Do Firms Learn to Manage Alliance Portfolio Diversity? The Diversity-Performance Relationship and the Moderating Effects of Experience and Capability

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Building on organizational learning theory, this study examines whether firms learn to manage alliance portfolio diversity. We argue that alliance portfolio diversity may be advantageous as well as disadvantageous for alliance portfolio performance. Subsequently, we theorize that the diversity-performance relationship is moderated by the firm’s alliance experience and capability. Bridging the previously separated literature of diversity and learning, our findings show a curvilinear relationship between diversity and performance. More important, using survey data, we reveal some key processes through which firms learn to manage alliance portfolio diversity.

Keywords: alliance capability; alliance experience; alliance performance; alliance portfolio diversity

Introduction

In recent years, we have witnessed a strong trend in which firms are increasingly involved in multiple strategic alliances with different partners at the same time (Gulati and Singh, 1998). These expanding alliance activities have led to a research stream that examines alliance portfolio diversity (APD). For instance, prior work showed that the expansion of alliance portfolios generates a variety of growth options (Powel et al., 1996; Vassolo et al., 2004), offers entrepreneurial opportunities (Ozcan and Eisenhardt, 2009), and positively influences a firm’s financial (Baum et al., 2000; Mouri et al., 2012), and innovative performance (Faems et al., 2005; Dell’Era and Verganti, 2010; Phelps, 2010; Srivastava and Gnyawali, 2011). In contrast, other studies found that high levels of APD have negative effects (e.g., Faems et al., 2010; Vasudeva and Anand, 2011). Since the emerging literature has identified both advantages and disadvantages of APD, the evidence on the diversity-performance relationship is inconclusive.

Relying largely on organizational learning theory, another research stream in the field of alliances has studied whether firms can learn to manage alliances (Anand and Khanna, 2000). Typically, such studies analyse the effect of learning processes on the performance of a firm’s alliance portfolio. The research in this field has shown that both experience and capabilities affect the success rates of alliances (Heimeriks and Duysters, 2007; Kale and Singh, 2007). For instance, Kale et al. (2002) demonstrate that, above and beyond experience, a dedicated alliance function positively influences...
alliance outcomes. Heimeriks et al. (2007: 375) define learning mechanisms as ‘organizational attributes that facilitate accumulation, codification and sharing of alliance-related knowledge generated through prior experience’. They show that the use of learning mechanisms is contingent on prior alliance experience, and that both are important predictors of a firm’s alliance portfolio performance (APP). While these studies have demonstrated the role that learning processes play in shaping alliance capabilities, they have been silent on the influence diversity has on alliance portfolio outcomes.

In spite of the important contributions to date, these two streams of research have developed in relative isolation. Because increased diversity implies increased managerial challenges (e.g., Duysters and Lokshin, 2011), it is likely that firms require greater management skills to tackle the complexity of such portfolios. In other words, it becomes important to verify to what degree firms learn to manage diversity. Therefore, this study’s aim is twofold. First, we seek to analyse the likely nonlinear nature of the diversity-performance relationship. In doing so, our study extends the emerging literature by establishing a comprehensive construct of APD that incorporates both alliance (e.g., dyadic vs. multi-partner) and partner (e.g., national vs. international) attributes.

Second, bridging the previously separated literatures on alliance capability and portfolio diversity, we build on organizational learning theory and argue that alliance experience and capability critically influence the diversity-performance relationship. In this paper we define APP to be the extent to which alliance objectives are realized (Hamel, 1991; Hamel et al., 1989; Heimeriks and Duysters, 2007). We posit that, as APD increases, experience and alliance capabilities are likely to positively influence APP outcomes. Using a unique database containing over 2,000 strategic alliances sponsored by 161 firms, we not only find a curvilinear relationship between diversity and performance but also demonstrate the role that alliance experience and capabilities play in moderating the diversity-performance relationship.

Theory and hypotheses

To date, the implications of diversity have been studied in a variety of settings. Some of these studies stress the potential advantages of diversity. By providing a firm with access to various knowledge resources and capabilities, a diverse alliance portfolio has been found to enhance, for example, firm growth (Powell et al., 1996), financial performance (Baum et al., 2000), and innovative performance (Faems et al., 2005; Dell’Era and Verganti, 2010; Phelps, 2010; Srivastava and Gnyawali, 2011; Mouri et al., 2012). Moreover, a recent study by Terjesen et al. (2011) found that the effect of manufacturing capabilities on venture performance is enhanced by APD (i.e., partner and alliance geographic diversity) because the manufacturing skills of young firms such as high-technology manufacturing ventures tend not to be well developed. In addition, Ozcan and Eisenhardt (2009) found that a diversified alliance portfolio increases an entrepreneurial firm’s ability to survive as it is better equipped to handle environmental complexity. In a similar vein, Hoffmann (2007) claimed that an alliance portfolio that consists of high levels of dispersion and low levels of redundancy or overlap increases a firm’s strategic flexibility and its ability to deal with high technological uncertainty.

While these studies pay direct attention to the advantages of diversity, recently other works have pointed to the potential disadvantages of APD. Some have argued, for instance, that APD causes higher levels of complexity and raises managerial challenges (e.g., Duysters and Lokshin, 2011). Faems et al. (2010), for instance found that the total effect of technology alliance portfolio diversity negatively influenced a firm’s profit margin. Moreover, Vasudeva and Anand (2011) found that high levels of APD relate negatively to knowledge utilization. In addition, Jiang et al. (2010) found that greater APD in terms of governance diversity is negatively related to firm performance.

Given the inconclusive findings on the diversity-performance relationship, we extend the prior work and argue that APD has a positive effect on APP, but only up to a certain point. In other words, at low levels of diversity, an increase in diversity is likely to generate a positive performance effect, whereas at higher levels such an increase is likely to have negative performance implications.

There are various reasons for the curvilinear diversity-performance relationship. First, as alliance activities expand, the ability to optimally take advantage of learning opportunities may decrease (Cohen and Levinthal, 1990). In fact, when the firm’s alliance portfolio becomes expansive and diverse in nature, the firm may not only forego such learning opportunities but fail to guard against leakage or knowledge spillovers (Jiang et al., 2010). This is in line with the work of Vasudeva and Anand (2011) who argue that beyond a certain point, high levels of diversity make learning more difficult as a consequence of which the disadvantages of diversity ultimately outweigh the benefits.

