

*Full Length Research Paper*

# **Do behavioral characteristics influence the performance of industry-university alliances? Evidence from China**

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Accepted 21 June, 2011

**Although the literature on industry-university alliances has begun to identify the factors that influence the performance of alliances, it gives relatively little concern on the behavioral characteristics of firms. This paper seeks to explore the behavioral characteristics that affect the performance of industry-university alliances. By taking a sample of 136 Chinese firms, the results indicated that several behavioral characteristics have significant impact on the performance of industry-university alliances. Resource investment and information sharing are found to have positive relationship with alliance performance, but no relationship was found between communication and alliance performance. It not only provided a theoretical model to analyze the behavioral characteristics that affect the performance of industry-university alliances, but was helpful both to improve management of alliances and to promote the success of alliances.**

**Key words:** Industry-university alliances, performance, behavior, communication.

## **INTRODUCTION**

Firms show more interest in forming alliances with universities. The uncertainty of innovation, globalization of market and rapid change of consumers has created a situation where single firm cannot keep competitiveness without cooperation with other organizations. Many firms have begun to construct more open innovation ecosystem by seeking innovation resource globally. As a key source of innovation, universities have played an important role in innovation system. Accordingly, an increasing trend is for companies to collaborate with universities, especially for the performance of more general-purpose research (Geiger, 2004). Many firms acquire critical external knowledge through forming alliances with universities. In industry-university alliances, each of the partners commonly designates organizational representatives or boundary role personnel, to interact at the knowledge interface (Sherwood and Covin, 2008)

While the prospect of such collaboration shows attractive for industry firms, collaboration between industry and universities still faces significant challenges (Bruneel et al., 2010). At the core of challenges are the different institutional norms governing public and private knowledge (Dasgupta and David, 1994). Although university researchers wish to disclose information to public, firms may want knowledge to be kept private so that they can appropriate the information and control the valuable resource. Thus, different industry firms show different behavior when they cooperate with universities. In fact, organizational features form part of the partners' behavior and have an influence on the behavior of their partners. Several theoretically oriented works have focused on the generic organizational factors underpinning success in industry-university alliances (Perkmann et al., 2011), such as the quality of communication, the existence of trust and commitment, conflict and dependence (Mora-Valentin et al., 2004; Das and Teng, 1998). The key point is to understand the behavioral characteristics of industry firms.

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In order to advance knowledge in this area, we argue that behavioral characteristics of firms have impact on the performance of industry-university alliances. Based on a review of relevant literature, we examine three factors: (i) factors related to resource investment of firms; (ii) factors related to quality of communication; and (iii) factors related to degree of information sharing. This paper explores the relationship between these three factors and the performance of industry-university alliances. First, we examine the impact of resource investment on alliance performance on the assumption that resource investment can enhance the alliance performance. Second, we explore whether communication plays an important role in increasing the alliance performance. Finally, we examine how the degree of information sharing influences the alliance performance.

Further, we provide an overview of industry-university alliances, the conceptual framework and elaborate our research hypotheses. Then, we describe the methodology and present our empirical results. Finally, we discuss the implications of these findings aims at increasing the performance of industry-university alliances.

## LITERATURE REVIEW

Cooperation usually refers to organizations use of complementary resource, skill and capacity to seek common benefit (Geisler, 1995). Nowadays, more firms realize that they cannot sustain success in the competitive marketplace if they only rely on themselves. By cooperating with universities, industry firms can acquire complementary resource and realize technology or product innovation. Good and sustainable cooperation relationship means that all partners could benefit from the alliances.

Kapmeier (2005) analyzes the interactive process between R and D organizations, and argues that firms will adjust its openness, transparency and R and D resource investment according to its knowledge, cooperation will and trust of management. Some researchers argue that keeping fair and equity is an effective way to acquire trust (Korsgaard and Roberson, 1995). To realize cooperative fair and equity, partner should show their active cooperation attitude and act according to fair devotion, fair distribution and reciprocity. Based on relevant researches, this paper considers the behavioral characteristics of firms from three aspects, including resource investment, communication and information sharing.

