA.
- Almeida P, Song J, Grant RM. 2002. Are firms superior to alliances and markets? An empirical test of cross-border knowledge building. *Organization Science* **13**(2): 147-161.
- Amit R, Schoemaker PJH. 1993. Strategic assets and organizational rent. *Strategic Management Journal* **14**(1): 33-46.
- Anand BN, Khanna T. 2000. Do firms learn to create value? The case of alliances. *Strategic Management Journal* **21**(3): 295-316.
- Argote L. 1999. *Organizational Learning: Creating, Retaining, and Transferring Knowledge*. Kluwer Academic: Boston, MA.
- Argote L, Ingram P. 2000. Knowledge transfer: a basis for competitive advantage in firms. *Organizational Behavior and Human Decision Processes* **82**: 150-169.
- Argote L, Ingram P, Levine JM, Moreland RL. 2000. Knowledge transfer in organizations: learning from the experience of others. *Organization Behavior and Human Decision Processes* **82**(1): 1-8.
- Argyres NS, Liebeskind JP. 1999. Contractual commitments, bargaining power, and governance inseparability: incorporating history into transaction cost theory. *Academy of Management Review* **24**(1): 49-63.
- Arino A. 2003. Measures of collaborative venture performance: an analysis of construct validity. *Journal of International Business Studies* **34**(1): 66-79.
- Arino A, De la Torre J. 1998. Learning from failure: towards an evolutionary model of collaborative ventures. *Organization Science* **9**(3): 306-325.
- Arino A, De la Torre J, Ring PS. 2001. Relational quality: managing trust in corporate alliances. *California Management Review* **44**(1): 109-131.
- Armstrong JS, Overton TS. 1977. Estimating nonresponse bias in mail surveys. *Journal of Marketing Research* **14**: 396-402.
- Axelrod R. 1997. *The Complexity of Cooperation*. Princeton University Press: Princeton, NJ.
- Bamford JD, Ernst D. 2002. Managing an alliance portfolio. *The McKinsey Quarterly* **3**: 29-39.
- Bamford JD, Ernst D. 2003. Growth of alliance capabilities. In *Mastering Alliance Strategy: A Comprehensive Guide to Design, Management, and Organization*. Bamford JD, Gomes-Casseres B, Robinson MS (eds). Jossey-Bass: San Francisco, CA: 312-333.
- Bamford JD, Gomes-Casseres B, Robinson MS. 2003. *Mastering Alliance Strategy: A Comprehensive Guide to Design, Management, and Organization*. Jossey-Bass: San Francisco, CA.
- Barney JB. 1991. Firm resources and sustained competitive advantage. *Journal of Management* **17**(1): 99-120.
- Bartholomew DJ. 1987. *Latent variable models and factor analysis*. Oxford University Press: New York.

- Baum JAC, Calabrese T, Silverman BS. 2000. Don't go it alone: alliance network composition and startups' performance in Canadian biotechnology. *Strategic Management Journal* **21**(3): 267-294.
- Benner MJ, Tushman ML. 2003. Exploitation, exploration, and process management: the productivity dilemma revisited. *Academy of Management Review* **28**(2): 238-256.
- Bernstein IH, Garbin C, Teng G. 1988. *Applied Multivariate Analysis*. Springer-Verlag: New York.
- Brown JS, Duguid P. 2001. Creativity versus structure: a useful tension. *MIT Sloan Management Review* **42**: 93-94.
- Callahan J, MacKenzie S. 1999. Metrics for strategic alliance control. *R&D Management* **9**(4): 365-378.
- Carley K. 1992. Organizational learning and personnel turnover. *Organization Science* **3**(1): 20-46.
- Carroll JS, Rudolph JW, Hatakenaka S. 2003. Learning from organizational experience. In Easterby-Smith M, Lyles MA (eds). *Handbook of Organizational Learning and Knowledge Management*. Blackwell: Oxford: 575-600.
- Chan S, Kesinger J, Keown A, Martin J. 1997. Do strategic alliances create value? *Journal of Financial Economics* **46**: 199-221.
- Chi T, McGuire DJ. 1996. Collaborative ventures and value of learning: integrating the transaction cost and strategic option perspectives on foreign market entry. *Journal of International Business Studies* **27**: 285-308.
- Cohen MD. 1991. Individual learning and organizational routine. *Organization Science* **2**(1): 135-139.
- Cohen M, Bacdayan P. 1994. Organizational routines are stored as procedural memory: Evidence from a laboratory study. *Organization Science* **5**: 554-568.
- Cohen J, Cohen P, West SG, Aiken LS. 2003. *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*. 3rd edition. Lawrence Erlbaum Associates, Publishers: Mahwah, NJ.
- Cohen WM, Levinthal DA. 1990. Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly* **35**: 128-152.
- Cohen WM, Sproull LS (eds). 1996. *Organizational Learning*. Sage Publications, Thousand Oaks, CA.
- Collis DJ. 1994. Research note: how valuable are organizational capabilities? *Strategic Management Journal* Winter Special Issue **15**: 143-152.
- Conlon DE, Sullivan DP. 1999. Examining the actions of organizations in conflict: evidence from the Delaware court of chancery. *Academy of Management Journal* **42**(3): 319-329.
- Conner K, Prahalad C. 1996. A resource-based theory of the firm: knowledge versus opportunism. *Organization Science* **7**(5): 477-501.
- Contractor FJ, Lorange P. 1988. *Cooperative strategies in international business*. Lexington: Lexington Books.
- Cote J. 2001. Structural Equations Modeling. *Journal of Consumer Psychology* **10**(1-2): 93-94.
- Cyert RM, March JG. 1963. *A Behavioral Theory of the Firm*. Prentice-Hall, Englewood Cliffs, NJ.
- Dacin MT, Hitt MA, Levitas E. 1997. Selecting partners for successful international alliances: examination of U.S. and Korean firms. *Journal of World Business* **32**(1): 3-16.
- Das TK, Teng B-S. 2000. A resource-based theory of strategic alliances. *Journal of Management* **26**(1): 31-61.
- Day GS. 1995. Advantageous alliances. *Journal of the Academy of Marketing Science* **23**(4): 297-300.
- Davis JA. 1985. *The logic of casual order*. Sage Publications, Thousand Oaks, CA.
- Dent SM. 1999. *Partnering Intelligence, Creating value for your business by building strong alliances*. Davies Black Publishing, Palo Alto.
- Dierickx I, Cool K. 1989. Asset stock accumulation and sustainability of competitive advantage. *Management Science* **35**(12): 1504-1511.