Second, as the firm’s alliance portfolio becomes more diverse in terms of alliance and partner attributes, the firm will be required to interact with a larger set of elements (Dess and Beard, 1984; Anderson, 1999; Marino et al., 2002). As a consequence, it is likely to become more difficult for the focal firm to coordinate scarce resources among alliances and distribute attention among alliance partners (Hoang and Rothaermel, 2005;
Hoffmann, 2005). High levels of APD may also make it more difficult for the firm to deal with conflicting requests from alliance partners. For example, it may be difficult to strategically align the goals of the multiple alliances and to monitor the alliance portfolio (Hoffmann, 2005).

Hence, we suggest that, whereas at lower levels diversity may positively impact performance, at higher levels APD is negatively related to APP. We therefore hypothesize:

**Hypothesis 1:** APD has an inverted-U-shaped effect on APP (i.e., as APD increases, performance first increases and then decreases).

**Moderating effect of alliance experience**

As mentioned earlier, one stream of alliance research has shown that firms learn to manage alliances through alliance experience (Anand and Khanna, 2000). We refer to alliance experience as the knowledge obtained by a firm’s involvement in former alliances (e.g., Gulati, 1995; Heimeriks and Duysters, 2007). Direct experience is recognized as representing an important source of learning through which companies may improve their performance (Yelle, 1979; Levitt and March, 1988; Huber, 1991). By engaging in various relationships over time, firms may derive fruitful lessons about how to structure alliances, how to deal with partners, and how to successfully manage their external links. Dekker and Van den Abbeele (2010), for example, find that partners’ experience is beneficial for learning because it reduces the need for control. A study by Lai et al. (2010: 258) has shown that experience is especially relevant when the firm is dealing with complex alliances, ‘as compared to alliances whose context can be easily defined’. However, other studies found no effect (e.g., Lubatkin, 1987; Barkema et al., 1997), or decreasing marginal returns (e.g., Hoang and Rothaermel, 2005; Sampson, 2005; Rothaermel and Deeds, 2006) for alliance experience.

As Barkema and Schijven (2008) point out, these inconclusive findings require further study of the role of experience. One explanation may be the inherent complexity of the task involved (e.g., Rivkin, 2001). Zollo and Winter (2002), for example, argue that when the heterogeneity of the task increases, past experience is more likely to lead to inappropriate generalizations and poorer results. Similarly, Parkhe (1991) highlighted that, for global strategic alliances, a critical aspect of the learning process is to recognize the differences and to accommodate them.

While learning-by-doing has been found to exist in repetitive and relatively homogeneous operating tasks (e.g., Argote, 1999), a high degree of APD makes learning from the accumulation of experience complicated for a number of reasons. First, APD limits the comparability of the alliances making up the portfolio. As APD increases, inferences become more difficult because the alliances differ in many aspects (Zollo and Winter, 2002). Lavie and Miller (2008), for example, found that when firms aim to derive advantages from their portfolio of international partners, experience with foreign partners is more helpful than experience with national partners. Moreover, learning may be partner-specific (Gulati et al., 2009). This makes the transfer of experience from one alliance to another or from one partner to another problematic. We argue, however, that the above findings may reflect the relative ease of learning from experience only in the presence of a low degree of diversity.

Second, APD may increase the chance of negative transfer effects or the inappropriate generalization of alliance experience (Halebian and Finkelstein, 1999; Reuer et al., 2002). As alliance portfolios become more heterogeneous, there is an increasing likelihood that lessons learned from prior experience will be applied to situations that appear similar but are inherently different (Reuer et al., 2002). However, if alliance portfolios become more diverse over time, this effect might level off because firms recognize that the alliances differ significantly from each other. As pointed out by Parkhe (1991), acknowledging differences is a first step toward making sense of them and thus fostering learning.

Third, learning-by-doing in diverse alliance portfolios may be hampered by a failure to understand the causes of superior performance. As APD increases, it becomes more difficult to understand the underlying cause-and-effect relationships and to make incremental adjustments over time. However, increased experience might improve the firm’s ability to recognize the causes and effects of specific actions over time. From this perspective, expanding the range of experiences increases the opportunity for accurate and refined pattern recognition because more inputs are available to the firm. The above consideration is supported by the research of Haunschild and Sullivan (2002) that examined patterns of learning in airlines and observed that when organizations are confronted with heterogeneity, the search for causality effects is generally deeper and broader.

From the above, we suggest that APD limits the comparability of the alliances making up the portfolio, and therefore inappropriate generalization of experience is more likely at higher levels of APD. Furthermore, we suggest that the causes of superior performance are more difficult to assess when the APD is high. However, these potential challenges might be mitigated by higher levels of alliance experience. We therefore argue that increased experience in managing diverse portfolios makes managers more aware of specific differences and thus less likely to misapply previous experience. Higher levels of experience might also improve the firm’s ability to
recognize the causes and effects of specific actions over time. Therefore, we hypothesize:

**Hypothesis 2:** Alliance experience positively moderates the relationship between APP and APD such that higher levels of alliance experience will increase the portfolio diversity that maximizes APP.

**Moderating effect of alliance capability**

Recently, a number of studies have argued that being experienced may not be sufficient for corporate development activities such as acquisitions (Zollo, 2009), and alliances (Heimeriks, 2009). Indeed, several studies have shown that, beyond experience, firms require alliance capabilities to optimize APP (Kale *et al.*, 2002; Heimeriks *et al.*, 2007). In contrast to the previous literature, alliance capability studies claim that success might not depend on the individual relationships between partners but rather the internal organization of the focal firm. Some companies may outperform others as a consequence of superior alliance management skills (Duysters *et al.*, 2011). It then follows that the effect of APD on performance is likely to depend on both alliance experience and alliance capabilities (see also Schilke and Goerzen, 2010). In an alliance portfolio context, alliance capability can be defined ‘as the organizational ability to manage a comprehensive alliance portfolio successfully’ (Hoffmann, 2005: 123).

Such a capability is likely to consist of multiple mechanisms that are aimed at sharing relevant knowledge, but also help to coordinate and strategize about the alliance portfolio (Schilke and Goerzen, 2010). Heimeriks and Duysters (2007) identify four categories of underlying mechanisms that can help to achieve this: functions (e.g., alliance department, alliance manager); tools (e.g., partner selection protocol, joint business planning, codified best practices); control and management processes (e.g., alliance metrics); and external parties (e.g., use of external consultants). In addition to alliance experience, each of these mechanisms may support the firm in dealing with diverse alliance portfolios.

