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The Influence of University's Scientific and Technological Innovation Capability on University and Industry Collaboration Performance

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ABSTRACT

This research article deployed the mix methodology between qualitative by in-depth interview and quantitative of survey methodology by choose the university of science and technology innovation ability as a breakthrough for the development of university-industry collaboration performance influence factor. The study on relevant theoretical literature review and in-depth interview first, analyzed the ability of science and technology in the process of university-industry collaboration specific forms, and science and technology innovation ability affect university-industry collaboration performance are discussed in detail in the middle of the process, The empirical model and related hypotheses are established by finding the corresponding alternative variables, which aims to open up the process of how technological innovation ability affects university-industry collaboration performance. Then, the empirical data were collected from the organizational level questionnaire and the theoretical model was empirically studied by using structural equation model (SEM).

The results show that: first, resource matching variable is the key variable in the process of university-industry collaboration in the intermediate process affecting the performance of university-industry collaboration. Secondly, the scientific and technological innovation ability of universities will affect the performance of university-industry collaboration through the resource matching in the process of university-industry collaboration. Finally, the technological innovation ability of colleges and universities also has a direct impact on the university-industry collaboration performance.

1. Introduction

Innovation is the core competitiveness of enterprise economic development and an important factor of national economic prosperity. With the development of the world economy toward globalization, no matter for an enterprise, a region, or even a country, improving innovation ability has become the only way to cultivate the core competitiveness of enterprises and improve the international competitiveness. Universities have become an important force for the rapid development of national science and technology innovation. With the development of national science and technology innovation, more and more colleges and universities bear the arduous task of science and technology innovation and knowledge innovation (Li Jianghua, 2019).

University-industry collaboration mainly relies on university innovation and research teams or leading enterprises as the main body, and the formation mode starts the point is higher; It follows the law of scientific and technological innovation and market competition, and has the characteristics of novel system, flexible mechanism, efficient operation and talent gathering. Market-oriented, innovation-driven, industrialization development as the purpose, focusing on the front-end and terminal of the industrial value chain (Zhou Ende and Liu Guoxin 2017).

In this context, any university relying only on its own limited internal resources can no longer meet the demands of scientific and technological innovation for all kinds of resources, universities have to turn their eyes to external enterprises. In this paper, the scope of organization is defined as the organization based on colleges and universities. Therefore, the organization's scientific and technological innovation capability is defined as the university's scientific and technological innovation capability. Colleges and universities to truly become the main force of national science and technology innovation, science and technology must be combined with enterprise's demand of science and technology innovation advantage, to promote the development of industry (Gao Qing,2021). Universities play a leading role, actively around the economic construction and the needs of the development of the industry focus on the need of enterprise product development and technology upgrade, and use of scientific and technological innovation, promote the development of industrialization, the colleges and enterprises closely linked, to build a base for the transformation of achievements, take university science park as the carrier, undertake large-scale research and development projects, and give full play to the integration and promotion role of university science and technology innovation in economic development (Geng Di, 2013). It has been a trend of globalization to obtain higher university-industry collaboration performance through open innovation, so university-industry collaboration performance has increasingly become the focus of academic research.

The objectives of this study are based on scientific and technological innovation theory, university-industry collaboration performance theory and as the foundation, to enhance the collaboration between colleges performance as the research target, using the method of theory combined with empirical research, the research university's scientific and technological innovation capability of the influence of university-industry collaboration performance. To find out the key process factors that determine the collaboration performance, and construct the basic analysis framework of this study. To analyze the influence mechanism of innovation ability on the process of industry-university research collaboration is studied.

2. Objectives

To explore the influence of scientific and technological innovation ability on the performance of university-industry collaboration through key process factors in the process of university-industry collaboration. In order to improve the ability of scientific and technological innovation and the performance of university-industry collaboration, this paper puts forward scientific and feasible management countermeasures.

3. Literature Reviews

Hereunder, the brief literature review on the relationship between university's scientific and technological innovation capability, resource matching and university and industry collaboration performance is discussed.