- Dillman DA. 1978. *Mail and Telephone Surveys: The Total Design Method*. New York: John Wiley.
- Dosi G, Nelson RR, Winter SG. 2000. *The Nature and Dynamics of Organizational Capabilities*. Oxford University Press: New York.
- Doz YL. 1996. The evolution of cooperation in strategic alliances: initial conditions or learning processes? *Strategic Management Journal* Special Issue **17**(3): 55-83.
- Draulans J, De Man A-P, Volberda HW. 2003. Building alliance capability: management techniques for superior alliance performance. *Long Range Planning* **36**(2): 151-166.
- Dutton JM, Thomas A. 1984. Treating progress functions as a managerial opportunity. *Academy of Management Review* **9**: 235-247.
- Dutton JM, Thomas A, Butler JE. 1984. The history of progress functions as a managerial technology. *Business History Review* **58**: 204-233.
- Duysters GM, Hagedoorn J. 2001. Do company strategies and structures converge in global markets? Evidence from the computer industry. *Journal of International Business Studies* **32**(2): 247-256.
- Dyer JH. 2000. *Collaborative Advantage, Winning through extended enterprise supplier networks*. Oxford University Press, New York.
- Dyer JH, Hatch NW. 2004. Using supplier networks to learn. *Sloan Management Review* **45**(3): 57-63.
- Dyer JH, Kale P, Singh H. 2001. How To Make Strategic Alliances Work, Developing a dedicated alliance function is key to building the expertise needed for competitive advantage. *Sloan Management Review* **42**(4): 37-43.
- Dyer JH, Singh H. 1998. The relational view: cooperative strategy and sources of inter-organizational competitive advantage. *Academy of Management Review* **23**(4): 660 – 679.
- Easterby-Smith M, Lyles MA (eds). 2003. *Handbook of Organizational Learning and Knowledge Management*. Blackwell: Oxford.
- Eisenhardt KM, Martin JA. 2000. Dynamic capabilities: What are they?. *Strategic Management Journal* Special Issue **21**(10-11): 1105-1121.
- Epple D, Argote L, Devadas R. 1991. Organizational learning curves: a method for investigating intra-plant transfer of knowledge acquired through learning by doing. *Organization Science* **2**(1): 58-70.
- Ernst D, Bamford J. 2005. Your alliances are too stable. *Harvard Business Review* **83**(6): 133-141.
- Financial Times*. 2000. Mastering management. Strategy must lie at the heart of alliances. October 16th, 2000. by B. Gomes-Casseres. Accessed March 9th, 2004.
- Forbes Magazine*. 2001. The Forbes Magnetic 40. May 21st, 2001.
- Foss NJ (ed).1997. *Resources, Firms and Strategies, A Reader in the Resource-Based Perspective*. Oxford: Oxford University Press.
- Fujimoto T. 2000. Evolution of manufacturing systems and ex post dynamic capabilities: case of Toyota's final assembly operations. In *The Nature and Dynamics of Organizational Capabilities*, Dosi G, Nelson RR, Winter SG (eds). Oxford University Press: Oxford, New York; 244-278.
- Geringer JM. 1991. Strategic determinants of partner selection criteria in international joint ventures. *Journal of International Business Studies* **22**(1): 41-62.
- Geringer JM, Hebert L. 1991. Measuring performance of international joint ventures. *Journal of International Business Studies* **22**(1): 41-62.
- Goerzen A. 2005. Managing alliance networks: emerging practices of multinational companies. *Academy of Management Executive* **19**(2): 94-107.
- Gomes-Casseres B. 1994. Group versus group: how alliance networks compete. *Harvard Business Review* **72**(4): 62-74.
- Gorsuch RL. 1983. *Factor Analysis*. Lawrence Erlbaum Associates: Hillsdale, N.J.
- Grant RM. 1996. Prospering in dynamically-competitive environments: organizational capability as knowledge integration. *Organization Science* **7**(4): 375-387.
- Greenhalgh L. 2001. *Managing Strategic Relationships*. New York: The Free Press.
- Gulati R. 1998. Alliances and Networks. *Strategic Management Journal* **19**: 293-317.

