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THE CASE OF THE GLOBAL TELECOMMUNICATION INDUSTRY**

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The SDC Platinum Database (Joint Ventures/Strategic Alliance section) was used to identify alliance portfolios for the global telecommunication industry during two distinct time periods, from January 1985 to December 1995 and from January 1996 to December 2005. Based on performance data availability from Thompson One Banker, we were able to obtain a panel data set containing the firm's global alliance portfolio diversity change matched with their corporate level performance change for 80 multi-national firms. Results from multivariate regression show that greater firm performance improvement is associated with an increase of industry diversity and a decrease in the governance diversity of the firm's global alliance portfolio. We conclude this paper with implications for theory, research and management practice.

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Introduction

Research on global strategic alliances has proliferated in line with a corresponding increase in the use of alliances by firms as a way to create and sustain competitive advantage (Ireland, Hitt, Camp & Sexton, 2001). The majority of the strategic alliance literature can be categorized into two main groups. One large body of work focuses on the alliance as the unit of analysis, examining the factors that determine the formation, governance, management, and performance of an alliance. The second large body of work adopts the network perspective, exploring outcome implications of a firm's position in a network of cooperative relationships. Both bodies of work have significantly increased our understanding of strategic alliances. However, few researchers have assumed the perspective of the firm by looking at the firm's alliances as a portfolio (see Goerzen and Beamish, 2005 and Stuart, 2000 for exceptions). We argue that a cooperative strategy can be an important part of a firm's corporate global strategy when firms exploit resources and explore new opportunities by skillfully managing a portfolio of alliances. This paper seeks to fill an important gap in the current literature by examining the firm's portfolio of alliances, and in particular the relationship between the change in the firm's global alliance portfolio diversity and the corresponding change in the firm's performance improvement. Since firms form their alliance portfolios over time we focus our attention in this study on the change in portfolio diversity and change in firm performance improvement over time.

In pursuing our line of inquiry, we adopt the resource-based view of the firm where the firm is considered a bundle of heterogeneous resources. We also subscribe to the dynamic capabilities framework contending that competitive advantages come from the firm's ability

to exploit as well as develop (including combining and re-combining) over time resources that are valuable, rare, and hard to imitate and substitute (Barney, 1991; Teece, et al., 1997). Firms often rely on a combination of internal operations (i.e., the make), external acquisitions (i.e., the buy), and alliances to create value. Our focus here is on alliances and in particular, a firm's portfolio of alliances with diverse partners.

An increasing use of alliances suggests that firms are adopting cooperative strategies as an indispensable part of their overall corporate strategies. The high rate of alliance failure, on the other hand, testifies to the difficulty in managing cooperative relationships. We suspect the lack of portfolio thinking in alliance management might be one reason why so many individual alliances fail, as certain individual alliances may not contribute to the overall corporate strategic goal for various reasons; alliances could have been established with the wrong partners, for the wrong reasons, and managed in the wrong manner. Additionally, several other interesting questions arise from issues within the context of an alliance portfolio perspective. For example, is it better to have a larger portfolio with many alliances or smaller portfolio with a few? Is it better to have alliances with more homogeneous partners or alliances with more diverse partners? Is it better to engage in alliances for limited types of activities or for a broader range of functional purposes? Should firms stick to a few governance structures that they are familiar with, or should they try with various different forms? We attempt to explore these specific questions by empirically testing whether the change in a firm's global alliance portfolio diversity – in terms of its alliance partners, functional purposes, and governance structures – affects the firm's performance improvement.

Our research will contribute to the literature both theoretically and empirically in several ways. Most of the prior research has taken the perspective of either a specific alliance or an overall network of alliances. Here, we assume the perspective of the firm and look at all the firm's alliances as a portfolio of the firm's alliance activity and, therefore, an indicator of the firm's overall cooperative strategy. This perspective allows us to examine the overall use of alliances and any effect this overall cooperative strategy may have on firm-level performance, regardless of the performance of the individual alliances that make up the firm's global alliance portfolio. While a firm's position in a network of cooperative relationships is a result of the combined actions of all involved parties, a firm can actively manage its portfolio of alliances to suit its strategic purposes. As such, the firm's global alliance portfolio is also an important part of managing the firm's overall bundle of resources and competencies. We also contribute to research by developing the notion as well as the measures of alliance portfolio diversity. By looking at the evolution of a firm's alliance portfolio, we will be able to better establish causality among the portfolio diversity variables and firm performance.

