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Inbound Open Innovation, Business Model Design and Firm Innovation Performance

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Abstract

Through systematic literature review, this study constructs a relationship model of the impact of inbound open innovation on firm innovation performance, and introduced two-dimensional business model design (novelty and efficiency) as mediation variables. It is preliminary confirmed theoretically that inbound open innovation has a positive impact on firm innovation performance, and the rationality of business model playing a mediation role in the relationship between inbound open innovation and innovation performance. Through questionnaire survey and empirical analysis, it is concluded that inbound open innovation has a positive impact on firm innovation performance; Two-dimensional business model design (novelty and efficiency) play a completely positive mediation role in the relationship between inbound open innovation and innovation performance. Based on these findings, this paper developed recommendations for future research.

Keywords: Inbound Open Innovation; Innovation Performance; Novelty-centered Business Model Design; Efficiency-centered Business Model Design

1 INTRODUCTION

In practice, in the era of information globalization and knowledge economy, the flow of information and knowledge is accelerated, the cycle of firm R&D and innovation is shortened, innovation activities are more frequent, and firm innovation is facing greater competition and pressure. Firms only rely on internal resources for closed innovation activities, which will aggravate the uncertainty and cost of firms, which is not conducive to the innovation activities of firms. The speed of knowledge and information replacement also puts forward higher requirements for innovation. Therefore, closed innovation activities can not meet the market demand and competition among firms. In the era of knowledge economy, it is inevitable for enterprise innovation to develop in an open way. Firms that are good at combining internal and external resources will get more innovation opportunities. Theoretically, since the economist Joseph Schumpeter creatively discussed the innovation theory in 1912, the topic of innovation has been widely concerned by the academic circles. Scholars in many fields also reconstruct the innovation theory from different perspectives. In 2003, Chesbrough formally put forward the open innovation theory [1]. Open innovation represents the main direction of innovation and has been widely concerned by scholars at home and abroad. Relevant innovation and opening research have also been carried out rapidly at home and abroad. This study aims to study the relationship between inbound open innovation, novel and efficient business models and innovation performance, and then put forward corresponding countermeasures and suggestions for firms on how to carry out open innovation and what business model design to adopt, so as to help firms improve innovation performance, which has certain practical significance.

2 LITERATURE REVIEW

In the study of the impact mechanism of open innovation on innovation performance, most scholars focus on the impact of innovation openness or openness type on innovation performance. In the research on the relationship between the two, Roper studied that innovation openness improves the sales volume of new or improved products in the manufacturing industry, and has a positive impact on firm innovation performance [2]; Barge found that closed,

semi open and open strategies have different effects on innovation performance. Under the open strategy, the sales percentage increases the fastest and the innovation performance of manufacturing firms is the highest [3].

After that, based on the study of the openness of open innovation, some scholars introduced intermediary variables and moderating variables to study their relationship. On the basis of studying the impact of openness on enterprise financial or strategic performance, Yan introduced innovation orientation and business model as meditation variables and found that innovation orientation and business model play a complete intermediary and partial mediation role between innovation openness and innovation performance [4]. Guo discussed the depth and breadth of innovation and opening up, found that the depth and breadth of innovation and opening up have a significant positive impact on firm financial and strategic performance, studied absorptive capacity as a moderating variable, and found that absorptive capacity plays a partial mediation role [5]. Zheng studied the impact of cluster firm openness on firm performance, and discussed that knowledge acquisition, as an intermediary variable, has a significant positive impact on the speed of product R&D and sales, and knowledge acquisition plays an mediation role in the relationship between them [6]; Studies by Cruz show that the dynamics of technological environment plays a negative and positive moderating role between the breadth and depth of innovation opening and the impact of opening on firm performance [7]; Ghisetti took the manufacturing industry of EU countries as a sample, and found that the absorptive capacity has a positive moderating effect, which is conducive to firms to introduce ecological innovation for firms through inbound open innovation [8]; Wang studied that the manufacturing industry in the Yangtze River Delta has a regulatory effect on the network openness on the cluster performance under the environmental uncertainty. The higher the uncertainty of the technical environment, the more significant the impact of the network openness on the performance, and vice versa [9]; Yang also found that environmental turbulence plays a positive moderating role on openness and innovation performance [10]; Wu studied the effect of network strength and openness on cluster performance under the influence of environmental uncertainty, and found that high environmental uncertainty will weaken the promoting effect of network strength, but will promote the positive effect of network openness [11]; Ma Wen concluded that the breadth of opening has a positive impact on firm innovation performance, the depth of opening has the best opening point, and the dynamic ability regulates the openness and innovation performance [12].

