

**Exploring Impact of Entrepreneurial Orientation, Network Capabilities
and Knowledge Management on the Alliance Performance (Insights into
the case of Chinese High-tech industry SMEs)**

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Abstract

The strategic alliance has gradually become an effective way for most small and medium-sized enterprises to obtain external resources and technologies. This study explores the main factors that affect the company's alliance performance and the role that alliance innovation plays in the relationship. While previous research has demonstrated the impact of entrepreneurial orientation, network capabilities, and knowledge management practices on firm performance, how alliance performance is affected in the context of alliances has not been specifically demonstrated. This paper establishes a new conceptual framework to evaluate the relationship between different elements and is supported by a questionnaire survey of 490 SMEs in China. The study demonstrates that knowledge management practices have the most significant impact on alliance performance. And alliance innovation plays a partial mediating role in the influence of different factors on alliance performance. The article concludes with the study's limitations and detailed directions for future research.

Key words: Entrepreneurial orientation, Network capabilities, Knowledge management practice, Alliance innovation and Alliance performance

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1. Introduction

Strategic alliances play a significant role in enabling companies acquire new knowledge (Dyer and Singh, 1998), identifying opportunities in the market (Bhagavatula et al., 2010), diversifying risks in product development (Das and Teng, 2001), developing new products (Haeussler et al., 2012) and integrating resources and capabilities (Chung et al., 2000). Strategic alliances enable SMEs to enhance economies of scale while maintaining their independence (Salisu and Abu Bakar, 2018). Many scholars have found through research that SMEs have improved their innovation indicators after participating in the alliance (Baum et al., 2000; Chen and Li, 1999; Dowling and Helm, 2006; Freel and Harrison, 2006; Haeussler et al., 2012; George et al., 2001; Neyens et al., 2010; Stuart, 2000).

However, previous work found an interesting observation that different firms in the same alliance do not necessarily earn exactly the same returns (Enkel and Heil, 2014; Belderbos et al., 2018). Therefore, the extent to which a firm achieves its original strategic goals in a strategic alliance can be used as an important indicator of alliance performance (Kale et al., 2002). Previous research has increasingly recognized the role of entrepreneurial orientation, network competence, and knowledge management practices in firm performance (eg, Hansen, 1995; Knoke, 1999; Leenders and Gabbay, 1999; Starr and MacMillan, 1990; Uzzi, 1996), however, remains to be explored how these factors collectively affect firm alliance performance. Although some studies combine entrepreneurial orientation, network capabilities, and knowledge management practices, they do not correlate well with firms' innovation performance (Vesalainen and Hakala, 2014; Bengesi and Roux, 2014;), there is still a lack of theoretical framework and empirical results on what role alliance innovation plays in the relationship between entrepreneurial orientation, network capability, and knowledge management time on alliance performance.

Entrepreneurship orientation shows the attitude and tendency of enterprises to participate in the entrepreneurial process and product innovation behaviours, which are mainly manifested in innovation, risk-taking and proactiveness (Covin and Slevin, 1989; Dai et al., 2014; Hughes et al., 2018a; Miller, 1983). More scholars began to explore the role of EO at the alliance level (Li et al., 2017; Shu et al., 2014). Under the promotion of EO, the company is more proactive in forming alliances with different partners, thereby achieving the effect of increasing alliance experience (Kreiser, Marino and Weaver, 2002; Dickson and Weaver, 1997).

One of the paths for alliance companies to achieve their entrepreneurial goals is to obtain and use the alliance network's external knowledge and technical resources by cooperating to develop entrepreneurial opportunities (Pillomem et al., 2016). The strategic alliance network is one of the most successful inter-organisational cooperation models (Currall and Inkpen, 2006) and helps alliance members absorb, create, and integrate knowledge (Tiwana, 2008). In a strategic alliance, the knowledge sharing between alliance members provides knowledge for the alliance, thereby effectively helping the alliance company expand the knowledge base and develop new knowledge while controlling the relative cost (Li et al., 2017).

Knowledge management (KM) has been one of the most influential and recognisable new approaches in the art and science of management. Recent studies have shown that knowledge management affects firm performance by providing organisations with a practical framework

for implementing their innovation strategies (Ciabuschi and Martin, 2012; Moustaghfir and Schiuma, 2013;). Therefore, KM seems to be an effective means to improve organisational innovation performance (Andreeva and Kianto, 2011; Li et al., 2010).

Recognizing the research gap, the researchers developed a theoretical framework to assess the joint contribution of entrepreneurial orientation, network capability, and knowledge management practices to alliance performance and the mediating role of alliance innovation . Researchers will use a theoretical framework to answer the following three research questions:

1. *What are the determinants of alliance performance?*
2. *To what extent do the determinants influence alliance performance?*
3. *What is the role of alliance innovation on a company's alliance performance and its determinants?*

2. Literature review and hypotheses

2.1 Alliance performance

Alliance performance is mostly shown by how well the company meets its original strategic goals in the strategic alliances. (Kale et al., 2002; Schreiner et al., 2009). Strategic alliances are the primary source of advantage for large companies and SMEs to participate in market competition (Das and Rahman, 2010). The resource-based view believes that alliance performance depends on the efficiency and extent of the alliance's creation of new resources (Wittmann et al., 2009). Due to the financial difficulties of SMEs, it may be challenging to develop new products or improve existing ones. SMEs usually establish alliances to help them contact and acquire the necessary knowledge and technical resources from partners (Mowery et al., 1996). A strategic alliance refers to forming a partnership with a strategic third party to reduce uncertainty and barriers to entry, thereby strengthening and maintaining a company's competitive advantage (Saravathy, 2001). The essence of the alliance is a complex structure that includes competition and collaboration between partners and carries and integrates bilateral information and knowledge (Ariño and Reuer, 2004). Providing the organisation with the resources and capabilities needed for market competition is one of the most considerable contributions of the alliance to the organisation's reduction of entry barriers (Hitt et al., 2001; Robson et al., 2006). The ability level and dynamic interaction of strategic alliance members significantly affect the alliance's entrepreneurial activities.