Our main overarching treatise is the diversity of a firm's global alliance portfolio rather than the size or the absolute number of alliances in which a firm participates is the significant feature that impacts firm performance. While a few studies have looked at alliance network heterogeneity, previous studies have focused only on the diversity of partners (Beckman and Haunschild, 2002; Goerzen and Beamish, 2005). We define alliance portfolio diversity as a much more encompassing multi-dimensional construct, including partner diversity, functional diversity and governance diversity and develop hypotheses about the impact of the various alliance portfolio diversities change on a firm's performance change. We

then draw from the group diversity literature and develop measures for the various diversity variables, and empirically test the relationships between our global alliance portfolio diversity constructs and firm performance change. Finally, our investigation is also highly relevant for management practitioners. That is, by teasing out the relationship between alliance portfolio characteristics and firm performance, we offer ways in which alliances can provide the most benefits to a firm, and hence certain key principles of cooperative strategies at the corporate level can be established. Moreover, while the current alliance-level literature is focused on helping management practice with specific alliances, corporate managers must maximize the possible competence- and value- enhancing benefits of an overall cooperative strategy that includes actively managing a portfolio of global alliances (Hoffman, 2005). We address this need in this paper as well.

In the following sections of this paper, we first define and describe the concept of global alliance portfolio diversity, then in critically reviewing the current alliance literature we theoretically develop hypotheses on the relationship between global alliance portfolio diversity and firm performance. That is followed by a presentation of our research design, statistical models, and empirical results. We conclude with a discussion of our results and their implications for theory, research and practice.

Theory and Hypotheses Development

Firms enter into alliances for various reasons. Some alliances are established to pool complementary resources from partners (Henderson and Cockburn, 1994; Eisenhardt and Schoonhoven, 1996), while some alliances are established so the partners can share the costs and the risk of undertaking expensive and highly uncertain projects (Hegedoorn, 1993; Kogut,

1988). Alliances are also established to gain strategic flexibility (Kogut, 1988), or to preempt and dominate competition (Pfeffer and Nowak, 1976). Recently, alliances have been used as an effective means to learn by gaining access and/or acquiring resources and capabilities that reside outside the firm (Hamel, 1991; Hegedoorn, 1993; Powell, Koput & Smith-Doerr, 1996). Prior studies suggest that alliances often have a positive impact on different measures of corporate performance. For example, a firm's external cooperative relationships have been found to be positively associated with firm survival (Baum and Oliver, 1991; Mitchell and Singh, 1996), higher firm growth rates (Powell et al., 1996), and innovation (Hagedoorn and Schakenraad, 1994). Stuart (2000:791), however, introduced the notion of an alliance portfolio and argued that "the advantage of a portfolio of alliances is determined not so much by the portfolio's size, but by the characteristics of the firms that a focal organization is connected to". We extend this notion and argue that with respect to a firm's portfolio of alliances, the size of a firm's alliance portfolio is not as significant a factor for firm performance as the diversity of the portfolio; not just in its partners, but also in its functional purposes and governance structures.

Alliance Portfolio Diversity

In entering into a strategic alliance, a firm has to consider a number of issues. First is the question of partner selection; with who should the firm ally (Hitt, Ireland & Santoro, 2004; Hoffman, 2005). Along these lines, the firm has to choose whether to enter into an alliance with partners similar to themselves or with partners that are dissimilar. More specifically, the firm can choose partners that are similar in industry background and knowledge base so that it might be easier to reach a level of understanding and familiarity that

will facilitate collaboration. On the other hand, the firm can also choose to cooperate with a wide variety of partners coming from different industries, different knowledge bases, and operating with different routines, in order to broaden its exposure to different pools of resources and capabilities and hence develop new and different competencies. In this case the firm will have a high degree of partner diversity in its alliance portfolio. Our alliance portfolio partner diversity concept is similar to the alliance network diversity construct developed by Goerzen and Beamish (2005:336), which refers to the degree of “variance in partners’ resources, capabilities, and industrial backgrounds” in a firm’s alliance portfolio.

Second, a firm also has the possibility to apply its cooperative strategy for different functional purposes. The firm can get involved in exploitative alliances like marketing or manufacturing collaborations, in which firms come together so that they can possibly generate greater levels of returns from their respective existing resources (March, 1991). Firms can also enhance or broaden its technological and development capabilities by combining force with partners through R & D alliances, otherwise known as exploratory alliances (March, 1991). Or, the firm can focus on lowering costs and increasing efficiency throughout its value-chain activities by entering into manufacturing or sourcing agreements. In this case, the firm has a higher level of functional diversity in its alliance portfolio.

Third, a firm also has choices in organizing and managing its alliances by assuming different governance structures, where, for example, cooperative relationships are established and structured as non-equity or equity-based. In equity-based joint ventures, a firm can choose to be a minor equity, equal share, or major equity partner. Different governance structures have different implications regarding the level of commitment, degree

of integration, as well as the learning effectiveness for different types of knowledge (Kogut, 1988). A firm's alliance portfolio has a high or low level of governance diversity depending on whether the firm tends to vary or converge on the type of governance structures used for their various alliances.