- Hagedoorn J. 2002. Inter-firm R&D partnerships- an overview of major trends and patterns since 1960. *Research Policy* **31**: 477-492.
- Hair JF, Anderson RE, Tatham RL. 1998. *Multivariate Data Analysis*. Macmillan: New York.
- Hamel G. 1991. Competition for competence and interpartner learning within international strategic alliances. *Strategic Management Journal* **12**: 83-103.
- Hamel G, Doz Y, Prahalad C. 1989. Collaborate with your competitors and win. *Harvard Business Review*. **67**(1): 133-139.
- Harbison JR, Pekar P jr. 1997. Cross-border alliances in the age of collaboration. 2nd in a Series of Viewpoints on Alliances.
- Harbison JR, Pekar P jr. 1998a. *Smart Alliances, A practical guide to repeatable success*. Jossey-Bass: San Francisco, CA.
- Harbison JR, Pekar P jr. 1998b. Institutionalizing alliance skills: Secrets of repeatable success. 3rd in a Series of Viewpoints on Alliances.
- Harrigan KR. 1988. Joint ventures and competitive strategy. *Strategic Management Journal* **9**(2): 141-158.
- He Z-L, Wong P-K. 2004. Exploration vs. exploitation: an empirical test of the ambidexterity hypothesis. *Organization Science* **15**(4): 481-494.
- Henderson R, Cockburn I. 1994. Measuring competence? Exploring firm effects in pharmaceutical research. *Strategic Management Journal* Special issue **15**: 63-84.
- Hergert M, Morris D. 1988. Trends in international collaborative agreements. In *Cooperative Strategies in International Business*. Contractor F, Lorange P (eds). Lexington Books: Lexington, MA: 99-109.
- Hill CWL. 1990. Cooperation opportunism and the invisible hand: implication of transaction cost theory. *Academy of Management Review* **15**(3): 500-513.
- Hill RC, Hellriegel D. 1994. Critical contingencies in joint venture management: Some lessons for managers. *Organization Science* **5**: 594-607.
- Hirschmann WB. 1964. Profit from the learning curve. *Harvard Business Review* **42**: 125-139.
- Hitt MA, Dacin MT, Levitas E, Arregle J-L, Borza A. 2000. Partner selection in emerging and developed market contexts: resource-based and organizational learning perspectives. *Academy of Management Journal* **43**(3): 449-467.
- Hoang HT. 2001. The impact of organizational and alliance-based complexity on the development of alliance capacity. white paper INSEAD.
- Hoang HT, Rothaermel FT. 2005. The effect of general and partner-specific alliance experience on joint R&D project performance. *Academy of Management Journal* **48**(2): 332-345.
- Hoffmann WH. 2005. How to manage a portfolio of alliances. *Long Range Planning* **38**(2): 121-143.
- Hoffmann WH. Strategies for managing a portfolio of alliances. *Strategic Management Journal* forthcoming.
- Holmqvist M. 2004. Experiential learning processes of exploitation and exploration within and between organizations: an empirical study of product development. *Organization Science* **15**(1): 70-81.
- Hosmer DW, Lemeshow S. 2000. *Applied Logistic Regression*. Wiley Interscience 2nd ed.
- Huber GP. 1991. Organizational learning: the contributing process and the literatures. *Organization Science* **2**: 88-115.
- Hunt SD, Morgan RM. 1996. The resource-advantage theory of competition: dynamics, path dependencies, and evolutionary dimensions. *Journal of Marketing* **60**(4): 107-114.
- Inkpen AC. 1998. Learning and knowledge acquisition through international strategic alliances. *Academy of Management Executive* **12**(4):69-80.
- Jaccard J. 2001. *Interaction effects in logistic regression*. Sage Publications: Thousand Oaks, CA.