Schulze (2017) said that alliances help businesses create a competitive environment, keep and grow their wealth, and stay ahead of the competition. However, due to the lack of market share and limited knowledge stock, their ability to obtain value and achieve strategic goals in cooperative innovation opportunities and competitive advantages is weak (Hitt et al., 2001). SMEs have found that forming strategic alliances is an excellent way to get external network resources, reduce risks, increase opportunities for innovation, and improve performance. (Ketchen et al., 2007). Strategic alliances provide SMEs with continuous opportunities to acquire new capabilities, help them deal with technological discontinuities in introducing new technologies, and control the costs and risks of innovation opportunities (Han et al., 2012). Strategic alliances can also make a company more flexible because companies in the alliance can work together on innovation projects that use fewer resources but produce more innovation.

(Bierly and Gallagher, 2007). A good alliance environment can display a broader pool of knowledge and resources, thereby providing members with professional knowledge that is conducive to the advancement of the organisation (Yli-Renko and Janakiraman, 2008).

2.2 Entrepreneurial orientation

EO is a company's strategic position that actively seeks and explores innovations in the face of uncertainty (Miller, 1983; Lumpkin and Dess, 1996). EO is theorized as a critical factor in promoting company performance, innovation, and competitive advantage under the combined action of five-dimensional factors (Lumpkin and Dess, 1996; Wiklund and Shepherd, 2011; Rauch et al., 2009). Covin and Slevin (1991) and Dess and Lumpkin (1996) found that high-EO companies are more likely and better at predicting the changing trends of the external environment and making risky investments to gain and keep a competitive edge. The high return is usually related to the high uncertainty in applying the new combination of resources in the alliance (Barrett and Weinstein, 1998). Alliance members who can handle risks better are more likely to take risks when combining their resources to find business opportunities and create value through cooperation.

High-EO companies are more likely to invest specific relationship assets into alliances (Teng, 2007) in order to improve the performance of alliances (Lavie et al., 2012). Wiklund and Shepherd (2011) say that proactive companies usually reach their goal of gaining a first-mover advantage by distributing their products early and making new ones before their competitors do. These companies have also shown much interest in getting and making potentially valuable resources (Kate et al., 2002). Also, finding and getting more resources outside of the alliance field may be possible, which would deepen resource integration with partners (Nielsen and Nelsen, 2009). At the same time, EO impacts company activities as one of the critical organisational characteristics (Miller, 1983). After the company joins the alliance, EO might be in charge of the alliance company's activities. For example, Sarkar, Echambadi, and Harrison (2001) and Teng (2007) say that EO could help alliance members learn new knowledge and technology together to create new business opportunities.

High-EO companies are more likely to achieve their strategic goals by entering strategic alliances (Lado et al., 1997; Sarkar et al., 2001). Companies will enhance significant positive returns when participating in collaborative innovation alliances (Han et al. 2012). Montoro-Sanchez et al. (2008) found that the ability of the member companies is essential in making alliances. Marino et al. (2002) believe that one-dimensional EO positively correlates with strategic alliances. Shu et al. (2014) found that the high EO of the companies in the alliance has a positive relationship with knowledge spillovers and opportunity creation. From this, we put forward a hypothesis:

H1: There is a positive relationship between entrepreneurial orientation and alliance performance

2.3 Network capabilities

Network capabilities are defined as the ability to establish, process, and use relationships (Hakansson, 2014; Ritter and Gemunden, 2004; Tyler and Evans, 2001); the ability to interact

with external partners (Lorenzoni and Lipparini, 1999); and the ability to establish, promote, and maintain relationships (Lambe et al., 2002). One sign of network capabilities is the company's ability to get resources and value (Hagedoorn et al., 2006). Over the past decade of research, scholars have slowly understood how essential network capabilities are to alliances. Kale et al. (2002) believe that the ability to coordinate the relationship network between partners helps the company acquire the necessary knowledge and technology from the outside and even further promotes its internal processes. External networks based on the development of network capabilities are significant for small and medium-sized enterprises with scarce resources. The literature in the past shows that small and medium-sized enterprises can access and obtain the resources they lack that are necessary for the company's competitive advantage through networks and alliances (Song et al., 2010; Dickson and Weaver, 2010; Gronum et al., 2012). However, not all alliances are successful (Hitt et al., 2007). Incompatibility of partners, many conflicts with partners and the inability to establish trust relationships have become common reasons for alliance failure. Developing the company's network capabilities is a crucial way to achieve the alliance's success, starting and maintaining cooperative relationships and gaining access to and using external network knowledge and technical resources to help the company replenish its resources and capabilities.

Establishing excellent and continuous relationships with partners is a prerequisite for coordinating resources and improving the utilisation of available resources (Seo, Edler and Massini, 2021). Network capabilities are even more critical for innovation-oriented SMEs because these organisations usually tend to be embedded in the same network with other partners who can share knowledge and resources (Laursen and Salter, 2005; Rothaermel and Deeds, 2006;). There are specific difficulties in achieving strategic goals and alliance performance in the network for SMEs because this is a progressive process with innovation as the core (Parida et al., 2015). Communication and interaction within the network refer to the goals of partner organisations, using relationship skills to discover potential partners to establish and coordinate relationships. This enables the company to enhance the use and sharing of resources and capabilities in acquiring partner resources, ultimately promoting the innovation of the entire network (Wales et al., 2020). Therefore, the hypothesis of this research should take into account the ability of alliance companies and alliance partners because the success of alliances relies on the exchange and sharing of complementary information and technological resources under common goals and innovation opportunities (Park, Kim and Kang, 2015; Omidvar et al., 2017).

From this, we put forward a hypothesis:

H2: There is a positive relationship between network capabilities and alliance performance.

2.4 Knowledge management practice

Knowledge management practices are defined as a series of management activities by companies to improve the effectiveness and efficiency of organisational knowledge resources (Andreeva and Kianto, 2011). The creation, integration and utilisation of knowledge are the main reasons for the survival and development of enterprises (Shan, Walker and Kogut, 1994). Its effective management can be realised in production and development—value creation

(DeCarolís and Deeds, 1999). Critical features of aspect-style knowledge management practices that are manipulated and controlled by conscious and directed managerial activities in organisations (Andreeva and Kianto, 2011; Foss and Michailova, 2009). Because of this, companies create and practice many projects or activities to enhance them using organisational capabilities and extract value (Andreeva and Kianto, 2012; Foss and Michailova, 2019).

