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TECHNOLOGICAL EXPLORATION AND MARKET EXPLOITATION IN INTERFIRM ALLIANCES

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ABSTRACT

This paper empirically examines the dichotomous contribution for innovation, for technological exploration and market exploitation, from alliances. Using a sample from US economy-wide alliances of US Public companies and employing cross-tabulation of various classifications of alliances and parent firms, the related phenomena are investigated. Results show that alliances are predominantly undertaken by technology-intensive companies and their frequency has a direct association with the parental technological intensity. However, technological explorative purposes do not dominate in the complete sample of alliances. Many firms, whether technologically intensive or not, enter into alliances also for market exploitative purposes. This contingent phenomenon shows that alliances offer a very important additional role that is not all technology centered, but that is also deeply market centered.

JEL: L14, L24, M10, O31, O32

KEYWORDS: Exploration, Exploitation, Innovation, Ambidexterity, Alliances, Technological Intensity

INTRODUCTION

There appears to be near consensus in the scholarly literature about the central role of alliances in technological innovation. Innovation occurs when creatively spun technological knowledge is successful in the market. The locus for the effort, sometimes long and always winding, is usually dichotomized and contrasted for scholarly convenience into classes of activities for exploration (for invention) and exploitation. Alliances can help with the locus of innovation. The notion that interfirm alliances are strongly associated with technological intensity and innovation is accepted partly because of the fortuitously high frequency of alliances in high technology industries, which scholars have favored for their studies.

There are reasons, however, that the usual organizational processes, already strained with natural internal conflicts and external uncertainties, may be further challenged to the point of ineffectualness along a locus that involves alliances. Alliances bring difficult boundaries and undecipherable structures and processes of external organizations. The overarching research question in this paper is if and where along the locus do alliances contribute to innovation. We will also ask if the technological intensity of the parent firms has an effect on the role of alliances. These questions can be investigated by examining the characteristics of the parent firms in conjunction with purposes of the alliances formed.

The paper presents an inquiry into the role of alliances in innovation and their association with the technological intensity of firms. The next section of the paper provides the literature review. Based on that review, a set of hypotheses are presented next. Details of data collection, preparation and research method follow in the following sections. Results are then presented and explained. They are further discussed and interpreted in the section that follows. The concluding section gives the expected reach and consequences of the findings as well as the limitations of the study.

LITERATURE REVIEW

A body of scholarly work has strongly established the role of alliances in advancing technological innovation. (e.g. Lavie, Stettner, & Tushman, 2010; Whittington, Owen-Smith, & Powell, 2009; Zeng, Xie, & Tam, 2010) It is useful in this context to keep in mind the classical theoretical conceptualization of innovation, which rests on the notion that organizations mediate the historical progress of *technology* and *markets* (Allen, 1984; De Solla Price, 1963; Myers & Marquis, 1969; Toynbee, 1948). The definition of innovation as *invention* + *exploitation* arises from this conceptualization. Such a conceptualization has enabled the scholars to divide the organizational locus of innovation broadly into sequential components starting with R&D and ending with commercialization.

Within and across each of these components, the scholars looked for patterns and structures that strengthen innovation. Several scholarly efforts that examine the technology transfer processes fall in this genre (Allen, 1984; Clark & Fujimoto, 1991; Roberts, 1964; Rothwell et al., 1974; Sherwin & Isenson, 1967; SPRU, 1972; Van de Ven & Rogers, 1988; von Hippel, 1987). A few scholars examined also the effects of environmental variables on innovation, such as the stages in the life cycle or the complexity of a technology (Henderson & Clark, 1990; Tushman & Anderson, 1986; Utterback, 1974). However, most of these early scholarly approaches took a *unitary* perspective of organizations and generally assumed that organizations take on the task of bridging knowledge base and markets single-handedly.

To be fair, not all scholarship in innovation overlooked the interdependence among organizations. Some interdependencies were found to be extremely important, as represented in the notions of gatekeepers (Allen, 1984), lead users (von Hippel, 1987), and, interlocking directorates (Allen, 1974; Mintz & Schwartz, 1981; Pennings, 1980). There were also some discomforting issues such as employee turnover (Allen, 1984) and informal know-how trading (Schrader, 1989; von Hippel, 1987) that suggested "leakage" of knowledge across firms.

