

Research on the influence of knowledge diffusion on enterprise innovation ability——The regulation effect based on regional distance

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Abstract: Based on the theories of knowledge diffusion and innovation capability, this paper constructs a relational model of knowledge diffusion and innovation capability in universities, and puts forward the hypothesis of university knowledge diffusion, enterprise absorptive capacity, regional distance and enterprise innovation capability. A questionnaire was used to investigate the enterprises in the ring and Yuncheng knowledge economy circle, and the regression analysis was used to test the hypothesis. The empirical results show that knowledge diffusion in universities has a positive effect on enterprise innovation ability, and absorptive capacity plays a partial intermediary role between knowledge diffusion and innovation capability, and regional distance plays a moderating role between university knowledge overflow and enterprise innovation capability.

Key words: knowledge diffusion in Colleges and universities; enterprise absorptive capacity; enterprise innovation ability; regional distance

Introduction

The university is a research subject, also an important source of knowledge diffusion, plays an important role in the construction of technology innovation system, but the current low efficiency of the cooperation, to a certain extent affected the absorption of the enterprise knowledge diffusion and innovation ability. Therefore, how to make effective use of knowledge diffusion and enhance the capability of independent innovation and innovation has become a hot topic for management practitioners and theoretical researchers.

With regard to the study of the relationship between knowledge diffusion and enterprise innovation ability, scholars have paid more attention to the discussion of knowledge diffusion between enterprises on enterprise innovation ability. For example, Audretsch and Feldman ^[1] demonstrate the existence and measurability of knowledge diffusion between enterprises from the perspective of innovation output and spatial distribution of innovation activities, and discuss the mechanism and influencing factors of knowledge diffusion among enterprises in promoting enterprise innovation process. Some scholars also pay attention to the role of knowledge diffusion in Colleges and universities. For example, Mowery ^[2] scholars have found that the knowledge of colleges and universities will overflow to the public institutions and benefit them. The research of domestic scholars mainly focuses on the mechanism of knowledge diffusion to knowledge diffusion in enterprises. For example, Wang

Liping^[3], it is found that the influence of knowledge diffusion on knowledge diffusion is positive and significant. But what is the role of knowledge diffusion in Colleges and universities for the innovation ability of the surrounding enterprises? What is the mechanism of knowledge diffusion in Colleges and universities?

1.Theoretical basis and research hypothesis

1.1 knowledge diffusion in Colleges and Universities

Fallah and Ibrahim ^[4] believe that knowledge diffusion refers to the unconscious transfer of knowledge among the subjects. Knowledge diffusion is a complex process, which includes explicit knowledge diffusion and tacit knowledge diffusion. Explicit knowledge can be transmitted by standardized and systematic language. Tacit knowledge, including beliefs, mental models and insights, is hard to replicate and imitate ^[5]. The knowledge diffusion for enterprises is the knowledge communication of University researchers and R & D personnel in a direct or indirect way, in the process of communication and interaction ^[6].

1.2 university knowledge diffusion and the innovation ability of the surrounding enterprises

Ari ^[7] thinks that enterprise innovation ability refers to the improvement of enterprise ability brought by product innovation or process innovation. The

innovation ability of enterprise depends on the innovation of product, production, organization process and service to a great extent. In order to better carry out innovative activities, enterprises need different types and levels of innovation capabilities, these capabilities include the management of innovation activities, the ability to acquire human resources and build knowledge base [8]. Birkinshaw and Young [9] research shows that the realization of enterprise's innovation capability is also important for external force, besides the influence of self capability. Simone and Mccann [10] research shows that knowledge inflow is an important external force to promote enterprise innovation and improve innovation ability, and external explicit knowledge diffusion promotes knowledge into enterprises. Thus, the diffusion of external explicit knowledge has an important impact on enterprise innovation ability. In addition, Fallah and Lbrahim^[4] argue that tacit knowledge plays an important role in the diffusion of knowledge, also has an important role in promoting enterprise innovation output, mainly reflected in the way the effect of tacit knowledge diffusion and diffusion, through knowledge talents in different spatial range of flow of tacit knowledge diffusion, and group interaction and communication around [11], the diffusion path on the one hand to promote the creation of new knowledge, on the other hand, to speed up the dissemination of knowledge in different groups, so as to promote technological innovation. Thus, University is the main dissemination of knowledge innovation, the university can promote the knowledge diffusion of the dominant knowledge

and knowledge flow into the enterprise talent flow in different space, exchanges and cooperation between knowledge and skills, to university and enterprise information, so as to promote and enable enterprises to gain more innovative activities in Colleges and Universities from the diffusion of knowledge resources needed then, to improve the innovation ability. According to this, the following assumptions are put forward:

H1: knowledge diffusion in Colleges and universities has a positive effect on the innovation ability of the surrounding enterprises.

