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by

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Research Notes

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Effects of Social Origins of Alliances on Alliance Performance

This research responds to two critics charged to the embeddedness approach, (1) it does not treat embeddedness as a variable and (2) it does not explain economic performance, by investigating how variations in social origins of alliances account for alliance performance. A core argument underlying the hypotheses is that strength of ties between individuals who initiate alliance formation processes is positively related to alliance performance because such ties reduces uncertainty that firms face when forming alliances and facilitate information exchange for sharing tacit knowledge. Results of analyzing the mail-survey data about biopharmaceutical R&D alliances, however, indicated that there does not exit such simple association. Rather, the activation of strong ties in forming alliances seems to be a double-edged sword that not only creates an opportunity for building successful alliances but also restricts organizational reachability to heterogeneous information and cutting-edge knowledge.

Alliances, embeddedness, social origins, and performance.

INTRODUCTION

Since the early 1980s, one of the leading questions in organization research has been how to account for the observed organizational variety in carrying out economic activities. One of the major discourses for resolving this theoretical issue is the embeddedness approach, proposed by Granovetter (1985), that emphasizes the role of ongoing social relations and social structures in economic transactions. Defining embeddedness as "the process by which social relations shape economic action" (Uzzi, 1996: 674), it holds, for instance, that "the behavior and institutions to be analyzed are so constrained by ongoing social relations that to construe them as independent is a grievous misunderstanding" (Granovetter, 1985: 481), and that "in going relations, human beings do not start fresh each day, but carry the baggage of previous interactions into each new one" (Granovetter, 1990: 99). The embeddedness approach highlights path-dependency of, and social embeddedness of, economic activities, which have been excluded in modern economic theory.

Two of the critics charged to this approach, however, are that (1) embeddedness has not been treated as a variable so that the embeddedness approach did not formulate any testable proposition, and that (2) an issue of economic performance has been excluded from the analytical framework so that it remains indefinite how embedded natures of economic actions relate to economic performance (Block, 1991; DiMagio & Louch, 1998; Uzzi, 1996, 1999). Because embeddedness has been framed as an academic program that complements modern economic theory by demonstrating the role of social relations and social structures, there have been few attempts to operationalize embeddedness and formulate propositions to predict other dimensions of organizational behavior. This lack of operationalization of embeddedness results in our limited understanding of how embedded nature of economic actions relates to economic performance.

The purpose of this research is to respond to these two critics by investigating formation and performance of biopharmaceutical R&D (research and development) alliances. In particular, this research examines how variations in social origins of R&D alliances account for alliance performance. An alliance is defined as "novel form of voluntary interorganizational cooperation that involves significant exchange, sharing, or codevelopment

and thus results in some form of enduring commitment between the partners" (Gulati & Gargiulo, 1999: 1440) or simply as "contractual asset pooling or resource exchange agreements between firms" (Stuart, 1998: 668). Alliances do not start without initial contact between individuals. As found in Larson (1992) and Uzzi (1996), there are variations in personal rapport and strength ties between individuals who make initial contact to propose formation of alliances. This research focuses upon a history of interactions between them and their tie strength, and investigates how this variation accounts for alliance performance by using questionnaire data from the U.S. biopharmaceutical firms. By doing so, this research adds new knowledge to the existing literature about relationships between embeddedness of economic actions and economic performance.

Biopharmaceutical R&D alliances provide an appropriate context for the purpose of this research. A number of previous studies stressed the importance of interorganizational collaboration for organizational growth and survival in the biopharmaceutical industry (Powell et al., 1996; Ryan et al., 1995). Also, the biopharmaceutical industry has been known as a research- and knowledge-intensive industry where gaining access to cutting-edge knowledge locating outside of organizational boundaries through alliances is a dominant organizational strategy. Furthermore, information exchange for research and development between scientists creates ties at the individual level across organizational boundaries so that the sufficient variance in the independent variables, embeddedness of alliance formation, can be expected.

