

Choosing the Right Partner or Controlling the Partner Right? Partner Selection, Control and Radical Innovation

Wenxia Yang

School of Management, Shanghai University, Shanghai 200444, China

yangwenxia1208@163.com

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Abstract: Partner selection and partner control are two important mechanisms to solve the potential control problems in inter-organizational innovation cooperation. However, few existing literatures comprehensively evaluate the impact of the two control mechanisms on enterprise innovation. Based on the theory of management control, the research constructs a joint effect model of partner selection and partner control that influences enterprise radical innovation, and examines the impact of partner selection and partner control on enterprise radical innovation and its internal mechanisms. The result shows that: (1) partner selection has no direct impact on enterprise radical innovation, but it has an indirect impact on enterprise radical innovation through partner control; (2) partner control can directly and indirectly affect enterprise radical innovation through partial mediation of strategic information sharing, and the direct effect of outcome control on enterprise radical innovation is more significant, the indirect effect of behavior control on enterprise radical innovation is more significant through inter-organizational strategic information sharing; (3) partner selection has an indirect impact on enterprise radical innovation through partner control and strategic information sharing, partner control and strategic information sharing play a role as a chain intermediary in the relationship between partner selection and enterprise radical innovation. The conclusion reveals that it is important to choose the right partner in the innovation cooperation, but it is more important to control the partner right. Only by exerting reasonable control over the partner can partner selection give full play to its value.

1. Introduction

Radical innovation refers to a company that has achieved a fundamental or significant breakthrough in technology, and is able to use new knowledge and technology to create new products, processes or services [1]. Radical innovation is vital to the sustainable development of enterprises. How to achieve radical innovation has become a topic discussed actively in the theoretical and practical circles. Radical innovation often requires a lot of financial support, and the innovation cycle is relatively long and the risks are high. In addition to the limited resources and innovation ability of enterprises, enterprises usually need to cooperate with others to achieve the radical innovation [2]. Inter-organizational cooperation can form synergistic competitive advantages

through the sharing and integration of resources, knowledge and technology, which can help enterprises reduce costs and risks, expand scale, enter new markets or promote innovation [3-5]. However, the actual inter-organizational cooperation faces a very high failure rate, among which inappropriate partner selection and partner control are two important reasons for the failure of innovation cooperation.

As two important factors influencing the success of innovation cooperation, partner selection and partner control have attracted the attention of many scholars. Existing literatures have carried out multi-faceted studies on the important role of partner selection and partner control in inter-organizational cooperation, such as mitigating the opportunistic behaviors of partner companies[6-7], promoting coordination and efficiency in the cooperation process [8-9] , improving the innovation ability and performance of enterprises [10-13] and so on. These research results provide a solid theoretical basis and literature support for this paper.

Partner selection pays attention to the prior relationship management of cooperation, and considers the strategic intention of cooperation as well as the efficiency and effectiveness of cooperation at the stage of relationship construction. Partner control can ensure the successful realization of radical innovation goals by reasonably setting cooperation goals and reward and punishment mechanisms, effectively controlling partners' opportunistic behaviors and various uncertain risks in the process of cooperation. Both of them are very important to the success of enterprise radical innovation. Existing researches focused on the management control problems in inter-organizational cooperation, discussed the importance of management and control mechanisms on the success of cooperation, and the impact of different control methods on enterprise innovation [11-16]. There are also some literatures further trace back to the problem of partner selection ahead of the design of management control mechanism in cooperation, and examine the role of partner selection in inter-organizational cooperation and its impact on enterprise innovation [13, 17-19]. However, the existing literatures still have a limited understanding of how partner selection and partner control play a role in the process of enterprise innovation cooperation, and seldom comprehensively evaluate the impact of these two control mechanisms on enterprise radical innovation. That is to say, the existing studies do not answer the question of choosing the right partner and controlling the partner right, which is more important for the enterprise's radical innovation. In addition, when discussing the influence of partner selection or partner control on enterprise radical innovation, existing researches only answered the direct relationship between the two, but did not clarify the internal influence mechanism.

Based on this, according to the theory of management control and considering the dual perspective of prior partner selection and post partner control, this paper intends to construct a joint effect model of partner selection and partner control that influences enterprise radical innovation, and examines the impact of partner selection and partner control on enterprise radical innovation and its internal mechanisms, in order to provide theoretical reference and practical enlightenment for enterprise innovation management.

2. Literature Review

Control is generally regarded as the regulatory and monitoring process to achieve organizational goals [20]. Partner control can be seen as a mechanism to create conditions to motivate partners to strive to achieve desired or predetermined results [21]. Previous studies have classified control in many different ways, such as outcome control and behavior control, contract control and social control, formal control and informal control, and so on. Among them, Dekker [21] proposed a classification method for inter-organizational relationship control, that is, partner control is divided into outcome control and behavior control, which has received more attention and application in the existing literatures. Outcome control monitors the achievement of goals through an accurate and

reliable assessment of partner performance, while behavior control reduces uncertainty by monitoring partner behavior during the cooperation process. Therefore, this paper uses the classification method proposed by Dekker.