Through the research on the types of inbound open innovation, Gassmann identified that the process of open innovation can be divided into inward type, outward type and coupling type. Some scholars studied the impact of these three types of openness on innovation performance [13]; Mazzola found that inbound, outbound and coupled open innovation have a positive impact on firm performance; Some scholars introduced mediation variables and moderating variables when studying the relationship between the two [14]. Zhang found that the actual absorptive capacity plays a complete intermediary role in the impact of inbound or outbound open innovation on innovation performance [15]; Du found that the project management process plays a positive moderating role in inbound open innovation and financial performance [16]. Colin found that strategic orientation positively regulates three kinds of open innovation and firm performance [17]; Bianchi have shown that the acquisition of technical knowledge from outside has a positive regulatory effect on the number of new products, patents and sales volume developed by firms under the organizational mechanism as a regulatory variable [18].

It can be seen from the above research review that when most scholars study the impact of open innovation on innovation performance, some scholars analyze and study its impact on firm innovation performance from the openness of open innovation, that is, the depth and breadth of openness. Most scholars conclude that the openness of innovation plays a positive role in promoting innovation performance; Some scholars start from the types of open innovation, that is, the impact of inbound or outbound open innovation on innovation performance.

3 HYPOTHESIS

3.1 The Effect of Inbound Open Innovation on Firm Innovation Performance

Since its proposal, open innovation has attracted extensive research and discussion by scholars, and has been gradually used and accepted by firms. Firms gradually transition from closed innovation to opening. Gassmann believed that there are three forms of open innovation: inbound open, outbound open and coupled open innovation [19]. Most scholars believed that the purposeful inflow and outflow of knowledge is the process of innovation.

Therefore, inbound open innovation can be regarded as a purposeful inflow of knowledge and information. Van equated the purposeful inflow of knowledge with technology exploration [20]. Inbound open innovation is to build an innovation network outside the firm by observing the external situation, and purposefully absorb and integrate external information or technology for internal innovation and commercialization [21]; According to the view of network resources, the key resources of the firm not only come from the internal resources of the firm, but also intersperse in the innovation network among firms. Through inbound and open innovation methods such as cooperation with external research institutions, purchase of knowledge patents and participation of users and suppliers, the firm establishes an open innovation network with external innovation organizations to obtain external creativity, knowledge Innovative resources such as solutions and technical projects can effectively supplement internal innovation, so as to improve the innovation ability of firms [22]. In addition, the proprietary relationships among innovative networks, such as proprietary assets, knowledge sharing practices, complementary resource capabilities and effective governance, will greatly enhance the quantity and speed of new product development, the speed of new products being marketed and the advanced technology [23]. Secondly, the development of inbound open innovation enables firms to timely clarify, understand and control customers and new market needs and their changes, which is conducive to the scientific and effective allocation of resources and network paths. Moreover, through the long-term utilization learning process in the network, firms enhance the ability to identify innovation opportunities, grasp innovation needs, quickly solve problems and maintain rapid response to new information; Miotti analyzed the effects of cooperation between firms and units in the vertical value chain such as suppliers or customers and horizontal cooperation between enterprises and external research institutions, competitors or cross industries on innovation performance. They found that vertical strategy can promote new product development market, and horizontal strategy is conducive to enterprise invention patents, intellectual property rights and cost reduction [24]. Anne's research shown that the availability of market information will improve the market novelty by 3%, and the cooperation with external research can improve the innovation of firms by 5% [25]. Rothaermel (2009) found that the coupling of novelty and efficiency has a significant positive impact on financial performance and innovation within the enterprise [26]. The open and dynamic organizational framework of the firm promotes the positive effect of inbound open innovation on innovation performance. The adoption of open and dynamic organizational structure can give full play to the advantages of external resources, integrate and use external resources in the innovation within the firm, and improve the possibility of creating new products, It is helpful for firms to create value through differentiated strategy or low-cost strategy. Based on the above analysis, the following assumptions are put forward:

H1: Inbound open innovation has a significant positive impact on innovation performance.