This research is organized as follows. In the next section, I discuss variations in social origins of alliance formation. I then propose hypotheses about relationships between variations of the social origins and alliance performance. The hypothesis section is followed by an explanation of methodology of the questionnaire survey. I then present results of the hypothesis testing and discuss theoretical contributions and implications of this research. Prior to the questionnaire survey, I conducted pre-tests at 18 biopharmaceutical firms and 2 industrial associations in the United States and interviewed 24 business development (BD) professionals and CEOs. I use the qualitative data to complement the data analysis and enrich my arguments by showing real examples.

VARIATIONS IN SOCIAL ORIGINS OF ALLIANCES

Previous research taking the embeddedness approach found that (1) formation of interorganizational networks is not independent of social structures and networks but dependent on a history of organizational and personal interactions (Eisenhardt & Schoonhover, 1996; Heide & Miner, 1992; Lazerson, 1995; Levinthal & Fichman, 1988; Parkhe, 1993), (2) firms rely upon previous interactions and pre-existing networks to find alliance partners so that social structures and networks provide both opportunities and constrains in building interorganizational networks (Gulati, 1995; Gulati & Gargiulo, 1999), and (3) embedding interorganizational transactions in social networks generates norms of reciprocity, empathy, and trust across organizational boundaries (Ring & Van de Ven, 1993).

One of the findings in these previous efforts, which is most relevant to the purpose of this research, is that firms activate pre-existing personal ties when they propose alliance formation to prospective partners (Larson, 1992; Uzzi, 1996). The activation of pre-existing ties was confirmed in my pre-tests. The followings are some of the examples that firms initiate alliance formation by using a relatively long history of interactions:

1. The origin of an alliance between firm A and B was the direct interlocking relationship. A CEO at firm C had sat on the boards of both firm A and B since he helped founding firm B about 5 years ago. The CEO knew the technological strength and weakness of the two firms, and this familiarity helped the alliance formation.
2. A senior scientist at firm C ahs known a member of the board of directors at firm D since they used to work for a bio-agricultural government project under the Kennedy administration. When firm D approached some firms to start collaboration for entering into human therapeutic applications, this connection helped firm C built a bridge between firm C and D.
3. Senior scientists at firm E and F had known each other for more than 20 years, when they used to work for the same large pharmaceutical firm. This collegial relationship helped the two firms form an R&D alliance.
4. A scientist founded a new firm 3 years ago when a pharmaceutical firm laid him off. He maintained connections with a manufacture of the pharmaceutical firm and formed an alliance with it.

The pretests, however, not only confirmed previous literature but also provided new findings: variations in social origins of alliances. It was found that some alliances emerged out of ties involving a limited history of interactions such as those developed from (1) third-party

referrals and (2) conferences and business trips.

Third party referrals operate on the principle that actors holding structural equivalent positions in networks are connected with the help of the third party (Burt, 1987; Scott, 1991). Examples of such third parties found in the pre-tests include (1) other firms with which firms had prior business transactions (e.x., former customers), (2) venture capitalists, (3) professors and scientists in research institutions and universities, and (4) industrial associations. Alliances that emerged from contact at conferences and in business trips may be idiosyncratic to the biopharmaceutical industry in which scientists and managers actively and constantly participate in scientific, business development, and investment conferences. Also, they frequently visit other firms for exchange of scientific information and research ideas as university scholars do in their "workshops" or "guest speaker seminars" (Nohria, 1992). These circumstances provide an opportunity for actors to create networks of acquaintances.