3.1 University's Scientific and Technological Innovation Capability and University and Industry Collaboration Performance

In the field of technology innovation, scholars mostly study the influence of technology characteristics on the way and effect of technology transfer from the perspective of technology transfer, while university-industry collaboration is a kind of technology transfer between universities and industry. Technology is a synthesis of information and know-how. Technology exists not only as a kind of embodied technical information written down, but also as a kind of non-embodied and localized knowledge. That technology, as a knowledge product, has three important characteristics: first, it has both universality and particularity. Second, both implication and expressiveness. Some aspects of the technology can be well expressed in language, and the details can even be recorded in manuals or published as articles or taught in university. Most of the others are intentional and cannot be translated into words. The knowledge contained in the technology can only be learned through practice or cases. Third, both openness and confidentiality (Dosi, 1988). The historical experience of collaboration enables partners to better manage the relationship and reduce the cost of collaboration. That the richer the cooperative experience of both parties, the more likely cooperative innovation will be successful (Li Xia, 2007). That the technological transformation ability of universities is closely related to the collaboration results. The technological transformation ability of universities can be analyzed from the following four aspects: university R&D ability, university ability to judge the value of technology commercialization, university ability to assist and support technology transfer, and university openness (Meanwhile, Zhang Yan 2007). That German Fraunhofer Association is mainly oriented towards the reality of the business community demand, around the technical problems of enterprise development, to provide technical and R & D service support, and rely on a strong research developing scientific research universities carry out oriented research for future enterprises. And with colleges and universities as a link, promote production combine study and research with application to improve school-enterprise cooperation performance (Ningyan, H. & Yuming, S., 2018).

Hypothesis H1: University's scientific and technological innovation capability has a positive and significant relationship on the university-industry collaboration performance.

3.2 Resource Matching and University and Industry Collaboration Performance

According to the resource-based theory, the reason for the collaboration between organizations is that innovation often involves a variety of scarce resources, which are difficult to be mastered by a certain organization at the same time. Therefore, enterprises will try to solve problems through the collaboration of resource exchange when faced with difficulties that are difficult for them to overcome (Barney, 1991; Dill, D. 1990). If the heterogeneous resources possessed by both parties can coordinate and match each other to meet the needs of each other, the collaboration performance will be higher (Geisler, E. 1995; Powell et al., 2005). According to the resource-based view, collaborative innovation is carried out by organizations to meet their own strategic resource needs. The complementary of resources is the core driving force for organizations to carry out cross-border cooperative innovation (Vuola O., 2006). The performance evaluation index system of cooperative research institutions from the perspective of research input and resource complementary by using the balanced scorecard on the basis of the current status of performance evaluation of cooperative research institutions (Ruihua, W. & Xuelin, C., 2018). Colleges and universities can make full use of their own advantages in scientific and technological resources and enterprises' resources cooperation to build an exchange platform. Solve various types of applications in the process of exchanging experience and technology so as to refine the research and innovation points, and finally expand the research direction and research field to improve the cooperation performance (Jianghua, L., 2019).

Hypothesis H2a: Resource matching has a positive and significant relationship on the university-industry collaboration performance.

3.3 University's Scientific and Technological Innovation Capability, Resource Matching and University and Industry Collaboration Performance

Colleges and universities in the collaboration between colleges and enterprises are a lot of standards to choose a good partner, including the history of the partner cooperation experience, partners, credit and reputation, the accumulation of partners, partners, technical transformation ability, partners in the geographical position, etc., but anyway, will eventually be implemented to resource matching degree between the two sides, It can be said that resource matching degree is the core index to evaluate the quality of partner selection. Therefore, this study uses the construct of "Resource Matching" to characterize the suitability of partners in university-industry collaboration (Yingxiang, D., 2011). For industry if the cost of technology development within the cooperation is too high or the complexity and uncertainty of innovation increase, collaborative innovation will become an important choice for enterprises' innovation strategy, because partners can share the innovation cost for enterprises and effectively reduce the risk of innovation (Agrawal A K, 2010). That universities-industry collaboration innovation can not only enable start-ups to obtain complementary assets, but also share costs and share costs risk, and then improve their R&D productivity and cooperation performance (Okamuro et al, 2010).

Hypothesis H2b: University's scientific and technological innovation capability has a positive and significant relationship on the Resource matching.