As interfirm alliances started to proliferate from the 1980s, their role in advancing innovation seemed all too obvious. The main thrust of the argument in support is that under conditions of increasing technological intensity, indicated by high technology-related expenses and consequent need for compensatory access to markets, it would be beneficial to form cooperative links that would help in hedging the bets on developmental investments, in bringing complementary technological skills and in providing market access. Alliance literature is now replete with studies that claim a positive association between alliance formation and technological intensity. (e.g. Badaracco Jr., 1991; Chesbrough & Teece, 1996; Hagedoorn, 1990; Hladik, 1985, 1988; Mowery, 1985, 1987; Pennings & Harianto, 1992; Van de Ven & Walker, 1984)

A very influential scholarly articulation of a parallel scholarly concept related to organizational learning, of exploration and exploitation (March, 1991), tuned out to be highly clarifying for innovation related processes. Although the scholars of innovation focused on aspects of 'invention' and 'exploitation,' they did so mostly from well-partitioned and separate bunkers. Although there was lip service for the need for better meshing between the inventive and exploitative activities in an organization, that was carried out more as a dutiful protest against the inevitable. March not only shed some new light on 'exploration of new possibilities,' essential for invention, and 'exploitation of old certainties,' essential for commercialization, but he also highlighted the stark trade-offs needed in each case to maintain the other.

Other scholars carried forward the work of balancing the trade-offs, and developed the theory and the empirical work around the requisite ambidexterity. (Andriopoulos & Lewis, 2009; Gupta, Smith, & Shalley, 2006; He & Wong, 2004; Raisch, Birkinshaw, Probst, & Tushman, 2009; Rothaermel & Alexandre, 2009; Simsek, 2009) The scholars of ambidexterity strongly and intuitively linked March's two concepts, which until then had been somewhat insulated due to the intrinsic contrasts between them.

The notion of alliances as aiding innovation has found new resurgence when viewed though the exploration-exploitation lens, although the classic conceptualization, earlier discussed, also could have quite sufficed. There are counter arguments to the point of view about alliances, arrived as above. Communication networks *within* organizations, and also within groups, are already too fragmented (Allen, 1984), integrative processes too over-extended (Roberts, 1987) and cultural chasms across groups too difficult to bridge (Katz, 1997) that significant managerial skills and efforts are still needed for mending and improving *internal* innovation processes, whether explorative or exploitative. It would seem that an *external* locus of innovation through alliances might only hinder the process. Additional organizational and geographical boundaries that interfirm alliances impose can only damage the process, if not thwart it entirely. The overwhelming failure rate of alliances (Chowdhury, 1992; Harrigan, 1985; Park & Russo, 1996; Shennan, 1992) could be one important clue related to this. Further, economic appropriability arguments (Basberg, 1987; Levin, Klevorick, Nelson, & Winter, 1987), particularly the protection of tacit knowledge (Polanyi, 1962, 1966; Reich & Mankin, 1986) do not favor the creation of formal cooperative links that might enable one partner to engage in opportunistic behavior detrimental to the other.

When considered comprehensively, the extant literature thus presents a somewhat conflicting picture. On the one hand, alliances can offer a promising locus for innovation and, on the other, the additional boundaries and other impedances might diminish and even annul the promise. The role of alliances for aiding innovation is usually assumed to be simply given, especially if the field of study where they are prevalent is also generally known for innovation (e.g. biotechnology and pharmaceutical industries, see: Gilsing & Nooteboom, 2006; Nielsen & Nielsen, 2009; Powell, Koput, & SmithDoerr, 1996; Rothaermel & Deeds, 2004; Whittington, et al., 2009). Whether alliances occur *in general* for companies with high technological (R&D) intensity, whether they offer unambiguous and direct locus of innovation, and, if so, whether predominantly for exploration, exploitation, or both, all are empirical questions not yet definitively answered. This paper seeks to find the answers by examining a random set of alliances, their purposes and their parents closely.

DATA AND METHODOLOGY

As we saw in the preceding review, technological innovation consists of activities whose goals may be broadly bifurcated into exploration (for inventions) *and* exploitation (for extracting rent from the market). For our purposes in this study, I will operationalize the former either as the intended creation of a new product or the modification of an existing product ("technological improvements"), and the latter as the intended creation of either a new or modified customer base ("new markets"). In order also to classify and to investigate alliances with either of these two purposes, the two variables will also be merged ("either technological improvements or market access"). Precise coding schemes follow in the next section.