Moreover, it was found in the pretests that some alliances emerged out of cold calls made by BD professionals. Most of the biopharmaceutical firms have units called "business development", "corporate development", or "technology development." BD professionals are, so-to-speak, network managers and boundary-spanners (Aldrich & Zimmer, 1986; Leifer & Huber, 1977) in that they are responsible for (1) scanning environment, (2) identifying prospective alliance partners, (3) conducting internal research and collecting information about them, (4) making contact with them, (5) coordinating due diligence processes, and (6) negotiating and making deals with appropriate partners. BD professionals in the biopharmaceutical industry typically subscribe such journals and newsletters for environment scanning as *Pharma Projects*, *R&D Focus*, *BioWorld*, *BioCentury*, and *Pharmaceutical Executives*. In order to identify and research prospective partners, they use the web sites of prospective partners, SEC filings, patents databases, and commercial databases, including *Recombinant Capital Biotechnology Alliance Database*, *Windhover's Healthcare Strategists*, *Windhover's Strategic Intelligence Systems*, and *Bioscan*. In addition, they are able to identify persons in prospective partners with whom they should contact by using these databases and directories such as *The International Directory of Licensing Professionals* and *Biotechnology Business Development Directory*. These information infrastructures enable

BD professional to make cold calls even though they do not have any prior interaction with the prospective partners.

The pretests therefore suggest that there exist variations in social origins of alliances. Firms use different types of pre-existing ties for alliance formation. These variations capture one of the facets of organizational embeddedness in conducting economic activities, given that embeddedness is defined as "the process by which social relations shape economic action" (Uzzi, 1996: 674). In the next section, I develop hypotheses that state relationships between social origins of alliances and alliance performance.

HYPOTHESES

A fundamental argument here is that social origins of alliances that determines a history of prior interactions influence alliance performance. There are the following three reasons for this argument.

First, ties involving a history of interactions enable firms to reduce uncertainty that they face when selecting alliance partners (Gulati & Gargiulo, 1999). Selection of alliance partners is one of the crucial factors of alliance performance because it determines complementarity of allying firms and their combination of strength and weakness in alliances (Doz & Hamel, 1998). However, firms do not know a priori which prospective partner will serve their interests best. It is uncertain whether or not prospective partners possess resources and technologies that complement the focal firms' weakness (Geringer, 1991). It is also uncertain whether or not prospective partners put their best efforts to achieve goals of alliances once formed (Ring & Van de Ven, 1992). Social ties involving a history of interactions enable firms to reduce the first types of uncertainty and indirectly enhance alliance performance. This is because individual connected with each other are better able to transmit detailed, thick, timely, accurate, and reliable information so that ties are conduits for firms to collect information about technological facets of prospective partners (Aldrich & Zimmer, 1977). Firms are able to collect better quality and greater quantity of information about prospective partners by activating social ties. This instrumental value of social ties increases the likelihood that firms find appropriate partnering firms that possess complementary technological strength.

Second, relating to the first point, another instrumental value of social ties enable firms to reduce the second type of uncertainty. This type of uncertainty is termed in agency theory literature as "moral hazard", meaning that partners "may simply not put forth the agreed-upon effort" and are "sharking" (Eisenahrdt, 1989: 61). Previous research suggests that firms are able to transfer behavioral expectations at the individual level to the organizational ones so that they are better able to avoid facing malfeasance and opportunistic behavior of partners (Larson, 1992; Uzzi, 1996). This is because norms of reciprocity and empathy developed through prior interactions shape partners' behavior and reduce the likelihood of partners' malfeasance (McNeil, 1980). Therefore, when firms form alliances upon ties involving a history of interactions, they are less likely to face partners' malfeasance so that alliance performance will increase.

Third, Doz and Hamel (1998) argued that exchange of tacit knowledge is one of the crucial determinants of R&D alliance performance. If a history of interactions reduces fear of partners' malfeasance, partnering firms are better able to transfer and share tacit knowledge (Ring & Van de Ven, 1993). This is because the reduced fear facilitates information exchange across organizational boundaries and generates shared cognitive frameworks whereby individuals are able to transfer and share tacit knowledge (Bouty, 2000; Nelson & Winter, 1982). Therefore, a history of interactions creates environments in which individuals are able to share tacit knowledge, and indirectly improves alliance performance.