The alliance literature is fairly rich with studies that deal with these questions individually. However, from an alliance portfolio perspective, the firm has to consider all three of these aspects in concert. Combining these notions we define a firm's alliance portfolio diversity as the degree to which the firm's global alliances portfolio differ with respect to the three dimensions of partner diversity, functional diversity, and governance diversity. Since a firm's cooperative strategy is a key component of the firm's overall corporate strategy we examine the extent to which a change in a firm's global alliance portfolio diversity affects a change in its corporate performance. We discuss each of the three components of a firm's global alliance portfolio diversity, i.e., partner diversity, functional diversity, and governance diversity, and their linkage to firm performance in the following sections.

Partner Diversity and Firm Performance

Partner selection is an important decision for firms entering into cooperative relationships (Hitt, et al., 2004). This is especially so in the current competitive environment where accessing and learning new skills from partner(s) have become a prevalent rationale for allying (Hamel, 1991; Hagedoorn, 1993; Hagedoorn and Schakenraad, 1994; Powell et al., 1996). The increasing emphasis on learning and capability-access has resulted since most firms increasingly compete in a global and technologically fast-paced environment. As a

result, resources and capabilities such as technological, marketing and managerial know-how are critical for obtaining and maintaining competitive advantages (Barney, 1991; Henderson and Cockburn, 1994; Eisenhardt and Martin, 2000). Since partners in cooperative relationships are potential sources of these new skills or needed resources, firms must choose the right partners (Hitt, et al., 2004).

Prior studies have focused on how partner characteristics affect the management and performance of a specific alliance. Parkhe (1991), for instance, proposed two types of inter-firm diversity and argued for their different effects on the longevity and dynamics of an alliance. Stuart (2000), on the other hand, studied how the attributes of a firm's partners may affect what the firm can gain from its portfolio of technology alliances. Stuart (2000) found that when a firm's alliance partners are larger and possess more technological resources, the focal firm tends to enjoy improved innovation and growth rates. Along the same lines, Hagedoorn and Schakenraad (1994) found the characteristics of alliance partners are more important for a firm's performance than the absolute number of alliances the firm participates in. Beckman and Haunschild (2002) linked a focal firm's network (through boards of directors) partners' diversity in acquisition experience and industry backgrounds to the premium it pays for its own acquisitions and Goerzen and Beamish (2005) found that diversity (similar to our partner diversity) in Japanese firms' foreign subsidiary networks has a mostly negative effect on corporate performance.

From an alliance portfolio perspective, the question arises as to whether a firm should select a more homogeneous group of firms as potential partners or venture into alliances with a diverse variety of firms. From a capability development perspective, access to

a diverse pool of resources, capabilities and routines will reduce the firm's risk of developing core rigidities and will help with the renewal and reconfiguration of the firms' portfolio of competences (Kogut and Zander, 1992; Teece et al, 1997; Stuart, 2000). Diverse portfolio partners mean more breadth in firms' search for new opportunities and solutions. Higher variation provides multiple options and is more likely to yield superior choices (Kattila and Ahuja, 2002). Diverse partners also bring more unique and non-redundant information and resources (Beckman and Haunschild, 2002). While these examples suggest alliances with diverse partners bring benefits, Goerzen and Beamish's (2005) recent study found that higher partner diversity in Japanese MNCs' international network reduces firm performance except for a few very large firms. Thus, controversy exists as to whether partner diversity has a positive or negative influence on firm performance. We agree with Parkhe (1991) in arguing that there are two types of partner diversity. Type I diversity really forms "the underlying strategic motivations for entering into alliances", in that the differences are actually the complementary resources that will "facilitate the formulation, development, and collaborative effectiveness" of global strategic alliances (Parkhe, 1991:580). At the portfolio level, diversity in partners' knowledge bases and resource pools might be desirable because they enrich the information and learning experience of the focal firm. Type II diversity, on the other hand, are differences in partner characteristics that might hurt communication, hinder knowledge transfer, and severely increase coordination difficulty. Therefore, we argue for different relationships between the two sub-dimensions of partner diversity, i.e., geographic diversity and industry diversity.