3.2 The Mediation Role of Business Model Design

1) The role of novelty-centered business model design

From the perspective of information, in addition to providing higher value to existing major customers, firms with novelty-centered business model design should also purposefully absorb new information through inbound and open innovation, solve customer problems, find new customer needs, provide additional or new value on the basis of existing products, or create new needs for customers, and subdivide and locate the market, Identify the source of new revenue. From the perspective of technology, firms can adopt inbound open innovation, absorb and obtain technical resources conducive to generating new customer value through open external technology sources such as scientific research institutes and cross industry technology providers, and make technological improvement or create value through breakthrough innovation. At the same time, it can also replace direct investment with its own technology output to quickly enter the new product market, prevent the use and development of this technology, form technical barriers, protect its own patents and intellectual property rights, avoid infringement, and keep the technology in a leading position. Finally, under the environment of open information and technology, firms will continue to explore customer value and form a model mechanism of novelty-centered business model. Under the influence of inbound open innovation, firms with novelty-centered business models pay attention to external transactions, use suppliers, partners and other trading parties in the open network alliance to search for new trading partners, and constantly adjust and build new trading networks to obtain external resources; Under the role of export-oriented and open

innovation, firms build business networks through licensing, transfer and sale to export internal resources, give play to the leverage mechanism through the integration of internal and external resources, improve firm innovation efficiency, create new value, and gradually build new transaction models, so as to determine the transaction mechanism of business model. After clarifying the customer value and establishing the external transaction network relationship, firms need to design the income mechanism of cooperatives and, including internal governance mechanisms such as internal cost control, capital turnover and benefit control, as well as the construction of transaction mechanisms such as internal and external relationship governance between networks.

H2A: Novelty-centered business model design plays a positive mediation role in the impact of inbound open innovation on firm innovation performance.

2) The role of efficiency-centered business model design

Through inbound open innovation, firms and relationship networks can fully share information, accelerate the flow of information, reduce the asymmetric communication between the two sides, and improve efficiency. According to cost economics, this transaction mechanism is conducive to reducing the direct or indirect transaction costs between firms and all transaction participants, Thus, it is conducive to firms to carry out innovation activities. Based on the transaction cost theory, the transaction is carried out through an efficient and concise transaction method, which reduces the complexity and information asymmetry of the transaction, increases the relationship between network alliance partners and enterprises, so as to make the firms in the whole value chain closer, enhance the bargaining power of firms in the competition, and create customer value.

H2B: Efficiency-centered business model design plays a positive mediation role in the impact of inbound open innovation on firm innovation performance.

4 RESEARCH DESIGN

4.1 Data Collection

In order to ensure the reliability and validity of the questionnaire, the following work has been done before designing the questionnaire: first, the author combed a large number of relevant documents such as open innovation, innovation performance and business model, refined the research theme on the basis of a large number of reading services, clarified the logical relationship between open innovation, firm innovation performance and business model, and put forward research hypotheses, It also summarizes the measurement indicators of variables to provide a solid theoretical basis for empirical research. Secondly, we selected four firms that are suitable for the research topic, conducted in-depth interviews with managers who have been more than in the enterprise through field investigation, and repeatedly supplemented and modified the content, logic and wording of the questionnaire by collecting opinions from different tutors and experts. Third, a pre-survey is conducted before the formal distribution of the questionnaire, and the questionnaire is modified according to the survey results to form the final questionnaire. According to the research hypothesis, the questionnaire consists of four parts. The measurement variables are inbound open innovation, firm innovation performance and business model. The first part is the basic situation of the investigated firms; The second part is the measurement of firm inbound open innovation; The third part is the measurement of firm innovation performance; The fourth part is the measurement of firm's main business model design, which is divided into two dimensions. The quantitative problem adopts Likert's five point subscale.