Hypothesis H2: Resource matching positively mediate the relationship between university's scientific and technological innovation capability and university-industry collaboration performance.

The proposed hypothesized conceptual framework is illustrated in figure 2.1.

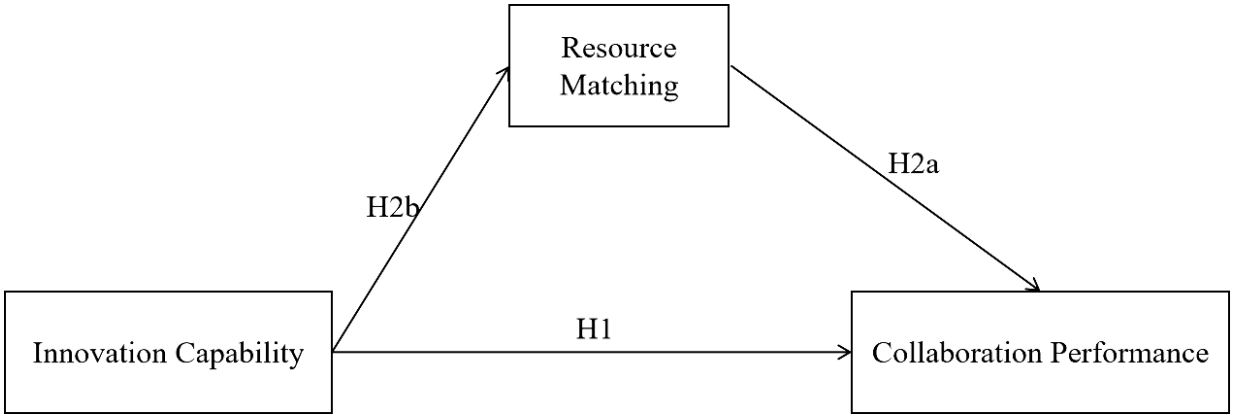

Figure 1: Conceptual Framework

4. Research Methodology

4.1 Population and sample of this study

This article mainly research in colleges and universities of the relationship between the performance of science and technology innovation ability and the cooperation between colleges, so the target of the matrix defined as industrial institute a comprehensive university in Taiyuan, Shanxi Province colleges and universities, and the investigation of professional classification is mainly to learn from the college (department) is part of the class, and the departments of scientific research team in the questionnaire survey of 350 college teachers.

4.2 Tools of this study

The questionnaire used in this study consists of four parts: demographic information of respondents, scientific and technological innovation ability of colleges and universities, resource matching degree, and school-enterprise cooperation performance. According to the previous literature and the content of this study, and referring to the scale in Geng Di (2013), the independent variable in this study is composed of 8 items, and the dependent variable is composed of 6 items by referring to the scale in Eva M. Mora-Valentin et al. (2004). The mediating variable resource matching degree is based on the scale in Deitza et al. (2010), which consists of three items.

4.3 Data Collection

In this study, Quantitative research adopts stratified random sampling to select samples.

4.4 Data Analysis

In this study, the data were analyzed by structural equation model, and the Bootstrap method was used to test the mediation effect by calculating 2000 iterations.

5. Results

5.1 Reliability and validity tests

The reliability and validity of variables measured by multiple indicators should be ensured when they are used. In this study, university-industry collaboration performance (UICP), university scientific and technological innovation capability (USTIC), resource matching (RM) are all measured by multiple questions and indicators. The Cronbach's Alpha coefficient values of all variables in this study are shown in Table 5.1. The Cronbach's Alpha coefficient of all constructs exceeds 0.7, which meets the research standard.