Social origins of alliances therefore accounts for variations in alliance performance. This research decomposes social origins of alliances into three parts by focusing upon relationships between contact persons in allying firms: (1) descriptions of their relationships, (2) original points of their contact, and (3) tie strength. These three dimensions are typically used in previous research to describe relationships between two individuals (Marsden, 1990). Contact persons are those who make contact to initiate discussions of possibilities of alliance formation. For instance, when a BD professional in firm A make the initial contact with a CEO in firm B, I focus on pre-existing relationships between the BD professional and the CEO with an assumption that their relationships portray a facet of organizational embeddedness in alliance formation (Larson, 1992).

The first dimension refers to qualitative descriptions of the relationships between two individuals (i.e., strangers, acquaintance, or friends). The second dimension captures another qualitative aspects of the relationships: how contact persons originally initiate the personal relationships (e.x., they used to work for the same firm). The third dimension, tie strength, refers to "a (probably linear) combination of the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterize the tie" (Granovetter, 1973: 1361). Given that as argued above, social origins of alliance formation account for variations in alliance performance, it follows that:

H1: Descriptions of relationships between contact persons account for variations in alliance performance.
H2: Origins of relationships between contact persons account for variations in alliance performance.
H3: Strength of ties between contact persons increases alliance performance.

Because the first and second dimensions of the social origin of alliance performance are qualitative rather than quantitative, the hypotheses stated above specify neither positive nor negative effect on alliance performance.

METHODS

Sample and mail survey procedures

The unit of analysis is an alliance. The sample frame included all of 285 publicly-traded biopharmaceutical firms identified in *Recombinant Capital Biotechnology Alliance Database* (ReCap), *Corporate Directory of Technology Companies*, *Windhover's Healthcare Strategists*, and *Standard & Poor's Compustat*. I distributed questionnaires to BD executives or CEOs of these 285 firms in February 2000. To ensure the highest possible response rates, I sent the follow-up cards to all of the non-responding firms 3 weeks after the initial distribution and re-send the survey packets to randomly-selected 90 non-responding firms 3 weeks after the second mailing. As a result of these efforts, 23 firms provided information on 46 alliance cases (the company-level response rate = 8%).

Non-response biases are checked with the following 1998 *Standard & Poor's Compustat* data: (1) ROI (return on investment), (2) ROE (return on equity), (3) ROA (return on assets), (4) R&D expenditure, (5) net income, (6) asset size, and (7) year-end stock price.

I found by running a logistic regression that there is no significant difference between responding and non-responding firms in terms of the financial characteristics.

Each survey packet contained questionnaire sheets on three of subject firms' R&D alliances formed from 1995 to 1999. I asked BD executives and CEOs to choose three of recently formed new (or non-repeated) alliances and re-distribute the questionnaires to those who are most familiar with each of them. This is because I found in the pre-tests that these senior managers are not necessarily most knowledgeable about details of histories of alliance formation processes and relationships between contact persons. I also limited my scope of analysis to R&D alliances from 1995 to 1999 to alleviate a recalling problem (Marsden, 1990).

Of the 23 subjects, 26% were CEOs. The average of their number of employees at the point of alliance formation was 172.03 with a standard deviation of 41.54. The average of their ROA at the point of alliance formation was –56.83 % with a standard deviation of 65.42 %, and that of the ROE was –75.12 % with a standard deviation of 164.27 %. On average the their organizational age at the point of 2000 was 1992.07 with a standard deviation of 3.32.

It should be noted that this survey procedure poses the following problems: (1) the sample size is small, (2) I excluded firms that had disappeared at the point of data collection, though alliance performance may relate to organizational performance and survival, and (3) the subjects selected the alliance cases for answering the questions with their own discretion so that the subjects may have excluded low-performing alliances. Because of these restrictions, an interpretation of the following arguments requires caution.

Variables

The dependent variable in this research is alliance performance. I followed a definition of alliance performance in Van de Ven and Ferry (1980: 327): "the extent to which the involved parties perceive each other organization (*agency* in original) to carry out its commitments and judge the relationship to be worthwhile, productive and satisfying." In operationalizing alliance performance, I modified their performance measures and constructed the following seven-Likert-scale items:

1. The partner firm carried out the commitments it initially agreed to in regard to my firm.
2. I feel that the partnership was scientifically successful.
3. The time and effort spent in developing and maintaining the relationships with my partner were worthwhile.
4. Overall, I am satisfied with the relationship between my firm and the partner.

