

Guanxi, Co-Production and New Product Performance: a Moderated Mediating Effect Model

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Abstract—Guanxi is an important channel for small and medium-sized enterprises (SMEs) to obtain external resources, but literatures did not pay much attention on the impact of Guanxi on the mechanism of enterprise innovation. This paper examines the mediating effect of the relationship on co-production in the process of new product development by examining the sample data of 275 small and medium enterprises from the Yangtze river delta and the pearl river delta in China, and further examines the moderating effect of dynamic environment. It is found that the relationship can directly improve the performance of new products of SMEs, and can also play an indirect role through co-production. Dynamic environments enhance the relationship between co-production and new product performance.

1 INTRODUCTION

Guanxi has long been regarded as an advantage of Shandong people and attaches great importance. But in recent years it has been regarded by some as an obstacle to innovation and economic development, which is obviously counterintuitive. Guanxi is a local Chinese concept. There are different concepts related to it in English literature and different expressions in other language contexts. But the definition of "Guanxi" in different contexts is not completely consistent with the translation. In the Chinese business environment, relationships are defined as interpersonal relationships between individuals that imply reciprocal obligations and mutual assistance. It occurs at the individual level, but it can benefit the whole organization.

Although the relationship resource comes from the external environment, it is a unique social capital within the enterprise, and an important channel to obtain external resources, bringing more successful opportunities for enterprise innovation. Literatures on relationship-driven enterprise innovation have focused more on the role of political relations and less on the role of business relations. Moreover, the existing literature focuses more on the direct impact of relationship on enterprise innovation, and less on the exploration of its mechanism. Therefore, in order to further expand the existing theoretical development, this paper will explore the influence of relationship on the innovation of SMEs, and further explore its mechanism of action -- the intermediary effect of co-production. This study is conducive to expanding the theory of how relationships drive enterprise innovation, and the research results can

also provide theoretical guidance for SMEs on how to improve product innovation efficiency.

2 LITERATURE REVIEW AND RESEARCH HYPOTHESES

A. Relationship and innovation

The word "Guanxi" in Chinese refers to the relationship between two or more entities, which can exist between human and non-human, between living and non-living, or even between concrete or abstract entities^[1]. The definition of "Guanxi" in different contexts is not completely consistent with the translation^[2]. Concepts in English literatures related to Guanxi include Relationship, Networked Relation, Social Capital, Social Connection and Managerial Tie, Reciprocal Obligation^[2], and Favor, and so on. However, the concept of Guanxi in Chinese derives from traditional Confucianism, which holds that human nature is Guanxi-oriented and that a strong and orderly hierarchy of relationships contributes to the realization of social and economic order. In the Chinese business contexts, Guanxi is defined as interpersonal relationships between individuals that imply reciprocal obligations and mutual assistance^[3]. Guanxi occurs at the individual level, but they can be used to benefit organizations and form organizational networks^[4].

SMEs are small in scale, lack of capital, lack of innovation resources, and are often unable to complete effective new product development due to lack of key knowledge or ability. Therefore, using external resources for innovation is an important way for SMEs to achieve rapid growth. Garud and Karnoe^[5] once mentioned a

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case of Danish wind turbine companies using relational resources for innovation. The company was unable to improve its product because it could not obtain key new parts, so it had to turn to its waste dealers to pick out key parts from the waste products for product improvement. But surprisingly, the parts recovered from the waste were better than their American counterparts, which used the new parts. Although this situation is not common in reality, this case is enough to demonstrate that enterprises lacking innovation resources can obtain key resources through external relations to realize innovation. Moreover, when the external environment changes rapidly, it is difficult for enterprises to have enough time to choose their favorite resources. Using relationships to obtain convenient external resources may be the best choice for them to realize rapid innovation.

The performance of a company's new product depends on the degree to which the product meets the market demand and the efficiency of channel management. The good relationship between enterprises and customers is conducive to the development of new products with market competitiveness and the improvement of channel management level in the listing process. First of all, a good relationship between enterprises and customers can help them acquire more knowledge from the outside^[6] and high-quality, timely information^[7], enhance subsequent interaction and promote mutual cooperation to benefit both sides. Secondly, trust, especially trust in capabilities, will enhance the partners' confidence in the success of innovation, thus making them more willing to cooperate with enterprises, such as sharing knowledge and technical expertise and increasing communication^[8]. Thirdly, the human dimension of the relationship between enterprises and customers means reciprocity, in which both parties believe that their efforts will be rewarded. If the enterprise has a good relationship with the customer, the customer will be more willing to share key technical knowledge with the enterprise, to help the enterprise break through the innovation problem; During the launch of new products, customers will take the initiative to help enterprises improve channel efficiency by reducing costs and ensuring fast delivery of quality. They will benefit from helping each other in the future. In conclusion, the hypothesis is proposed as follow:

H1: Guanxi has a significant positive effect on the new product development performance of SMEs.