First of all, the use of alliance functions or units, in charge of the management and coordination of alliance activities within the firm (Heimeriks *et al.*, 2009), may support the management of diverse alliance portfolios. Especially for diverse portfolios, it is important to assign managers and perhaps establish an alliance department that is charged with overseeing and formulating alliance strategies (Kale *et al.*, 2002; Hoffmann, 2005). These managers are critical in managing the balance between under- and over-committing resources to alliances (Khanna *et al.*, 1998). Tools and guidelines for day-to-day management also facilitate the management of diverse portfolios. Firms can use tools to help organize the details of the diverse portfolio by formalizing and standardizing approaches for the different alliances and partners. In addition, tools such as training programmes help to capture and share the lessons learned from different alliance and partner types. Firms thereby benefit from a more systematic implementation of processes that leverage alliance know-how (Zollo and Winter, 2002). This helps management to be aware of some of the underlying cause-and-effect linkages (Kale and Zollo, 2005; Zollo, 2009) as portfolio diversity increases.

In addition, control and management processes provide support in evaluating the contribution of the alliance portfolio to the company’s success. More importantly perhaps, using alliance evaluations and specific metrics aids management in keeping track of progress as APD increases. Moreover, such processes can help to compare performance differences among alliances, thereby enabling management to reconfigure the portfolio if necessary (Bamford and Ernst, 2002). Finally, the use of external parties may reduce APD by providing extra support in areas that go beyond extant expertise or when urgent action is required. For example, in the case of conflict, mediators can help to reduce the pressure on the firm and enable it to better deal with the demands of its diverse portfolio.

Overall, being equipped with a variety of alliance management skills is critical in enabling firms to successfully manage diverse alliance portfolios. The various learning mechanisms foster the firm’s alliance capability which will support the firm in coordinating, strategizing, and sharing experience on the commonalities and differences of relatively diverse alliances. Therefore, we expect that a firm’s alliance capability will enable it to deal with APD and consequently lead to better performance. Therefore, we hypothesize:

**Hypothesis 3:** Alliance capabilities will positively moderate the relationship between APP and APD such that higher levels of alliance capabilities will increase the portfolio diversity that maximizes APP.

**Methods**

**Sample and descriptive statistics**

To test our hypotheses we used data from the Alliance Capability Assessment survey. The survey, conducted in 2006, covers strategic alliance activities (including strategic supplier relationships, minority stakes, joint ventures, cross-licensing arrangements, joint marketing agreements, and research consortia), the use of alliance capability mechanisms, and managerial assessments of a firm’s strategic APP in the period from 2002 to 2006.
The sampling procedure is described in more detail in Heimeriks and Duysters (2007) and is in line with earlier studies in this field (e.g., Beamish, 1984). The database of the Association of Strategic Alliance Professionals (ASAP) was used to approach 2,283 alliance managers and others with knowledge of the performance of alliance portfolios and the learning mechanisms used in their firms. After a reminder was sent, 181 responses were received, a response rate of about 8%. One of the reasons for this low response may be that only a few firms are aware of or purposively manage their alliance activities (Hoffmann, 2005). We found no significant non-response bias with respect to firm size, sales, or alliance performance variables: chi-square tests revealed that there is no difference in the item scores and the response time of early and late respondents (Armstrong and Overton, 1977).

After deleting entries that were unusable because of missing values, the dataset contained 161 valid cases from several industries: information and communication technology (ICT) (21%), pharmaceuticals and biotechnology (9%), chemicals (3%), manufacturing (13%), software (9%), financial services (12%), other services (6%), public sector (3%), and others (24%). The majority of the companies (68%) were large, employing over 1,000 people. Companies with fewer than 500 employees were also well represented (26%). Only 6% of the companies had between 500 and 1,000 employees. Most respondents were based in the US (67%), followed by Europe (25%).

**Dependent variable: alliance portfolio performance (APP)**

The descriptive statistics and the details of the measurement are presented in Table 1. In line with previous studies (Hamel, 1991; Heimeriks and Duysters, 2007; Heimeriks et al., forthcoming), we use a subjective measure for APP and operationalize it as the extent to which the alliance objectives were realized. While there is no perfect measure for alliance portfolio outcomes, managerial evaluations of performance represent a reasonable appraisal of alliance performance (e.g., Kale et al., 2002). Furthermore, subjective and objective measures of alliance performance have been shown to be highly correlated (Geringer and Hebert, 1991). Similarly, Zollo and Meier (2008) find that the task- and process-level correlate highly with subjective overall performance measures.

The question in the survey on APP pertains to the period 2002–2006. To measure APP we asked the respondents to assess their company’s overall alliance success rate (i.e., the percentage of alliances in the firm’s portfolio where the initial goals were realized) over the last five years. This is a categorical variable, taking values 1, 2, 3, 4 and 5 according to the five-point Likert scale (0–20%, 21–40%, 41–60%, 61–80%, 81–100%). The dependent variable (i.e., APP) represents the overall satisfaction of managers with the performance of the firm’s set of alliances. Thus, it embodies a dyadic measure of alliance performance aggregated (by the respondents) at the portfolio level. The companies in our sample have experienced the following success rates for the alliances in their portfolios (see Table 2). About 26% of the firms have a success rate of 61%–80%; about 30% have a rate of 41%–60%, and about 27% have a rate of 21%–40%. About 8% have a rate of more than 81%, and about 9% have a rate of 0%–20%.