Several studies have shown that general knowledge processes, including knowledge creation and sharing (Chen et al., 2010), knowledge sharing, application, and storage (Lee et al., 2013). Knowledge creation, documentation, storage, sharing, and acquisition (Andreeva and Kianto, 2011) have a favourable effect on the company's innovation performance. Wang and Chen (2013) discovered that social capital serves as a bridge between HRM practises and radical innovation capabilities, while institutionalised knowledge and coding experience (i.e., organisational capital) moderate the relationship between HRM practises and incremental innovation capabilities. Furthermore, Castro et al. (2013) discovered that a well-structured firm's customer network and highly creative, skilled, and experienced personnel (i.e., human capital) are crucial ingredients for obtaining high innovation performance. Meno et al. (2007) continue along the same lines by discussing the degree of internal and external integration with suppliers and the skill levels of employees and related organisational learning capabilities (i.e., human capital). Other researchers have discovered that corporate culture plays a significant role in knowledge-related workplace behaviours (e.g. De Long and Fahey, 2000; Leidner et al., 2006).

Numerous empirical studies have examined how various features of knowledge assets and knowledge management affect alliance effectiveness. Some findings from strategic alliance research indicate that one of the primary purposes of firms entering into alliance partnerships is to acquire skills and knowledge from alliance partners that they lack (Dyer and Nobeoka, 2000; Easterby-Smith et al., 2008). Although firms can successfully acquire knowledge through strategic alliances (DeHolan and Phillips, 2004), knowledge management practices are still required to realise the potential of absorbed knowledge. Because innovation usually requires collating and transforming various knowledge from different sources (Tiwana, 2008). In order to enhance alliance performance, alliance companies must integrate external knowledge into existing knowledge and transform it into innovation results through effective knowledge management practices (Kodama, 2009; Zhang et al., 2010).

From this, we put forward a hypothesis:

H3: There is a positive relationship between knowledge management practice and alliance performance.

2.5 Alliance innovation

In this study, we define alliance innovation as the development of unique solutions with social or economic value. Acquiring external knowledge is the key driving force of innovation and is regarded as the mainstream view of entrepreneurial theory by most scholars (Li and Calantone, 1998; Narver and Slater, 1990; Phelps et al., 2012). In the development process of enterprises, more knowledge is obtained from the external environment, which is more conducive to ongoing entrepreneurial activities and new product research and development. In the current market environment, high-tech companies tend to contact more partners to obtain

external knowledge to maintain a competitive advantage because they find that independent exploitative or exploratory innovation activities have particular challenges and difficulties (Chesbrough, 2003). Therefore, one of the main ways for SMEs to obtain the resources needed for their innovation activities is to establish productive cooperation. SMEs can obtain new technologies through inter-company innovations and improve their competitive advantages.

Scholars have advocated for a deeper understanding of the dynamics of the processes that facilitate the acquisition and utilization of resources in coalitions (Hitt et al., 2000). Interest in joint alliances and innovation remains high, both from a theoretical and practical perspective. Theoretically, there is still much to learn about entrepreneurial orientation, network capabilities, and knowledge management as "black boxes" of the relationship between practice and alliance performance. Accumulating evidence from research on alliance innovation supports Powelle et al. (1996) asserted that the core of innovation resides in a network of firms, rather than individual firms, and that organizations can be centres of learning and knowledge accumulation.

The key to the successful collaborative innovation of alliance enterprises lies in the transmission, sharing and creation of knowledge. High-EO encourage them to invest more resources in the alliance, and technology and knowledge support the development of the alliance (Politis, 2005; Ravasi and Turati, 2005; Li et al., 2017), thereby promoting the generation of new knowledge and the development of innovation within the alliance (Li et al., 2017). Companies with a higher level of network capability have a positive impact on the communication and exchange within the alliance, thereby promoting the mutual exchange of knowledge within the alliance and the research and development of new products and services (Song et al., 2010; Dickson et al., 2006; Gronum et al., 2012). Companies with higher practical capabilities in knowledge management help them better integrate external knowledge and technologies acquired through alliances, transform them into internal knowledge and technologies, and innovate processes and results of existing products and technologies (Kodama, 2009).

Increasing the knowledge base or redeveloping existing knowledge contributes to firm innovation (Nonaka and Takeuchi, 1995). Recent research has highlighted the need for external linkages to foster innovation (Levinson, 2010; Olander and Hurmelinna-Laukkanen, 2010), and the need for a dedicated alliance function to coordinate and oversee overall alliance activities (Salge et al., 2012) to generate alliance success (Kale and Singh, 2007) and enhance the alliance performance of enterprises. Although partner interactions in collaborative efforts can mobilize resources for invention creation, recent evidence suggests that the most successful alliances are those whose activities are overseen by committed managers (Kale and Singh, 2007). Furthermore, feedback from practitioners on changing existing business models suggests that additional research is needed to understand the factors that influence alliance performance, especially the role that alliance innovation plays in targeting the impact of different factors on alliance performance, so that firms can formulate Strategies to promote alliance innovation and enhance alliance performance (Dew and Hearn, 2009; Heimeriks et al., 2007; Inkpen and Pien, 2006; Levinson, 2010).

From this, we put forward a hypothesis:

H4a: There is a positive relationship between alliance innovation and alliance performance.

H4b: Alliance innovation mediates the relationship between EO and alliance performance

H4c: Alliance innovation mediates the relationship between Network capabilities and alliance performance

H4d: Alliance innovation mediates the relationship between Knowledge management practice and alliance performance

Insert Figure 1 Here

3. Methodology

This research will use positivist philosophy and quantitative analysis methods to conduct hypothesis testing. Sharp, specific and closed research questions and hypotheses are based on detailed and comprehensive literature reviews and further developed. Based on the literature review and the proposed hypotheses, the researchers' information comes from previous research and data results, so the influence of personal information and subjective positions is greatly reduced.

3.1 Sample size and data collection

According to the classification standards for information transmission (2021), software and information technology services by the Small and Medium Enterprises Bureau of the Ministry of Industry and Information Technology of China: Small and medium-sized enterprises with less than 500 employees and operating income of fewer than 1 billion yuan. Among them: are micro-enterprises with less than ten employees and operating income of fewer than 10 million yuan; small enterprises with less than 100 employees and operating income of fewer than 100 million yuan; small enterprises with less than 500 employees and operating income of fewer than 1 billion yuan medium-sized enterprises.

The target sample size of this study is 300 Information transmission, software and information technology services SMEs from three regions in mainland China. Researchers will randomly sample 100 companies in each of the eastern coastal regions (developed regions), central regions (medium-developed regions), and western regions (underdeveloped regions) based on the level of regional development.