Despite the consensus about the role of alliances in innovation, it is not completely clear where in the locus of innovation alliances provide most help. Due to the usually common high technological intensity of the parents of an alliance, it is sometimes implicitly assumed (e.g. Gilsing & Nooteboom, 2006; Hargadon & Sutton, 1997; Powell, et al., 1996) that alliances are more helpful in the explorative activities leading to inventions. The following two hypotheses are proposed to test the implied propensity for explorative functions in alliances and the likely influence of the technological intensity of parents on such propensity:

Hypothesis # 1 Creation of technological improvements is a predominant goal for alliances.

Hypothesis # 2 Higher the technological intensity of the parents, greater is the propensity to form alliances with the goal of creating technological improvements.

It is equally plausible, given the softer but remarkably widespread claims around the benefits of meshing of complimentary resources in alliances (e.g. Lockett, Murray, & Wright, 2002; Shipilov, Rowley, & Aharonson, 2006), that perhaps exploitative activities instead dominate alliances. To test the same and to check for the impact of parental technological intensity, the following two hypotheses are proposed:

Hypothesis # 3 Creation of market access is a predominant goal for alliances.

Hypothesis # 4 Higher the technological intensity of the parents, greater is the propensity to form alliances with the goal of creating market access.

Since *either* exploratory or exploitative functions in alliances can be crucial for innovation and since one of these two might indeed take place within organizational boundaries of a parent, the following two hypotheses are also proposed combining the four hypotheses above:

Hypothesis # 5 Creation of either technological improvements or market access is a predominant goal for alliances.

Hypothesis # 6 Higher the technological intensity of the parents, greater is the propensity to form alliances with the goal of creating either technological improvements or market access.

The main source of the data used in this paper is the Wall Street Journal (WSJ) *abstracts*. The WSJ abstracts were searched electronically for three key phrases: "joint venture," "license," and "alliance." A subset of abstracts containing the key phrases were then electronically filtered and parsed, with manual supervision for each record, to generate an *intermediate* dataset. The period covered was from January 1985 to December 1990. The raw data were collected over a period towards the end of the 1990s. Further data manipulations and processing were carried out in the 2000s and completed recently. Such techniques of extracting data from public domain sources for social science research is well established (Herman & Chomsky, 1988), and is now utilized even by major data vendors. (Standard & Poor, 2004; Thomson Reuters, 2013)

The source data from WSJ are *very* comprehensive and devoid of selection bias based on the type of industry or business segment. Further, alliances are included irrespective of their purpose (e.g. R&D, manufacturing, marketing, etc.). However, since WSJ attempts to publish all information that has relevance to the market value of the public firms in the US, the information is "centered" around those firms. Alliances of private firms appear in the WSJ only if the partner is a public firm. In other words, there is a selection bias against private firms in the source data.

For statistical and other analyses, a *base* alliance dataset was next created from the intermediate set by selecting only alliances by US public firms. This choice of public firms was made not just because of relative absence of selection bias of industry or segment, but also because the needed firm-level characteristic data are readily available only for them. The base dataset consisted of 7515 public US firms with 1435 relationships from 427 US industries. For the study reported in this paper, I selected, from the base dataset, a random sample (without replacement) of 109 alliances and information about their parents. Since we also need to examine carefully the purposes for which the alliances are used, full text announcements in the WSJ of the 109 alliances were also downloaded from the Dow Jones News Retrieval Database.

For each of the 109 alliances, I created four variables. The first three are based on subjective ratings derived from the full text announcements. Two graduate students independently rated the alliances based on schemata I will present shortly. It should be noted that the interrater agreement was 84.4% for the subjective ratings. In view of this remarkably high degree of agreement, revisiting the ratings for any further improvements was not deemed necessary. For all the analyses in this paper, the "first" rater's classifica-

tions are used. It is also worth noting that much of the 15.6% disagreement is likely to be due to random error. The fourth variable is based on a classification of the R&D intensity of the parent firms. The details of creating each variable follow.