<table>
<thead>
<tr>
<th>Variable Description</th>
<th>Alliances in firm’s portfolio that were successful. Categorical variable, taking values 1, 2, 3, 4, and 5 according to five-point Likert scale (0–20%, 21–40%, 41–60%, 61–80%, 81–100%).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alliance portfolio performance (APP)</td>
<td>Herfindahl index derived from alliance types a firm reports being engaged in. Types defined according to types of activity ((1) percentage of co-marketing, (2) percentage of co-production, (3) percentage of distribution, (4) percentage of research alliances to develop new technology; organizational form ((5) percentage of of equity alliances); number of partners involved ((6) percentage of multi-partner alliances (more than two partners); and the types of partners ((7) percentage of competitors, (8) percentage of suppliers, (9) percentage of non-industry, (10) percentage of international).</td>
</tr>
<tr>
<td>Alliance portfolio diversity (APD)</td>
<td>Based on sum of scores of firm’s deliberate learning mechanisms (see Appendix Table A1 for overview of mechanisms). Value = 1 if sum is above mean, else zero.</td>
</tr>
<tr>
<td>Alliance capability</td>
<td>Based on number of alliances formed by focal firm during 2002–2006. Value = 1 if number is above mean, else zero.</td>
</tr>
<tr>
<td>Experience</td>
<td>Alliance Capability Assessment survey measures firm size according to three-point Likert scale (1–500, 500–1000, and more than 1000 employees).</td>
</tr>
<tr>
<td>Firm size</td>
<td>Activity ((1) percentage of co-marketing, (2) percentage of co-production, (3) percentage of distribution, (4) percentage of research alliances to develop new technology); organizational form ((5) percentage of equity alliances); number of partners involved ((6) percentage of multi-partner alliances (more than two partners); and the types of partners ((7) percentage of competitors, (8) percentage of suppliers, (9) percentage of non-industry, (10) percentage of international).</td>
</tr>
</tbody>
</table>

| Table 2 Alliance success rates, aggregated at portfolio level |
|-----------------|-----------------|-----------------|
| **Alliance success rate** | **Frequency** | **Share of total (%)** |
| 81–100% | 14 | 8.7 |
| 61–80% | 42 | 26.09 |
| 41–60% | 47 | 29.19 |
| 21–40% | 43 | 26.71 |
| 0–20% | 15 | 9.32 |
| **Total** | **161** | **100** |

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Independent variable: APD

Since there are many factors that may impact diversity, it is difficult to measure APD. Diversity is a multidimensional concept that includes numerous alliance and partner attributes (Jiang et al., 2010; Wassmer, 2010). Therefore, we measure APD by examining the extent to which a firm’s alliance portfolio varies in terms of 10 specific alliance and partner attributes. We consider type of activity ((1) co-marketing, (2) co-production, (3) distribution, (4) research alliances to develop new technology), the organizational form (i.e., (5) equity alliances), the number of partners (i.e., (6) multi-partner alliances consisting of more than two partners), and the types of partners (i.e., (7) competitor, (8) supplier, (9) non-industry and (10) international partners). To measure the diversity, we asked the respondents to indicate what percentage of their firm’s alliance portfolio consisted of these elements. We assumed that alliances typically last three to five years (e.g., Lavie and Miller, 2008). Our APD measure is constructed using a Herfindahl-type measure (e.g., Powell et al., 1996; Duysters and Lokshin, 2011). Formally, we calculate:

\[
APD = 1 - \sum_{i=1}^{10} r_{imm}^2
\]

\[
APC = 1 - \sum_{i=1}^{10} r_{imm}^2
\]

for each firm \( i \) in our sample, where \( r_{imm} \) is share of each type of alliance in the overall portfolio of firm \( i \).

Moderating variables: alliance experience and alliance capability

In the survey, firms were asked to indicate how many alliances they formed over the five-year period (i.e., over the pre-sample period 2002–2006), which is deemed to be a period in which an alliance can contribute to the firm’s level of experience (Kale et al., 2002; Li and Rowley, 2002; Zollo et al., 2002; Sampson, 2005). Therefore, in line with prior research we used this variable as a proxy for alliance experience (e.g., Tsang, 2002; Lavie and Miller, 2008; Heimeriks and Duysters, 2007; Gulati et al., 2009). A five-point Likert scale was used to define different brackets representing the number of alliances formed: (1) 0–5, (2) 6–15, (3) 16–25, (4) 25–40, and (5) more than 40. Table 3 indicates the number of firms that fall into each of the five categories. We split our sample firms into groups based on level of experience, high or low. We distinguish between firms with high capability (observations with the score above 20, which is the sample mean), firms with low capability (score below 20) and the rest group with capability score equal to 20. The last category is only about 4% of the sample.

<table>
<thead>
<tr>
<th>Number of alliances (2002–2006)</th>
<th>Frequency (approximate number of alliances in parentheses)</th>
<th>Share of total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–5</td>
<td>54 (=138)</td>
<td>33.54</td>
</tr>
<tr>
<td>6–15</td>
<td>64 (=672)</td>
<td>39.75</td>
</tr>
<tr>
<td>16–25</td>
<td>25 (=512)</td>
<td>15.53</td>
</tr>
<tr>
<td>26–40</td>
<td>4 (=132)</td>
<td>2.48</td>
</tr>
<tr>
<td>&gt;40</td>
<td>14 (=560)</td>
<td>8.70</td>
</tr>
<tr>
<td>Total</td>
<td>161</td>
<td>100</td>
</tr>
</tbody>
</table>

Heimeriks and Duysters (2007) and measure alliance capability by examining to what extent a firm internally applies learning mechanisms that facilitate the transfer and adaptation of the knowledge attained through participation in alliances. There are several advantages to this approach. First, in contrast to measuring the external dimensions of alliance capability, our approach results in a proxy that is close to actual managerial practice. Second, the implementation of such mechanisms reflects the firm’s commitment to the management of their alliance portfolio. The alliance mechanisms used for the capability measure are listed in Appendix Table A1. The 34 mechanisms investigated are each measured by a single-item dummy variable (grouped in four categories: functions, tools, control or management processes, and external parties). We used the binomial scale (i.e., yes or no) to assess whether a firm has a certain mechanism in place. Similarly to the experience variable, we split our sample firms into groups based on capability, high or low. We distinguish between firms with high capability (observations with the score above 20, which is the sample mean), firms with low capability (score below 20) and the rest group with capability score equal to 20. The last category is only about 4% of the sample.

Control variables

Prior empirical research suggests that firm size is correlated with the propensity to engage in alliances (e.g., Harrigan, 1988; Belderbos et al., 2006). Larger firms have more resources and may find it easier to manage multiple alliances. We included firm size and measured it using a three-point Likert scale (1–500, 500–1000, and more than 1,000 employees).