Insert Table 1 Here

Researchers develop an English version of the questionnaire after an in-depth and detailed review of relevant literature and then translate it into Chinese. In order to test the hypothesis proposed in the hypothesis development part, this study will adopt a data collection questionnaire survey method. In sample selection, to avoid systemic deviations caused by economic differences, companies in regions with different economic development levels in China will all be included to reflect the differences in innovative practices. Before the design and distribution of the questionnaire, this study identified the sample target participants as the core employees of the sample companies involved in formulating critical strategies, including

CEOs, CTOs, CSOs and their nominated candidates. This group of people will become the first choice of questionnaire participants because they are the primary and direct participants in formulating company policies and strategies. In the process of the questionnaire method, the researcher gives the interviewee a detailed introduction of how to fill in the questionnaire and how to ensure the safety and confidentiality of the information, aiming to help participants reduce the misunderstanding of the problem and reduce the participants' worries about information leakage.

Subsequently, the researchers sent an email with a link to the questionnaire to 2,302 companies in different regions of China. They explained in detail how to fill out the questionnaire and ensure the security and confidentiality of the information in the email, aiming to help the respondents reduce their concerns about the questionnaire. Misunderstanding of the problem and fear of information leakage. In the end, 616 valid questionnaires were recovered, and 490 met the sample requirements. The effective response rate is 21.3%

3.2 Variables measurement

All latent variables will be measured by a multi-item scale and randomly sorted to minimise deviations in the survey methodology. Each scale item uses a seven-point Likert-type scale, from 1 "strongly disagree" to 7 "strongly agree."

Independent variable 1: entrepreneurial orientation

The researchers plan to use 15-item Likert seven-point scales to measure entrepreneurial orientation. In previous studies on EO, most researchers used Covin and Slevin's scale to measure the dimensions of EO's innovation, risk-taking, and initiative. Lumpkin and Dess (1996) further increase the dimensions of autonomy and competitive aggressiveness. Aiming at the research goals and research questions of this article, EO will be measured in five dimensions. Researchers will use fifteen-item scales from Dess and Lumpkin (2005) to measure five components of EO's innovativeness, proactiveness, risk-taking, autonomy and competitive aggressiveness in the enterprise.

Independent variable 2: Network capabilities

Network capabilities will be measured using a 19-item, seven-point Likert scale. Walt et al. (2006) developed the Network Capability Scale, which researchers will use for measurement. Walter's Network Competence Scale was the first research application of entrepreneurial orientation. Network capabilities include coordination, partner knowledge, relational capabilities, and mutual communication.

Independent variable 3: Knowledge management practice

Knowledge management practices will be assessed using a 23-item Likert seven-point scale. Dibella and Nevis (1996) believe that knowledge management can be understood globally. Subsequently, Daniel and Fernando's (2006) developed a scale to express knowledge management practices. Knowledge management practices include orientation towards the development, transfer and protection of knowledge; continuous learning in the organisation; an understanding of the organisation as an overall system; development of an innovative culture

to encourage R&D projects; an approach based on individual competence development and management based on competencies.

Independent and mediator variable: Alliance innovation

In order to measure the innovation of the company's alliance, we use the four items obtained in the established measures evaluated by Kale et al. (2002). Through these measures, it is possible to determine the innovation and new products, technology and markets obtained by enterprises after entering the strategic alliance, and determine whether the company's innovation is actively affected by the strategic alliance (Kale et al., 2002).

Dependent variable: Alliance performance

Strategic alliances are usually assessed objectively and competently. Harrigan (1988) evaluates the success of the alliance by the survival status of the alliance. Arino (2003) suggested using financial performance and profitability as measures. However, alliances rarely report objective financial performance data (Krishnan et al., 2006), and there is a strong correlation between objectivity and regulatory standards (Geringer and Hebert, 1991). Alliance performance will be measured through a four-item scale developed by Kale et al. (2002) judged by the degree to which the original strategic goals were achieved after joining the alliance by subjective assessment.

Control variable

Considering the influence of external variables on the research, this research includes four control variables.

First, firm age is controlled due to its potential impact on strategic decision-making and the likelihood of displaying innovative ideas (Anderson and Eshima, 2013). "1" for 0-5 years old, "2" for 5-10 years old, "3" for 10-15 years old, "4" for 15-20 years old, and "5" for over 20 years old.

Secondly, the size of the enterprise can affect the attitude of the enterprise to the use of the Internet and innovation to a certain extent, so the size of the company is controlled. Micro businesses with ten or fewer employees are set to "1". Small businesses with between 11 and 100 employees are set to "2", and medium businesses with 101 to 500 employees are set to "3".

Third, the investment made by enterprises in innovation has a particular impact on the competitiveness of enterprises and the promotion of enterprise innovation. Enterprises that invest more in innovation are more aware of the importance of innovation for improving their competitiveness. The researchers rated firms' commitment to innovation on a scale of "1" for very low, "2" for low, "3" for medium, "4" for high, and "5" for very high.

Finally, because the uncertainty of the technological environment has an impact on the promotion of corporate innovation (Li and Calantone, 1998; Song and Montoya-Weiss, 2001), the high intensity of competition may be an external incentive for corporate EO and technology commercialisation, the researchers set the survey participants' perception of the competitiveness of the firm's industry. "1" is very weak, "2" is weak, "3" is medium, "4" is strong, and "5" is very strong.

3.3 Reliability analysis and construct validity

Reliability analysis

Most scholars currently use Cronbach α as the evaluation standard for reliability (Cronbach, 1946). A given result of 0.7 indicates that Cronbach's α coefficient for the content is sufficient to support good internal consistency of the items in the scale (Cronbach, 1946). Therefore, the researchers used SPSS 29.0 software to conduct a reliability analysis on the scale items of the three variables. The results are listed in Table 2. Table 2 shows that Cronbach's α coefficients of the three variables are more significant than 0.7. The results indicate sufficient consistency between items and exhibit good reliability.

Insert Table 2 Here

Construct validity

According to Carmines and Zeller (2013), measuring the degree of agreement between indicators and theoretical expectations is the primary purpose of structure validation. Convergent validity and discriminant validity are two subcategories of construct validity commonly employed. The purpose of convergent validity is to test the degree to which scale values are related to values from different scales designed to assess the same construct (Fornell and Larcker, 1981). Discriminant validity is mainly used to assess the degree of difference between a given scale and the rest of the scales (Fornell and Larcker, 1981). Confirmatory factor analysis is currently the primary evaluation method adopted by most scholars for construct validity testing, so the researchers used AMOS 28.0 and SPSS 29.0 software to conduct confirmatory factor analysis on the scales of the three variables in the questionnaire. Since each variable adopted a multidimensional scale, the researchers conducted a second-order validation new factor analysis. The results are shown in Table 3.