Classification of Alliances Based on *Technological Improvements*

This variable operationalizes the construct about exploration (for inventions) as a binary variable indicating the presence or the absence of a declaration about technological improvement for the alliance. This was done in two steps. The raters were given the classification schema shown in Table 1. As shown in step 1, they would first classify each alliance using eight mutually exclusive and collectively exhaustive criteria. Products are created or modified in classes 1-5, and products are unchanged in classes 6-8. The criteria help put alliances into bins depending on whether or not the parents separately or collectively create a new product or modify an old one. If they do, criteria 1-5 would apply, and if they do not, 6-8 would. Each of the eight criteria would receive a binary assignment from the raters. As step 2, the binary variable, T_Explore, for use in our analyses was created by simply recoding the initial classification to indicate technological improvements or their absence in an alliance.

Table 1 - Classification of Alliances Based on Technological Improvements

STEP 1	According to the characteristics of the technological improvements involved in the alliance, each alliance was classified into one of the following: 1. Firms develop a new product together and market both "together" and/or separately" 2. One firm develops a new product and second firm markets 3. One firm develops new product • Second firm modifies and markets • Both firms help in modifying and second firm markets • Both firms help in modifying and both firms market 4. One firm provides existing product • Second firm modifies and markets • Both firms help in modifying and second firm markets • Both firms help in modifying and both firms market 5. Both firms supply existing products • Second firm modifies and markets • Both firms help in modifying and second firm markets • Both firms help in modifying and both firms market 6. Both firms supply existing products and either or both firms market without any modification 7. One firm provides an existing product and second firm markets 8. One firm produces existing product and second firm helps in selling it (e.g.: advertising help)
STEP 2	Based on the above classification, the final binary variable T_Explore was created to indicate technological improvements or their absence in an alliance.

Note: The steps given in the table were used to classify each alliance according to the technological explorations purposed in it. The first step created a detailed and fine-grained classification. That was converted in the second step to a binary classification indicating the presence of absence of technological exploration.

Classification of Alliances Based on *Access to New Markets*

This variable operationalizes the construct about (market) exploitation. The raters were provided a second schema, shown in step 1 of Table 2, to classify each alliance according to targeted markets. As in the previous case, the more comprehensive initial classification (from the first step) was recoded (in second step) to obtain a binary variable M_Exploit that simply indicates whether the alliance targeted new markets.

Combining the Technology and Market Based Classifications

In a third binary variable Explore_Exploit, I combine T_Explore and M_Exploit. If T_Explore indicates *absence* of technological improvements *and* M_Exploit indicate access to *no* new markets, Explore_Exploit would indicate *absence* of any discernible benefit to innovation processes from the alliance. Otherwise, it would indicate the *presence* of benefit for innovation from either or both of T_Explore and M_Exploit.

Table 2 - Classification of Alliances Based on Access to New Markets

STEP 1	As a result of an alliance, the target customer base for the product from it could be: 1. *Unchanged* E.g. two automobile companies enter into a joint venture so that one learns just-in-time manufacturing from the other. This classification applies if the new buyers are not in a different segment than before the venture. 2. *Modified* E.g. two automobile companies enter into a licensing arrangement so that one (which until the alliance made and sold only cars) learns to manufacture and sell, say, sport-utility vehicles (SUV) from the other. This classification applies if the company newly selling SUVs targets a customer base it did not have before the licensing arrangement. The new customers are different from car buyers, but not dramatically so. 3. *Entirely new* E.g. two computer companies enter into an alliance to produce, say, software tools for distance learning. This classification applies if customers are really new, and have little experience in using the new or similar products. For each parent and the alliance, the target customer base is to be classified as one of the above or unknown.
STEP 2	Based on the above classification, the final binary variable M_Exploit was created to show whether any new or modified market was targeted or not in an alliance.

Note: The steps given in the table were used to classify each alliance according to the market exploitations purposed in it. The first step created a detailed and fine-grained classification. That was converted in the second step to a binary classification indicating the presence of absence of market exploitation.