Table 1 Cronbach's Alpha Coefficients of Each Variable

variable	Measuring item	CITC	Item Cronbach's Alpha value deleted	Cronbach's Alpha
UICP	Q1	0.742	0.857	0.884
	Q2	0.718	0.861	
	Q3	0.608	0.878	
	Q4	0.732	0.858	
	Q5	0.697	0.864	
USTIC	Q6	0.682	0.867	0.898
	Q7	0.741	0.879	
	Q8	0.732	0.88	
	Q9	0.653	0.887	
	Q10	0.631	0.889	
	Q11	0.618	0.89	
	Q12	0.644	0.888	
	Q13	0.635	0.889	
RM	Q14	0.791	0.874	0.896
	Q15	0.787	0.858	
	Q16	0.777	0.866	
	Q17	0.82	0.829	

According to the reliability analysis results in the above table, a total of 17 measurement items were set in this study, corresponding to 3 latent variables, and the Cronbach's Alpha of school-enterprise cooperation performance was 0.884. Cronbach's Alpha of scientific and technological innovation ability of universities was 0.898; Cronbach's Alpha for resource matching is 0.896; and the Cronbach's Alpha coefficient of each latent variable meets the basic

standard of greater than 0.7. It can be seen that the questionnaire adopted in this study has good reliability. In addition, the CITC (total correlation of corrected items) between the observed variables and their latent variables meets the requirement of greater than 0.5, which indicates that the question Settings of each latent variable are good and the questionnaire reliability is good. At the same time, through the exclusion of observation variables, the specific method is to delete each variable once. If the reliability index does not improve after the deletion, the measurement question of the variable is considered to have good credibility. The results in the above table show that the overall Cronbach's Alpha coefficient is not improved after deleting each item, indicating that each item is well set.

According to the judgment criteria of KMO coefficient and Bartlett sphericity test when performing factor analysis by Yuan Fang (1999), the KMO metric value should be greater than 0.5, and the closer it is to L, the more suitable it is for performing factor analysis: When the Bartlett sphericity test value is large and the corresponding concomitant probability value is less than the given significance level (0.001), factor analysis is suitable. In this study, KMO coefficient and Bartlett spherical test were performed on the data, and the test results are shown in Table 2:

Table 2 KMO Coefficient and Bartlett Spheroid Test Results List

KMO sampling suitability quantity		0.926
Bartlett sphericity test	The approximate chi-square	4773.116
	Degree of freedom	253
	Significance	0.000

As can be seen from Table 5.2, The test results show that the KMO test value of the survey data is 0.926, which is greater than 0.70, indicating that the questionnaire is suitable for factor analysis. Bartlett sphericity test results showed that the approximate chi-square value was 4773.116, and the significance probability was 0.000 (P<0.01). Therefore, the null hypothesis of Bartlett sphericity test was rejected, and the scale was considered suitable for factor analysis, so the validity structure was good.

5.2 Correlation analysis

When there is a relation between things but it cannot be directly explained as causality, the relation between things is called correlation relation. This paper first analyzes the relationship between variables in this study through Person correlation.

Table 3 Correlation Analysis

	1	2	3
UICP	1		
USTIC	.613**	1	
RM	.505**	.497**	1

was significantly associated at the0.01 level (two-sided).

The above table shows the correlation analysis results. The results show that the P values corresponding to the correlation coefficients of the 3 latent variables involved in this paper are all less than 0.05, which has significant statistical significance, indicating that the 3 latent variables are all significantly correlated with each other.

5.3 Path Analysis and inspection results

The path diagram of the theoretical model in this study is shown in Figure 4.8. Among them, the scientific and technological innovation ability of colleges and universities is an exogenous latent variable, which is measured by 8 measurement items. University-industry collaboration performanc, resource matching are endogenous potential variables. They have their own measurement items to measure. The relationship between potential variables is shown in Figure 5.1.