1.3 The intermediary role of enterprise absorptive capacity

Cohen and Levinthal ^[12] believe that absorptive capacity is a kind of ability to evaluate, assimilate and apply external new knowledge to form commercialization eventually, and point out that knowledge reserve is one of the important factors that affect its absorptive capacity. Yli and Autic ^[13] studies have found that knowledge diffusion between organizations is beneficial to the organization of knowledge, skills and experience, thus improving the ability of organization to acquire and transform knowledge. Ahuja and Katila ^[14] believe that the acquisition of technical and professional talents in related fields can effectively improve the knowledge base of enterprises and form knowledge accumulation, which helps to improve the ability of enterprises to acquire, digest and apply knowledge. The research of Zahra and George ^[15] shows that the absorptive capacity of an enterprise can be divided into potential

absorptive capacity and real absorptive capacity. Knowledge acquisition and knowledge digestion ability belong to the potential absorptive capacity of enterprises, and the ability of knowledge transformation and knowledge application belongs to the real absorptive capacity of enterprises. It can be seen that the university is an important source of knowledge diffusion, the explicit and tacit knowledge diffusion is conducive to the accumulation of knowledge and reserves, promote enterprise to digestion and transformation of knowledge, and then promote the enterprise potential absorption. This can be seen as an important source of university knowledge diffusion, the explicit and tacit knowledge diffusion conducive to the accumulation of knowledge and reserves, promote enterprise to digestion and transformation of knowledge, and then promote the potential absorptive capacity and realistic absorption capacity.

Schilling ^[16] research shows that the improvement of absorptive capacity of enterprises can further consolidate their knowledge and technology base, improve their knowledge acquisition, utilization and transformation capabilities, and further promote their technological innovation, while technological development contributes to the improvement of enterprise innovation capability. Study on Wei Ying ^[17] also confirmed this view, he believes that plays a key role in the absorptive capacity of enterprises to improve enterprise innovation ability, the absorptive capacity of enterprises can not only enable enterprises to obtain external new knowledge, increase the accumulation of knowledge, but

also through knowledge sharing within the enterprise and the application of knowledge in product innovation and service innovation then, to improve the innovation ability of enterprises.

Based on the above analysis, it can be seen that the diffusion of knowledge in Colleges and universities can enhance the absorptive capacity of enterprises and enhance the innovation ability of enterprises. According to this, the following assumptions are put forward:

H2: enterprise absorptive capacity plays a mediating role between knowledge diffusion and enterprise innovation ability in Colleges and Universities

1.4 The regulation of regional distance

Knowledge communication refers to the process of knowledge, skills, information, new ideas and so on through the spread of time and space, so that the process of knowledge sharing among the different subjects of knowledge is realized ^[18]. Thus, it can be seen that knowledge dissemination is influenced by the distribution of the space and time of the subject and object. Knowledge dissemination is an important process of knowledge diffusion in universities. The effect of knowledge diffusion in universities will also be influenced by the time and space distance between universities and their knowledge dissemination objects. Anselin^[6] found that knowledge space diffusion has local or spatial embeddedness characteristics, which makes geographical distance and distance have important influence on knowledge

diffusion. Torre and Gly^[19] research shows that shorter geographical distance can promote better interaction between two sides, promote communication and cooperation between knowledge, skills and information, and further promote organizational knowledge diffusion. Antonelli^[20] further found that high regional distance is conducive to frequent face-to-face communication between organizations, promote the spread of tacit knowledge, and further promote enterprise innovation. The study of Wang Liping³ shows that knowledge diffusion from the geographic media of colleges and universities is widespread, and the diffusion of knowledge in Colleges and universities is space dependent. Based on the above analysis, this paper puts forward the following assumptions

H3: regional distance can enhance the relationship between knowledge diffusion and innovation capability, that is, high regional distance will enhance the positive impact of knowledge diffusion on enterprise innovation capability.