Classifying Alliances Based on the *R&D Intensity* of the Parents

In order to classify each alliance according to its two parents, first *each* parent needs to be classified. The parents were classified as follows. Using data from COMPUSTAT (Standard & Poor, 2004), a commercial database that carries various financial and related information, a variable *R&D intensity* was constructed as a fraction of average *R&D Expenses* over *Sales*. The averaging was done over the six years for which the alliance data were originally collected. The distribution of *R&D Intensity* (quartiles and outliers) for firms was used to code classes of the same as shown in Table 3. The levels are "Z," "S," "M," and "L," representing "Zero", "Small", "Medium", and "Large" of R&D Intensity. The alliances then were characterized by *literally* merging the levels of the two parents to obtain levels such as L2L, L2M, L2S, L2Z, M2M and so on. This new alliance-level variable is called P1toP2.XRD, a shortened version of Parent-to-Parent-R&D-Intensity.

Table 3 - Classifying Parent Firms Based on Their R&D Intensity

Levels in R&D Intensity	Levels Recoded to	Explanation for Acronym of Recode
Zero	Z	"Zero"
Quartile 1	S	"Small"
Quartile 2	M	"Medium"
Quartile 3	M	"Medium"
Quartile 4	L	"Large"
High Outliers	L	"Large"

Note: The parents of alliances were classified using the above scheme based on their respective R&D Intensity. R&D intensity was constructed as a fraction of average R&D Expenses over Sales. The levels in the first column were then computed statistically from the distribution of R&D intensity.

The hypotheses proposed earlier in the paper can be tested by examining the tabulations of appropriate classes of variables. Where two variables are involved each with multiple classes, as they are for Hypotheses 2, 4, and 6, *cross*-tabulations can be prepared and dependence between the variables can be stated with statistical confidence. For frequencies involving classes of just a single variable, as would be the case for Hypotheses 1, 3, and 5, only a descriptive comparative approach is available.

RESULTS AND DISCUSSION

The results of the analysis are given below. Since all the variables used in the analyses are categorical, it should be noted that the summary statistics, customary for continuous variables, are not available and not provided.

Technological Improvements through Alliances

Table 4 shows the extent to which alliances are used for creating technological improvements. The table indicates that a little more than half of all the alliances in the sample for US public companies are set up for this purpose. We would hold back judgment on whether creation of technological improvements, and therefore, exploration is the predominant goal until other comparable results are available. Next, in Table 5, we see how the alliances break out by the technology intensity of the parents (P1toP2.XRD). Alliances in which both parents have the highest technology intensity dominate (55%). If we consider alliances in which at least one parent has the highest intensity, they account for 77% of the total. Although this table does not correspond directly to any of our hypotheses, it is indicative of the influence of parental technological intensity.

Table 4 - Extent of Use of Alliances for Technological Improvements

Technological Improvements (T_Explore)	**Percent of Alliances**
Yes	51
No	49
Total	100
(n)	(105)

Note: The table shows that roughly half the alliances in the sample are used for technological improvements.

Table 5 - Classification and Frequency of Alliances According to the R&D Intensity of Parent Firms

Alliance Class by R&D Intensity of Parents (P1toP2.XRD)	**Percent of Alliances**
L2L (Both Parents have "Large" R&D Intensity)	55
L2M (One parent has "Large" and second "Medium")	5
L2Z (One parent has "Large" and second "Zero")	17
M2M (Both Parents have "Medium" R&D Intensity)	2
M2Z (One parent has "Medium" and second "Zero")	5
Z2Z (Both Parents have "Zero" R&D Intensity)	16
Total	100
(n)	(109)

Note: Classes of R&D intensity of the parents are shown in Table 3. The classes of two parents are concatenated to obtain the classification for an alliance, such as L2L, L2M, L2S, L2Z, M2M and so on. The table shows that 55% of the alliances have both parents with large R&D intensity and 77% of the alliances have at least one parent with large R&D intensity

I cross-tabulate, in Table 6, the above two variables to examine the extent of use of alliances for technological improvements as a function of the R&D intensity of parents. While technological improvements are seen in 62% of the alliances in which both parents have the highest R&D intensity, they are seen in only 12% of the alliances in which both parents have the lowest (Z2Z) R&D intensity. The diagnostic numbers ($\chi^2 = 19.14$ and $p = 0.002$) also indicate that the two variables T_Explore and P1toP2.XRD are not independent. This result, therefore, provides support for Hypothesis #2.