- Johnson JL, Cullen JB, Sakano T, Takenouchi H. 1996. Setting the stage for trust and strategic integration in Japanese-U.S. cooperative alliances. *Journal of International Business Studies* **27**: 981-1004.
- Kale P, Dyer JH, Singh H. 2002. Alliance capability, stock market response, and long term alliance success: the role of the alliance function. *Strategic Management Journal* **23**(8): 747-767.
- Kale P, Singh H. 1999. Alliance capability and success: a knowledge-based approach. working paper Wharton School, University of Pennsylvania.
- Kale P, Singh H, Perlmutter H. 2000. Learning and protection of proprietary assets in strategic alliances: building relational capital. *Strategic Management Journal* Special Issue **21**(3): 217-237.
- Kanter R. 1994. Collaborative advantage. *Harvard Business Review* **72**(4) 96-108.
- Khanna T. 1998. The scope of alliances. *Organization Science* **9**(3): 340-355.
- Khanna T, Gulati R, Nohria N. 1998. The dynamics of learning alliances: competition, cooperation, and relative scope. *Strategic Management Journal* **19**(3): 193-210.
- Klecka WR. 1980. *Discriminant Analysis*. Series: Quantitative Applications in the Social Sciences. Sage Publications.
- Kogut B, Zander U. 1992. Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science* **3**: 383-397.
- Kogut B, Zander U. 1996. What firms do? Coordination, identity, and learning. *Organization Science* **7**(5): 502-518.
- Kor YY, Mahoney JT. 2005. How dynamics, management, and governance of resource deployments influence firm-level performance. *Strategic Management Journal* **26**(5): 489-496.
- Kumar BN, Nti KO. 1998. Differential learning and interaction in alliance dynamics: a process and outcome discrepancy model. *Organization Science* **9**(3): 356-367.
- Lambe CJ, Spekman RE, Hunt SD. 2002. Alliance competence, resources, and alliance success: conceptualization, measurement, and initial test. *Journal of the Academy of Marketing Science* **30**(2): 141-158.
- Lane PJ, Lubatkin M. 1998. Relative absorptive capacity and interorganizational learning. *Strategic Management Journal* **19**(5): 461-477.
- Lei D, Slocum JW jr, Pitts RA. 1997. Building cooperative advantage: managing strategic alliances to promote organizational learning. *Journal of World Business* **32**(3): 203-223.
- Leonard-Barton D. 1995. *Wellsprings Of Knowledge*. Harvard Business School Press, Mass: Boston.
- Levin DZ. 2000. Organizational learning and the transfer of knowledge. *Organization Science* **11**(6): 630-647.
- Levinthal DA, March JG. 1993. The myopia of learning. *Strategic Management Journal* **14**: 95-112.
- Lewin AY, Volberda HW. 1999. Prolegomena on coevolution: a framework for research on strategy and new organizational forms. *Organization Science* **10**(5): 519-534.
- Li SX, Rowley TJ. 2002. Inertia and evaluation mechanisms in interorganizational partner selection: syndicate formation among U.S. investment banks. *Academy of Management Journal* **45**(6): 1104-1119.
- Long JS. 1997. *Regression models for categorical and limited dependent variables*. Sage Publications: Thousand Oaks, CA.
- Lorange P, Roos J. 1990. *Strategic Alliances, Formation, Implementation and Evolution*. Cambridge, MA: Blackwell.
- Lorenzoni G, Baden-Fuller C. 1995. Creating a strategic center to manage a web of partners. *California Management Review* **37**(3): 146-163.
- Lorenzoni G, Lipparini A. 1999. The leveraging of interfirm relationships as a distinctive organizational capability: a longitudinal study. *Strategic Management Journal* **20**(4): 317-338.
- Lyles MA. 1988. Learning among joint venture sophisticated firms. *Management International Review* Special Issue **28**: 85-97.

- Madhok A, Tallman SB. 1998. Resources, transactions and rents: managing value through interfirm collaborative relationships. *Organization Science* **9**(3): 326-339.
- Madsen TL, Mosakowski E, Zaheer S. 2003. Knowledge retention and personnel mobility: the nondisruptive effects of inflows of experience. *Organization Science* **14**(2): 173-191.
- Mahoney JT. 1995. The management of resources and the resource of management. *Journal of Business Research* **33**(2): 91-101.
- Makadok R. 2001. Toward a synthesis of the resource-based and dynamic-capability views of rent creation. *Strategic Management Journal* **22**(5): 387-401.
- Man de A-P. 2004. *The Network Economy: Strategy, Structure and Management*. Edward Elgar, Northampton, MA.
- March JG. 1991. Exploration and exploitation in organizational learning. *Organization Science* **2**(1): 71-87.
- Margulis M, Pekar P. 2001. The Next Wave of Alliance Formations: Forging Successful Partnerships with Emerging and Middle-Market Companies. Houlhan Lokey Howard & Zukin.
- Mayer KJ, Argyres N. 2004. Learning to contract: evidence from the personal computer industry. *Organization Science* **15**(4): 394-410.
- McLeod LD, Swygert KA, Thissen S. 2001. Factor analysis for items scored in two categories. In *Test Scoring*, Thissen D, Wainer H (eds). Lawrence Erlbaum: Mahwah, NJ, 189-216.
- Medcof JW. 1997. Why Too Many Alliances End in Divorce. *Long Range Planning* **30**(5): 718-732.
- Miller KD. 2003. An asymmetry-based view of advantage: towards an attainable sustainability. *Strategic Management Journal* **24**(10): 961-976.
- Mohr J, Spekman R. 1994. Characteristics of partnership success: partnership attributes, communication behavior and conflict resolution. *Strategic Management Journal* **15**: 135-152.
- Mowery DC, Oxley JE, Silverman BS. 1996. Strategic alliances and interfirm knowledge transfer. *Strategic Management Journal* Special Issue **17**: 77-91.
- Muthen B, Christoffersson A. 1981. Simultaneous factor analysis of dichotomous variables in several populations. *Psychometrika* **48**: 485-500.
- Nault BR, Tyagi RK. 2001. Implementable mechanisms to coordinate horizontal alliances. *Management Science* **47**(6): 787-799.
- Nelson R, Winter S. 1982. *An Evolutionary Theory of Economic Change*. Harvard University Press, Cambridge, MA.
- Nunally JC. 1978. *Psychometric Theory*. McGraw Hill: New York (2nd ed).
- Nunally JC, Bernstein IH. 1994. *Psychometric Theory*. 3rd edition. McGraw-Hill: New York.
- Oliver AL. 2001. Strategic alliances and the learning life-cycle of bio-technology firms. *Organization Studies* **22**(3): 467-489.
- Oppenheim AN. 1966. *Questionnaire Design and Attitude Measurement*. Heinemann: London.
- Parise S, Casher A. 2003. Alliance portfolios: designing and managing your network of business-partner relationships. *Academy of Management Executive* **17**(4): 25-39.
- Park SO, Ungson GR. 2001. Interfirm rivalry and managerial complexity: a conceptual framework of alliance failure. *Organization Science* **12**(1): 37-53.
- Parkhe A. 1993. Strategic alliances structuring: a game theoretic and transaction cost examination of interfirm cooperation. *Academy of Management Journal* **36**(4): 794-829.
- Paulus PB, Yang H-C. 2000. Idea generation in groups: a basis for creativity in organizations. *Organizational Behavior and Human Decision Processes* **82**(1): 76-87.
- Peter JP, Olson JC. 2004. *Consumer Behavior and Marketing Strategy*. McGraw-Hill: New York.
- Peteraf M. 1993. The cornerstones of competitive advantage: a resource-based view. *Strategic Management Journal* **14**(3): 179-191.