A large amount of literatures have confirmed that the partner control mechanism plays an important role in mitigating opportunistic behaviors, safeguarding the interests of partners, coordinating activities between enterprises, promoting knowledge integration [16, 22] and improving the innovation performance of enterprises. For enterprises in innovation cooperation, effectively controlling partners' opportunistic behaviors and various uncertain risks is the key to ensure the successful realization of radical innovation goals. Enterprises can improve the innovation performance by implementing appropriate management control on partners. For example, Bedford [11] discussed the application of control mechanisms in different modes and their impact on enterprise performance, and found that they play an important role in innovation management. Carson [14] clearly pointed out in the relevant research on R&D alliance that enterprises need to establish and implement inter-organizational management control mechanisms to achieve enterprise innovation goals. Based on the theory of product innovation and management control, Wang and Li [12] analyzed the impact of control methods on enterprise radical innovation, and found that both outcome control and behavior control can promote enterprise radical innovation. In addition, other studies have found that control mechanism will affect the inter-organization information sharing, and the inter-organization information sharing and knowledge transfer can also improve the radical innovation ability of enterprises [23-25].

Partner selection refers to the process by which enterprises search, evaluate, and ultimately select partners, which is generally considered to be the key to effectively managing the relationship between enterprises [21, 26]. Ding et al. [27] conceptualized partner selection as the relative importance of different selection criteria in the actual selection of partners, and applied different weights to these criteria based on the characteristics of the transactions that generated specific risk level. If the importance of selection criteria increases, companies will invest more time and effort in the process of partner search, and use these criteria together to conduct a more comprehensive evaluation of potential partners to ensure that the ultimately selected partner meets these criteria. In addition, the information obtained in the process of partner selection helps enterprises to understand the trading partners and the trading environment, design reasonable control mechanisms, reduce differences, control partner opportunistic behaviors, reduce trading risks and improve corporate innovation performance [28-29]. In theory, for the control problems that may arise in inter-organizational cooperation, choosing a good partner in advance and designing reasonable post partner control mechanisms can both be used as the methods to deal with this problem. The partner selection phase mainly focuses on mitigating control problems by finding a reliable and competent partner, while the design of subsequent partner control mechanisms focuses on mitigating and managing control problems. Both are crucial to the success of inter-organizational cooperation.

Although the positive effects of the two control mechanisms of partner selection and partner control on enterprise radical innovation have been confirmed by scholars, the influence mechanism is still unclear. And most existing studies only consider one of the control mechanisms, prior partner selection or post partner control, rarely comprehensively evaluate the impact of these two control mechanisms on the radical innovation of enterprises. Therefore, this paper intends to construct a joint effect model of partner selection and partner control (results control and behavior control) that influences enterprise radical innovation, and examine the impact of partner selection and partner control on enterprise radical innovation and its internal mechanisms.

3. Theoretical Analysis and Research Hypothesis

3.1 Partner selection and radical innovation

The scarcity resources and the limited innovation ability often lead to the failure of enterprises to achieve the success of radical innovation only by relying on their own resources and innovation ability, and they need to seek cooperation from outside [13]. In order to achieve good cooperation results, give full play to the advantages of cooperation, and achieve the success of radical innovation, partner selection is extremely important. The quality of partner selection will directly affect the information acquisition, strategic coordination and cooperation efficiency in the cooperation process. The correct selection of partners is the basis to ensure the effective implementation of enterprise radical innovation, which can control the risks of cooperative innovation from the source and improve the performance of cooperative innovation. For example, Hao [7] found that choosing the right partner is conducive to the formation of efficient and stable strategic partnerships, and further promote the value creation among partners.

In the process of extensive partner search, companies can obtain a large amount of external knowledge and information, which is conducive to improve enterprise innovation performance [28-30]. Deng [19] pointed out in research that the way in which enterprises look for partners and what kind of partners they have looked for determined to a large extent what kind of external knowledge and information enterprises can obtain from cooperation. When selecting a partner, the company will consider the consistency of the technology innovation goals among them, evaluate whether the technologies and resources owned by potential partners are complementary, and screen those who can provide specific resources and technologies based on their own development goals as cooperation partners. Partner enterprises selected through strict criteria are more willing to form close partnerships with each other, and are more likely to trust and cooperate with each other, which will help enterprises communicate with each other and jointly achieve their radical innovation goals. Thus, the following hypothesis is proposed:

H1: Partner selection positively affects enterprise radical innovation.

3.2 Partner control and radical innovation

Radical innovation often has a long innovation cycle and high risks, so companies need to exert effective management control over partners to reduce risks and improve efficiency in innovation cooperation. Outcome control emphasizes the ultimate realization of radical innovation goals, which clarifies the results of innovation and the corresponding reward and punishment mechanisms to indicate the direction of task performance, increase the consistency of goals, reduce the opportunistic behavior of partners, and inspire them to make efforts for innovation. Lack of outcome control may lead to partners avoiding innovation in order not to take responsibility for innovation failure. Behavior control emphasizes continuous and effective communication with partner companies in the process of innovation cooperation, which clarifies and monitors the behavior of partners to reduce the information asymmetry in the process of cooperation, timely discover and deal with problems arising in the process of innovation cooperation and make the cooperative parties make efforts toward the established goals and promote the realization of radical innovation. Lack of behavioral control may cause partners to deviate from their goals in the innovation process.