The Cronbach's alpha for these items was .88, so I aggregated these measures by taking average with logarithm transformation and termed it *performance*.

In order to test H1 stating relationships between alliance performance and descriptions of relationships of contact persons, I followed Marsden and Campbell (1982) and asked the subjects to indicate whether the contact person in the allying firm was (1) a stranger, (2) an acquaintance, (3) a good friend, or (4) a very close friend. I termed this qualitative variable *description*.

In order to test H2 stating relationships between alliance performance and origins of relationships of contact persons, I modified a question in Granovetter (1973) on the basis of the pretests and asked the subjects where and how contact persons originally met by presenting the following nine categorical items:

1. They used to work in the same company.
2. They went to the same school or university.
3. One of them sat on the board of the other's firm.
4. Both are committee members of other firms or other organizations (i.e. industrial associations).
5. They met in a workshop or conference.
6. They met when one of them visited the other's firm during her/his business trip.
7. A venture capitalist introduced them.
8. Someone, other than venture capitalists, introduced them.
9. One of them found the other's name in a directory or database.

Because the first and second items indicate previous shared experience along with the academic and professional careers, I re-coded them as "*shared experience*." The third and fourth items represent shared memberships in other organizations, so I re-coded them as "*shared membership*." The fifth to sixth items indicate that relationships started from scientific or professional activities, so I re-coded them as "*scientific / professional activities*." The seventh and eighth items represent third-party referrals, re-coded as "*third-party*

referrals." Finally, the last item was termed as "*cold call*." I termed this qualitative variable *origin*.

In order to test H3, I followed Granovetter (1973) and McPherson et al. (1992) and asked the subjects how long the contact person had knew each other prior to the initial contact to discuss the possibility of alliances (*length of interactions*) and how often they had seen each other prior to the initial contact (*frequency of interactions*). I used the following coding scheme to measure *length of interactions*: (1) had never met, (2) less than a month, (3) less than a year, (4) 1 – 3 years, (5) 3 – 10 years, and (6) more than 10 years. I used the following coding scheme to measure *frequency of interactions*: (1) never, (2) once a year or less, (3) once every 6 months, (4) once every 3 months, (5) once a month, (6) once a week, and (7) more than once a week.

Two other variables are used as control in a regression analysis for testing H3: (1) collaborative alliances (*collaboration*) and (2) stage of research project in alliances (*stage*). First, some of biopharmaceutical R&D alliances do not involve mutual collaboration but take the form of research outsourcing in which one of the partnering firms contract out its research projects to the other. The form of collaboration may change the importance of social origins of alliances in determining alliance formation (Gulati, 1995). The subjects were asked to indicate whether or not partners work equally for discovering and developing new pharmaceutical products in the alliance. I coded this variable, *collaboration*, 1 if the alliance involved mutual collaboration. Second, the degree of interorganizational interactions required for achieving goals of alliances is contingent upon stage of the collaborative projects (Gulati & Singh, 1999). For instance, upstream projects for biological synthesis and extraction should involve more interactions between scientists across organizational boundaries than do the downstream projects (e.x., clinical trials) (Windhover, 1997). The subjects were asked to indicate the project / product stages at the point of alliance formation out of the following items: (1) synthesis and extraction, (2) biological screening and pharmacological testing, (3) pre-clinical studies (toxiology and safety testing and pharmaceutical dosage formulation and stability), (4) clinical studies phase I, (5) clinical studies phase II, and (6) clinical studies phase III. On the basis of these items, I coded *stage*

as 1 when the collaborative project in the alliance is an up-stream one involving synthesis and extraction or biological screening and pharmacological testing.