Geographic diversity. Alliances are now increasingly involving firms from different

geographic regions. Prior research has identified several benefits from allying across borders including sharing costs and facilitating market entry (Glaister and Buckley, 1996), obtaining complementary capabilities (Inkpen and Dinur, 1998; Hitt, Dacin, Levitas, Arregle, and Borza, 2000; Lane, Salk, and Lyles, 2001), and integrating different knowledge bases (Lubatkin Florin, and Lane, 2001). However, geographic diversity also contains high potential for conflict. Societal culture pervades many important aspects of life within a region including areas such as values, norms, and managers' behaviors. Cultural differences in different part of the world can affect people's ways of perceiving, thinking, and reasoning (Parkhe, 1991). In some countries, cultural norms suggest that issues be immediately solved where managers create deliberate strategies and take quick actions for response. In other cultures, it is encouraged that problem solving be handled by devil's advocacy and dialectical inquiry techniques where different perspectives can often enhance strategic decision-making (Parkhe, 1991). Parke (1991) found that inter-firm diversity in the way of social, cultural and national contexts negatively influences the longevity of a global strategic alliance. At the firm level, increased operational scope in different geographic environments has been found to lead to inferior corporate performance (Goerzen and Beamish, 2003). For an alliance portfolio that includes partnerships with many different geographic contexts, the challenge for the firm to adjust and learn to deal with partners with different values, routines, and decision-making styles can sometimes overwhelm management capabilities. In these cases, we believe the coordination and integration costs will outweigh the potential benefits from getting exposure to different markets. Therefore, we formally propose:

Hypothesis 1a: An increase in geographic diversity of a firm's global alliance portfolio will lead to a negative change in the firm's performance.

Industry Diversity. Firms have the opportunity to ally with a variety of firms, those operating in the same industrial sector and those in different industrial sectors. Firms sometimes ally with competitors to learn or to share risk and costs (Das and Teng, 2000; Tyler and Steensma, 1995), or they choose to work with suppliers or customers to achieve economies of scale and scope for efficiency gain (Das and Teng; 2000; Kogut, 1988). Firms can also collaborate with firms operating in completely unrelated fields where knowledge among partners is non-redundant (Beckman and Haunschild, 2002; Santoro & Chakrabarti, 2002). When a firm enters into alliances with organizations from a wide range of industry backgrounds, the firm gets exposed to different knowledge, skill sets, and technology bases (Santoro & McGill, 2005). Allying with firms from different industrial sectors also offers different challenges and opportunities that occur and evolve from different industry dynamics. This wide variation in partners enables the firm to learn different skills, provide an opportunity to meld complementary resources, update and modify its learning routines, and as a result possibly make inroads into unexplored new areas of opportunity. Following this line of reasoning, we contend that it is more beneficial for firms to collaborate with firms from different industrial sectors than with firms from the same industrial sector. We therefore formally propose:

Hypothesis 1b: An increase in the industry diversity of a firm's global alliance portfolio will lead to a positive change in the firm's performance.

Functional Diversity and Firm Performance

Corresponding to the various rationales for entering into collaborative relationships, alliances can be categorized into different types based on the functional

purposes they serve. R & D alliances are especially prevalent as the technological advances pick up speed and both the costs and the risk of R & D projects increase considerably since the 1990s (Doz and Hamel, 1998; Hagedoorn, 1993). Firms are also using cooperative strategies for marketing efforts, manufacturing tasks, and distribution channels, as they continue to focus more on fewer areas of their core competences. In many instances, alliances are being used for all activities in firms' value chains beginning with supplier networks to marketing and distribution partnerships. These initiatives are consistent with the increasing understanding that firms have finite resources and should therefore focus more on its core competencies and not get distracted by non-core activities (Santoro & Chakrabarti, 2002). Among alliances established for different functional purposes, some alliances are more in the way of dealing with exploration activities (such as R & D alliances used to create new products or technologies) whereas some alliances are more in the way of dealing with exploitation activities (such as manufacturing agreements used to gain economies of scale). As March (1991) pointed out, it is important for a firm to maintain a good balance between both exploration and exploitation activities. Exploitation activities guarantee a firm's current viability while exploration may critically influence a firm's future viability. When a firm engages in both types of alliances, thus showing a higher degree of diversity in its alliance portfolio's functional purposes, this indicates a more balanced use of alliance for both exploration and exploitation, thus enhancing the firm's competences (Stuart and Podolny, 1996). Having a variety of alliances serving different functional purposes also provides a firm with opportunities to develop new capabilities, as each different type of functional alliances will involve different inputs from partners, thus further increases the firm's breadth in search

and deter the firm from developing core-rigidity. Following this line of reasoning, we formally propose:

Hypothesis 2: An increase in the functional diversity of a firm's global alliance portfolio will lead to a positive change in the firm's performance.