B. The mediating effect of co-production

Co-production is a series of activities undertaken by economic and social actors within the network. It integrates mutual resources to achieve value allocation through collaboration and dialogue execution^[9]. Co-production involves working directly or indirectly with customers. Customer involvement can take the form of a catalytic role on the periphery of a company's processes or an active role by applying knowledge and sharing information with the company. The success of co-production also requires the satisfaction of three necessary conditions^[10]: opportunities for combination or

exchange, expectations for innovative results, and incentives.

Firstly, as a kind of social capital, relationship helps enterprises obtain various resources necessary for innovation and provides opportunities for enterprises to combine or exchange. Managers or r&d personnel of SMEs can obtain resources through their personal relationships, which can be tangible material resources or funds, or intangible information or knowledge^[11]. With the help of these external resources, enterprises can carry out innovative activities that could not be carried out by relying on their own resources. Second, relationships can raise the expectations of successful innovation on both sides of the partnership. The cooperation based on a good relationship is conducive to the formation of an innovative atmosphere of mutual trust, so that researchers pay more attention to the long-term and team results, effectively avoid the conflict between team interests and individual interests, and improve the cohesion of the team. Third, the relationship is conducive to enhancing the incentive of innovation achievements to both parties. In the process of cooperative innovation, reputation and altruism within the network are the main perceived benefits^[12]. By sharing knowledge with the enterprise to complete collaborative innovation, customers can improve their image and build their reputation as technical experts in the network. When an enterprise conducts cooperative development with well-connected customers, both sides work towards the same goal, which will reduce disputes caused by cognitive differences^[13] and increase altruistic behaviors between them^[14], obtaining satisfaction by demonstrating their altruistic behavior^[15]. In conclusion, the hypothesis is proposed as follow:

H2: Co-production plays an intermediary role in the influence of Guanxi on the performance of new product development of SMEs, that is, Guanxi can promote the co-production of customers and SMEs, thus improving their performance of new product development.

C. The moderating effect of dynamic environments

Environmental dynamics can be considered from both technical and market perspectives^[16]. Technological turbulence reflects the speed of innovation in the industry and pushes enterprises to accelerate the pace of new product development in response to external competition^[17]. Market volatility is reflected in the continuous changes in customer preference, competition structure and product prices, which makes it more difficult for enterprises to accurately judge the market. Therefore, under the dynamic changing environment, enterprises cannot respond to all the technology and market development internally, so they must take the initiative to acquire external knowledge and provide new solutions to cope with the dynamic environment faster^[18]. Previous studies have found that using external knowledge for exploratory innovation is more effective in a dynamic environment, while using internal knowledge for development and learning is detrimental

to the financial performance of an organization. In conclusion, the hypothesis is proposed as follow:

H3: Dynamic environment can adjust the relationship between co-production and new product performance. When the environment is more dynamic, the effect of co-production on new product performance will be enhanced. When the environment becomes less dynamic, the effect of co-production on the performance of new products will be weakened

3 RESEARCH METHODS

A. Sample

The sample enterprises are all small and medium-sized manufacturing enterprises with overseas business. Jiangsu province in the Yangtze river delta and Guangdong province in the pearl river delta are selected for the survey. These two regions have a large number of small and medium-sized manufacturing enterprises engaged in import and export business, which belong to the regions with developed manufacturing industry. According to the random sampling method, enterprises meeting the screening conditions were selected from march to August 2018 to issue and return the questionnaires, which were divided into two rounds. In the first round, 210 questionnaires were collected, and 45 questionnaires with incomplete information and inconsistencies were eliminated. In the second round, 140 questionnaires were collected, and 30 questionnaires with more data missing were eliminated. A total of 275 valid samples were obtained through the two questionnaires.