Turner and Makhija [31] pointed out that the enterprise's control systems have ability to manage internal knowledge flows. Similarly, we believe that the partner control mechanisms also play an indispensable role in inter-organizational information and knowledge management. The proper management and control of partners will affect the flow of knowledge and information in the

process of inter-organizational cooperation, promote inter-organizational information sharing and the transfer and integration of knowledge, and help enterprises to acquire new knowledge and new technologies required for radical innovation, thus promote radical innovation. Liu et al. [15] established a theoretical model of the internal control mechanism and the innovation mode of the enterprise, and found that process control is positively related to enterprise radical innovation. Wang and Li [12] analyzed the influence of different control methods on the performance of enterprise radical innovation, and found that both outcome control and behavior control have positive effects in promoting enterprise radical innovation.

In summary, effective partner control (outcome control and behavior control) can reduce the opportunistic behavior of partners, reduce the risk of various uncertainties in the cooperation process, enhance the consistency of the goals, which makes inter-organizational information sharing and knowledge transfer easier and faster, stimulates the recombination of existing knowledge and newly acquired knowledge, which helps enterprises to achieve radical innovation. Thus, the following hypothesis is proposed:

H2: Partner control positively affects enterprise radical innovation.

H2a: Outcome control positively affects enterprise radical innovation.

H2b: Behavior control positively affects enterprise radical innovation.

3.3 The mediating effect of partner control

Effective inter-organizational cooperation begins with appropriate partner selection because it precedes the design of contracts and management control mechanisms [32]. Companies invest a lot of time and energy in the process of extensive search for partners to obtain the knowledge and information related to potential partners. This knowledge and information can not only help companies make the right choices, but also help companies set reasonable cooperation innovation goals and reward and punishment mechanisms, as well as develop more detailed and appropriate partner behavior control mechanisms to manage cooperation in the subsequent cooperation process. The partner selection process is essentially a learning process that can facilitate the design of subsequent partner governance structures. Dekker [26] found that the efforts of enterprises to search for and select partners are positively correlated with the use of a wider partnership governance mechanism. That is, partner selection and partner control complement each other in dealing with the control problems in cooperation. Dekker and Abbeele [33] found that partner search and partner experience promote organizational learning and help enterprises obtain more vendor-specific and comparative information, which not only facilitated the use of subsequent partner control mechanisms (outcome control or behavior control), but also may enhance their ability to design control mechanisms for new inter-firm transactions. Ding et al. [27] found that the partner selection process can play a complementary role in mitigating transaction risks, because the information obtained in this process helps enterprises to understand trading partners and trading environment, promotes contract design, and mitigates partners' opportunistic behavior. Which shows that with the increase of transaction risks, enterprises will pay more attention to partner selection and design more complex partner control mechanisms to manage inter-organizational cooperation.

There are two ways to deal with the control problems that may arise during the cooperation process. One is to choose a good partner before the cooperation begins; the other is to design a reasonable partner control mechanism during the cooperation process. First of all, once a company confirms that it is superior to its own production with external cooperation, it needs to seek external cooperation [32]. If, after the cooperation relationship is established, the company sets innovation goals that are difficult to achieve and unreasonable reward and punishment mechanisms, or does not exert any control over the partners during the cooperation process, the control is too strict or the

original control method is used invariably, it may lead to the failure of innovation cooperation. Therefore, after choosing the right partner, the company needs to design and implement a series of appropriate management control mechanisms to govern the cooperation between the two parties. In theory, the partner selection phase focuses on mitigating control problems by finding a reliable and competent partner, while the design of subsequent partner control mechanisms focuses on mitigating and managing control problems through appropriate mechanisms during the cooperation process.

In summary, partner selection affects the design of subsequent partner control mechanisms (outcome control and behavior control), and outcome control creates incentives for partners and promotes partner behavior consistent with the enterprise goals, and behavior control sets the limit for the partner, which reduces the opportunistic behavior and uncertain risk in the cooperation process, and then promote the radical innovation of enterprises. Thus, the following hypothesis is proposed:

H3: Partner control plays an intermediary role in the relationship between partner selection and enterprise radical innovation.

H3a: Outcome control plays an intermediary role in the relationship between partner selection and enterprise radical innovation.

H3b: Behavior control plays an intermediary role in the relationship between partner selection and enterprise radical innovation.

3.4 The mediating effect of strategic information sharing

Enterprises contact and learn partners' resources, knowledge, and technology are often one of the main reasons for the establishment of inter-organizational cooperation [34], and inter-organizational information sharing is usually the key way for enterprises to obtain these resources and information from cooperation.

Mahama [16] found that in the process of inter-organizational cooperation, the formal controls (outcome control and behavior control) implemented by enterprises are helpful for inter-enterprise knowledge transfer. Zhang and Zhou [22] investigated the relationship between Chinese manufacturing companies and suppliers, and found that formal control (outcome control and behavior control) promoted the flow and transfer of knowledge in transaction relationships. According to the existing literature, the partner control mechanism has inherent information processing properties, which can coordinate the relationship among the partners by setting effective cooperation rules and management control mechanisms, thus promoting inter-organization information sharing. Among various types of partner control mechanisms, outcome control can promote the effective coordination between partner companies aiming to pursue common goals to achieve inter-organization information sharing and knowledge transfer and integration. While behavior control can manage the inter-organizational cooperation process and promote information communication between the two parties [35] through the use of formal procedures and supervision. Effective partner control mechanisms can also improve the efficiency and effectiveness of inter-organization information sharing, make information sharing and knowledge transfer easier and information exchange faster.