Governance Diversity and Firm Performance

In addition to selecting partners and functions for its portfolio of alliances, a firm also faces the important decision of how to organize and manage each of the alliances in its portfolio. Firms can use an array of governance structures, ranging from non-equity contracts or agreements, minority equity to dominant-equity joint ventures. Different forms of governance represent different levels of commitment and/or control (Santoro & McGill, 2005). Previous work shows that governance forms can vary in their effectiveness for organizational learning where for instance, equity joint ventures can be particularly beneficial for learning intangible un-codified knowledge (Kogut and Zander, 1992). Other studies have shown that firms' experience with a certain type of alliances tend to lead to more use of this particular type of governance structure (Sampson, 2005). Prior experience with a certain governance structure also enhances the performance of the alliance. Arguably, when a firm repeatedly adopts the same governance structure, learning occurs and the firm accumulates and enhances its alliance management skills. Moreover, each different governance structure tends to have its own unique set of features and issues. Equity and non-equity joint ventures, for instance, require different resource commitments, managerial attention, and relationship building routines. High diversity in governance structure can often result in increased complexity and coordination costs for the firm as it has to deal with a wider range of issues, develop a more complex set of operational protocols, and be required to continually provide

sometimes unique and new solutions commensurate with each different governance situation it employs. As a result, we formally propose:

Hypothesis 3: An increase in the governance diversity of a firm's global alliance portfolio will lead to a negative change in the firm's performance.

Research Method

In order to track changes in a firm's alliance portfolio diversity and its impact on a firm's performance change, we employed a simple prospective panel design for this study. In doing so, we collected data at two distinct points of time, i.e., January 1985-December 1995 and January 1996-December 2005, from the same sample. We elaborate upon our sample and data in the following sections.

Sample and Data

The SDC Platinum Database (Joint Ventures/Strategic Alliance section) was used to identify alliance portfolios for the global telecommunication industry during the period from January 1985 to December 1995 and from January 1996 to December 2005. We focused on parent firms from the global telecommunication industry where the parents' primary SIC was 4810, 4811, 4812 and 4813 identified each of the firm's respective alliance portfolios. The global telecommunication industry was chosen due to its extensive use of alliances and largely because of the 1996 telecommunication Act that brought a much greater degree of competition that was used as a logical dividing point for the industry as we pursued a prospective panel design study.

An alliance portfolio is defined as the collection of all the alliances established

during the sample period. Based on performance data availability from Thompson One Banker, we were able to obtain complete data sets containing the firm's global alliance portfolio matched with their corporate level performance for 80 multi-national firms (total count of alliances combined in year 1995 was 1922 and 4384 in year 2005). For a highly consolidated and global industry, this data set offers a sizeable number of alliances and firms to study the relationship between alliance portfolio diversity and firm level performances.

Measures

Dependent Variable. Our dependent variable for this study is Change in Return on Equity (ROE) Per Share for a Three-Year Average (year 2003, year 2004 and year 2005)

ROE Per Share is calculated by dividing earnings per share by last year's book value per share and multiplying the result by 100. Return on equity was chosen since this measure reveals how much profit a company earned in comparison to the total amount of shareholder equity found on the balance sheet. Moreover, Return on Equity (ROE) has been used in a number of previous studies to determine firm performance (Karr, 2005 and Peng, 2004) and ROE is a good way of comparing companies in the same industry, since firms in the same industrial sector are subject to similar business conditions. Given that we are trying to determine whether and how a firm's alliance portfolio diversity can affect a firm's ability to outperform other firms in a global market, ROE is a most appropriate measure for firm performance. To help alleviate the effect of any particular year, we used three-year average of ROE. To make sure the pattern of change is not dependent on the particular measure and is not simply an artifact of unreliable measure. We also replicate the analysis with another performance measure, change in net profit margin three-year-average. The result is quite similar; therefore,

our measure for performance change is reliable.

Independent Variables. We defined *Alliance Portfolio Diversity* as a multi-dimensional construct, including partner diversity, functional diversity, and governance diversity. For alliance partner diversity, we identified two sub-dimensions including industry diversity for partners' different industry backgrounds and geographic diversity for partners' different national origins. For functional diversity, we classified alliance activities into 4 categories, marketing, manufacturing, R&D and other services. To measure governance diversity, we used the focal firm's equity ownership in the strategic alliances, ranging from zero to one hundred percent. We describe each of these measures more fully in the sections below.

We first coded each alliance into different categories. For instance, industry diversity has four categories. If an alliance is formed with a partner in the same 4-digit SIC code, it was coded "4"; if the partner is in the same 3-digit SIC code, it was coded "3"; same 2-digit SIC code, "2"; same 1-digit SIC code, "1", and finally if the partner shared no SIC code, it was coded "0". This categorization captures whether alliances are formed with competitors (within same 4-digit SIC code), cooperators (same 2- or 3-digit SIC code), or unrelated industry player (1- or 0 same SIC digit). Likewise, each alliance was also coded into 23 different categories on geographic aspects. We coded the alliances in this sample into as many different categories as possible to capture maximum variability.