2 Research Methods

2.1 Research Objects

The study obtained data from the questionnaire, and the respondents were from the enterprises around the Yuncheng knowledge economy circle. The data mainly come from 33 enterprises in Yuncheng City, the results of questionnaire, the questionnaire is the main object in the senior management of the enterprise, this is because the focus of this study is mainly on the

enterprise level, and under normal circumstances, managers and working hours in the company because of high the level is relatively long, have more knowledge of the business strategy and performance, they on the various aspects of enterprise information more fully, so as to ensure the smooth realization of the project in the study. During the research process, 330 questionnaires were sent to enterprises in the knowledge circle of Yuncheng rim, and 283 questionnaires were actually recovered, with a recovery rate of 85.8%. After rejecting the unqualified questionnaires, 256 valid questionnaires were finally obtained, with an effective recovery rate of 77.6%. Among them, 83.7% of the small and medium-sized companies with less than 100 enterprises and 69.1% of the company under 10 years.

2.2 Variable Measurement

This study involves 4 variables: knowledge diffusion ability, enterprise innovation ability, enterprise absorptive capacity and regional distance. According to the relevant research literature at home and abroad and the actual situation of China's universities and enterprises, this study defines and measures the variables in the model.

The knowledge diffusion of independent variables in Colleges and universities includes 6 problems: the diffusion of explicit knowledge and the spread of tacit knowledge. The absorptive capacity of the medium variable enterprises, including the potential absorptive capacity of the enterprise and

the actual absorption capacity of the enterprise, is a total of 12 problems. There are 4 questions in the innovation capability of dependent variable. The distance between regulatory variables and distance is measured by the actual spatial distance. In this paper, the distance between enterprises in Yuncheng knowledge economic circle is recorded as 5, 3 and 1 respectively. The control variables in this study include the size of the enterprise and the number of years of the business. In addition to adjusting variables, three variables were used to measure the above variables. All the other variables were scored by Likert five point scale. Choose 1 - very low, choose 5 - high.

3 data analysis and results

3.1 reliability and validity test

Before the model is verified, the reliability of all the elements involved in the study is analyzed, that is, reliability analysis. The reliability of the questionnaire was tested by calculating the coefficient of internal consistency of the various variables. The Cronbach 's alpha value was estimated and verified. It is generally considered that the alpha value is greater than 0.70 as the standard of measurement recommendation, indicating that the survey has high measurement quality (Table 1).

Through the exploratory factor analysis of the validity of the enterprise innovation ability questionnaire, this paper uses 4 items to measure the innovation ability. In order to get the innovation ability factor, we adopt the

exploratory factor analysis method. The test results showed that the KMO value was 0.87, the Bartlett spherical test value was 372.35, and the significant level was 0, indicating that it was suitable for factor extraction. The results show that the public factors explain 67.06% of the total variation, indicating that the innovation capacity scale has a good construction validity.

3.2 descriptive statistical results

The Spss20.0 was used to make descriptive statistics. The correlation coefficient of the mean and standard deviation of the variables was shown in Table 1. The research hypothesis proposed in this paper has been preliminarily supported, and the knowledge diffusion in Colleges and universities has a significant positive correlation with the enterprise absorptive capacity.

Table 1:

	Alpha	Path	MSE
The ability of knowledge diffusion in Colleges and Universities	0.807	0.861	0.63
Enterprise absorptive capacity	0.700	0.849	0.72
Technological innovation ability of enterprises	0.731	0.761	0.65
Regional distance	0.812	0.729	0.75

3.3 Comparison of structural equation models of mediating effects

The three step medium regression analysis method is used to test whether the enterprise absorptive capacity has the intermediary effect between knowledge diffusion and enterprise innovation ability. The first test of university knowledge

diffusion is the ability to have a significant impact on enterprise absorption, followed by testing the knowledge diffusion is the innovation ability of the enterprise has a significant effect, the final test of absorptive capacity of enterprises (including the knowledge diffusion) on whether the enterprise innovation ability has significant influence on the results, see Table 2