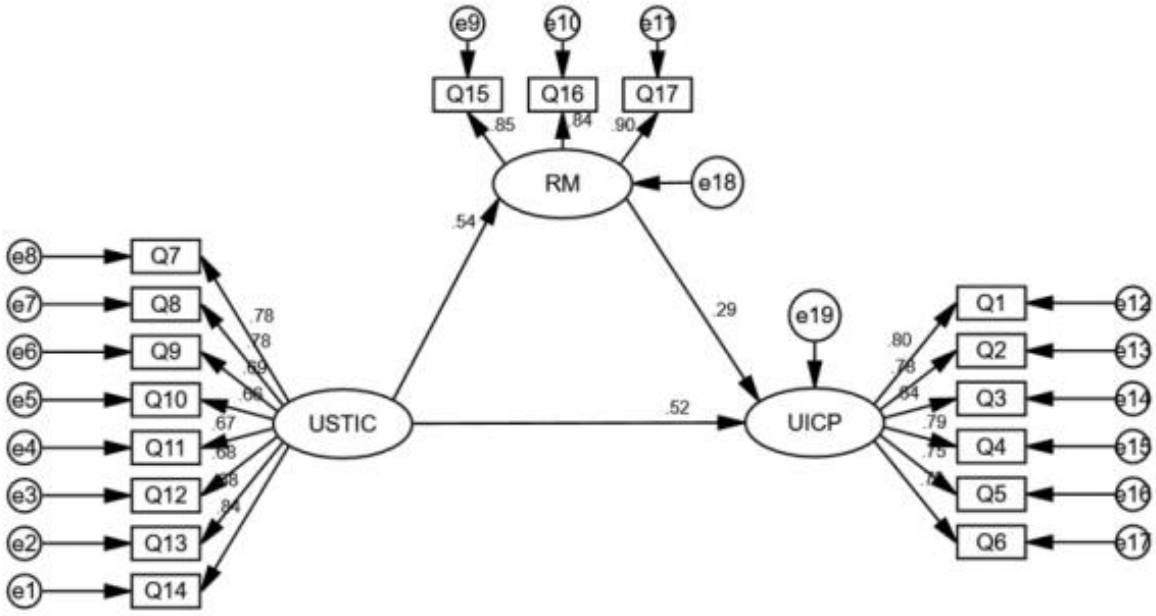

Figure 2: SEM Analysis Model

Different scholars use different methods to test the validity of structural equation models, but the main indicators are the same. In this paper, the general evaluation method of structural equation model is used to evaluate the fitting index of the model. Table 5.4 shows the fitting index of the model of the influence of scientific and technological innovation ability of colleges and universities on university-industry collaboration performance.

Table 4 Model Fitting Index

Fit index	Ideal value	Actual value
χ^2/df	＜3	1.784
GFI	＞0.9	0.933
AGFI	＞0.9	0.912
RMSEA	＜0.08	0.047
NFI	＞0.9	0.940
IFI	＞0.9	0.973
CFI	＞0.9	0.973
NNFI(TLI)	＞0.9	0.968

According to the above table, χ^2/df value is 1.784, less than 3; RMSEA was 0.047, which was lower than the standard level of 0.08, indicating good adaptation. GFI=0.933, AGFI=0.912, NFI=0.940, IFI=0.973, CFI=0.973, TLI=0.968, all goodness-of-fit indexes reached the general standard, indicating that the structural equation model established in this study was effective and matched well with the recovered data.

The standardized path coefficients among latent variables in the overall research model are shown in Table 5.5.

Table 5 Standardized Path Coefficients Among Latent Variables of The Overall Research Model

Path			Normalized path coefficient	S.E.	C.R.	P
RM	<---	USTIC	0.507	0.054	9.396	***
UICP	<---	RM	0.301	0.060	5.051	***
UICP	<---	USTIC	0.509	0.060	8.502	***

Note: * means P <0.05; ** means P <0.01; *** means p < 0.001.

According to the path analysis results in the above table, the standardized path coefficient of scientific and technological innovation ability of colleges and universities to the matching of resources is 0.507 (t =9.396, p=0.000< 0.001), indicating that the scientific and technological

innovation ability of colleges and universities has a significant positive impact on the resource matching, and hypothesis H2b was supported. The standardized path coefficient of resource matching degree on university-industry collaboration performance was 0.301 (t =5.051, p=0.000< 0.05), indicating that resource matching degree has a significant positive impact on university-industry collaboration performance, and hypothesis H2a was supported. The standardized path coefficient of scientific and technological innovation ability of colleges and universities on university-industry collaboration performance was 0.509 (t =8.502, p=0.000< 0.001), indicating that the scientific and technological innovation ability of colleges and universities has a significant positive impact on the performance of university-industry collaboration. Hypothesis H1 was supported. In this study, Amos23.0 software was used to analyze the data, and the Bootstrap method was used to test the mediation effect by calculating 2000 iterations.