A total of 300 questionnaires were distributed in this study, of which 171 were valid, accounting for 57% of the total questionnaire. Data Table 1 is the descriptive statistical table of sample. It can be seen from Table 1 that the establishment years of firms are concentrated between 5-25 years, and only 24% of them are less than 5 years and more than 25 years. The scale of the sample firms is more distributed within 1000 people, and there are only 8 firms with more than 1000 people. This is because the survey sample is manufacturing industry, and the scale of manufacturing industry is relatively large. Most of the firms with less than 300 people belong to technology intensive firms, such as its software, hardware, communication and other industries. The scale of traditional manufacturing industries such as consumer goods, home appliances and machinery manufacturing are relatively large. Multi industry analysis can improve the applicability of the research results to firms. The company is located

in different regions and has different resources. This sample is mainly from firms in the East region.

TABLE 1 DESCRIPTIVE STATISTICAL ANALYSIS OF SAMPLE FIRMS (N=171)

Index	Value	Frequency	%	Min	Max	Mean	Std. Dev.
Firm Age	Less than 5 years	22	12.87%	1	4	2.58	0.853
	5-10 year	47	27.49%				
	11-25year	83	48.54%				
	More than 25 years	19	11.11%				
Region of firms	East region	134		1	3	1.27	0.564
	Middle region	27					
	West region	10					
Registered capital of firms	Less than 5 million yuan	55		1	4	2.35	
	5-10 million yuan	46					
	10-20 million yuan	25					
	More than 20 million yuan	45					
Number of employees	Less than 100	61	35.67%	1	5	1.89	0.897
	100-300	81	47.37%				
	300-1000	21	12.28%				
	1000-2000	3	1.75%				
	More than 2000	5	2.92%				
Industry of the firms	Consumer goods	29	16.96%	1	7	3.68	
	Machinery manufacturing	34	19.88%				
	Electrical optics	18	10.52%				
	Semiconductor electronic information	26	15.20%				
	IT hardware / software	26	15.20%				
	Chemical / biological / pharmaceutical	21	12.28%				
	Other manufacturing	17	9.94%				

4.2 Defining Variables

1) Dependent variables

Scholars have increasingly standardized and standardized the measurement of innovation performance, and expanded from one dimension to multiple dimensions. However, it is mainly measured from the aspects of innovation process and results. The innovation process mainly measures the firm's investment in R&D, such as the proportion of R&D funds, the introduction of R&D equipment, innovation training expenses, etc. Some scholars also believe that firm innovation strategy and atmosphere will also have an impact on innovation performance, so they measure firm innovation performance from the aspects of innovation strategy and internal innovation environment. This paper adopts Chen's scale [27], including 5 items: *Number of new products; New product development speed; Success rate of innovative projects; Number of patent applications; Sales rate of new products.*

2) Independent variables

The measurement items of innovation during inward opening are mainly based on Chesbrough's definition rules of inbound open innovation: in order to obtain the required information or technology, firms purposefully improve and upgrade their internal technology through horizontal alliances to create greater value [1]. It include 5 items: *Firms often search and obtain technology, information, ideas, knowledge and other information in the external environment; When firms innovate, they take the initiative to obtain knowledge and technology from external partners; Firms actively contact with external partners to obtain better technologies and products; Firms have formed a perfect system for searching and acquiring external knowledge and technology; Firms seek or purchase technologies, patents and external intellectual property rights of other companies, research groups or universities for their own R&D.*

3) Mediation variables

This study mainly adopts the scale developed by Zott and Amit, combined with the actual situation of Chinese firms, deletes and improves the scale developed by scholars through the "back translation method" and translates it into Chinese [28], and then the questionnaire translated into Chinese is translated into English by experts proficient in