- Philips LW. 1981. Assessing measurement error in key informant reports: a methodological note on organizational analysis in marketing. *Journal of Marketing Research* 18(November): 395-415.
- Pisano GP. 1989. Using equity participation to support exchange: evidence from the biotechnology industry. *Journal of Law, Economics, and Organization* 5: 109-126.
- Pisano GP. 2000. In search of dynamic capabilities: the origins of R&D competence in biopharmaceuticals. In *The Nature and Dynamics of Organizational Capabilities*, Dosi G, Nelson RR, Winter SG (eds). Oxford University Press: Oxford, New York; 129-154.
- Pisano GP, Bohmer RMJ, Edmondson AC. 2001. Organizational differences in rates of learning: evidence from the adoption of minimally invasive cardiac surgery. *Management Science* 47(6): 752-768.
- Porter ME. 1987. From competitive advantage to corporate strategy. *Harvard Business Review* 65: 43-59.
- Powell WW, Koput KW, Smith-Doerr L. 1996. Interorganizational collaboration and the locus of control of innovation: networks of learning in biotechnology. *Administrative Science Quarterly* 41(1): 116-145.
- Press SJ, Wilson S. 1978. Choosing between logistic regression and discriminant analysis. *Journal of the American Statistical Association* 7: 699-705.
- Reuer JJ, Park KM, Zollo M. 2002a. Experiential learning in international joint ventures: the roles of experience heterogeneity and venture novelty. In *Cooperative Strategies and Alliances*. Contractor FJ, Lorange P (eds). Elsevier Science: Oxford: 321-344.
- Reuer JJ, Ragozzino R. Agency hazards and alliance portfolios. *Strategic Management Journal* forthcoming.
- Reuer JJ, Zollo M, Singh H. 2002b. Post-formation dynamics in strategic alliances. *Strategic Management Journal* 23(2): 135-151.
- Ring PSA, Van de Ven AH. 1994. Developmental processes of cooperative interorganizational relationships. *Academy of Management Review* 19: 90-118.
- Robinson JP, Shaver PR, Wrightsman LS. 1991. Criteria for scale selection and evaluation. In *Measures of Personality and Social Psychological Attitudes*, Robinson JP, Shaver PR, Wrightsman LS (eds). Academic Press: San Diego, CA: 1-15.
- Rothaermel FT, Deeds DL. Alliance type, alliance experience and alliance management capability in high-technology ventures. *Journal of Business Venturing* forthcoming.
- Rugman AM, Verbeke A. 2002. Edith Penrose's contribution to the resource-based view of strategic management. *Strategic Management Journal* 23(8) 769-780.
- Sanchez R (ed). 2001. *Knowledge Management and Organizational Competence*. Oxford University Press: New York.
- Sarkar MB, Aulakh PS, Madhok A. 2004. A process view of alliance capability: generating value in alliance portfolios. White paper presented at KUN seminar, Nijmegen, the Netherlands.
- Scharmer CO. 2001. Self-transcending knowledge: organizing around emerging realities. In *Managing Industrial Knowledge, Creation, Transfer and Utilization*. Nonaka I, Teece DJ (eds). Sage: London: 68-90.
- Simon HA. 1991. Bounded rationality and organizational learning. *Organization Science* 2(1): 125-134.
- Simonin BL. 1997. The importance of collaborative know-how: an empirical test of the learning organization. *Academy of Management Journal* 40(5): 1150-1174.
- Sivadas E, Dwyer RF. 2000. An examination of organizational factors influencing new product development in internal and alliance-based processes. *Journal of Marketing* 64(1): 31-40.
- Spekman RE, Isabella LA, MacAvoy TC. 1999. *Alliance Competence, Maximizing the value of your partnerships*. John Wiley & Sons, New York.
- Stuart T, Hoang H, Hybels RC. 1999. Interorganizational endorsements and the performance of entrepreneurial ventures. *Administrative Science Quarterly* 44: 415-452.
- Szulanski G. 1996. Exploring internal stickiness: impediments to the transfer of best practice within the firm. *Strategic Management Journal* Special Issue 17: 27-43.