The results of confirmatory factor analysis showed that the measurement model fit the data well ($\chi^2/df=1.796$, $GFI=0.832$, $RMSEA=0.04$, $CFI=0.928$, $NFI=0.852$, $TLI=0.928$, $IFI=0.928$). At the same time, it can be seen from Table 3 that the fitting effect of the first-order model of each variable is accepted. For convergent validity, when the loading of a latent variable is greater than 0.65, the AVE is more significant than 0.5, and the combined reliability is more significant than 0.7, it indicates that the variable has good convergent validity (Fornell and Larcker, 1981). It can be seen from Table 3 that the loading values of all variables are 0.707-0.969, all of which are more significant than 0.65. The AVE values were 0.5699-0.8225, all greater than 0.5. The combined reliability value is 0.8410-0.9625, all greater than 0.7. It shows that the variables in the model have good convergent validity. For discriminant validity, most scholars currently use the criterion that the square root of a variable's AVE is more significant than its correlation coefficient's absolute value, which indicates that the discriminant validity of the model is adequate (Fornell and Larcker, 1981). The researchers ran the SPSS 29.0 software to perform Pearson correlation analysis on the three latent variables and calculated the square root of AVE to draw Table 2. According to Table 2, the square root value of the AVE of each latent variable is greater than the absolute value of the correlation coefficient

between variables, indicating that the model has discriminant validity.

Insert Table 3 Here

4. Analysis and Results

4.1 Regression Analysis and Results

Insert Table 4 Here

From Model 1 in Table 4, it can be seen that among the control variables, company size and company industry competitiveness have an impact on alliance performance. Smaller company size corresponds to higher alliance performance ($B = -0.103$, $t = -2.102$). More intense industry competition is associated with higher alliance performance ($B = 0.092$, $t = 2.425$).

According to Model 3, the result shows that higher levels of EO are associated with higher alliance performance ($B = 0.143$, $t = 2.825$). This result shows that H1 is supported. This is consistent with previous research findings showing that the higher a firm's EO level is, the stronger the firm's ability to achieve its goals of joining the alliance will be. Compared with conservative companies, companies with high EO levels are more aware of the importance of resources obtained from alliance partners (Li et al., 2017). Their resource management ability has also been significantly improved in the process of entrepreneurial learning (Politis, 2005; Ravasia and Turati, 2005; Li et al., 2017). Especially the higher EO level of alliance members means that the innovative ideas of strategic alliances are more advanced. This leads to more accurate insights, practical ideas, and ways of thinking in the face of entrepreneurial opportunities (Avlonitis and Salavou, 2007). It can be seen that high-level EO alliance members have played a role in promoting the competitive advantages of strategic alliances and related companies that have been formed (Lambe, Spekman, and Hunt, 2002; Schilke and Goerzen, 2010; Li et al., 2017).

At the same time, a higher level of network capability corresponds to a higher level of alliance performance ($B = 0.150$, $t = 2.523$). Therefore, Hypothesis 2 is supported. The company's capabilities play an essential role in its market behaviour. Company capability can drive innovative actions and impact specific forms (Covin and Slevin, 1991). As one of the critical capabilities of a company (Kale et al., 2002), network capabilities help firms improve the efficiency of internal processes (Doz and Hamel, 1989; Sivadas and Dwyer, 2000), make the company coordinates well and efficiently with its partners (Mohr and Spekman, 1994), and acquires external knowledge and technology that it does not possess (Das and Teng, 2000). It can be seen that through good communication and cooperation in the strategic alliance, the company can better realize the established strategic goals when joining the alliance and improve the performance of the alliance.

The findings show there is a significant positive correlation ($B = 0.429$, $t = 7.201$) between a firm's knowledge management practices and alliance performance, implying that Hypothesis 3 holds. Effective knowledge management is usually one of the main ways enterprises improve innovation capabilities. According to Darroch and McNaughton (2002), firms' innovation performance is often closely related to knowledge management practices. Firms achieving

innovation-based competitive advantage rely on knowledge management practices that facilitate new knowledge generation and organisational learning (Zack et al., 2009). Therefore, a better knowledge management practice helps enterprises acquire more knowledge and technology in the alliance and realize the acquisition and development of new knowledge of the enterprise, so as to better realize its strategic goals and improve alliance performance through strategic alliances.

Furthermore, higher alliance innovation corresponds to better alliance performance outcomes, supporting Hypothesis 4a ($B=0.221$, $t=5.569$).

In addition, from Model 3 in Table 4, it can be seen that the standardized regression coefficient value of knowledge management practice ($\beta=0.365$) is the highest among all descriptive variables, which explains that the most important factor affecting alliance performance in this model is knowledge management practice.

Insert Table 5 Here

It can be seen from Table 5 that entrepreneurial orientation has a positive impact on alliance innovation ($B=0.147$). The mediation effect value of alliance innovation in the relationship between entrepreneurial orientation and alliance performance is 0.033. It has the same sign as the regression coefficient of entrepreneurial orientation on alliance performance, and the 95% CI interval is [0.003-0.070]. This result shows that the mediation effect exists and is significant. Alliance innovation plays a partial mediating role in the relationship between entrepreneurial orientation and alliance performance, which supports hypothesis 4b..

Meanwhile, higher network capability matches better alliance innovation ($B=0.209$). The mediation effect value of alliance innovation in the relationship between network capability and alliance performance is 0.046. It has the same sign as the regression coefficient of network capability on alliance performance, and the 95% CI interval is [0.002-0.090]. This result shows that the mediation effect exists and is significant. Networking ability plays a partial mediating role in the relationship between entrepreneurial orientation and alliance performance. Assumption H4c holds.

In addition, knowledge management practice is positively correlated with alliance innovation ($B=0.520$). For the relationship between knowledge management practice and alliance performance, the mediating effect value of alliance innovation is 0.115. It has the same sign as the regression coefficient of knowledge management practice on alliance performance, and The 95% CI interval is [0.046-0.160]. This result shows that alliance innovation plays a partial mediating role in the relationship between entrepreneurial orientation and alliance performance, and the result is significant. At the same time, according to the proportion of effects in the last column of Table 5, alliance innovation has the strongest mediating effect on the influence of network capabilities on alliance performance. Alliance innovation has the highest mediating effect in the relationship between network capability and alliance performance, with a value of 23.583%.