Based on this coded information, we then composed the portfolio level industry diversity by using the Blau Index of Variability (Blau, 1977). The Blau Index has been used widely in the group diversity literature to measure variability of categorical variables.

Hambrick et al. (1996) referred to this index as the Herfindal-Hirschman index of heterogeneity. For any given diversity variable:

$$D = 1 - \sum p_i^2$$

where D represents degree of diversity or heterogeneity, and p represents the proportion belonging to a given category, i is the number of different categories. As diversity is maximized, values of proportions belonging to any given category are low and p_i^2 is minimized. We used the Blau index since it allowed us to measure the level of diversity present among a portfolio of alliances where a perfectly homogeneous group would receive a score of 0, while a perfectly heterogeneous group (with members spread evenly among an infinitesimal number of categories) would receive a score of 1. To draw an example from this study, if all of the alliances in a given firm's portfolio were from the same SIC code, the Blau index would be 0, indicating perfect homogeneity. If 25% of the alliances were from the same 4 digits, 25% were from the same first 3 digits, 25% were from the same first 2 digits, and 25% were from only the same first digit, then the Blau index would be 0.75, indicating the highest level of heterogeneity achievable in a situation with four categories. As the number of categories increases, the highest possible Blau score increases.

One caveat to our measure scheme is that the size of alliance portfolio (measured by number of alliances within the portfolio) varies from firm to firm. In our sample, it ranges from 2 to 97 with a mean of 15. With the use of Blau index, the highest possible Blau score for a firm with 2 alliances is 0.5; while the highest possible Blau score for a firm with 4 alliances is 0.75. Therefore, if we want to compare different firm's level of alliance portfolio diversity, we can only use the relative (or standardized) measure. As a result, we divide the

absolute diversity score by the highest possible Blau score based on their portfolio size.

Using this method, we were able to code the two partner diversity variables: *Industry diversity*, *Geographic diversity*. We were also able to use this method to code our two other portfolio diversity variables: *Functional diversity* and *Governance diversity* that we describe below. With respect to *Functional diversity* we first classified alliance activities into 4 categories, marketing, manufacturing, R&D and other services, and then aggregated them into a portfolio level diversity measure using Blau Index. With respect to *Governance diversity* we focused on a firm's level of equity holding in an alliance. In doing so, we coded each alliance into one of the following categories: "1"= non-equity, "2"= minor equity up to 20%, "3"= substantial share 21-49%, "4"=equal share 50%, "5"= major share 51-79% and "6"=dominant share 80% and above. Portfolio governance diversity is calculated using Blau index. The change in portfolio diversity is measured by subtracting diversity scores in 1995 from diversity scores in 2005.

Control Variables. Our single industry study design helps us to control for much of the industry and environmental variances that might have confounded our results. We also include two control variables, i.e., firm size and alliance portfolio size, to exclude alternative explanations for firm performance. We controlled for portfolio size by using the number of total alliances for the firm during the sample period. Finally, firm size is measured by a log transformation of total assets; this approach has been widely used in the management literature and is often useful for correcting problems with skewed data, outliers, and unequal variation (Damanpour, 1992).

Statistical Design

A two-step hierarchical multiple regression procedure was used for hypotheses testing (Cohen and Cohen, 1983). The hierarchical multiple regression analyses were performed with force entry of the variables. In step 1 the control variables were entered (i.e., firm size and portfolio size). Step 2 contained the independent variables, that is, net change in industry diversity, national diversity, organizational diversity, functional diversity and governance diversity from 1995 to 2005. We standardized the variables, prior to creating the interaction terms, to improve their interpretability and to reduce the threat of multicollinearity (Aiken and West, 1991).

Results

Table 1 lists the original means, standard deviations of the key variables that we wanted to observe in these two different time periods. We also conducted t tests to see if any significant changes could be detected.

 Insert Table 1 about here

Table 2 provides the means, standard deviations, and correlations for the changes in the study variables. Regression results for the tests of hypotheses are presented in Table 3. As shown in Table 1, the average size of a portfolio in our global telecommunication industry sample is 24 in year 1995 and increased to 55 in year 2005, confirming the importance of a cooperative strategy for this industry and an ever increasing use of alliances as a key part of

the firms' overall strategy. At the same time, the average size of the firm as measured by total assets increased from 20 millions dollars to 36 million dollars. In terms of financial performance, the firms in this study increased their net profit margin from 1.61 to 5.68 in 10 years, although this is statistically insignificant it is notable. As for the four portfolio diversity variables, industry diversity and governance diversity did not change significantly. However, geographic diversity increased significantly which may reflect an increasingly global cooperative outreach by the firms in this sample. On the other hand, functional diversity reduced significantly, which may imply that firms become more focused when deciding what kinds of value chain functions should be done jointly with other firms.