- Szulanski G. 2000. The process of knowledge transfer: a diachronic analysis of stickiness. *Organizational Behavior and Human Decision Processes* **82**(1): 9-27.
- Tabachnick BG, Fidell LS. 2001. *Using Multivariate Statistics*. 4th edition. Allyn and Bacon: Needham Heights, MA.
- Takeishi A. 2001. Bridging inter and intra-firm boundaries: management of supplier involvement in automobile product development. *Strategic Management Journal* **22**(5): 403-433.
- Teece DJ, Pisano G. 1994. The dynamic capabilities of firms: an introduction. *Industrial and Corporate Change* **3**(3): 537-556.
- Teece DJ, Pisano G, Shuen A. 1997. Dynamic capabilities and strategic management. *Strategic Management Journal* **18**(7): 509-533.
- Thomke S, Kuemmerle W. 2002. Asset accumulation, interdependence and technological change: evidence from pharmaceutical drug discovery. *Strategic Management Journal* **23**(7): 619-635.
- Tsang EWK. 2002a. Acquiring knowledge by foreign partners from international joint ventures in a transition economy: learning-by-doing and learning myopia. *Strategic Management Journal* **23**(9): 835-854.
- Tsang EWK. 2002b. Sharing international joint venturing experience: a study of some key determinants. *Management International Journal* **42**(2): 183-205.
- Tuchi C. 1995. Firm heterogeneity and performance of strategic alliances: a synthesis of conceptual foundations. Working paper. MIT Sloan School of Management.
- Tucker LR, MacCallum RC (eds). 1997. *Exploratory factor analysis*. Internet publication: [www.http://www.unc.edu/~rcm/book/factornew.htm](http://www.unc.edu/~rcm/book/factornew.htm).
- Wernerfelt B. 1984. A resource-based view of the firm. *Strategic Management Journal* **5**(2): 171-180.
- Westney DE. 1988. Domestic and foreign learning curves in managing international cooperative strategies. In *Cooperative Strategies in International Business*, Contractor FJ, Lorange P (eds). Lexington Books: Lexington, MA: 339-346.
- Williamson OE. 1975. *Markets and Hierarchies: Analysis and antitrust implications*, New York: Free Press.
- Williamson OE. 1985. *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*. Free Press: New York.
- Williamson OE. 1991. Comparative economic organization: the analysis of discrete structural alternatives. *Administrative Science Quarterly* **36**: 269-296.
- Winter SG. 2003. Understanding dynamic capabilities. *Strategic Management Journal* **24**: 991-995.
- Yelle LE. 1979. The learning curve: historical review and comprehensive survey. *Decision Sciences* **10**: 302-308.
- Yoshino MY, Rangan US. 1995. *Strategic Alliances. An entrepreneurial approach to globalization*. Harvard Business School Press: Boston, MA.
- Young-Ybarra C, Wiersema M. 1999. Strategic flexibility in information technology alliances: the influence of transaction cost economics and social exchange theory. *Organization Science* **10**(4): 439-459.
- Zahra SA, George G. 2002. Absorptive capacity: a review, reconceptualization, and extension. *Academy of Management Review* **27**(2): 185-203.
- Zahra SA, Nielsen AP. 2002. Sources of capabilities, integration and technology commercialization. *Strategic Management Journal* **23**(5): 377-398.
- Zollo M, Winter SG. 2002. Deliberate learning and the evolution of dynamic capabilities. *Organization Science* **13**(3): 339-351.
- Zollo M, Reuer JJ, Singh H. 2002. Interorganizational routines and performance in strategic alliances. *Organization Science* **13**(6): 701-713.

FIGURES AND TABLES

Table 1 Distribution of alliance portfolio size over period 1997-2001

Category	Number / Percentage of respondents
0-5	3 / 1.6%
6-15	85 / 44.3%
16-25	47 / 24.5%
26-40	24 / 12.5%
> 40 alliances	7 / 3.6%
“Don’t know”	26 / 13.5%
Average	18.11

N=192

Table 2 Distribution of % market value generated via alliances

Category	Market value in 2001	Market value in 2007
0-20%	39 / 20.3%	29 / 15.1%
21-40%	76 / 39.6%	24 / 12.5%
41.-60%	46 / 24.0%	60 / 31.3%
61-80%	22 / 11.5%	47 / 24.5%
81-100%	7 / 3.6%	22 / 11.5%
“Don’t know”	2 / 1.0%	10 / 5.2%
Average	37.98%	51.41%

N=192

Table 3 Descriptive statistics and correlation matrix

	Mean ^c	S.D.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Alliance performance ^a	3.2216	1.3057	.054	.205**	.166*	.207**	-.097	-.117	-.010	.017
Alliance experience (1)	2.1302	1.4100	1	.041						
Alliance mechanisms ^b (2)	5.0833	3.7686	.041	1						
Organization level learning mechanisms OLM (3)	3.6927	2.9292	.047	.947**	1					
Group level learning mechanisms GLM (4)	1.4063	1.3773	.013	.731**	.474**	1				
Equity percentage (5)	1.5052	1.0486	-.120	-.005	-.033	.057	1			
Firm size ^d (6)	2.7240	1.3072	-.085	.504**	.540**	.237**	.072	1		
ICT sector (7)	.4271	.4960	-.026	.123	.221**	-.133	-.004	.046	1	
Service sector (8)	.6458	.4795	-.030	-.085	-.093	-.035	.002	-.057	-.087	1

N=192, $p < .01$; $p < .05$

a Categorical variable representing alliance success

b Mechanisms = metric variable with value ranging from 0 to 29 (see appendix 3)

c Mean and standard deviation are uncentered, while correlations are given for centered variables.

d. Firm size = annual sales revenues in year 2000

Table 4 OLS regression (*dependent: alliance experience*)

	Model I	Model II
Independent variable		
Alliance mechanisms		.386***
Controls		
Firm size (sales)	.394***	.201**
ICT sector	.173**	.134*
Service sector	-.072	-.054
R ²	.202	.311
F-value	15.852***	21.062***
Degrees of freedom	3	4

N=192, *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Table 5 Eigenvalues

Function	Eigenvalue	% of variance	Cumulative %	Canonical correlation
1	0.386*	100.0	100.0	0.528

* First 1 canonical discriminant functions were used in the analysis.