5. Discussion and conclusion

Facing modern society's highly changing competitive environment, the corporate strategy

combining entrepreneurship and collaboration has become the primary way for SMEs to gain competitive advantages (e.g., Covin and Slevin, 1991, Lumpkin and Dess, 1996, Wiklund and Shepherd, 2003; Anand and Khanna, 2000, Kale and Singh, 2007). However, understanding how to select and use specific strategies effectively is needed (Sampson, 2007). Most past studies have focused on firm-level entrepreneurial orientation, knowledge management practices, and network capabilities and have yet to explore the context of strategic alliances fully. Alternatively, explore the relationship between entrepreneurship and alliances without knowledge of management practices and network capabilities as critical factors. This study integrates the research streams of the four theories and makes an essential contribution to these literature theories.

The study's results suggest that firms with more competitive industries and greater emphasis on innovation in their funding will be more active in achieving innovation from alliances. Furthermore, as predicted by our four hypotheses, entrepreneurial orientation, network capabilities, and knowledge management practices positively affect firms' ability to capture innovation from alliances. While alliance innovation has a positive impact on alliance performance, it mediates the impact of EO, network capabilities, and knowledge management practices on alliance performance. These findings combine the strategies companies choose in the face of highly competitive development environments and find that the ability of companies to achieve innovation through alliances is greatly enhanced under the combined effects of entrepreneurial orientation, network capabilities, and knowledge management practices. Among them, the influence of knowledge management practice on innovation is particularly significant, which also means that companies still need high-level knowledge management practice to provide adequate measures and approaches for innovation after actively seeking innovation and successfully acquiring knowledge and technology through the network.

5.1 Implication for theory

Our study integrates four separate research streams—on entrepreneurship, network capabilities, knowledge management practices, and strategic alliances—into a single research framework. And the result emphasizes hybrid analysis across the domains of entrepreneurship, network capabilities, knowledge management practices, and strategic alliances importance. And the research results successfully explored the factors that have the most significant impact on alliance performance, making contributions to the related literature.

Second, previous research provides a wealth of perspectives and evidence supporting the positive impact of EO, network capabilities and knowledge management practice on firm innovation and alliance success (Politis, 2005; Ravasi and Turati, 2005; Li et al., 2017). However, this study focuses alliance performance through the alliance background, which makes the research questions and objects more specific and detailed. Furthermore, it may improve, to some extent, the knowledge in the research of alliance environment about the lack of innovation of firms themselves through joining alliances.

Thirdly, we recognise that EO positively impacts firms' ability to innovate through alliances. However, we strengthen our understanding of the factors that influence firms' innovation through alliances by including more explanatory variables, such as network capabilities and knowledge management practices. Network capabilities emphasise the

importance of effective interaction between enterprises and alliance partners in alliances (Walter et al., 2006). The knowledge management practice is the necessary way for enterprises to transform and produce success after effectively obtaining resources through the network.

Finally, we introduce alliance innovation as a mediator variable. The existence of mediator variables explains that part of the influence of EO, network capabilities and knowledge management practices on alliance performance needs to be realized through alliance innovation. Effective alliance innovation can better transform the strategic deployment of EO, the communication skills of network capabilities, and the system integration of knowledge management practices into the product and service innovation of the enterprise itself, so as to achieve the improvement of alliance performance.

5.2 Implication for practice

The conclusions of this study may be of some help to business managers and alliance practitioners. Positive entrepreneurial orientation is essential for firms to achieve innovation through alliances. Companies with higher innovation, initiative, risk-taking, autonomy and competitive aggressiveness will be able to play the role of the alliance better and realize their enterprise innovation by acquiring knowledge and technology from the alliance. Therefore, companies must encourage and facilitate a more proactive learning process and be prepared to take risks in cooperation to utilize alliance resources better.

In addition, the company's network capabilities are also crucial for companies to achieve innovation through alliances. Without a high-level network capability, it is difficult for a company to maintain a friendly interactive relationship with alliance partners in an alliance environment, and it is difficult to actively and effectively acquire the technologies and resources it needs.

At the same time knowledge management practices are essential for firms aiming to innovate from alliances. After the alliance is formed, the company must transform the resources and technologies it acquires from the alliance into internal knowledge and innovation processes through efficient knowledge management practices to realize its innovation finally.

Finally, the study shows that alliance innovation plays a mediating role and plays a role in the influence of entrepreneurial orientation, network capability and knowledge management practice on alliance performance. This also means that SMEs need to pay attention to the impact of alliance innovation on the improvement of their alliance performance. This will help small and medium-sized enterprises better understand how to properly invest more resources and knowledge into strategic alliances to promote alliance innovation and transform their alliance performance.

6. Limitations and future research

Despite the contributions of this research, some inherent limitations cannot be avoided.

First of all. It would be beneficial to develop a longitudinal study to reflect the alliance performance prior and post Covid, at different environment contexts. More variables would be helpful to explore more in-depth the factors that may moderate the strength of the relationships between EO, Knowledge management, and network and alliance performance. Comparison

between firm clusters can also be useful to identify the impact of firm characteristics on alliance performance.

Second, the results of this study are specific to the context of the Internet industry in China. Future research should expand to different industries in China and other emerging economies to verify whether the results and findings are valid.

Third, cooperation and resource sharing between different alliances may vary. Due to the utterly anonymous questionnaire survey method adopted in this study, the researchers cannot know which participants are from companies within the same strategic alliance. Therefore, future research can investigate different companies in the same alliance to further verify the relationship between their capabilities and the final innovation results.