In inter-organizational cooperation, enterprises strengthen partnerships by sharing information and understanding each other's business. The shared information may involve important, proprietary, and information necessary for enterprise to achieve radical innovation. The perfect information sharing mechanism can promote the rapid transmission and acquisition of important information such as new knowledge, new technologies and successful experiences among partners. As an important competitive advantage of an enterprise, radical innovation is closely related to

enterprise's creative ability. Enterprise creativity is mainly built on the input of intangible assets such as knowledge and information [36]. Complementary knowledge and experience from different companies and even different fields outside the organization have a positive effect on improving enterprise creativity [37-39]. Kang et al. [38] studied the relationship between external knowledge sources and enterprise technological innovation performance, and found that there is a positive correlation between information transmission and technology acquisition and enterprise technological innovation performance. Zhang et al. [39] found that the knowledge accumulation of enterprises and the sharing of internal and external knowledge information are conducive to improving the innovation ability of enterprises. Information sharing helps to improve the ability of manufacturers to absorb the knowledge of supplier, especially when specific information is shared between manufacturers and upstream and downstream suppliers, which can further promote manufacturers' product mutation innovation. In addition, strategic information sharing may increase the effectiveness of innovation. In the supply chain environment, the sharing of external information between manufacturing companies and core suppliers helps both parties better grasp customer needs and identify opportunities for new product development and product improvement, thus making innovation more effective.

In summary, the post partner control mechanisms (outcome control and behavior control) can promote inter-organization strategic information sharing, and the perfect information sharing mechanism can promote the rapid transmission and acquisition of important information such as knowledge and technology between organizations, and further promote the radical innovation of enterprises. Thus, the following hypothesis is proposed:

H4: Strategic information sharing plays an intermediary role in the relationship between partner control and enterprise radical innovation.

H4a: Strategic information sharing plays an intermediary role in the relationship between outcome control and enterprise radical innovation.

H4b: Strategic information sharing plays an intermediary role in the relationship between behavior control and enterprise radical innovation.

The theoretical model of this paper is shown in figure 1.

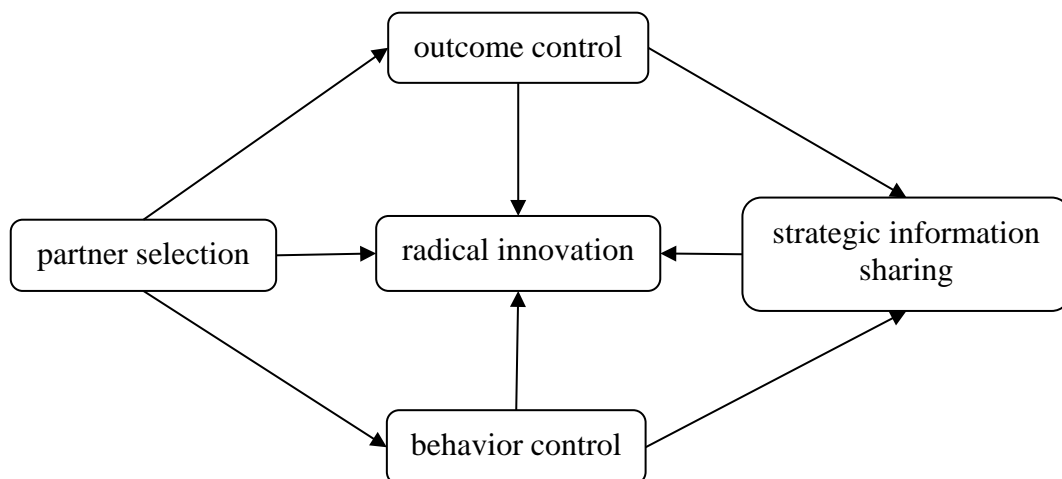


Figure. 1 Theoretical model

4. Research Design

4.1 Samples and data sources

This paper collects the data required for the study through questionnaire survey. All scales in the questionnaire were designed with reference to mature scales at home and abroad. In order to ensure the quality of the questionnaire, we conducted a pre-test before the formal survey. First, we consulted a number of scholars and entrepreneurs in the field, and made secondary corrections to the measurement items with reference to their opinions and suggestions. Then, we selected some companies for pre-tests, and further modified and improved the questionnaire according to the test results. In the formal survey phase, a total of 452 enterprises from Shanghai, Zhejiang and Jiangsu province were surveyed. In the first phase, the working time of the formal survey was from July 2015 to October 2015, and a total of 402 questionnaires were issued; the second phase is the supplementary survey phase, which begins in January 2017 and ends in March 2017, a total of 50 questionnaires were issued. We screened the collected questionnaires and eliminated the questionnaires with missing key information and failed the trap question test^①, and finally got 205 valid questionnaires with an effective recovery rate of 45.35%. In order to prove the representativeness of the survey samples, we further tested the differences of valid questionnaires collected from different channels, and the results showed that the sample companies do not have significant differences in terms of asset size and ownership nature.