Our results also show that firm size increased significantly related to alliance portfolio size increase ($r=.28, <0.05$), which suggests firms tend to create a larger alliance portfolio as the size of their firm increases.

Insert Table 2 about here

In the multivariate tests of our hypotheses, we began with a baseline model including just our control variables (model 1). Comparisons in the model fit between our baseline model and the fully specified model (model 3) provides an indication of the overall explanatory power of our hypotheses. In addition to these two models, we also presented one

model with only the partner diversity variables (main effects of industry diversity and geographic diversity) plus control variables to determine their respective independent effects on firm performance (model 2). Overall, the results shown in Table 3, particularly given the dramatic increase of the explanatory power from model 1 to model 3, suggests the relevance and importance of alliance portfolio diversity on firm performance.

Insert Table 3 about here

Our results show that the baseline, i.e., Model 1 is insignificant, suggesting that a change in firm size in the telecommunication industry does not have a significant positive impact on the performance of the firm. In addition, and in line with a key treatise of this paper is that the increase in alliance portfolio size is insignificant. This result is consistent with previous work that looked at alliance network size's impact on firm performance (Baum, Calabrese and Silverman, 2000). Our results and results from the Baum and colleagues work (2000) suggests that merely establishing more and more alliances and hoping some of them will work will not necessarily bring success to a firm. On the other hand, establishing a diverse alliance portfolio along the proposed dimensions may lead to better firm performance improvement.

Hypotheses 1a and 1b predicted relationships between two different dimensions of alliance partner diversity change and firm performance improvement. Hypothesis 1a stated that increased geographic diversity will lead to decreased firm performance improvement. Our results across both Model 2 and Model 3 do not provide support for this hypothesis.

Thus, hypothesis 1a is not supported. H1b stated that increased industry diversity leads to positive firm performance change. The results in Model 2 and Model 3 confirmed our a priori notion that an increase in industry diversity is related to increased firm performance improvement. This result is consistent across both model 2 (-.17, $p < 0.10$) and model 3 (-.22, $p < 0.05$). We therefore find support for hypothesis 1b. Hypothesis 2 argued that an alliance portfolio's functional diversity increase will lead to firm performance improvement. The results provided in both Model 2 and Model 3 do not provide support for this hypothesis, thus hypothesis 2 is not supported. Finally, Model 3 (-0.40, $p < 0.01$) shows that an increase in alliance governance diversity is significantly related to a decrease in firm performance change. This result provides support for hypothesis 3.

Discussion and Conclusion

Research on strategic alliances has greatly increased our understanding of the role of cooperative strategy within the context of a firm's overall corporate strategy. While the role of alliance network structure and firm characteristics on firm performance is attracting increasing attention, there has been limited effort in viewing a firm's alliance activities from a portfolio perspective (Hoffman, 2005; Reuer and Ragozzino, 2006). Equally important, there has been no prior study that examined the change in a firm's alliance portfolio and its relationship to firm performance over time. This current study reported on in this paper addresses these two needs in the literature. As a result of this study we found that firms can benefit from actively managing a portfolio of alliances by establishing relationships with a variety of industries, engaging in both exploitation and exploration collaborations, and by accumulating alliance management skills using a more focused governance structuring

strategy.

Here, we defined alliance portfolio diversity as a multi-dimensional construct that moved beyond just partner characteristics (Beckman and Haunschild, 2002; Goerzen and Beamish, 2005) to include also diversity in functional activity and governance structure. Our more comprehensive construct of portfolio diversity encompasses three major decisions that corporate managers have to deliberate on formulating cooperative strategy. Partner diversity of an alliance portfolio points to a firm's search behavior regarding source of information. Higher partner diversity would imply a combination of local and distant search, the benefit of which needs to be balanced against potential higher costs resulting from increased complexity and conflict potential due to partner differences. Functional diversity suggests a balance between exploration and exploitation, which can be beneficial for capability development in the long run. Governance diversity, on the other hand, may suggest a certain lack of experience and learning accumulation on the part of management.

The empirical results from our study indicate a complex relationship between different aspects of alliance portfolio diversity change and firm performance change. Among the two partner diversity dimensions, diversity in partners' industry backgrounds has a significantly positive impact on firm profitability improvement, confirming our expectation. This wide variation in partners' industry background enables the firm to learn different skills, update its routines, and possibly make inroads into unexplored areas. The negative sign for governance diversity shows the importance of learning and accumulating experience by organizing collaborations using a focused set of governance structures.