Table 2: An analysis of the intermediary role of enterprise absorptive capacity

Variable	Enterprise absorptive capacity		Technological innovation ability of enterprises	
	M1	M2	M3	M4
1. Control variables:				
Enterprise scale	0.13	0.13	0.08	0.08
Business years	0.14	0.12	0.03	0.02
2. Independent variable				
Knowledge diffusion in Colleges and Universities		0.34	0.3	0.26
3. Mediating variables				
Enterprise absorptive capacity				0.34
R ²	0.07	0.40	0.34	0.37
ΔR ²	0.07	0.33	0.32	0.03
ΔF	5.47	32.24	38.44	31.34

Can be seen from table 2, the regression equation of intermediary variables of independent variables, for mediating the absorptive capacity of enterprises, the knowledge diffusion has significant positive effects on the absorptive capacity of enterprises, after excluding the influence of control variables, the knowledge diffusion variation can explain enterprise absorptive capacity of 26% (see model 2), university knowledge diffusion variation can

explain the enterprise innovation ability 33% (see model 4)

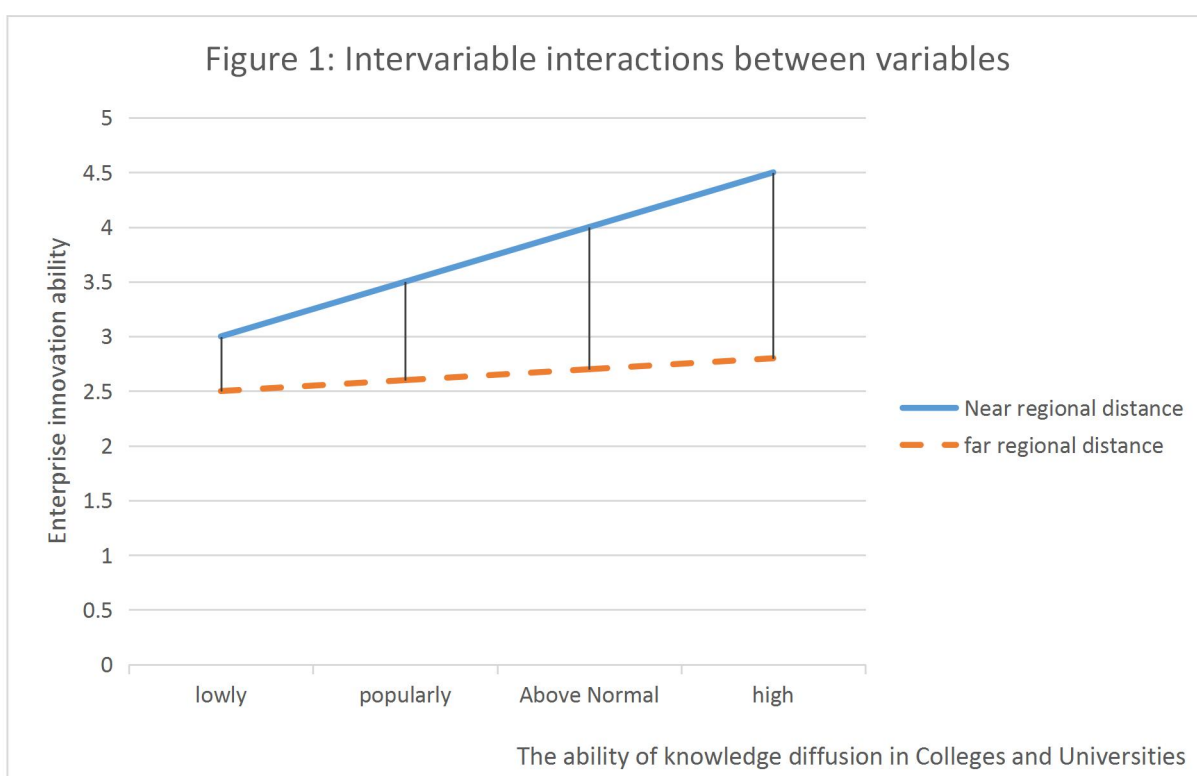
In Table 2, it can be seen that knowledge diffusion in Colleges and universities has a significant positive impact on enterprise innovation ability. At the same time, the influence of absorptive capacity and knowledge diffusion on innovation ability of enterprises is also investigated. These results indicate that play a part of the intermediary role between the absorptive capacity of enterprises in the knowledge diffusion and innovation ability of enterprises; and for mediating the absorptive capacity of enterprises, and the effects of absorptive capacity and the knowledge diffusion effect on enterprise innovation ability, has significant positive effects of absorptive capacity of enterprises, affecting the knowledge diffusion are significantly reduced.