### Resource investment

The resource-based theory view firms as attempting to

find the optimal resource boundary through which the value of their resources is better realized than through other resource combinations (Das and Teng, 2000). When efficient market exchange of resources is impossible, firms are more likely to cooperate with other organizations. Resource is necessary for the formation of industry-university alliances.

Resource includes human resource, financial resource, material and equipments, also includes reputation, market and knowledge. Resource investment represents how industry firms think of industry-university alliances. The higher level of resource investment, the more firms think highly of alliances, the more they hope that alliances gain high performance. Meanwhile, sufficient resource ensures the development of alliances, and provides solid base for the success of alliances. When industry firms just invest little resource into industry-university alliances, the activities of alliances may not carry out successfully as they lack essential resource, and the alliance cannot gain a high performance as a result.

### Communication

Industry firms and universities have different view of value orientation. Universities pursue academic value, while industry pursues business value, the conflict between them leads to their goal difference. For example, some universities usually omit the market of scientific research. They do R and D projects mainly for academic value and position instead of market needs, which cannot bring effective technology supply to industry firms. In addition, because the dependence of industry and universities is always asymmetry, so the dominate partner may take opportunistic actions that intensify the conflict between them.

Mohr and Nevin (1990) think that the major omission in alliance research area concerned studies of how communication relates to the overall performance of alliance. Communication process underlies most aspects of how alliances function and are thus critical to alliance success (Kaiser, 2004). Ineffective communication can reduce the effectiveness of alliance and thus lead to conflict between partners (Jain, 1987). The first function of communication is transferring knowledge from sender to receiver, including knowledge, experience, idea and suggestion to influence the knowledge structure of receiver. Communication can also transmit emotion. By showing emotion, one can get the sympathy of its partners. In addition, communication can help to create harmonious organization atmosphere, cultivate the private friendship between partners, which also help to smoothen the communication channel and diminish the conflict caused by strangeness.

Many papers emphasize the importance of communication in cooperative agreements (Mora-Valentin

et al., 2004). There are two kinds of communication channels for industry-university alliances: formal and informal channels. Formal channels include academic seminar, top management contact, technology file exchange and telephone conference. These channels help partners to develop common goals about their situation, thus partners can come to an agreement on relative questions and avoid partners buck-passing in cooperation, or cannot understand each other, which affect the progress of alliances. Informal channels are often conducted by private talking and face-to-face contact. They are not only main ways for team members to acquire information, but also most used method to coordinate and keep project progress in innovation activities (Brown and Eisenhardt, 1997).

The measurement of communication includes both breadth and deepness. Breadth refers to the quantity of channels, while deepness refers to the frequency of communication. Extensive and sufficient communication shows the openness of alliances and the wish and ability of partners to share information and knowledge in organization conventions (Kelly et al., 2002). At the same time, effective communication can lower the cost of knowledge transferring and sharing, which is vital to the success of alliances.

### **Information sharing**

Several papers have noticed that the meaningful and timely exchange of information can result in a more trusting relationship between partners (Mohr and Spekman, 1994). As a typical open innovation network, industry-university alliances provide industry firms a way to acquire external knowledge. However, with the uncertainty of innovation process and outcome, there also exists high risk in industry-university alliances.

A high level of information sharing has been found to be positively correlated to satisfaction within a partnership (Monckza et al., 1998). Because there are plenty of informal and tacit knowledge transfer in industry-university alliance, high level of information sharing can promote the understanding of partners, thus partners can commit themselves to clarify the knowledge coding process. Meanwhile, information sharing can also help to construct the platform for knowledge sharing, and provide opportunity for industry firms and universities to learn from each other. By observing, touching and continuous feedback, industry firms and universities build up trust in cooperation, which facilitate the success of alliances.

### **The performance of industry-university alliances**

Academics and practitioners have been troubled by the measurement of industry-university alliances

performance. The main reason is that there are so many different subjects, and the goal of each alliance is not the same, so the multiple motivation leads to the complexity of measurement.