English and business model design, and compared with the original questionnaire, The final accurate questionnaire is formed through continuous correction. The Likert five point scale is used to measure the efficiency or novelty of the firm's business model design in the past three years. Novelty-centered business model design include 10 items: *The business model has formed new products, services and information; The business model attracts new participants; The rewards offered to trading participants are innovative; The business model brings unprecedented diversification and a large number of participants and / or commodities; Business models connect participants in novel ways; The richness (i.e. quality and depth) of the relationship between participants is novel; Firms are constantly introducing innovation into their business models; There is a competitive business model that will surpass the current one; There are other important aspects that make the business model novel; The business model of my organization is novel.* Efficiency-centered business model design also include 10 items: *Reduced inventory costs for business model participants; From the user's point of view, the transaction is simple; The business model reduces the error rate of executing transactions; Other costs of business model participants are reduced (e.g., marketing, sales, transaction, communication costs); Systematicness of business model (which can handle small and large transactions); The business model enables participants to make rational decisions; Transactions are transparent: the flow and use of information, services and goods can be verified; As part of the transaction, information is provided to participants to reduce the asymmetry between them about the quality and characteristics of products; You can get a lot of information about products, services and other participants; This business model improves transaction efficiency*

4) Control variables

Combined with the existing research, this study selects five control variables, namely, the firm's establishment years, the firm address, the number of employees, the firm's registered capital and the firm's industry.

5 RESULTS ANALYSIS

5.1 Exploratory Factor Analysis

The KMO value of inbound open innovation, two-dimensional business model design (novelty and efficiency) and innovation performance is 0.938, greater than 0.9, which is very suitable for factor analysis; The CHI-square value of Bartlett sphere test is 4400.534, the significance value is 0, less than 0.05, which is suitable for factor analysis.

5.2 Reliability and Validity Analysis

In order to measure the consistency and stability of variables, the degree of variation of the system can be reflected by the measurement results of reliability test. In general, Cronbach's alpha coefficient is greater than 0.7. Cronbach's alpha coefficient of the overall scale is 0.966, indicating that the overall scale has good internal consistency reliability. Cronbach's alpha coefficient of inbound open innovation is 0.858, indicating that the measurement of inbound open innovation has good internal consistency. Cronbach's alpha coefficients of two-dimensional business model design (novelty and efficiency) are 0.938 and 0.932 respectively, indicating that the measurement of two-dimensional business model has good internal consistency. The Cronbach's alpha coefficient of innovation performance is greater than 0.902, indicating that the measurement has good internal consistency.

The questionnaire design of the subject selects the measurement indicators based on the analysis of literature and relevant empirical data, determines the items and scales of relevant variables, and can ensure that each measurement scale of the text questionnaire has a certain content validity.

The validation factor load shows that through CFA on inbound open innovation, two-dimensional business model design and innovation performance, the results are shown in Table 2. RMSEA, χ^2/df, CFI and NFI of potential variables all meet the adaptation standard or exceed the critical value. Therefore, CFA is effective in measuring inbound open innovation, two-dimensional business model design and innovation performance.

TABLE 1 CONVERGENT VALIDITY ANALYSIS

Fit index	Value		Model fitness judgment
RMSEA	Inbound open innovation	0.056	Reasonable
	Novelty-centered business model	0.092	Ordinary
	Efficiency-centered business model	0.092	Ordinary
	Innovation performance	0.087	Reasonable
χ^2/df	Inbound open innovation	1.535	Good
	Novelty-centered business model	2.426	Good
	Efficiency-centered business model	2.449	Good
	Innovation performance	2.274	Good
CFI	Inbound open innovation	0.996	Good
	Novelty-centered business model	0.957	Good
	Efficiency-centered business model	0.955	Good
	Innovation performance	0.990	Good
NFI	Inbound open innovation	0.989	Good
	Novelty-centered business model	0.929	Good
	Efficiency-centered business model	0.928	Good
	Innovation performance	0.983	Good