Common method bias

Although it seems to be a misconception that self-reported variables are biased upward (Spector, 2006), the potential effects of common-method bias (CMB) on our results are attenuated for several reasons. First, the survey was designed to minimize the potential for CMB. Not only were the scales for our dependent and independent measures structured in different ways, they
were also measured in different parts of the survey (Podsakoff et al., 2003). Moreover, where possible we relied on previously tested scales, reducing the possibility of item ambiguity (Podsakoff et al., 2003). Second, CMB is especially critical in survey designs in which the respondent’s perceptions play a role, because these could be related by some common holistic (latent) factor. The questions in the Alliance Capability Assessment survey ask managers to provide estimates of objectively measurable items (e.g., number of alliances, presence of particular alliance management policies), mitigating concerns about CMB (Conway and Lance, 2010). Third, we ensured anonymity in the administration of the survey (Podsakoff et al., 2003). Last, our primary interest lies in identifying the interaction effects. Recent research has shown that interaction effects cannot be artifacts of CMB; rather, interaction terms can be severely deflated by CMB, making identification more difficult (Siemsen et al., 2010).

In addition to these preventive measures, we conducted several tests to check the validity of our measures. First, a Harman one-factor test revealed that the variables did not load on a single factor. A principal-component factor analysis using eigenvalues above one as the cut-off produced two factors, but neither accounted for the majority of the covariance. Common method variance can be linked to the way in which the scales are formatted (Fiske, 1982). Second, using the partial correlation procedure suggested by Podsakoff et al. (2003), the general factor score gave similar evidence. Overall, we did not find any evidence that CMB had influenced our results.

**Statistical method**

To test our hypotheses, we estimated an equation that explains a firm’s APP as a function of APD and its square term, alliance experience, alliance capabilities, interactions terms, and firm size. Formally, the estimated equation is given by:

\[
APP_i = \beta_0 \cdot APD_i + \beta_1 \cdot APD_i^2 + \beta_2 \cdot Experience_{High_i} + \beta_3 \cdot Experience_{Low_i} + \beta_4 \cdot Capability_{High_i} + \beta_5 \cdot Capability_{Low_i} + \beta_6 \cdot APD_i \cdot Experience_{High_i} + \beta_7 \cdot APD_i \cdot Experience_{Low_i} + \beta_8 \cdot APD_i \cdot Capability_{High_i} + \beta_9 \cdot APD_i \cdot Capability_{Low_i} + \beta_{10} \cdot Size_i + \epsilon_i
\]

The variable \(APP_i\), the alliance portfolio performance, crosses several thresholds as we move up the ordering alternatives. For low \(APP_i\), the success rate of the APP is low, for \(APP_i > 1\) the success rate improves, and so on. The sign of the regression parameters \(\beta\) can be interpreted as determining whether the variable \(APP_i\) increases with the regressors.

In the estimation, we applied the generalized method of moments (GMM) method using robust (heteroscedastic-consistent) standard errors, since the White test rejects the assumption of homoscedasticity at 10%. The GMM estimator has been shown to produce more efficient estimates than the traditional IV/2SLS estimator (e.g., Hansen et al., 1996; Stock and Wright, 2000; Baum et al., 2003). The endogeneity of the APD variable and its square term is an issue that requires careful consideration. Prior studies have noted that endogeneity can be an issue since a manager’s decisions are endogenous to the expected outcomes (e.g., Shaver, 1998; Leiblein et al., 2002; Hamilton and Nickerson, 2003).

We addressed this problem by projecting APD and its square term on firm size, dummies for each of the following sectors (chemicals, ICT, ICT services, financial services, other services, pharma/biotech, other manufacturing, public sector), and the importance of alliances to the firm’s overall corporate strategy. We treated firm size as exogenous with respect to APP. Pair-wise mean comparison tests of APP between the three size classes did not reject the null that the APP means are not different. We performed a similar exercise among the eight industries, and for each of the pair-wise tests of the differences in means the null of no difference could not be rejected. A multivariate regression of APP on the industry dummies and the firm size revealed that none of the explanatory variables are significant, thus providing some evidence that in our sample firm size and industry membership are exogenous relative to alliance performance. These variables are, however, significantly related to our APD measure, that is, when we regressed our APD measure on industry dummies and firm size, the F test rejected the null that all industry dummies are jointly equal to zero \((F(6, 54) = 1.96, p-value 0.07)\). Furthermore, the coefficient on the size variable was positive and significant \((p-value = 0.01)\). The variable that captures the importance of strategic alliances for the overall company strategy (the question is as follows: ‘How important are alliances to realize your company strategy?’) was only weakly statistically related to APP but strongly to APD. We can therefore reasonably assume that alliances being important for company strategy do not automatically guarantee the success of these alliances. However, this measure may be a sound predictor of the expansiveness of the firm’s alliance portfolio. Omitting this variable from the list of instruments does not qualitatively change the results.

We also ran a number of tests to check the validity of our instrumental variable (IV) approach. Under-identification tests revealed that our equation is identified: the Kleinberg-Paap Wald test rejected the null hypothesis of under-identification \((p < 0.05)\), while the Anderson-Rubin Wald test could not reject the null hypothesis that over-identifying restrictions are valid.

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(p < 0.05). The Sargan test did not reject the over-identification restriction (p > 0.1), and the F-test based on Shea’s partial R² of the first-stage regression was significant (p < 0.001), indicating the appropriateness of the instruments.

Results

Table 4 reports the results of model 1. We start with a restricted model I, in which we explain APP with APD, its square term, alliance experience, and alliance capability dummies. These results are presented in column (1) of Table 4. The overall model is statistically significant: the likelihood-ratio (LR) test clearly rejects the naïve model (with intercept only) in favour of the current specification (LR = 11.8, p < 0.01). The coefficient on the APD measure is positive and statistically significant (β₁ = 12.77, p < 0.01), while the square APD term is negative and significant (β₂ = -17.22, p < 0.01), suggesting that portfolio diversity and performance have an inverted-U-shaped relationship. This result supports our Hypothesis 1. In model 2, we introduce the interaction terms between APD and the experience variables. Our empirical approach allows the testing of whether the optimal level of APD on APP differs between high- and low-capability and high and low experiencing firms, respectively. By establishing this difference we can infer on the presence of the moderation effect of capability and experience in the relationship between APD and APP. These results are presented in column (2) of Table 4. The interaction effects between APD and experience test whether higher levels of alliance experience increase the positive effect of APD on APP. We split the moderating effect of experience on APD by the level of alliance experience. The coefficient on the interaction term of high alliance experience and APD is positive and statistically significant (β₇ = 13.87, p < 0.01) as is that of low alliance experience and APD (β₈ = 12.13, p < 0.01). The difference between the two coefficients is not statistically significant. This outcome provides support for a positive moderating effect of alliance experience on alliance diversity, as postulated by Hypothesis 2.