Bonaccorsi and Piccaluga (1994) put forward a model to evaluate the performance of industry-university alliances. They argue that the performance of industry-university alliances includes the generation of knowledge, the transmission of knowledge and the derivation of knowledge, and the performance can be measured by both objective and subjective index. The objective measurement includes the quantity of new products, researchers, publications and patents, while the subjective index depends on how firms evaluate the performance of industry-university alliances. Hellstrom and Jacob (1999) think that the performance of industry-university alliances should be measured by productivity, scope, financial efficiency, education, publication and patent.

In general, two kinds of methods can be used to measure the performance of industry-university alliances. One is based on the financial outcome of firms; the other is based on the evaluation of the firm. The limitation of objective method is that innovation is accompanied with high degree of uncertainty, thus the performance of industry-university alliances cannot be measured only with rigid objective index (Ailes and Roessner, 2002; Ham and Mowery, 1998). On the contrary, the subjective method depends on the evaluation of partners (Cukor, 1992), such as the realization of goal, the degree of satisfaction and the contribution of alliances. Some researchers believe that the latter method may overstate the actual performance of industry-university alliances, but Arino (2003) argues that based on a multiply index system, the subjective measurement is still a reliable method. Because there are a plenty of tacit knowledge transfer and exchange in industry-university alliances, subjective method can show the real goal and cooperative anticipation of alliance partners. Based on relevant research, this paper measures the industry-university performance from three aspects, the realization of goal, the satisfaction of firms and the contribution of alliance.

### **Theoretical framework**

There is plenty of tacit knowledge transferring in industry-university alliances. Comparing with explicit knowledge, tacit knowledge is hard to be encoded and usually embed in the social network. It is transferred by the touch, observation and feedback between partners. The cooperative relationship of alliances is built on the close interaction of partners, and long-term relationship of alliances needs partners to participation for common

goals (Lunnan and Haugland, 2008), thus behavioral characteristics of partners have an impact on the performance of industry-university alliances.

Firstly, Lerner and Tirole (2005) suggest that a corporation may not be able to credibly commit to keeping all source code in the public domain. More resource investment in industry-university alliances results in greater stability and trust than few resource. When industry firms invest more resource in industry-university alliances, they will adopt a long-term perspective to the relationship and show effective commitment to universities.

Secondly, communication promotes the information exchange between industry firms and universities. Communication enhance the quantity and quality of channels by which industry firms acquire new knowledge from universities, lower the cost of knowledge transferring, ensure the high efficiency of knowledge utilization and increase the performance of alliances. If partners have difficult in communication, it is easy to lead to conflict between industry and universities due to value and culture difference.

Thirdly, information sharing can enhance the openness and transparency of partners, lower the asymmetry of information, hinder the opportunistic behavior of partners and facilitate the construct of trust between partners, thus increase the alliance performance. The low degree of information sharing transfers a passive signal that trusts between partners is insufficient, so the conflict and contradiction increases and the common goal can not be achieved smoothly.

On the basis of these assumptions we can put forward the following hypotheses:

H<sub>1</sub>: The performance of industry-university alliances is affected positively by resource investment of industry firms.

H<sub>2</sub>: The performance of industry-university alliances is affected positively by communication.

H<sub>3</sub>: The performance of industry-university alliances is affected positively by information sharing.

## METHODOLOGY

### Data

Since our study is designated to analyze the relationship between behavioral characteristics of firms and the performance of industry-university alliances, we conducted a survey of firms that have been engaged in cooperation with universities. Because many industry firms seek cooperate with universities within technological field or R and D area, most of respondents are managers or employees coming from R and D department who are familiar with industry-university alliances. To develop the survey questionnaire, we conducted a lot of interviews with industry firms as well as reviewing the literature. We developed a questionnaire containing 16 items. After removing questionnaire with incomplete information, we got a final sample of 136 Chinese firms. The sample covered a diverse range of firms, including different sizes, ages and sectors, from manufacturing, electronics, to business service.