5.3 Correlation Analysis

Correlation analysis is the basis of multiple linear regression analysis. Its purpose is to test whether the relationship between variables affects each other. Regression analysis is meaningful only if there is a highly correlated relationship between variables. If there is no correlation analysis between variables and direct regression analysis is easy to produce false regression. The purpose of the study is to determine whether there is a significant correlation between these variables, such as inbound open innovation, two-dimensional business model design (novelty and efficiency) and innovation performance, The correlation coefficient matrix between key variables is shown in Table 3. It can be concluded from the table that there is a significant medium positive correlation between inbound open innovation and innovation performance, and the correlation coefficient is 0.642; There was a significant moderate correlation between inbound open innovation and two-dimensional business model design (novelty and efficiency), and the correlation coefficients were 0.739 and 0.686 respectively; There is a significant medium degree positive correlation between two-dimensional business model design (novelty and efficiency) and innovation performance, with correlation coefficients of 0.800 and 0.797. The correlation coefficients between two-dimensional business model design (novelty and efficiency) and inward open innovation and innovation performance have reached more than 0.6, so business model design is likely to play an intermediary role.

TABLE 3 CORRELATION ANALYSIS

Variable	1	2	3	4
Inbound open innovation	1			
Novelty-centered business model	0.739**	1		
Efficiency-centered business model	0.686**	0.863**	1	
Innovation performance	0.642**	0.800**	0.797**	1

Note: ** $p < 0.05$

5.4 Regression Analysis

The control variables (firm establishment years, firm address, firm registered capital, number of employees and industry), inbound open innovation, two-dimensional business model design and innovation performance were analyzed by SPSS, and the independent variables were entered into the model by "enter" method.

As shown in Table 4, the standardized partial regression coefficients of inbound open innovation and two-dimensional business model design (novelty and efficiency) are 0.068, 0.388 and 0.411 respectively. The larger the regression coefficient, the greater the contribution to the regression model. At the same time, the P values of the hypothesis test of the regression coefficients are 0.306, 0000 and 0.000 respectively. The P values show that the regression coefficients of two-dimensional business model design (novelty and efficiency) are statistically significant. It is generally believed that the smaller the T value (tolerance), the more serious the multicollinearity. When the T value is less than 0.1, there is serious collinearity. The T values of inward open innovation and two-dimensional

business model design (novelty and efficiency) are 1.028, 4.058 and 4.671 respectively, which are greater than 0.1, so there is no obvious collinearity problem; The variance expansion factor VIF (reciprocal of tolerance) is generally considered not to be greater than 5. In this case, the VIF is not greater than 5, so it can be considered that there is no obvious collinearity problem.

TABLE 4 RESULTS OF REGRESSION ANALYSIS

Variables	B	S.E.	Beta	T	P	VIF
Constant	.340	.283		1.203	.231	
Inbound open innovation	.067	.065	.068	1.028	.306	2.288
Novelty-centered business model	.404	.099	.388	4.058	.000	4.772
Efficiency-centered business model	.434	.093	.411	4.671	.000	4.031
Firm Age	.032	.057	.029	.569	.570	1.387
Region	-.063	.075	-.038	-.831	.407	1.076
Registered capital	.000	.041	.000	-.005	.996	1.420
Number of employees	-.024	.057	-.023	-.425	.672	1.557
Industry	.005	.021	.011	.259	.796	1.021
F-test			44.981***			

Note: *** p <0.001

TABLE 5 MAIN EFFECT ANALYSIS

Variables	Model 1		Model 2		Model 3		Model 4		Model 5	
	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
Constant		.000		.000		.000		.000		.231
Firm Age	.019	.834	.011	.854	-.022	.737	.025	.725	.029	.570
Region	-.181	.021	-.081	.131	-.039	.508	-.085	.165	-.038	.407
Registered capital	.034	.707	-.012	.851	-.020	.762	-.013	.852	.000	.996
Number of employees	-.030	.749	-.052	.424	-.030	.673	-.055	.453	-.023	.672
Industry	-.036	.636	-.055	.293	-.046	.424	-.029	.632	.011	.796
Inbound open innovation			.730	.000	.685	.000	.632	.000	.068	.306
Novelty-centered business model									.388	.000
Efficiency-centered business model									.411	.000