Table 6 Wilks' Lambda

Test of function (s)	Wilks' lambda	Chi-square	Df	Sig.
1	0.722	39.959	29	0.085 ⁺

⁺ $p < .10$.

Table 7 Classification matrix (predicted group membership)

		DUMSUC01	0	1	Total
0 = 0-40%	Count	0	27	21	48
		1	16	53	69
		ungrouped cases	19	25	44
1=61-100%	%	0	56.3	43.8	100
		1	23.2	76.8	100
		ungrouped cases	40.8	59.2	100

N=161, a total of 68.4% of the original grouped cases is correctly classified.

Table 8 Exploratory factor analysis and reliability of factor-based scales^a

Subordinate Variables ^b (Questionnaire items)	Factor 1 Organization level learning mechanisms	Factor 2 Group level learning mechanisms
Cronbach's alpha	0.82	0.63
Eigenvalue	6.864	1.778
VP of alliances (1)	0.728	
Alliance manager (4)	0.885	
Local alliance manager (6)	0.784	
Internal alliance training (7)	0.463	
External alliance training (8)		0.557
Training in intercultural management (9)		0.551
Partner selection program (10)	0.516	
Intranet (13)	0.541	
Alliance best practices (14)		0.938
Culture program (15)		0.589
Comparison of alliance evaluations (18)	0.532	
Rewards for alliance managers tied to alliance performance (21)	0.960	
Formally structured knowledge exchange between alliance managers (23)	0.591	
Alliance metrics (25)		0.688
Country-specific alliance policies (26)	0.521	

^a Factor analysis and Cronbach's alpha were performed for the entire sample (N=192)

^b All variables used are measured as dichotomous items (0 = mechanisms is not used; 1 = mechanism is used)

Table 9 Ordinal logistic regression analysis (*dependent: alliance portfolio performance*)

	Model I	Model II
Independent variables		
Organization level learning mechanisms (factor 1)		-.103
Group level learning mechanisms (factor 2)		.411**
Controls		
Alliance experience	.446***	.483*
Firm size (sales)	.031	.093
ICT sector	-.122	.106
Service sector	.245	.210
Nagelkerke R ²	.060	.115
Chi-square	8.900 ⁺	17.486**
Degrees of freedom	4	6

N=166, *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; + $p < .10$.

Table 10 Ordinal logistic regression analysis

	Model I	Model II	Model III	Model IV
Independent variables				
Organization level mechanisms (factor 1)	-.103	-.181	-.202	-.097
Group level mechanisms (factor 2)	.411**	.914***	.944***	.402**
Equity percentage*OLM		.057	.078	
Equity percentage*GLM		-.332*	-.367*	
Equity percentage			.126	.093
Controls				
Alliance experience	.483*	.493*	.497*	.487*
Firm size (sales)	.093	.123	.115	.085
ICT sector	.106	.091	.068	.087
Service sector	.210	.154	.159	.212
Nagelkerke R ²	.115	.152	.156	.117
Chi-square	17.486**	23.633**	24.249	17.815
Degrees of freedom	6	8	9	7

N=166, *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; + $p < 0.10$.

APPENDICES

Appendix 1 Table 4 Test of equality of group means

Alliance mechanisms	Wilks' lambda	F-value	Sig.
VP of alliances (1)	0.930	10.285	.002**
Alliance department (2)	0.975	3.476	.034*
Alliance specialist (3)	0.989	1.488	.225
Alliance manager (4)	0.948	7.578	.007**
Gatekeeper or boundary-spanner (5)	0.992	1.146	.286
Local alliance managers (6)	0.977	3.224	.075 ⁺
Internal alliance training (7)	0.993	0.986	.327
External alliance training (8)	0.975	3.448	.065 ⁺
Training in intercultural management (9)	0.989	1.504	.222
Partner selection program (10)	0.951	7.099	.009**
Joint business planning (11)	0.999	0.080	.778
Alliance database (12)	0.897	15.758	.000***
Use of intranet to disperse alliance knowledge (13)	0.935	9.514	.002**
Alliance best practices (14)	0.975	3.538	.062 ⁺
Culture program (15)	1.000	0.003	.956
Partner program (16)	0.994	0.882	.366
Individual evaluation (17)	0.960	5.777	.018*
Comparison of alliance evaluations (18)	0.998	0.303	.583
Joint evaluation (19)	0.959	5.825	.017*
Rewards for alliance managers tied to alliance performance (20)	0.982	2.535	.114
Rewards for business managers tied to alliance performance (21)	0.983	2.414	.123
Formal exchange of experience among alliance managers (22)	0.957	6.102	.015*
Use of own knowledge about national differences in international alliances (23)	0.948	7.578	.007**
Alliance metrics (24)	0.963	5.196	.024*
Country-specific alliance policies (25)	0.999	0.157	.693
Consultants (26)	0.986	1.992	.160
Legal experts (27)	0.999	0.177	.675
Mediators (28)	0.973	3.796	.053 ⁺
Financial experts (29)	0.991	1.247	.266

N=139, *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; + $p < 0.1$.