## Measures and method

### Dependent variables

As discussed earlier, to measure the performance of industry-university alliances, we focused on three items directly related to the alliance performance. These items were based on interviews with firms and the relevant literature (Saxton, 1997; Becerra et al., 2008). These were: "The outcome of industry-university alliances realized our goal, so it is successful"; "In general, we are satisfied with the performance of industry-university alliances"; "Industry-university alliances are helpful to enhance our competitiveness". Each item was measured on a five point Likert scale ('1' for strongly disagree and '5' for strongly agree).

### Explanatory variables

We measured resource investment with eight items. The items included: "we invest human resource"; "we invest equipments and materials"; "we invest financial resource"; "we invest knowledge"; "we are willing to allocate resource to industry-university alliances"; "we guarantee those employees who are engaged in industry-university alliances have sufficient time"; "those employees who are engaged in industry-university alliances can cooperate with universities actively"; "our top management treasure industry-university alliances".

Built on the research of Mora-Valentin et al. (2004), we measured communication through three items. The items included: "we communicate with universities frequently"; "we communicate with universities mainly through formal channels"; "we communicate with universities mainly through informal channels".

In order to measure information sharing, we considered five items. The items were: "we are willing to offer universities information that they need"; "universities are willing to offer us information that we need"; "there are little conflict between us in cooperation"; "relationship with universities can be considered harmonious"; "The disagreements between us can be resolved by coordination".

### Control variables

We also included two variables that may have impact on the performance of industry-university alliances. First, we controlled firm size. Large firms are likely to own more resources to work with external organizations such as universities (Tether, 2002; Mohnen and Hoareau, 2003). Second, we control the age of firms. We would expect firms that have long age to have more resources for and more experience of cooperating with universities, and therefore, to have impact on the performance of industry-university alliances.

## RESULTS

Table 1 reported the descriptive statistics and correlation matrix of the independent variables in the model to present the main characteristics of the sample. As shown in Table1, results revealed that the variables of behavioral characteristics have high correlation with alliance performance.

Results of regression analysis of hypotheses were given in Table 2. We set two models to analyze the impact of behavioral characteristics on the performance of industry-university alliances. In model 1, we entered only control variables. It could be seen that both the size

**Table 1.** Descriptive statistics and correlation matrix of variables.

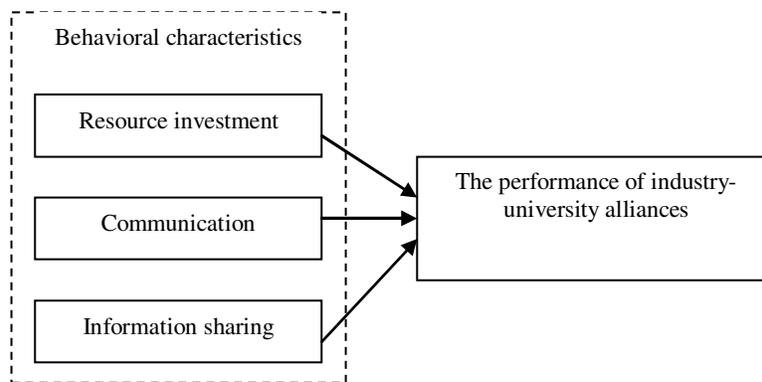
Variable	Min	Max	Mean	S. D.	1	2	3	4	5	6
Alliance performance	2.00	5.00	3.62	0.66	1					
Resource investment	1.50	5.00	3.50	0.80	0.579**	1				
Communication	1.33	5.00	3.36	0.86	0.498**	0.533**	1			
Information sharing	1.20	5.00	3.73	0.67	0.633**	0.621**	0.616**	1		
Age	1.00	6.00	4.04	1.34	0.014	-0.042	0.111	0.043	1	
Size	1.00	4.00	2.85	1.16	-0.035	-0.091	0.123	-0.132	0.616**	1

\*\*correlation is significant at the 0.01 level.