Among the 205 valid samples, there are 84 listed companies, accounting for 40.98%; 121 unlisted companies, accounting for 59.02%. From the perspective of enterprise scale, there are many enterprises with assets between 100-300 million and 300-500 million, accounting for 24.39% and 22.44% respectively; there are 29 enterprises with assets less than 50 million, accounting for 14.15%, the same as enterprises with assets between 500-1000 million; there are 31 enterprises with assets between 50-100 million, accounting for 15.12%; there are 11 enterprises with assets between 1-5 billion, accounting for 5.37% and 9 enterprises with assets more than 5 billion, accounting for 4.39%. From the perspective of ownership nature, there are 35 state-owned enterprises, accounting for 17.07%; 104 private enterprises, accounting for 50.73%; 61 foreign-funded enterprises and Sino-foreign joint ventures, accounting for 29.76%; and there are also 5 enterprises of other ownership.

4.2 Measurement of variables

The main variables of this paper are partner selection, partner control (outcome control and behavior control), strategic information sharing and radical innovation. In order to ensure the content validity of the scale, all the variable designs in this paper refer to mature scales at home and abroad.

(1) Partner selection. Based on the measurement method of Ding et al. [27], this paper measures partner selection from the perspective of selection criteria, that is, constructs the indicator of "importance of partner selection criteria" to reflect the degree to which enterprises attach to specific criteria when actually selecting partners [27]. According to the requirements of this paper, the partner selection dimension is mainly based on the innovation-oriented selection criteria, including three items: "technical expertise", "product design and development capability" and "services", which are measured using the Likert 7-point scale, 1 means the selection criteria is not important, 7

^① Trap question refers to asking the same question from two opposite angles. If there are contradictions in the answers, the questionnaire will be judged as invalid.

means very important.

(2) Partner control. Including outcome control and behavior control. The outcome control mainly refers to Joshi's scale [40], including four items: "Our company sets specific and clear cooperation goals for major suppliers", "Our company will continue to monitor the performance of major suppliers to achieve their goals", "Our company's rewards to major suppliers are mainly based on the degree of achievement of the cooperation goals" and "Our company regularly reviews the supply situation of major suppliers and eliminates poor suppliers". The behavior control mainly refers to the scale of Heide et al. [41], which also includes four items: "Our company will monitor the production plans and production conditions of major suppliers", "Our company will monitor the storage and operation of major suppliers", "Our company will monitor the quality control procedures of major suppliers" and "Our company will regularly check the quality of products at major supplier factories". Likert 7-point scale was adopted to measure these items, and the questionnaire holders are required to make objective judgments based on the actual situation of the enterprise. 1 means completely disagree with the item statement and 7 means fully agree.

(3) Strategic information sharing. This paper refers to the research of Li et al. [42] and Choe [43], including seven items: "Sales terminal information", "Market trends", "Customer value information", "Product design information", "Manufacturing technology information", "Enterprise development strategy" and "Enterprise development plan". Likert 7-point scale was adopted to measure these items, 1 means that the information is rarely exchanged and 7 means frequently exchanged.

(4) Radical innovation. This paper refers to the scales of Sun et al. [44], including four items: "Compared with peers, our products are completely new in performance", "Compared with peers, our company is often the first to apply new technologies in the industry", "Our company innovates products on the basis of industry technological changes" and "Our company is the creator of new processes and new technologies". Likert 7-point scale was adopted to measure these items, 1 means completely disagree with the statement content of the item and 7 means fully agree.

(5) Control variables. This paper selects three types of control variables. One is the variables of enterprise characteristics such as the enterprise size, ownership nature and listing background. Second, the variables that reflect the characteristics of partners, such as the source channel of the supplier and the ownership nature of supplier. Third, variables such as supplier concentration that reflect the quality of inter-organizational cooperation.

5. Data Processing and Empirical Test

5.1 Common method deviation test

In order to avoid the problem of homology deviation, this paper uses Harman's single factor test to analyze the potential influence of common method deviation. This paper uses statistical software SPSS19.0 to do exploratory factor analysis on all variables in the model. The results of unrotated factor analysis show that there are five common factors with eigenvalues greater than 1, among which the explanatory power of the first common factor is 35.473%, indicating that common method deviation would not have a serious impact on the results of this paper.

5.2 Reliability and validity test and correlation analysis

This paper tested the reliability and validity of the designed scale. As shown in table 1, the Cronbach's α value of four of the five latent variables all exceed 0.7, while the Cronbach's α of the other latent variable is 0.676, which is also close to 0.7, indicating that the measurement in this paper is true and reliable, and the reliability of the scale is good. Validity test includes

polymerization validity test and discriminant validity test. Polymerization validity is determined by factor load and average variance extraction AVE obtained by factor analysis. As shown in table 1, the factor loads of each variable measurement item are mostly greater than 0.7, and only two are between 0.6 and 0.7, and the AVE values of each latent variable are greater than the critical value of 0.5, which indicates that the measured variable has a higher aggregation validity. Discriminant validity is determined by comparing the relative magnitudes of the square roots of the AVE of each latent variable with the correlation coefficients of this variable and other variables. As shown in table 2, the square roots of the AVE of each latent variable are greater than the correlation coefficient values of its row and column, which indicates that the discriminant validity of each latent variable in this paper is good.