Appendix 2 Structure matrix

	Function 1
Alliance database	-.546
Vice-President of alliances	.441
Use of intranet to disperse alliance knowledge	.418
Use of own knowledge about national differences in international alliances	.379
Alliance manager	.379
Partner selection program	.367
Formally structured knowledge exchange between alliance managers	.340
Joint alliance evaluation	.332
Individual alliance evaluation	.331
Alliance metrics	.314
Alliance department	.295
Mediators	.268
Alliance best practices	.259
External alliance training	.255
Local alliance manager	.247
Rewards and bonuses for alliance managers	.219
Rewards and bonuses for business managers	.214
Consultants	.194
Training in intercultural management	.169
Alliance specialist	-.168
Financial experts	.154
Gatekeeper	.147
Internal alliance training	.135
Country-specific alliance policies	.132
Partner program	-.125
Comparison of alliance evaluations	.076
Legal experts	-.058
Joint business planning	.039
Culture program	.008
N=139	

Appendix 3 Explanatory variables

	Alliance mechanisms
Functions	(1) Vice-President of alliances, (2) alliance department, (3) alliance specialist, (4) alliance manager, (5) gatekeeper, (6) local alliance manager
Tools	(7) internal alliance training, (8) external alliance training, (9) training in intercultural management, (10) partner selection program, (11) joint business planning, (12) alliance database, (13) use of intranet to disperse knowledge, (14) best practices, (15) culture program, (16) partner program, (17) individual alliance evaluation, (18) comparison of evaluations, (19) joint evaluations
Control and management processes	(20) rewards and bonuses for alliance managers, (21) rewards and bonuses for business managers, (22) formally structured knowledge exchange between alliance managers, (23) use of own knowledge about national cultural differences, (24) alliance metrics, (25) country-specific alliance policies
External parties	(26) consultant, (27) lawyer, (28) mediator, (29) financial expert

‘Functions’ refer to individual positions or units which manage a number of critical tasks for a firm with respect to its alliances.

‘Tools’ are practical mechanisms that aid the process of day-to-day management of alliances by increasing know-how of particular stages of the alliance life-cycle or by raising alliance know-how throughout the firm.

‘Control and management processes’ are geared towards support of specific aspects of alliance management; i.e. control, formal use and sharing of particular knowledge and management of responsibility.

Appendix 4 Survey items

1. Company demographics

- a. Number of employees: 1-500, 500-1000, >1000
- b. Total worldwide sales volume in 2000 in USD\$: <1m, 1-100m, 100m-1b, 1b-50b, >50b.
- c. Primary industry your company is active in:

2. Alliance background

- a. How many alliances has your company formed over the last 5 years? 0-5, 6-15, 16-25, 26-40, >40.
- b. What is your company's overall alliance success rate (% of alliances where the initial goals were realized) over the last 5 years? 0-20%, 21-40%, 41-60%, 61-80%, 81-100%.
- c. What percentage of your company's alliances are equity alliances? 0-20%, 21-40%, 41-60%, 61-80%, 81-100%.

3. Alliance mechanisms

(0-1 scale, all items were defined and explained in the questionnaire)

Functions

(1) Vice-president of alliances; (2) alliance department; (3) alliance specialist; (4) alliance manager; (5) gatekeeper; (6) local alliance manager.

Tools

(7) internal alliance training; (8) external alliance training; (9) training intercultural management; (10) partner selection program; (11) joint business planning; (12) alliance database; (13) use of intranet; (14) alliance best practices; (15) culture program; (16) partner program; (17) individual alliance evaluation; (18) comparison of alliance evaluation; (19) joint alliance evaluation.

Control and management processes

(20) rewards and bonuses for alliance managers tied to alliance success; (21) rewards and bonuses for business managers tied to alliance success; (22) structural knowledge exchange between alliance managers. (23) use of own knowledge about cultural differences; (24) alliance metrics; (25) country specific alliance policies.

External parties

(26) consultants; (27) legal experts; (28) mediators; (29) financial experts.

Appendix 5 Interview protocol

Section A

From your experience, why do you think the following mechanisms are of particular importance to successful alliance management?

Why do you think alliance experience positively influences alliance performance?

To what extent do you think the following mechanisms help firms develop alliance capabilities? And why?

At what experience level(s) do you expect the following mechanisms to be especially relevant to improve a firm's alliance performance? Please add comments with regard to motivations why you listed certain mechanisms at a certain level.

To what extent do you think alliance capabilities are developed by dispersing alliance experience using learning mechanisms to develop alliances routines inside the firm?

Section B

Did your firm follow a specific path when it comes to developing its ability to transfer knowledge with regard to alliance management? If so, please shortly describe the process.

If your firm followed a certain path to develop its alliance capabilities, could you specify on basis of what arguments certain mechanisms were selected?

From your experience, what purposes do you think group level and organization level learning mechanisms serve when it comes to alliance management?

Our interpretation of the findings is that: (1) group A mechanisms mainly serves to transfer knowledge at a group level and that the mechanisms mainly allow for transferring knowledge about dyadic or bilateral alliance issues whereas (2) group B mechanisms help transfer knowledge at the organization level and help institutionalize knowledge on alliance portfolio issues. On basis of your experience, do you share these insights?