The above results show that the enterprise absorptive capacity plays a partial intermediary role between the knowledge diffusion and the innovation ability of the enterprise.

3.4 Hierarchical regression analysis of regulation effect

This paper uses the hierarchical regression analysis to test the regulatory role of knowledge diffusion in the process of influencing the innovation ability of enterprises. First, the control variable is introduced into the regression equation. Secondly, the distance between the knowledge diffusion and the variable area of the independent variable is introduced into the regression equation. Finally, the interaction term between knowledge diffusion and

regional distance is introduced into the regression equation. Hierarchical regression analysis showed that the control of the control variables, the main effect of adding knowledge diffusion in universities and regional distance between the two variables, the enterprise innovation ability explanation effect increased significantly ($R^2=0.311$, $p<0.01$). The interaction effect between regional distance and university knowledge diffusion has a significant impact on enterprise innovation ability (the standardized slope is 0.187, $p<0.01$), which indicates that the relationship between regional distance and knowledge innovation and innovation ability is significant. In addition, the 4 points of knowledge difference and distance between universities and colleges are selected as the benchmark for drawing the interaction diagram of variables (see Figure 1). From Figure 1, it can be seen that the higher the regional distance, the higher the positive effect of knowledge diffusion on the enterprise innovation ability.



4. Conclusion

The purpose of this study is to explore the influence mechanism of knowledge diffusion on corporate innovation capability, especially the mediating role of absorptive capacity and the moderating role of regional distance. First of all, through the review on the knowledge diffusion, absorptive capacity and innovation ability of literature, put forward a series of hypotheses, and then use the questionnaire data obtained on the concept of scale reliability and validity, and to examine the hypothesis by regression equation model. The study found that: 1 the explicit and tacit knowledge diffusion is positively related to the innovation ability of the enterprise; the University of knowledge diffusion, absorptive capacity has significant predictive effects on the ability of innovation; the potential absorptive capacity and practical business absorptive capacity plays a partial intermediary role between explicit knowledge and tacit knowledge diffusion diffusion and innovation ability of enterprises in the area of colleges and universities; distance between University and enterprise innovation ability of knowledge diffusion plays a moderating role.

4.1 Theoretical significance and practical enlightenment

The purpose of this study is to explore the influence mechanism of knowledge diffusion on innovation capability, especially the mediating role of corporate absorptive capacity and the moderating effect of regional distance. Its main theoretical contributions are embodied in the following two aspects.

(1) in past studies, the relationship between knowledge diffusion and enterprise innovation capacity was mainly concerned with the role of knowledge diffusion, and the lack of research on the relationship between knowledge diffusion and innovation capability. In addition, this paper combs the literature about knowledge diffusion and innovation capability in universities, and finds that geographic distance also has an important impact on knowledge diffusion and enterprise innovation ability, but there are relatively few empirical studies. Therefore, this paper explores the relationship between knowledge diffusion and innovation capability from the perspective of regional distance, and further enriches the research on the relationship between knowledge diffusion and innovation capability.

(2) to discuss the knowledge diffusion of colleges and universities from an important perspective of production, learning and research. The current research focuses on the common development between the three sides of enterprises, universities and research institutes. However, there is a lack of research on how to enhance cooperation between universities and enterprises, and promote knowledge diffusion and innovation in universities. Therefore, this paper further enriches the related theories of production, learning and research, and provides an important empirical support for strengthening the cooperation between school and enterprise.

4.2 Limitations and Prospects

Taking the knowledge economic circle in Yuncheng rim as an example, this paper discusses the influence and influence process of knowledge diffusion on neighboring enterprises' innovation ability in Yuncheng. Although some beneficial discoveries have been made, this paper still has some limitations. First of all, select the enterprises in the knowledge circle of Yuncheng rim as a research sample, which is representative and unique. At the same time, the universality of the questionnaire survey results and conclusions is limited. In the future research, the enterprises of other universities and colleges can be selected as the research object to further verify the universality of the conclusion. Secondly, for the regional distance measurement, we use Laura and Helen approach, which uses the actual distance measurement, but Beckman believes that regional distance measurement is not only a measure of space distance, also need to consider the transportation or communication time and cost factors. Therefore, in the future research, we can further improve the measurement of regional distance.

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