Our results from this study also provide empirical support to the claim that "a

company's alliance portfolio" "crucially influences its competitiveness and financial performance (Hoffman, 2005). Through effective cooperative strategy, firms can exploit, develop, and renew their bundles of resources by allying with diverse group of partners for various functional purposes. Firms that understand the strategic importance of cooperative strategy, develop an effective alliance portfolio management system, and actively manage their portfolio will be able to gain dynamic capabilities that are valuable for success (Teece et al., 1997). Therefore, alliance portfolio management should become a key responsibility of corporate-level strategic management.

In addition to being one of the first empirical papers linking alliance portfolio diversity change to firm performance improvement, this paper also contributes to the empirical research by developing a comprehensive multi-dimensional construct as well as specific, testable measures for alliance portfolio diversity. We developed appropriate measures for diversity variables by borrowing from the much fully developed group diversity literature. Future research can be done to test the applicability of our measures in other empirical settings.

For practicing managers, it is important for them to have a portfolio perspective in alliance management, and develop a portfolio management system (Hoffman, 2005). They should seek collaborations with firms coming from different kinds of industry background, getting access and exposure to a diverse pools of resources. Furthermore, managers are cautioned not to try out a new governance structure every time they set up an alliance. Our results suggest that managers can better accumulate alliance management skills by focusing on only a limited type of governance structures. Along these lines, prior research shows that

firms can accumulate alliance management skills when they repeatedly adopt similar governance structures (Sampson, 2004). Our study suggests that more governance diversity with its increased and more complex coordination may be a costly alternative that firms should not pursue.

The fact that this is a single-industry study limits our ability to generalize our findings. However, cooperative strategy is of critical importance for the global telecommunication industry and our sample does represent a major part of the global telecommunication industry network. To extend this current research we presented here, we suggest future studies investigate this phenomenon with firms from different industrial sectors that also rely heavily on alliances such as the automobile industry and electronics industries. In this way, more insights can be gained on whether and the extent to which our findings are applicable in those settings as well. Another possible avenue for future research and an interesting extension to this current study for instance, is the possible interactive effect between partner, functional diversity and governance diversity. Governance diversity change is negatively associated with performance change in our study. However, transaction cost analysis has time and again shown that governance structure is a major way of attenuating potential appropriation hazards and opportunistic behavior (Santoro and McGill, 2005). Therefore, when a company enters into cooperative arrangements with a variety of organizations each with different motives, it might follow that the company ought to use different governance structures accordingly. This may imply interaction effects between a variety of partner, functional, and organizational diversities and governance diversity. While intriguing, this aspect was beyond the scope of this current study.

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Table 1. Means, Standard Deviations and T tests for Key Variables

Year	1995		2005			
Variable	Mean	S.D.	Mean	S.D.	T test	Sig.
1. Net Profit Margin	1.61	43.28	5.68	22.66	.87	.39
2. Portfolio Size	24.03	45.45	54.80	78.15	5.87	.00
3. Total Assets	20284.57	23616.27	35813.20	42958.17	3.55	.00
4. Industry Diversity	.4825	.3003	.4827	.2231	.01	.99
5. Geographic Diversity	.3553	.2641	.4007	.1524	1.90	.06
6. Functional Diversity	.5814	.2642	.5045	.2010	-2.96	.00
7. Governance Diversity	.3749	.2420	.3797	.1532	.21	.83

Table 2. Means, Standard Deviations, and Pearson Correlations for Changes

Variable	Mean	S.D.	1	2	3	4	5	6
1. Net Profit Margin Change	4.07	41.81						
2. Portfolio Size Change	30.78	46.92	-.09					
3. Total Assets Change	15528.63	39134.52	-.08	.28*				
4. Industry Diversity Change	.0458	.1367	.33**	-.18	-.20			
5. Geographic Diversity Change	.0782	.1493	.20	-.05	-.05	.17		
6. Functional Diversity Change	-.0218	.1823	.15	-.30**	-.06	.07	.24*	
7. Governance Diversity Change	.0418	.1515	-.07	-.055	.05	.21	.02	.03

1. *p<0.10, **p<0.05, ***p<0.01

2. n=80

Table 3. OLS Analysis: Net Profit Margin 3-Year Average Change as the dependent variable

Independent Variables	Model 1	Model 2	Model 3
Portfolio Size Change	.08	.11	-.03
Total Assets Change	-.23	-.18	.06
Industry Diversity Change		.26*	.38**
Geographic Diversity Change		-.14	-.10
Functional Diversity Change			.05
Governance Diversity Change			-.40***
Model F	1.21	1.66	2.30
R ²	.05	.12	.25
Adjusted R ²	-.00	.05	.15

1. The entries in the table are standardized regression coefficients (β)

2. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

3. $n = 80$