In addition, it can be seen from table 2 that partner selection is significantly positively correlated with outcome control and behavioral control at the level of 1%; outcome control and behavior control are significantly positively correlated with strategic information sharing at the level of 1%; partner selection, outcome control, behavior control and strategic information sharing are significantly positively correlated with radical innovation at the 1% level. The above results provide preliminary support for verifying the four main hypotheses in this paper.

5.3 Influence path test

In this paper, the structural equation model and Mplus7.0 software are used to test the proposed hypotheses. The results are shown in table 3. H1 proposed that “Partner selection positively affects enterprise radical innovation” and the result shows that the regression coefficient of partner selection on enterprise radical innovation is 0.076 ($p > 0.100$), indicating that hypothesis H1 has not been verified. H2 proposed that “Partner control positively affects enterprise radical innovation” and the results show that the regression coefficient of behavioral control on enterprise radical innovation is 0.252 ($p < 0.050$) and the regression coefficient of outcome control on enterprise radical innovation is 0.420 ($p < 0.010$), indicating that hypothesis H2a and hypothesis H2b have not been verified. In addition, the regression coefficient of partner selection on behavior control is 0.504 ($p < 0.001$), the regression coefficient of partner selection on outcome control is 0.450 ($p < 0.001$); the regression coefficient of behavior control on strategic information sharing is 0.481 ($p < 0.010$), the regression coefficient of the outcome control on strategic information sharing is 0.295 ($p < 0.100$); the regression coefficient of strategic information sharing on enterprise radical innovation is 0.217 ($p < 0.010$). In summary, the final path analysis of this paper is shown in figure 2.

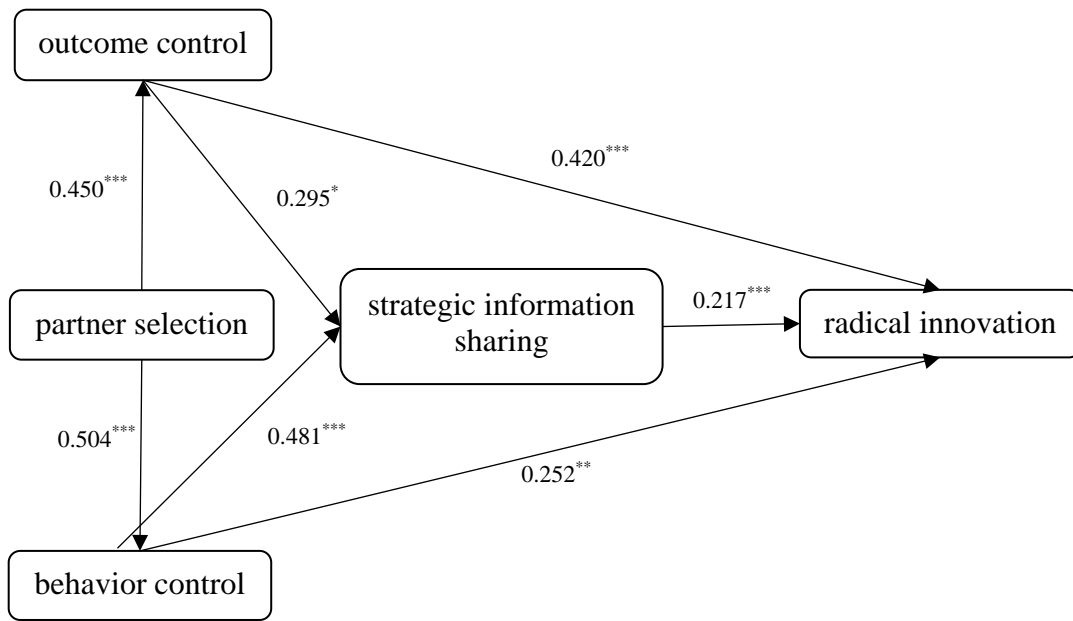


Figure. 2 Path analysis

5.4 Mediation effect test

Bootstrap test does not need a large sample, which can overcome the non-normal distribution problem of mediation effect, and does not need standard error when estimating the confidence interval of mediation effect, so it is suitable for testing chained intermediary effect. This paper further uses the bias-corrected non-parametric percentage Bootstrap test to repeat the sampling 5000 times and calculate the 95% confidence interval. The results are shown in table 4. The confidence intervals of the indirect effect that partner selection affects enterprise radical innovation through partner control (outcome control and behavior control) are [0.092, 0.316] and [0.035, 0.245] respectively, indicating that hypothesis H3a and hypothesis H3b have been verified. The confidence intervals of the indirect effects that partner selection affects enterprise radical innovation through the chained intermediary effect of partner control (outcome control and behavior control) and strategic information sharing are [0.002,0.078] and [0.015,0.131] respectively, both of which do not include zero, indicating that the chained intermediary effect is significant. The results not only prove the mediating effect of partner control and strategic information sharing between partner selection and enterprise radical innovation, but also further verify the mediating effect of strategic information sharing between partner control (outcome control and behavior control) and enterprise radical innovation, indicating that hypothesis H4a and hypothesis H4b have been verified.