Analysis

Although the sample is not large, I presumed in the following analysis that this research has the minimum number of observations to conduct parametric analyses. In order to test H1 and H2, I simply conducted ANOVA. In order to test H3, I run a random effect maximum-likelihood regression[2] (Stata, 2000). This is because some firms have more than an entry (an alliance) in the database whereby I needed to control within-subjects variance. The random-effect model allows the error terms across firm-years to be correlated.

RESULTS

Table 1 reports results of ANOVA for testing H1 about effects of differences in descriptions of prior relationships between contact persons.

<TABLE 1 ABOUT HERE>

The upper rows of the table show mean differences across the analytical groups. Although alliances that emerged out of *good friend* have higher scores than those that emerged out of *stranger*, ANOVA did not reject the null hypothesis that population means of these groups are same. Therefore, H1 was not supported.

Table 2 reports results of ANOVA for H2 about effects of origins of relationships between contact persons.

<TABLE 2 ABOUT HERE>

Although a visual inspection identifies certain differences, ANOVA did not reject the null hypothesis that population means of these groups are same. Therefore, H2 was not supported.

Table 3 shows descriptive statistics for a regression analysis in Table 4.

<TABLE 3 AND 4 ABOUT HERE>

In Table 4, I ran the random-effects maximum-likelihood regressions for testing H3 about effects of strength of ties between contact persons on alliance performance. The model with

[2] I also ran an ordinal least-square (OLS) regression to test H3 and did not find any difference between the two regressions in terms of its significance and the direction of coefficients.

the two variables of tie strength has higher x^2 (6.26) than one without them (x^2 = .96), though the model x^2 is not still large. A coefficient of *length of interactions* was significant and positive, rendering support to H3 (b = .053, p < .05). A coefficient of *frequencies of interactions* was, on the other hand, significant and negative (b = -.051, p < .05). Because H3 stated positive associations between tie strength and alliance performance, this part of the regression analysis presented the opposing evidence to H3. In short, the regression analysis provided both supporting and counter evidences to H3.

DISCUSSIONS

Results of the statistical analyses above presented mixed support to the argument in this research that social origins of alliances account for alliance performance. The analysis did not support H1 and H2, stating that descriptions of relationships between contact persons and their origins of the relationships explain variations in alliance performance. In addition, it was found that while the length of interactions between contact persons prior to alliance formation significantly improves alliance performance, the frequencies of interactions significantly and negatively relate to alliance performance. Although caution is required to interpret these results due to the small number of observations, these findings highlight an interesting facet of organizational behavior.

The positive effect of the length of interactions was found probably because, as stated above, a history of interactions enables firms to reduce uncertainty in selecting alliance partners and increase interactions between scientists in collaborative projects. On the other hand, the negative effect of the frequencies of interactions was found probably because the reliance on embedded ties in forming alliances restricts firms to reach heterogeneous resources and cutting-edge technology in environments so that firms are less likely to maximize the benefits of alliance formation when forming alliances out of ties involving higher frequencies of prior interactions. Previous research suggests that information flowing in closed networks tend to be redundant and homogeneous (Burt, 1992; Granovetter, 1973). When ties prior to alliance formation involve higher frequencies of interactions, information and technology between the firms tend to become similar and redundant so that firms are unable to reap the benefit of alliance formation, namely gaining access to resources

and knowledge that the focal firms do not currently possess. In other words, this research demonstrates both positive and negative aspects of embedded ties in constructing interorganizational networks. While a history of interactions enables firms to reduce the uncertainty and facilitate interorganizational collaboration after alliance formation, it also restricts organizational reachability to heterogeneous and non-redundant information and resources in environments.

This interpretation is consistent with another finding in this research. H1 and H2, which did not address quantitative characteristics of social origins of alliances, were not supported probably because the positive effect was cancelled out by the negative effect. Moreover, this interpretation is partially consistent with two of previous studies in that possible risk of forming alliances upon embedded ties is pointed out. Gulati and Gargiulo (1999) argued that when firms form alliances with others with which they previously collaborated, they are less able to procure resources and information that they have never faced. Saxton (1997) also found that prior interorganizational affiliation was linked to managers' initial satisfaction of alliances but not to their long-term satisfaction because while such affiliation helps trust-building at the early stage of alliances, the familiarity restricts exposition to new resources and technology.