Table 6 - Extent of Use of Alliances for Technological Improvements as a Function of the R&D Intensity of Parents

Technological Improvements (T_Explore)	Percent of Alliances in Classes Determined by R&D Intensity of Parents (P1toP2.XRD)					
	L2L	L2M	L2Z	M2M	M2Z	Z2Z
Yes	62	75	44	0	83	12
No	38	25	56	100	17	88
Total	100	100	100	100	100	100
(n)	(58)	(4)	(18)	(2)	(6)	(17)
$\chi^2 = 19.14^{**}$, p = 0.0018						

Note: The diagnostic numbers suggest that parental R&D intensity and technological improvements are not independent and, therefore, are associated with each other. Although strict ordinality should not be assumed for P1toP2.XRD, a positive influence of parental R&D intensity with respect to technological improvements can be observed in the data.

Creation of Market Access through Alliances

Table 7 shows that nearly two-thirds of the alliances are set up with the purpose of opening new markets. Although this is a slightly bigger fraction than that for technological improvements, we will once again restrain from commenting whether this is the predominant goal until after all the relevant results have been presented. I cross-tabulate, in Table 8, the extent of use of alliances for market access (M_Exploit) as a function of the R&D intensity of parents (P1toP2.XRD). While new market access is expected in only about 50% of the alliances in which both parents have the highest R&D intensity, it is expected in 81% of the alliances in which both parents have the lowest (Z2Z) R&D intensity. However, the results show that ratios do not show a consistent pattern across the levels of R&D intensity of parents. The diagnostic numbers ($\chi^2 = 10.05$ and p = 0.07) fail to reject the independence between the two variables M_Exploit and P1toP2.XRD. This means that Hypothesis 4 is not supported.

Table 7 - Extent of Use of Alliances to Access New Markets

Access to New Markets (M_Exploit)	Percent of Alliances
Yes	64
No	36
Total	100
(n)	(105)

Note: The table shows that 64% of the alliances in the sample are used for accessing new markets.

Table 8 - Extent of Use of Alliances to Access New Markets as a Function of the R&D Intensity of Parents

Access to New Markets (M_Exploit)	Percent of Alliances in Classes Determined by R&D Intensity of Parents (P1toP2.XRD)					
	L2L	L2M	L2Z	M2M	M2Z	Z2Z
Yes	51	80	78	100	83	81
No	49	20	22	0	17	19
Total	100	100	100	100	100	100
(n)	(59)	(5)	(18)	(1)	(6)	(16)
$\chi^2 = 10.05$ ns, p = 0.0739						

Note: The diagnostic numbers suggest independence between parental R&D intensity and seeking of market access. The pattern of market access appears to trend similarly across levels of parental R&D intensity.

Overall for Innovation - Either Technological Improvements or Market Access through Alliances

We see in Table 9 that a large percent of alliances (82%) is set up with either purpose of technological improvements or access to new markets (Explore_Exploit). With reference to hypotheses 1, 3, and 5, it is now clear that, first, exploration and exploitation separately are used only in 51% and 65% of alliances respectively, and, second, either use (exploration *or* exploitation) is found in 82% of alliances. In other

words, firms employ alliances for innovation in a contingent manner, utilizing one or both of its dichotomous elements opportunistically.

The cross-tabulation of Explore_Exploit and P1toP2.XRD in Table 10 show that across differing technological intensities a pattern is fairly stable. The diagnostic numbers ($\chi^2 = 0.86$ and $p = 0.97$) fail to reject the null hypothesis of independence between the two variables. Hypothesis 6 is not supported.

Table 9 - Extent of Use of Alliances either for Technological Improvements or to Access New Markets

Technological Improvements or New Market Access (Explore_Exploit)	**Percent of Alliances**
Yes	82
No	18
Total	100
(n)	(104)

Note: The table shows that 82% of the alliances in the sample are used either for technological improvements or to access new markets.