Table 1 Measurement items, reliability and polymerization validity

Measurement items	Factor load	Cronbach's α	AVE
Partner selection		0.676	0.609
1) Technical expertise	0.816		
2) Product design and development capability	0.768		
3) Services	0.755		
Outcome control		0.734	0.557
1) Our company sets specific and clear cooperation goals for major	0.803		

suppliers			
2) Our company will continue to monitor the performance of major suppliers to achieve their goals	0.739		
3) Our company's rewards to major suppliers are mainly based on the degree of achievement of the cooperation goals	0.680		
4) Our company regularly reviews the supply situation of major suppliers and eliminates poor suppliers	0.758		
Behavior control		0.801	0.629
1) Our company will monitor the production plans and production conditions of major suppliers	0.802		
2) Our company will monitor the storage and operation of major suppliers	0.793		
3) Our company will monitor the quality control procedures of major suppliers	0.771		
4) Our company will regularly check the quality of products at major supplier factories	0.805		
Strategic information sharing		0.869	0.561
1) Sales terminal information	0.743		
2) Market trends	0.617		
3) Customer value information	0.771		
4) Product design information	0.746		
5) Manufacturing technology information	0.722		
6) Enterprise development strategy	0.798		
7) Enterprise development plan	0.826		
Radical innovation		0.764	0.586
1) Compared with peers, our products are completely new in performance	0.774		
2) Compared with peers, our company is often the first to apply new technologies in the industry	0.704		
3) Our company innovates products on the basis of industry technological changes	0.756		
4) Our company is the creator of new processes and new technologies	0.824		

Table 2 Correlation coefficient matrix and discriminant validity

	Enterprise scale	Listed	Supplier concentration	Supplier Source	Partner selection	Outcome control	Behavior control	Strategic information sharing	Radical innovation
Enterprise scale	1.000								
Listed	0.341***	1.000							
Supplier concentration	-0.099	0.005	1.000						
Supplier Source	0.152**	0.055	0.004	1.000					
Partner selection	-0.010	0.006	0.301***	0.018	0.780				
Outcome control	0.223***	0.038	0.261***	0.080	0.437***	0.746			
Behavior control	0.106	0.027	0.287***	0.069	0.432***	0.612***	0.793		
Strategic information sharing	0.224***	0.012	0.163**	0.183***	0.208***	0.474***	0.553***	0.749	
Radical	0.253***	0.117*	0.235***	0.133*	0.370***	0.639***	0.613***	0.542***	0.766

innovation									
Mean	3.410	0.410	5.315	0.527	5.712	5.674	5.634	5.379	5.449
Sd	1.593	0.493	1.178	0.501	0.789	0.813	0.920	0.997	0.957

1) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; 2) The data in bold on the diagonal is the square root of AVE; 3) The data below the diagonal are the correlation coefficients between variables.

Table 3 Results of direct path coefficients test

Direct path	unstandardized path coefficients	Standard error	p-value	95% confidence interval	
				Lower limit	Upper limit
1. partner selection→ radical innovation	0.076	0.074	0.307	-0.085	0.209
2. partner selection→ behavior control	0.504	0.085	0.000	0.341	0.670
3. partner selection→ outcome control	0.450	0.071	0.000	0.304	0.585
4. behavior control→ radical innovation	0.252	0.121	0.037	0.051	0.511
5. outcome control→ radical innovation	0.420	0.122	0.001	0.182	0.665
6. behavior control→ strategic information sharing	0.481	0.175	0.006	0.172	0.857
7. outcome control→ strategic information sharing	0.295	0.165	0.074	-0.077	0.563
8. strategic information sharing→ radical innovation	0.217	0.083	0.009	0.073	0.402

Table 4 Results of intermediary path coefficients test

Intermediary path	unstandardized path coefficients	95% confidence interval		Mediating effect
		Lower limit	Upper limit	
1. partner selection→ outcome control→ radical innovation	0.189	0.092	0.316	significant
2. partner selection→ behavior control→ radical innovation	0.127	0.035	0.245	significant
3. partner selection→ outcome control→ strategic information sharing→ radical innovation	0.029	0.002	0.078	significant
4. partner selection→ behavior control→ strategic information sharing→ radical innovation	0.053	0.015	0.131	significant

6. Conclusion and discussion

6.1 Research conclusion

Existing studies have focused on management control problems in inter-organizational cooperation, and discussed the important role of prior partner selection and post partner control in innovation cooperation, but rarely comprehensively evaluated the impact of the two control mechanisms on enterprise innovation. According to the theory of management control and considering the dual perspective of prior partner selection and post partner control, this paper constructs a joint effect model of partner selection and partner control that influences enterprise radical innovation, and examines the impact of partner selection and partner control on enterprise radical innovation and its internal mechanisms. The study found that: (1) partner selection has no direct impact on enterprise radical innovation, but it has an indirect impact on enterprise radical innovation through partner control; (2) partner control not only has a direct impact on enterprise radical innovation, but also indirectly affects enterprise radical innovation through part of the intermediary effect of strategic information sharing, and the direct effect of outcome control on enterprise radical innovation is more significant, the indirect effect of behavior control on enterprise radical innovation is more significant through inter-organizational strategic information sharing; (3) partner selection has an indirect impact on enterprise radical innovation through partner control and strategic information sharing, partner control and strategic information sharing play a role as a chain

intermediary in the relationship between partner selection and enterprise radical innovation. The results show that the positive influence of partner selection on enterprise radical innovation can only be realized through chain intermediary of partner control and strategic information sharing. It is important to choose the right partner in the innovation cooperation, but it is equally important to control the partner right. Only by exerting reasonable control over the partner can partner selection give full play to its value and promote enterprise radical innovation.