Note: ** p <0.05,*** p <0.001

We assumed letters represent variables: independent variable (X), intermediate variable (M), dependent variable (Y), inbound open innovation is X, the novelty-centered business model is M1, efficiency-centered business model is M2, and the innovation performance is Y. The established equation is as follows:

$$M_1 = a_1 x + e\ ;\ M_2 = a_2 x + e\ ;\ Y = cx + e;\ Y = c'x + b1m1 + b2m2 + e$$

According to the test, the regression $M_1 = a_1 x + e$ is significant, the value a is 0.730, and the significance P< 0.000; The regression $M_2 = a_2 x + e$ was significant, the value a was 0.685, and the significance P < 0.000. Test whether the c in the equation $Y = cx + e$ is significant. It can be seen from the Table 5 that the regression effect of the equation $Y = cx + e$ is significant, with a value of C 0.632 and a significance of P< 0.000. Suppose H1 is true. The equation $Y = \mathbf{c}'x + b_1 m_1 + b_2 m_2 + e$ is tested, the value of $\mathbf{c}'$ the equation is 0.068, P> 0.05, not significant, the value b_1 is 0.388, P< 0.05, significant, the value b_2 is 0.441, P< 0.05, significant, and the hypothesis H2a and hypothesis H2b are valid. It shows that the effect of inbound open innovation on innovation performance is completely realized through novelty-centered business model or efficiency-centered business model, and the two-dimensional business model design plays a complete mediation role.

6 RESULTS DISCUSSION AND CONCLUSION

6.1 Managerial Implication

By building an external innovation network, firms can purposefully absorb and integrate external information or technology for internal innovation and commercialization, cooperate with external research institutions, purchase knowledge patents, user supplier participation and other inbound open innovation methods, and jointly establish an

open innovation network with external innovation organizations to obtain external creativity, knowledge Innovative resources, such as solutions and technical projects, are beneficial supplements to internal innovation, so as to improve the innovation ability of firms. In addition, the use of proprietary assets, knowledge sharing practices, complementary resource capabilities and effective governance based on inter organizational relationships will greatly enhance the quantity and speed of new product development, speed the new product to market and the advanced technology. Secondly, the development of inbound open innovation enables firms to timely clarify, understand and control customers and new market needs and their changes, which is conducive to the scientific and effective allocation of resources and network paths. Moreover, through the long-term utilization learning process in the network, firms enhance the ability to identify innovation opportunities, grasp innovation needs, quickly solve problems and maintain rapid response to new information.

Under the influence of inbound open innovation, firms should choose the appropriate business model to match the inbound open strategy. The firm adopts a novel business model to open the suppliers, partners and other trading parties in the network alliance, search for new trading partners, constantly adjust and build a new trading network to obtain external resources, build a business network through licensing, transfer and sale to output internal resources, and give play to the leverage mechanism through the integration of internal and external resources to improve the innovation efficiency of the firm and create new value. Through inbound open innovation and the use of efficiency business model, we can fully share information between firms and relationship networks, accelerate the flow of information, reduce the asymmetry of communication between the two sides, improve efficiency and enhance the bargaining power of firms in competition, so as to create value.

6.2 Conclusion

Through literature review and theoretical research, this study puts forward research hypotheses and constructs a model between the four variables. After completing the analysis of reliability and validity, we use correlation analysis and regression analysis to draw the research conclusion: inbound open innovation has a positive impact on innovation performance, and novelty or efficiency business model plays a complete mediation role in the impact of inbound open innovation on innovation performance. In the future, we can continue to study from the following aspects: (1) The types of open innovation can be divided into inbound and outbound, and we can study their impact on innovation performance from these two dimensions; (2) The sample firms studied are manufacturing firms, and there is no in-depth investigation and research on different types of manufacturing firms. we can focus on a certain type of manufacturing firms to make the conclusion more conducive to practice; (3) Explore the relationship between coupled business model and innovation performance.

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