Table 10 - Extent of Use of Alliances either for Technological Improvements or to Access New Markets as a Function of the R&D Intensity of Parents

Technological Improvements or New Market Access (Explore_Exploit)	**Percent of Alliances in Classes Determined by R&D Intensity of Parents (P1toP2.XRD)**					
	L2L	**L2M**	**L2Z**	**M2M**	**M2Z**	**Z2Z**
Yes	79	80	83	100	83	88
No	21	20	17	0	17	12
Total	100	100	100	100	100	100
(n)	(58)	(5)	(18)	(1)	(6)	(16)
$\chi^2 = 0.86$ ns, $p = 0.9731$						

Note: The diagnostic numbers suggest independence between parental R&D intensity and Explore_Exploit. The trend appears to be fairly similarly across levels of parental R&D intensity.

In summary, we closely examined a set of sample alliances by US public companies to understand their role either for creating technological improvements ("exploration") or for creating access to new markets ("exploitation"). We also examined these roles as a function of the R&D Intensity of the parents of an alliance. There are several important observations to be made based on the alliance level analyses. Tables 4, 7 and 9 show that (i) technological improvements is the least frequent purpose (51%) in our sample, (ii) access to new markets is bit more prevalent (64%), and, (iii) *either* of the two is the most dominant purpose (82%). The finding that technological improvement is *not* a predominant goal in alliances is a very important one in this paper.

Tables 5 shows that more than 50% of the alliances have *both* parents with large ("L") R&D intensity, and about 80% of the alliances have *at least one* parent with large R&D intensity. Notwithstanding other nuances uncovered in the results, this shows that alliances are observed largely around technology-intensive firms. We also know from the statistically significant pattern in Table 6 that there is a direct relationship between R&D Intensity and seeking of technological improvements through alliances. This association between the variables is another important finding in this study.

We also uncovered in Tables 8 and 10 that neither market access nor general innovation seeking (that is, the goal of *either* market access or technological improvement) has any statistically discernible relationship to technological intensity of parent firms. In conjunction with the earlier results, the implication of this study are that, overall, *irrespective* of their technological intensity firms mostly use alliances contingently either for explorations or for exploitation and that technology intensive firms use them a bit more for explorations.

CONCLUDING COMMENTS

A major contribution of the paper is the added insight from the in-depth examination of alliances as they relate to the dichotomous elements of innovation - exploration and exploitation. This allows us to corroborate some parts of scholarly consensus and to discount others. On the one hand, technology-intensive companies predominantly undertake alliances and their frequency has a direct association with the parental technological intensity. On the other hand, technological explorative purposes do not dominate in alliances. Firms, whether technologically intensive or not, and many are not, also enter into alliances for market exploitative purposes. This contingent phenomenon shows that alliances offer a very important additional role that is not all technology centered, but that is also deeply market centered. Although the idea of matching complimentary resource in alliances may provide a general umbrella for the latter concept, our analyses go one-step further and give direct evidentiary proof for the importance of exploiting markets through alliances.

For the literature of learning around exploration and exploitation, the above observation has additional implications. It is well accepted that balancing the somewhat orthogonal processes of exploration and exploitation - that is, being ambidextrous about both - in an organization is a great challenge. (Dunlap-Hinkler, Kotabe, & Mudambi, 2010; Kaplan & Henderson, 2005; O'Reilly & Tushman, 2004) As we see in the paper, when technological competence or market access is lacking, an alliance can sensibly bridge the chasm quickly. That might even obviate the need for developing and maintaining the difficult internal ambidexterity. In short, alliances can offer a locus of innovation that is not limited by the constraints of the internal structures and processes of an organization.

In considering the above contributions, some limitations of the study should be kept in mind. Although the work is safely generalizable for US public companies for the foreseeable future, absence of alliances by private companies in the data is an important limitation. Further, the inferences in the paper were made using classified data. More fine-grained data are now available about alliances. These would permit a more thorough unpacking of the characteristics of alliances. Additional analytical techniques also would become plausible with data that are more comprehensive. It is also important not to lose sight of the fact that classifications for exploration and exploitation are based on the *alliance* itself.

It is possible that a given technological breakthrough takes place *within* a parent firm and an alliance just serves as a conduit to take it to certain pre-existing customer base. This study did not have the information on the source technologies. It would be ideal if the full locus of a sample of technological inventions to the markets can be tracked. There appears to be considerable promise for future work around such a design. Patterns of choices for the locus, whether it is fully or only partially contained within organizations, types of compromises for ambidexterity, between exploration and exploitation within as well as across organizations, and the performance impact from them for alliances would all be of great scholarly interest.

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