In model 3, we add the interaction terms for alliance capability variables with APD. According to the model diagnostic statistics, models 2 and 3 provide a better fit than model 1 does. We note that the identification of the parameters in the nonlinear model with the interaction

<table>
<thead>
<tr>
<th>Dependent variable: APP</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm size</td>
<td>0.22**</td>
<td>0.18*</td>
<td>0.15</td>
</tr>
<tr>
<td>(0.11)</td>
<td>(0.10)</td>
<td>(0.10)</td>
<td></td>
</tr>
<tr>
<td>APD</td>
<td>12.77***</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>(4.86)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>APD squared</td>
<td>-17.22***</td>
<td>-16.32***</td>
<td>-16.45***</td>
</tr>
<tr>
<td>(5.91)</td>
<td>(5.61)</td>
<td>(5.53)</td>
<td></td>
</tr>
<tr>
<td>High experience</td>
<td>0.26</td>
<td>-0.48</td>
<td>0.12</td>
</tr>
<tr>
<td>(0.91)</td>
<td>(1.01)</td>
<td>(1.26)</td>
<td></td>
</tr>
<tr>
<td>Low experience</td>
<td>0.51</td>
<td>0.67</td>
<td>1.48</td>
</tr>
<tr>
<td>(0.82)</td>
<td>(0.68)</td>
<td>(1.01)</td>
<td></td>
</tr>
<tr>
<td>High capability</td>
<td>1.11**</td>
<td>1.03**</td>
<td>0.19</td>
</tr>
<tr>
<td>(0.48)</td>
<td>(0.43)</td>
<td>(0.89)</td>
<td></td>
</tr>
<tr>
<td>Low capability</td>
<td>0.82*</td>
<td>0.83*</td>
<td>0.51</td>
</tr>
<tr>
<td>(0.47)</td>
<td>(0.42)</td>
<td>(0.89)</td>
<td></td>
</tr>
<tr>
<td>APD × high experience</td>
<td>13.87***</td>
<td>12.73***</td>
<td></td>
</tr>
<tr>
<td>(4.80)</td>
<td>(5.34)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>APD × low experience</td>
<td>12.13***</td>
<td>10.63***</td>
<td></td>
</tr>
<tr>
<td>(4.29)</td>
<td>(4.84)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>APD × high Capability</td>
<td>2.50*</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>(1.51)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>APD × low Capability</td>
<td>0.61</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>(1.59)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shea (first-stage) partial R²</td>
<td>0.10</td>
<td>0.11</td>
<td>0.11</td>
</tr>
<tr>
<td>Kleibergen-Paap Wald statistic (p-value)</td>
<td>22.33 (0.02)</td>
<td>23.83 (0.02)</td>
<td>26.29 (0.01)</td>
</tr>
<tr>
<td>Anderson-Rubin Wald statistic (p-value)</td>
<td>1.47 (0.14)</td>
<td>1.40 (0.17)</td>
<td>1.37 (0.19)</td>
</tr>
<tr>
<td>Hansen J statistic (p-value)</td>
<td>5.94 (0.82)</td>
<td>6.23 (0.86)</td>
<td>6.00 (0.87)</td>
</tr>
<tr>
<td>Log-likelihood model</td>
<td>-172.27</td>
<td>-173.23</td>
<td>-177.31</td>
</tr>
<tr>
<td>N firms</td>
<td>161</td>
<td>161</td>
<td>161</td>
</tr>
</tbody>
</table>

Robust standard errors are in parentheses.
***Indicates significance at 1%, **at 5%, *at 10% level, two-sided.
terms are not hampered by multicollinearity. Although
the correlation coefficients between the linear terms and
the cross terms are, as expected, high, the regression
coefficients are individually significant. We report the
correlations between the variables used in the estimation
in Appendix Table A2.

The results from model 3 reveal that the estimated
coefficient on the interaction term of high alliance capa-
bilities and APD is positive and significant ($\beta = 2.5,$
$p < 0.05$) but not that between low alliance capabilities
and APD. The results from model 3 indicate that the APP
peaks around an APD of 0.39 for firms with high alliance
experience and around an APD of 0.32 for firms with low
experience. We tested whether this difference is
statistically significant: the chi-square test rejects
($\text{Chi}^2(1) = 2.85$ (0.09)) the null hypothesis that APP
peaks at the same APD level for high- and low-
experience firms. Similarly, APP peaks around an APD
of 0.08 for firms with high alliance capabilities and
around an APD of 0.02 for firms with low capabilities.
Again, we tested whether this difference is statistically
significant: the chi-square test rejects ($\text{Chi}^2(1) = 3.04$
(0.08)) the null hypothesis that APP peaks at the same
APD level for high- and low-capability firms. The dif-
ference is moderately statistically significant in both
cases ($p < 0.10$). Furthermore, it appears that alliance
capabilities alone are not sufficient to maintain high
levels of APD in order to maximize APP. Moreover, firm
size is just inside the conventional significance level
($p < 0.10$) in models 1 and 2. The coefficients on the
dummy variables alliance capabilities and experience
are not significant in the full model. We also experi-
mented with additional control variables such as the
number of alliance specialists and measures of whether
alliances are formed bottom-up (e.g., partners approach
the focal firm, business units look for partners as they
see fit) or top-down (company strategy defines the need
for alliances and based on this need a partner search is
started). These additional control variables were not sta-
istically significant and did not improve the fit of the
model.

Discussion

With firms engaging in more and more alliances, both
alliance portfolio diversity (APD) and the alliance capa-
bilities required to manage such portfolios are likely to
increase. However, while prior work suggests that diver-
sity is likely to influence performance, it has been
unclear to what degree firms learn to manage APD.
Relying on organizational learning theory, we have used
a unique dataset containing over 2,000 strategic alli-
ances formed by 161 firms to understand how the
diversity-performance relationship is moderated by alli-
ance alliance experience and capability.

Our findings shed new light on existing work in three
important ways. First, since current work has largely
pointed to the advantages of diversity (e.g., Ozcan and
Eisenhardt, 2009; Faems et al., 2010), we contribute to
the literature by arguing that the relationship between
diversity and APP is nonlinear. Using a comprehensive
measure of APD that considers both alliance (type
of activity, governance mode, number of partners
involved) and partner (competitor vs. non-competitor,
inter-industry vs. intra-industry, national vs. interna-
tional) attributes, we find that diversity has a curvilinear
impact on alliance portfolio outcomes.