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Fig.1 Conceptual framework

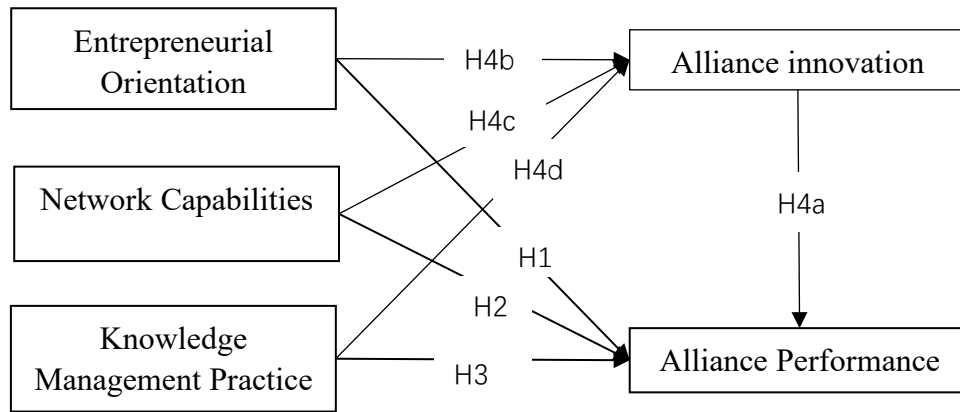


Table 1. Company Information Statistical Results

	Percentage of number
<i>Company age</i>	
0-5	3.7
6-10	26.7
11-15	43.1
16-20	17.3
21 and order	9.2
<i>Company size</i>	
Less than or equal to 10	3.3
Between 11 and 100	55.1
Between 101 and 500	41.6
More than 500	0
<i>R&D investment (%)</i>	
Below 10%	5.7
11%-20%	31.0
21%-40%	46.3
41%-60%	14.3
Over 61%	2.7
<i>Industry competition</i>	
Very weak	0.2
Weak	2.4
Medium	13.3
Strong	41.6
Very strong	42.4

Table 2: Pearson correlation and Square root of AVE

	EO	Network capabilities	Knowledge management practice	Alliance innovation	Alliance performance

EO					
NC	0.758**	--			
KMP	0.707**	0.783**			
Alliance innovation	0.600**	0.646**	0.699**		
Alliance performance	0.641**	0.684**	0.740**	0.669**	
Square roots of AVE	0.8290	0.8414	0.9625	0.7877	0.7549
Cronbach's α	0.904	0.915	0.941	0.866	0.841
Note: Significant at **p < 0.01.					

Table 3. Confirmatory factor analysis results

Variables	Factor	Loading	Question	Loading	AVE	Composite reliability	Evaluating model fit
EO	Autonomy	0.909	Q3.1.1	0.708	0.6873	0.9161	$\chi^2/df=1.759$ GFI=0.957 RMSEA=0.039 CFI=0.980 NFI=0.954 TLI=0.981 IFI=0.980
			Q3.1.2	0.774			
	Competitive Aggressiveness	0.844	Q3.2.2	0.711			
			Q3.2.3	0.671			
	Innovativeness	0.872	Q3.3.1	0.740			
			Q3.3.2	0.760			
			Q3.3.3	0.750			
	Proactiveness	0.794	Q3.4.1	0.790			
			Q3.4.2	0.811			
			Q3.4.3	0.755			
NC	Coordination Skills	0.905	Q4.1.1	0.833	0.7080	0.9057	$\chi^2/df=2.239$ GFI=0.958 RMSEA=0.05 CFI=0.974 NFI=0.954 TLI=0.966 IFI=0.974
			Q4.1.2	0.691			
			Q4.1.5	0.659			
	Relationship Skills	0.881	Q4.2.1	0.780			
			Q4.2.2	0.771			
			Q4.2.3	0.781			
			Q4.2.4	0.746			
	Partner Knowledge	0.865	Q4.3.1	0.796			
			Q4.3.2	0.724			
			Q4.3.3	0.743			
			Q4.3.4	0.719			
	Internal Communication	0.699	Q4.4.1	0.737			
			Q4.4.3	0.761			
			Q4.4.4	0.786			
Knowledge management practice	Orientation towards the development, transfer and protection of knowledge	0.909	Q5.1.1	0.797	0.8108	0.9625	$\chi^2/df=2.125$ GFI=0.945 RMSEA=0.048 CFI=0.971 NFI=0.948 TLI=0.964 IFI=0.972
			Q5.1.2	0.734			
			Q5.1.4	0.687			
	Continuous learning in the organisation	0.919	Q5.2.1	0.742			
			Q5.2.2	0.759			
			Q5.2.3	0.768			
	An understanding of the organisation as a global system	0.969	Q5.3.1	0.768			
			Q5.3.2	0.742			
			Q5.3.5	0.742			
	Development of an innovative culture that	0.921	Q5.4.1	0.787			
			Q5.4.2	0.784			

	encourages R&D projects		Q5.4.3	0.746			
	The approach based on individuals	0.853	Q5.5.2	0.671			
			Q5.5.3	0.797			
			Q5.5.4	0.743			
	Competence development and management based on competences	0.824	Q5.6.1	0.797			
			Q5.6.2	0.746			
			Q5.6.3	0.726			
Alliance Performance			Q6.1.1	0.794	0.5699	0.8410	
			Q6.1.2	0.767			
			Q6.1.3	0.707			
			Q6.1.4	0.749			
Alliance Innovation			Q6.3.1	0.801	0.6205	0.8673	
			Q6.3.2	0.766			
			Q6.3.3	0.756			
			Q6.3.4	0.826			

Table 4: Result of multiple regression analysis

Hierarchical Multiple Regression Result (n=490)

	Model 1			Model 2			Model 3		
	B	t	β	B	t	β	B	t	β
Constant	0220	1.051	-	0.199	0.833	-	0.177	0.766	-
EO	0.179**	0.052	0.159	0.175**	3.388	0.157	0.143**	2.825	0.128
Network capabilities	0.211**	0.06	0.185	0.196**	3.236	0.172	0.150*	2.523	0.131
Knowledge management practice	0.567**	0.057	0.483	0.544**	9.451	0.463	0.429**	7.201	0.365
Company age				-0.049	-1.734	-0.051	-0.044	-1.589	-0.046
Company size				-0.100*	-1.981	-0.059	-0.103*	-2.102	-0.06
R&D investment (%)				0.062	1.841	0.057	0.048	1.465	0.44
Industry competition				0.111**	2.872	0.094	0.092*	2.425	0.077
Alliance innovation							0.221**	5.569	0.227
R 2	0.586			0.601			0.626		
Adjustment R 2	0.583			0.596			0.619		
F	F (3,486)=229.212,p=0.000			F (7,482)=103.904,p=0.000			F (8,481)=100.455,p=0.000		
ΔR 2	0.586			0.446			0.024		
ΔF	F (3,486)=229.212,p=0.000			F (3,482)=179.750,p=0.000			F (1,481)=31.017,p=0.000		
Dependent variable: Alliance performance									
* p<0.05 ** p<0.01									