6.2 Theoretical contribution and management enlightenment

The theoretical contribution of this study includes three aspects.

First, in recent years, scholars have realized the importance of partner selection and partner control in inter-organizational cooperation, and have confirmed their positive role in innovative cooperation [10-12]. However, these two control mechanisms are rarely considered at the same time, ignoring the joint influence of partner selection and partner control on enterprise radical innovation. Different from the previous literatures, this study starts from the dual perspectives of partner selection and partner control, and builds a joint effect model of partner selection and partner control on enterprise radical innovation based on management control theory, which makes up for the defects of the previous theoretical and empirical studies from a single perspective. At the same time, this paper provides incremental empirical evidence for the study of partner selection and partner control.

Second, previous studies have discussed the impact of partner control on enterprise radical innovation [11-12,16], but have not clarified its internal influence mechanism. For example, Wang and Li [12] only considered the direct impact of different control methods on enterprise radical innovation when studying the impact of alliance control methods on enterprise radical innovation, and did not further explore how different control mechanisms affect the radical innovation. By introducing the mediating variable of strategic information sharing, this paper confirms that partner control (outcome control and behavior control) not only has a direct impact on enterprise radical innovation, but also promotes enterprise radical innovation indirectly by strengthening inter-organizational strategic information sharing. From the perspective of direct path, we find that the positive effect of results-oriented incentive mechanism on enterprise radical innovation is more significant. From the perspective of indirect path, we find that behavior control has a more significant effect on inter-organizational strategic information sharing than outcome control. This conclusion corresponds to the attributes of the two types of partner control mechanisms, outcome control and behavior control. Outcome control sets clear innovation goals and rewards and punishment mechanisms for innovation cooperation, which has a stronger direct incentive effect on enterprise radical innovation. Behavior control focuses on the supervision and guidance of the behaviors of partner enterprises in the process of cooperation, which can enhance the confidence of partner enterprises in cooperation and the willingness to share information, improve the efficiency of information communication, and thus promote the radical innovation of enterprises. Therefore, our study reveals in more detail the influence path of different partner control mechanisms on enterprise radical innovation, and improves the research on control methods and enterprise innovation.

Third, Previous studies generally directly examined the relationship between partner selection and enterprise radical innovation, and how to select partners to promote enterprise radical innovation. For example, You and Huang [13] designed the evaluation system of enterprises select radical innovation partners and build the corresponding evaluation model. Yu and Hu [17] revealed the problems and key elements in the process of innovation partner selection in their research. Deng [19] proved that partner selection could promote enterprise technological innovation. However, few

studies have further considered how partner selection specifically affects enterprise innovation, whether it directly promotes innovation or indirectly promotes innovation in some way. Thus, based on existing researches, this paper build a integration model of partner selection, partner control and inter-organizational strategic information sharing influencing enterprise radical innovation, we found that partner selection has an indirect impact on enterprise radical innovation through partner control and strategic information sharing, which enhances the existing literature's understanding of the mechanism of cross-organizational control affecting enterprise radical innovation.

The management implications of this study are as follows:

First, since partner selection can promote the design of subsequent partner control mechanisms, enterprises should search partners extensively in a planned and purposeful way, and fully understand the detailed information of knowledge, resources, technology and other aspects of potential partner enterprises in the search process, so as to lay a foundation for the effective design and application of subsequent partner control mechanisms.

Second, Since the positive influence of partner selection on enterprise radical innovation can only play its role through appropriate partner control, reasonable innovation goals and reward and punishment mechanisms should be set after the establishment of the innovation cooperative partnership, and the management and control of partners should not be ignored to prevent the failure of innovation cooperation due to improper control.

Third, this study reveals that partner control can indirectly affect enterprise radical innovation through strategic information sharing, and the intermediary role of inter-organizational strategic information sharing between behavior control and enterprise radical innovation is more significant. Therefore, in the process of innovation cooperation, enterprise managers should pay more attention to strengthen inter-organization strategic information sharing by implementing management control over partner behaviors, so as to promote enterprise radical innovation.

6.3 Research limitations and future research directions

Although every effort has been made to ensure the scientificity and objectivity of the research, there are still some shortcomings. First, due to the limited research scope of the questionnaire survey, non-probability sampling surveys will affect the universality of the research conclusions to some extent. Secondly, the empirical analysis in this study relies on cross-sectional data, so it still needs to be cautious to make causal inferences based on this. Future studies may consider collecting time series data to further test the research hypotheses in this paper.

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