Second, and more important, our results demonstrate
the important role that alliance experience plays in man-
aging the challenges of APD. Given the emerging nature
of this field, to date scholarly work has not considered
how a firm’s alliance experience influences the diversity-
performance link. Our results show that alliance experi-
ence positively moderates the relationship between
diversity and APP. This suggests that experience indeed
enables a firm to deal more effectively with the diversity
in its alliance portfolio.

Third, while prior scholarly work addressed the
capability-performance link (e.g., Kale et al., 2002; Heimeriks
and Duysters, 2007; Kale and Singh, 2007), our study refines
those insights by directly showing how alliance capabilities
moderate the diversity-performance relationship. Using a comprehensive measure for alliance
capability, we found that capabilities positively moderate
the effect of APD on performance but only at high levels
of capabilities. In doing so, the results shed light on the
components of the ‘multi-alliance capability’ (Hoffmann,
2005, 2007) required to manage diverse alliance portfo-
lios, which is an important aspect unaddressed by prior
work. Our results provide support for the notion that
higher levels of APD require higher levels of alliance
management skills (Blau, 1970; Borys and Jemison,

Collectively, our findings inform and bring together
the emerging literature on alliance diversity and alliance
capabilities. They highlight the importance of underly-
ning learning mechanisms that help firms to deal with the
challenges involved in managing diversity in alliance
portfolios. In doing so, we add to this literature by dem-
onstrating that the diversity-performance link is contin-
gent on alliance experience and capability, thereby
pointing to underlying learning mechanisms that may
help deal with both the advantages and disadvantages of
diversity. Our results confirm the existence of the
paradox identified by Fiol (1994): learning is enhanced
by diversity but at the same time suffers from it. Related
to this, our paper responds to the recent call to consider
the partners and the alliance attributes jointly (Wassmer,
2010).

Moreover, relying on organizational learning theory,
we argue that the impact of diversity on performance
may well be under management’s control. In contrast to the work of Jiang et al. (2010) however, our main interest is not the relationship between various sources of APD and performance. We focus on how firms learn to deal with APD and the associated managerial challenges. In this endeavour, we have elucidated the moderating role of two specific learning mechanisms: alliance experience and alliance capabilities. Our discussion advances previous research on the debate about the importance of general alliance experience and capability.

Our results suggest that APD cannot be tackled with low levels of capability. Indeed, it requires a high degree of sophistication in terms of alliance capability to be manageable for the firm. Clearly, these results raise a number of important questions about the nature of experience. For instance, what degree of novelty or specificity of experience is optimal for overcoming the challenges posed by APD? We have considered levels of experience, but we have not captured the richness or breadth of the firm’s experience or distinguished between recent and older experience.

Another interesting set of questions relates to the nature of the firm’s alliance capabilities. In the current research setup, capabilities capture the multidimensional nature of the construct by including various underlying mechanisms. However, the ability of the firm to handle APD may hinge on the composition or use of the firm’s alliance capability. For example, do certain sets of mechanisms interact well to help the firm deal with the challenges posed by APD? In addition, the experience or background of the managers involved in developing or using the firm’s alliance capability may influence the impact of the moderating effect. In 1998, in a company-wide effort to position itself as ‘the number 1 preferred partner’ in the pharmaceutical industry, Eli Lilly started training hundreds of its employees over an extended period to increase its alliance management skills. Perhaps such training and other specific mechanisms jointly help to increase the firm’s ability to manage alliance portfolio complexity. In other words, other levels of analysis, such as the actor or individual level of analysis, may shed even more light on how firms learn to deal with APD.

Limitations and future research

Despite our contributions, there are several limitations to this study. First, we were limited in our ability to draw conclusions regarding the causal relationship between APD and APP because of the cross-sectional nature of our data. Moreover, we do not focus on the moderating role of firm size in the relationship between APD and APP. This could be an interesting area for future research. Furthermore, we cannot draw inferences about how firms develop alliance capabilities in line with the increase in diversity of their alliance portfolios. It would be interesting for future research to examine how firms develop alliance portfolios and capability over time and how this affects their APP.

Furthermore, we have measured the performance of the alliance portfolio by asking respondents about the extent to which the objectives of the firm’s alliances were realized. While this measure aggregates alliance performance at the portfolio level, it is a relative, additive dyadic measure that may not capture certain synergies between alliances at the portfolio level. Our data does not allow us to address the issue of how experience and capability help mitigate the disadvantages of high levels of APD. Because we can only infer the disadvantages associated with increasing APD from our theory, the interpretation of the interaction term between experience and capability and the squared term of APD are not straightforward. We, however, recognize that such an approach would help to expand our understanding of the phenomenon (by directly limiting negative effects instead of preventing them).

Second, we used the ASAP database, which may limit our ability to generalize the findings because members of the ASAP are familiar with alliance management. Third, in addition to our subjective measure of APP, it would be useful to have an objective performance measure such as a stock-market measure or the firm’s financial performance. Fourth, we considered only alliance experience in general and omitted the heterogeneity of such experience. It would be interesting to investigate the effect of heterogeneity (Zollo et al., 2002; Reuer et al., 2002; Shenkar and Reuer, 2005; Gulati et al., 2009), on the relationship between APD and APP. In addition, our traditional measure of alliance experience, based on the accumulated number of prior alliances, fails to capture the time span of the alliances and the true interaction with the partners. As mentioned earlier, our data only allows us to test the effects of general partnering experience (see Gulati et al., 2009). Fifth, we did not make any distinctions between different kinds of mechanisms underlying alliance capability and different levels of diversity. It would be interesting to explore how different levels of diversity relate to different compositions of alliance capabilities (i.e., different combinations of alliance mechanisms). For example, while we know that expanding alliance portfolios demands different alliance capabilities (see Heimeriks et al., 2009), it would be interesting to analyse what mechanisms help manage what type of diversity.

Finally, in our analysis we accounted for endogeneity of the APD variable. This, in itself, is an improvement over the extant literature that largely treated alliance diversity as exogenous. While our instrumental variables are valid according to the Sargan and Anderson diagnostic tests, we acknowledge that the instruments are not
ideal from the theoretical point of view. The largest firms in our sample do not seem to be superior compared to the other firms in terms of alliance success rates, while there is some evidence that larger firms tend to manage alliances better (e.g., Phelps et al., forthcoming). Also, we considered APD only in terms of diversity among partner types and alliance types. However, many more source types may impact APD; these could be taken into account. Overall, we believe that this paper makes an important step toward a better understanding of the interplay between APD, alliance experience, capability, and APP.