B. Variables and measurements

In order to ensure the reliability and validity of the measuring tools, the scales used in the study were mainly mature scales in domestic and foreign literatures. Likert grade 7 score was used for evaluation. From 1 to 7, the acceptance level of respondents to the measurement items was indicated: 1 was "strongly opposed" and 7 was "strongly agreed". For the measurement items of the main variables, please refer to table 1. According to the existing research results, factors at the enterprise level can also affect the performance of new products. Enterprise size and age are used as control variables. The measurement method of enterprise size is the natural logarithm of sales, and the measurement method of enterprise age is the length of time from the enterprise registration to 2017. Relevant studies have pointed out that SMEs pay more attention to product innovation in order to gain competitiveness in export (Zhang, Hartley, 2018), so competitiveness is also taken as a control variable in the model.

TABLE I. VARIABLES AND MEASUREMENT

Variables	Items	Factor Loading	AVE	CR	α
NPP	Our new product is of good	0.849	0.632	0.841	0.706
	The price of our new product is reasonable	0.823			
	Our new product arrived on time	0.706			
GX	We have good personal relationships with major suppliers	0.810	0.564	0.795	0.702

	We have a good personal relationship with our major buyers	0.697			
	We have a good personal relationship with our main agents	0.742			
CP	Our major customers cooperate with us in NPD	0.892	0.676	0.862	0.758
	Our key customers work with us to improve the new products	0.764			
	Our major customers work with us to develop new products	0.806			
DE	The technology in our industry is changing fast	0.767	0.531	0.850	0.668
	In our industry, most technological developments are fundamental changes to existing technology	0.735			
	In our industry, changes in technology can open up many opportunities for companies	0.745			
	In our business, customers' needs and preferences for products vary greatly over time	0.707			
	Our customers always tend to look for new products in the market	0.689			

C. Reliability and validity

The reliability of variables is measured by Cronbach's Alpha, as shown in table 2. Cronbach's Alpha of most variables is greater than 0.7, while the Alpha coefficient of Cronbach's of dynamic environment is 0.698, slightly lower than 0.7. Generally speaking, the reliability of the scale is good. The above variables were measured using mature overseas scales, which have been used many times in related studies, so the content validity of the scales is good. In the process of data processing, confirmatory factor analysis was used to further test the structural validity of the scale, mainly convergence validity and discriminant validity. It can be seen from table 2 that the factor load of each variable item is within the range of 0.656-0.892, which is significant, and the combined reliability CR value of each scale is greater than 0.70, and the mean variance extraction variation value is greater than 0.50 threshold value, so the scale has good convergent validity. At the same time, the square of the maximum value of the correlation coefficient between different factors is less than the minimum value of AVE of each factor, that is, the relative value of any two variables in the model is less than their AVE values, so the discriminant validity of the scale is better.

D. Homologous variance and no reaction bias test

In this study, Harman's single-factor method was used to conduct homologous variance test, and exploratory factor analysis was performed on the measurement items of all variables such as relationship, co-production, dynamic environment and new product development performance. According to the results of exploratory factor analysis, the cumulative contribution rate of the first factor is 33.72%, and the threshold value is less than 50%, so it can be considered that homologous variance will not significantly affect the results. At the same time, non-response deviation test was conducted, that is, whether there were significant differences in sales volume, number of employees, age of enterprises and other aspects of the data collected before and after two rounds were tested by the independent sample T-test. The results showed that the t value was not significant at the level of 0.05, so there was no unresponsive bias in the data. Moreover, the above three factors are not significantly different in the

T-test of the two provinces, which further supports that there is no unresponsive bias in the data.

4 HYPOTHESIS TESTING

A. Correlation analysis and T-test

In this study, Pearson and Spearman correlation analysis was conducted for each major variable. The independent variable and new product performance were significantly positively correlated in Pearson and Spearman test, and hypothesis 1 was preliminarily verified. There is a significant positive correlation between the intermediary variable co-production and the performance of new products, indicating that customer co-creation has an important impact on the performance of new products. There is a significant positive correlation between independent variables and intermediate variables in co-production, indicating that the relationship has an important impact on co-production. On this basis, the `coldiag2` command is further used to test whether there is a serious multicollinearity problem between the main variables. The test result is less than the threshold value of 30, indicating that there is no serious multicollinearity problem between the variables. In addition, the main variables were grouped according to the median of the relational variables, and the mean differences between different groups of variables were compared. The results showed that the performance of new products and co-production in the better relationship quality group were higher than those in the lower relationship quality group, which further indicated that the relationship had a significant promoting effect on the performance of co-production and new products.