Table 5: Summary of mediation test results

Summary of mediation test results								
Item	c total effect	a	b	a*b Mediating effect value	a*b (95% BootCI)	c' direct effect	test results	Effect ratio
EO=>Alliance innovation=>Alliance performance	0.175**	0.147*	0.221**	0.033	0.003 ~ 0.070	0.143*	partial mediation	18.553%
NC=>Alliance innovation=>Alliance performance	0.196**	0.209*	0.221**	0.046	0.002 ~ 0.090	0.150*	partial mediation	23.583%
KM=>Alliance innovation=>Alliance performance	0.544**	0.520*	0.221**	0.115	0.046 ~ 0.160	0.429*	partial mediation	21.169%
* p<0.05 ** p<0.01								

Appendix

Entrepreneurial orientation
<i>Autonomy</i>
To what extent do you agree that your firm develops the necessary culture, processes, and incentives to inspire and support employee ideas for product innovation?
To what extent do you agree that your firm implements structural changes such as small self-governing groups to stimulate new ideas?
<i>Competitive Aggressiveness</i>
To what extent do you agree that your firm enhances its competitive position by entering markets with drastically lower prices, copying the business practices or techniques of successful competitors, or making timely announcements of new products or technologies?
To what extent do you agree that your firm knows when it is in danger of acting overly aggressive and avoid such actions which can lead to erosion of firm reputation and retaliation by competitors?
<i>Innovativeness</i>
To what extent do you agree that your firm actively encourages and stimulate innovation in technology, product markets and management processes?
To what extent do you agree that your firm is able to spot innovations that are difficult for competitors to imitate? Is your company able to spot innovations that are difficult for competitors to imitate?
To what extent do you agree that your firm is still able to secure an adequate proportion of its R&D investment during difficult economic times?

<i>Proactiveness</i>
To what extent do you agree that your firm strives to be a pioneer in the industry and can benefit from it?
To what extent do you agree that your firm can effectively use the following methods to act proactively: proactively introduce new products and technologies in the competition and constantly seek to improve?
To what extent do you agree that your firm typically continuously monitors customer feedback and evaluation trends to determine or predict future customer needs?
<i>Risk-taking</i>
To what extent do you agree that your firm has always improved its competitive risk position by researching and evaluating risk factors to minimize uncertainty?
To what extent do you agree that your firm always manages risk carefully to avoid innovating without adequate research and planning?
To what extent do you agree that your firm has always improved its competitive risk position by combining effective technologies and processes in other areas?
Network capabilities
<i>Coordination skills</i>
To what extent do you agree that your firm always analyzes different strategic goals that can be achieved with different partners?
To what extent do you agree that your firm matches the use of resources such as people and finances with personal relationships?
To what extent do you agree that your firm has dedicated coordinators for different partner companies?
<i>Relationship skills</i>
To what extent do you agree that your firm has the ability to build good relationships with business partners?
To what extent do you agree that your firm has always successfully positioned itself as a partner?
To what extent do you agree that your firm can always communicate and cooperate flexibly with partners?
To what extent do you agree that your firm is always working with partners on constructive problem-solving?
<i>Partner knowledge</i>
To what extent do you agree that your firm has a comprehensive and in-depth understanding of the partner's market?
To what extent do you agree that your firm has a comprehensive and in-depth knowledge of partner products, programs and services?
To what extent do you agree that your firm has a comprehensive and in-depth understanding of partner strengths and weaknesses?
To what extent do you agree that your firm has a solid understanding of competitors' potential and strategies?
<i>Internal communication</i>

To what extent do you agree that your firm always holds regular meetings for each collaborative project?
To what extent do you agree that communication in your firm is often across projects and subject areas?
To what extent do you agree that different levels in your firm are always giving each other feedback and suggestions about their work?
Knowledge management practice
<i>Orientation towards the development, transfer and protection of knowledge</i>
To what extent do you agree that your firm has a system for codifying explicit knowledge?
To what extent do you agree that your firm's employees can access required information through information technology and systems?
To what extent do you agree that your firm does a lot of cross-departmental projects?
<i>Continuous learning in the organization</i>
To what extent do you agree that your firm has a professional plan for continuous learning?
To what extent do you agree that your employees are happy to receive training that applies to their day-to-day work?
To what extent do you agree that your firm has a system of continuous improvement for processes that have met the standards?
<i>An understanding of the organization as a global system</i>
To what extent do you agree that your firm has a system to notify customers, suppliers and employees of current needs?
To what extent do you agree that your firm encourages knowledge transfer through approaches such as cross-functional teams and advancement groups?
To what extent do you agree that your firm has systems for capturing and processing relevant process information?
<i>Development of an innovative culture that encourages R&D projects</i>
To what extent do you agree that your employees must receive the necessary training before participating in innovation projects?
To what extent do you agree that your firm has external benchmarking techniques that can understand the success or failure of other companies with new technologies?
To what extent do you agree that your firm has good monitoring mechanisms for innovation projects?
<i>Approach based on individuals</i>
To what extent do you agree that your firm encourages teamwork?
To what extent do you agree that your firm has mechanisms for understanding employee opinions and satisfaction?
To what extent do you agree that your firm's employees can learn about and achieve success in innovation projects?
<i>Competence development and management based on competences</i>
To what extent do you agree that your firm has a system for measuring employee competency?

To what extent do you agree that your firm's compensation and promotion system promotes the development of employee competencies, ideas and knowledge?
To what extent do you agree that your firm uses benchmarking techniques to improve employee capabilities?
Alliances innovation
To what extent do you agree that your company has prototyped ideas for new products through alliances over the past three years?
To what extent do you agree that your company has launched new products in existing markets or developed new markets through alliances over the past three years?
To what extent do you agree that your company has significantly enhanced existing products and services through alliances over the past three years?
To what extent do you agree that your company has significantly improved existing production or manufacturing technology or developed new technology through alliances over the past three years?
Alliance performance
To what extent do you agree that the alliances that your firm has participated in or formed are characterized by strong and harmonious relationships between alliance partners?
To what extent do you agree that your firm has achieved the primary goal of forming or joining an alliance?
To what extent do you agree that your firm has greatly enhanced its competitiveness after joining or forming an alliance?
To what extent do you agree that your firm has successfully acquired effective resources, knowledge and technology from alliance partners after joining or forming an alliance?