Conclusions

As firms continue to expand their alliance activities, the firm’s ability to manage alliance portfolio diversity has become a prominent issue in alliance research. Prior research has either examined the diversity-performance (e.g., Lavie and Miller, 2008), or capability-performance link (Kale et al., 2002; Heimeriks et al., 2007). This study has sought to bring these two research streams together. Acknowledging that there may be advantages and disadvantages to APD, we argued that the diversity-performance relationship is contingent on the firm’s alliance experience and capability. Our core contribution is the insight that the relationship between APD and APP is moderated by alliance experience and capabilities. In doing so, we not only integrate and expand two previously separated literatures (Hoffmann, 2007; Wassmer, 2010), but also provide fresh insight into the role that alliance experience and capabilities play in shaping the firm’s ability to manage APD and optimize APP.

References


Appendix

Table A1 Deliberate learning mechanisms underlying alliance capability construct

<table>
<thead>
<tr>
<th>Functions</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Alliance department</td>
<td>0.67</td>
<td>0.47</td>
</tr>
<tr>
<td>(2) Alliance manager</td>
<td>0.84</td>
<td>0.37</td>
</tr>
<tr>
<td>(3) Alliance specialist</td>
<td>0.62</td>
<td>0.49</td>
</tr>
<tr>
<td>(4) Gatekeeper</td>
<td>0.34</td>
<td>0.47</td>
</tr>
<tr>
<td>(5) Vice-president of alliances</td>
<td>0.54</td>
<td>0.5</td>
</tr>
<tr>
<td>(6) Local alliance manager</td>
<td>0.72</td>
<td>0.45</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tools</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(7) Alliance best practices</td>
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<td>0.46</td>
</tr>
<tr>
<td>(8) Alliance database</td>
<td>0.56</td>
<td>0.5</td>
</tr>
<tr>
<td>(9) Alliance handbook</td>
<td>0.38</td>
<td>0.49</td>
</tr>
<tr>
<td>(10) Alliance management development plan</td>
<td>0.35</td>
<td>0.48</td>
</tr>
<tr>
<td>(11) Training in intercultural management</td>
<td>0.22</td>
<td>0.42</td>
</tr>
<tr>
<td>(12) Competency framework for alliance managers</td>
<td>0.4</td>
<td>0.49</td>
</tr>
<tr>
<td>(13) Cross-alliance evaluation</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>(14) Culture programme</td>
<td>0.3</td>
<td>0.46</td>
</tr>
<tr>
<td>(15) External alliance training</td>
<td>0.42</td>
<td>0.49</td>
</tr>
<tr>
<td>(16) In-house alliance training</td>
<td>0.49</td>
<td>0.5</td>
</tr>
<tr>
<td>(17) Individual alliance evaluation</td>
<td>0.81</td>
<td>0.39</td>
</tr>
<tr>
<td>(18) Intranet</td>
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<td>0.46</td>
</tr>
<tr>
<td>(19) Joint business planning</td>
<td>0.85</td>
<td>0.36</td>
</tr>
<tr>
<td>(20) Joint evaluation</td>
<td>0.76</td>
<td>0.43</td>
</tr>
<tr>
<td>(21) Partner portal</td>
<td>0.65</td>
<td>0.48</td>
</tr>
<tr>
<td>(22) Partner programs</td>
<td>0.75</td>
<td>0.43</td>
</tr>
<tr>
<td>(23) Standard partner selection approach</td>
<td>0.67</td>
<td>0.47</td>
</tr>
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</table>

Control and management processes

<table>
<thead>
<tr>
<th>Control and management processes</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(24) Formally structured knowledge exchange between alliance managers</td>
<td>0.47</td>
<td>0.5</td>
</tr>
<tr>
<td>(25) Approval processes</td>
<td>0.75</td>
<td>0.44</td>
</tr>
<tr>
<td>(26) Rewards and bonuses for alliance managers</td>
<td>0.62</td>
<td>0.49</td>
</tr>
<tr>
<td>(27) Rewards and bonuses for business managers</td>
<td>0.45</td>
<td>0.5</td>
</tr>
<tr>
<td>(28) Alliance metrics</td>
<td>0.72</td>
<td>0.45</td>
</tr>
<tr>
<td>(29) Use of own knowledge about national cultural differences</td>
<td>0.83</td>
<td>0.37</td>
</tr>
<tr>
<td>(30) Country-specific alliance policies</td>
<td>0.45</td>
<td>0.5</td>
</tr>
</tbody>
</table>

External parties

<table>
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<th>Mean</th>
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</tr>
</thead>
<tbody>
<tr>
<td>(31) Consultants</td>
<td>0.41</td>
<td>0.49</td>
</tr>
<tr>
<td>(32) Financial experts</td>
<td>0.48</td>
<td>0.5</td>
</tr>
<tr>
<td>(33) Legal experts</td>
<td>0.11</td>
<td>0.32</td>
</tr>
<tr>
<td>(34) Mediators for conflict resolution</td>
<td>0.27</td>
<td>0.44</td>
</tr>
</tbody>
</table>

Table A2 Descriptive statistics and pair-wise correlations for sampled firms (N = 161)

<table>
<thead>
<tr>
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<th>Mean</th>
<th>S.D.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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</thead>
<tbody>
<tr>
<td>1. APP</td>
<td>2.98</td>
<td>1.12</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>2. APD</td>
<td>0.47</td>
<td>0.25</td>
<td>-0.03</td>
<td>1.00</td>
<td></td>
<td></td>
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<tr>
<td>3. APD²</td>
<td>0.28</td>
<td>0.21</td>
<td>-0.02</td>
<td>0.96</td>
<td>1.00</td>
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<td></td>
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<tr>
<td>4. High experience</td>
<td>0.49</td>
<td>0.49</td>
<td>-0.10</td>
<td>0.13</td>
<td>0.11</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Low experience</td>
<td>0.50</td>
<td>0.50</td>
<td>0.10</td>
<td>-0.13</td>
<td>-0.11</td>
<td>-1.0</td>
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<td>6. High capability</td>
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<td>0.50</td>
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<td>-0.06</td>
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<td>7. Low capability</td>
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<td>8. Firm size</td>
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<td>0.14</td>
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