B. Main effect and mediating effect test

Testing to the main effect and the mediation effect are as follows: the first step to test the influence of the independent variable on the dependent variable of new product performance (M1), and then test the independent variable for the intermediary variable customer to create the effect of (M2), and finally, the intermediary variable and independent variables and at the same time into the model 3, test their influence on the performance of new products, test results are shown in table 2. The emotional dimension of the relationship has a significant effect on the performance of new products ($\beta=0.362$, $P<0.001$). Hypothesis H1 is verified, indicating that the relationship between employees and customers is conducive to improving the performance of new products of SMEs. Emotional impact on customer co-creation is also significant ($\beta=0.413$, $P<0.001$); From the point of the test results of model 3, at the same time into the feelings and customers to create a test their effect on new product performance, the regression coefficients are significant, and the feelings of standardized regression coefficients decreased significantly after join intermediary variables, from 0.362 to 0.26, so that customers create in the emotional relationship between the performance of new product has partial intermediary role, assuming that H2 through inspection.

TABLE II. MAIN EFFECT AND MEDIATING EFFECT

	(1)	(2)	(3)
Variables	M1(NP)	M2(CP)	M3(NP)
competency	0.180***	0.172***	0.138***
firmage	-0.069	0.061	-0.084
sale_1	0.011	0.027	0.004
GX	0.362***	0.413***	0.260***
CP			0.248***
Constant	2.917***	1.881***	2.451***
Observations	274	274	274
Adj R ²	0.232	0.267	0.274
soe FE	YES	YES	YES
F-test	17.454	20.852	18.172
Prob > F	0.000	0.000	0.000

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

C. Moderating effect test of dynamic environment

In this study, hierarchical multiple regression method was used to test the moderating effect of dynamic environment on the relationship between customer co-creation and new product performance. Team effectiveness and moderating variables (model 4) are put in first, and again, the interaction terms of the customer co-creation and dynamic environment (model 5). The test results are shown in table 3. According to the data analysis results, dynamic environment had a significant moderating effect on the relationship between co-production and new product performance ($\beta=0.129$, $P<0.001$), and Adjusted R² was improved from 0.238 before to 0.282 after the addition of the interaction terms, and the model interpretation was significantly enhanced after the addition of the interaction terms. This result indicates that when the environment is dynamic, the positive effect of co-production on the performance of new products will be strengthened.

TABLE III. MODERATING EFFECT OF DYNAMIC ENVIRONMENT

	(1)	(2)
Variables	M4(NP)	M5(NP)
competency	0.183***	0.158***
firmage	-0.029	-0.040
sale_1	-0.015	-0.013
soe	-0.564***	-0.548***
internation	0.130	0.131
CP	0.337***	0.282***
DE		0.258***
DE * CCC		0.129***
Constant	3.049***	2.073***
Observations	211	211
Adjusted R-squared	0.238	0.282
F-test	11.959	11.288
Prob > F	0.000	0.000

D. Further testing

On the basis of the above analysis, Sobel test, Goodman1 test and Goodman2 test were respectively

conducted by sobel-goodman method. The test results show that the Sobel, Goodman1 and Goodman2 statistics of co-production are all significant. It is assumed that H2 is further supported, that is, the influence of the relationship on the performance of new products is partly co-created by customers, and the intermediary effect of co-production on the relationship is 31.9%.

5 CONCLUSION AND PROSPECT

The purpose of this study is to explore the influence of Chinese-style relationship on innovation of SMEs and its mechanism by constructing a moderated mediating effect model and using questionnaire data from 275 technology-based SMEs for hypothesis testing. It is found that the three dimensions of Chinese-style relationship can not only directly improve the new product performance of SMEs, but also indirectly promote the new product performance of SMEs through the intermediary effect created by customers. At the same time, the dynamic environment will adjust the relationship between customer co-creation and new product performance. When the environment is more dynamic, the effect of customer co-creation on new product performance will be enhanced.

This paper tries to explore the mechanism of the influence of Chinese-style relationship on the development of new products of SMEs. Although some research findings have been made, there are still some limitations, which need to be further explored in the future. First of all, this paper only USES data from small and medium-sized manufacturing enterprises with overseas business in the Yangtze river delta and the pearl river delta for hypothesis verification. The research conclusions may have certain industry limitations. In the future, the comparative study of small and medium-sized enterprises in other regions or service industries can be considered to strengthen the research results of this paper. Secondly, in addition to customers, external participants in the development of new products can also include suppliers, investors and users. This paper only studies the role of customers. The follow-up research can further expand the scope of external subjects involved in enterprise innovation. Finally, in addition to the external environment, the situational factors that affect customer co-creation may also play a moderating role. Future studies can focus on situational variables such as team innovation atmosphere, organizational culture and leadership style.

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