In short, this research suggests that there is no simple positive association between social origins of alliances and alliance performance. It should not be presumed that alliances emerging out of close friends outperform those emerging out of strangers. Although a history of interactions certainty brings positive values for managing alliances (i.e., uncertainty reduction and collaboration), it seems that it simultaneously limits opportunities to learn non-redundant information and knowledge through alliance formation. This research advances previous knowledge about effects of variations in organizational embeddedness on economic performance by focusing upon effects of social origins of alliances on alliance performance and by providing evidence about both positive and negative aspects of embedded ties.

There are several limitations in this study, which suggest directions of future research. First, the sample size is so small that all findings and arguments in this research

must be considered to be tentative.

Second, this research used data from the single side of allying firms. It is reasonable to collect data from both sides of partnering firms because it is often reported that the managers in different firms tend to have different views of the same alliances (Doz & Hamel, 1998). Moreover, in addition to the perception data, future research should collect more various data of alliance performance not only for increasing reliability but also for capturing multidimensionality of alliance performance (Gulati, 1998). It is interesting and important to collect, for instance, length of alliances and reengagement of interorganizational collaboration as alternative measures of alliance performance.

Third, the data used in this research were collected from only a single industry. This research design disabled me to specify the extent to which industrial contexts and characteristics influence the findings here. Given that the value and the role of embedded ties in conducting economic transactions are contingent on complexity of technology in industries (Granovetter, 1995), future research should expand its scope of research so as to collect data from more than an industry.

Finally, alliance performance should be viewed as a function of a number of various factors. At this point, no empirical research is available that portraits the entire model for explaining alliance performance. Although this research may have provided a possible factor that accounts for variations in alliance performance, its explanatory power is very limited. In particular, future research should integrate organizational activities after alliance formation with social origins of alliances.

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Table 1: Results of ANOVA: *Performance* and *Description*

Description	N	Mean of *performance*	S.D. of *performance*
Stranger	27	3.028	.313
Acquaintance	12	3.136	.202
Good friend	6	3.229	.155
Very closer friend	0	-	-
	Mean Square	**d.f.**	**F**
Direct effect	.121	2	1.63
Residual	.074	42	
R^2	.072		

Table 2: Results of ANOVA: *Performance* and *Origin*

Origin	N	Mean of *performance*	S.D. of *performance*
Shared experience	5	3.117	.22
Shared membership	3	3.202	.096
Scientific / professional activities	17	3.109	.257
Third-party referrals	7	3.042	.197
Cold call	13	3.033	.384
	Mean Square	**d.f.**	**F**
Direct effect	.026	4	.32
Residual	3.255	40	
R^2	.031		

Table 3: Descriptive Statistics

	Variable	N	Mean	S.D.	1	2	3	4	5
1	*Performance*	45	3.08	.28	1				
2	*Length of interactions*	45	2.38	1.70	.19	1			
3	*Frequencies of interactions*	44	2.64	1.73	-.17	.47	1		
4	*Collaboration*	46	0.48	.51	.14	.17	.03	.1	
5	*Stage*	46	.33	.47	.02	.04	.04	.33	1

Table 4: Results of Regression

Variable	b	b	
Length of interactions		.053	*
		(.027)	
Frequencies of interactions		-.051	*
		(.025)	
Collaboration	.084	.066	
	(.087)	(.083)	
Stage	-.043	-.036	
	(.090)	(.086)	
Constant	3.060	3.069	
	(.063)	(.084)	
Log likelihood	-3.869	-2.166	
x^2	.96	6.26	

Note 1: The dependent variable is performance.
Note 2: Random-effects maximum-likelihood regression
Note 3: Standard errors in parentheses