**Table 2.** Regressive analysis results.

Variables	Alliance performance	
	Model 1	Model 2
Control variables		
Age	0.028	-0.019
Size	-0.04	0.032
Explanatory variables		
Resource investment		0.228***
Communication		0.072
Information sharing		0.406***
$R^2$	0.003	0.465
Adjusted $R^2$	-0.012	0.444
$F$	0.218	22.588***

Two-tailed. Unstandardized coefficients are reported. \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$



**Figure 1.** Relationship between behavioral characteristics and the performance of industry-university alliances.

of firm and age have no significant relationship with alliance performance.

In model 2, we introduced explanatory variables. First, we suggested that more resource investment will enhance alliance performance. The coefficient of resource investment was positively associated with

alliance performance. Next, we suggested that the quality of communication is positively associated with alliance performance. The coefficient was positive but not significant. Finally, as expected, the coefficient of information sharing was positively associated with alliance performance, indicating that high degree of

information sharing between partners is associated with high alliance performance.

## CONCLUSIONS AND IMPLICATIONS

The performance of industry-university alliances is important for both industry firms and universities. Although it has been widely understood that there are several behavioral characteristics that have impact on alliance performance, we still lack empirical evidence. Our research casts light on how behavioral characteristics affect the performance of industry-university alliances. Alliance performance was related to resource investment and information sharing-positively and directly. Without sufficient resource and information sharing, industry-university alliances cannot show a high performance. Meanwhile, long-term and continuous cooperation depends on the relationships of partners.

Resource is a key to keep a long-term cooperative relationship and influence the performance of industry-university alliances. When industry firms invest more resource into the collaboration with universities, they wish gain more profit from the alliances, thus play an important role in enhancing the performance.

Industry firms and universities are born of different nature, it is impossible for industry firms and universities to cooperate smoothly without information sharing. Information sharing facilitates the stability and continuous of partners' relationship, then benefit the development of alliances.

From the data analysis, we conclude that firms have much awareness of whether collaborate with universities can bring them more profit. To enhance the performance of industry-university alliances, firms should pay more attention to resource investment and degree of information sharing. By investing resource into alliance, firms show their commitment and gain the trust of universities. Meanwhile, alliance requires long-term investment, particular for industry and universities which are based on different systems and goals, so necessitates a focus on various contacts between partners. Firms which share more information with universities usually create an atmosphere that partners can acquire more valuable knowledge during the cooperation, and help partners to realize mutual benefits by reducing misunderstanding, thus facilitating the performance of industry-university alliances.

Our research has several practical recommendations that may be useful for the management of industry-university alliances. The results show that both the size of firm and age has no significant relationship with alliance performance. It is inconsistent with the study of Tether (2002) who argues that, compared with small business, bigger firms can benefit more from cooperating with universities. Moreover, communication is not related to alliance performance as expected. Although this is congruent with other studies, we think that it would be

due to the cultural or social impact, so deep analysis needs to be carried out in future research.

Moreover, during the establishment and development stages of industry-university alliances, it is recommended to design managerial mechanism that promotes a high degree of resource investment and information sharing. This is especially true for emerging economies like China who wants to enhance national innovation capacity and play more and more important role in world economy.

To conclude, it must be said that this study represents a starting point for future researches intended to give an in-depth thinking on the performance of industry-university alliances. While we place an emphasis on how behavioral characteristics of firms influence alliance performance, additional factors such as innovative performance, network positioning of industry and firm's technology strategies may also be considered in measuring alliance performance. Future researches should examine how other factors might be applied to measure the performance of industry-university alliances. An understanding of these factors may offer great potential for government to make new policies to promote the success of industry-university alliances.

## ACKNOWLEDGEMENTS

This work is supported by the National Natural Science Foundation of China (Grant No. 70972065); Doctoral Dissertation Program of Shanghai Science and Technology Development Foundation (Grant No.11692190200).

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(Figure 1 was not cited but it was provided, kindly effect this correction).