Table 6 Mediation Effect Test of Bootstrap Method

Parameter	Estimate	Lower	Upper	P
USTIC -RM -UICP	0.156	0.094	0.234	**

Note*: * means P <0.05; ** means P <0.01; *** means p < 0.001.*

The above table uses the Bootstrap method based on AMOS software to test the mediating effect. Samples are repeated for 2000 times and 95% confidence intervals are calculated. According to the above table results, the effect value of the mediating path [university's scientific and technological innovation capability - resource matching - university-industry collaboration performance] is 0.156. The upper and lower interval of 95% confidence is [0.094-0.234], excluding 0, and the P value is less than the significance level 0.05, indicating the existence of mediating effect, so hypothesis H1 was supported.

Table 7 Summary of Hypotheses

Hypotheses	**Results**
H1: University's scientific and technological innovation capability has a positive and significant relationship on the university-industry collaboration performance	**Support**
H2a: Resource matching has a positive and significant relationship on the university-industry collaboration performance	Support
H2b: University's scientific and technological innovation capability has a positive and significant relationship on the Resource matching	Support
H2: Resource matching positively mediate the relationship between university's scientific and technological innovation capability and university-industry collaboration performance	Support

6. Discussion

The scientific and technological innovation capability of colleges and universities influences the university-industry collaboration performance through the intermediary of resource matching in the process of university-industry collaboration. The scientific and technological innovation capability of universities has a significant impact on the resource matching (Beta=0.54, P<0.001), and the resource matching has a significant impact on the university-industry collaboration performance (Beta=0.29, P<0.001). Hypothesis H2 is supported, indicating that the selection of a suitable partner depends on the accurate judgment of the university leaders on the potential, scale and credit of the enterprise.

This kind of judgment is based on the changing information exchange, university of science and technology innovation ability of colleges and universities tend to establish a team of external information monitoring and filtering mechanism, thus able to timely and accurate to evaluate potential partners and selection, never can eventually find a relatively satisfactory partner. The ability of scientific and technological innovation in colleges and universities can help colleges and universities to understand the changes of the external environment in a timely manner, constantly screen and absorb useful information and knowledge, so as to quickly find effective innovation resources, and then choose better partners, so that the resource matching between the two sides is also strong. In terms of its content, school-enterprise cooperation is to jointly invest resources (especially resources with high matching degree) to carry out technological research and development activities. Colleges and universities can make full use of their own advantages in scientific and technological resources and enterprises' resources cooperation to build an exchange platform. Solve various types of applications in the process of exchanging experience and technology so as to refine the research and innovation points, and finally expand the research direction and research field to improve the cooperation performance (Jianghua, L., 2019). The higher the resources matching between the university and the enterprise, the more interdependent the two parties will be in the cooperation process, the more stable the personnel and technical equipment allocation will be in the process of the cooperation, the more detailed the distribution scheme of the output of the university-industry collaboration, and the clearer the contractual relationship and interest relationship will be. Therefore, the cooperation project will progress more smoothly, and the final performance of university-industry collaboration will be higher.

Scientific and technological innovation capability of universities → university-industry collaboration performance (Beta=0.52, P<0.001). The stronger the scientific and technological innovation capability of universities, the more stable will be the personnel and technical equipment allocation in the process of collaboration projects, the more detailed will be the distribution scheme of the output of university-industry collaboration, and the clearer will be the contractual relationship and interest relationship. Therefore, the collaboration project will progress more smoothly, and the final performance of school-enterprise cooperation will be higher.

The collaboration between enterprises and universities, on the one hand, can improve the innovation performance of enterprises, on the other hand, it is also conducive to realizing the accumulation of enterprise knowledge, which can be converted into new technology and organizational innovation (Gao Qing, 2021). Therefore, the scientific and technological

innovation ability of colleges and universities is an important factor affecting the growth of school-enterprise cooperation performance. The process of collaboration directly affects the development of university-industry collaboration.

7. Conclusion

According to the data in Figure 1 and Table 2, resource matching variable is the key variable in the process of university-industry collaboration in the intermediate process affecting the performance of university-industry collaboration. It can be seen from the data in Figure 1 that the scientific and technological innovation ability of universities has a positive impact on the resource matching, and the resource matching has a positive impact on the university-industry collaboration performance, the scientific and technological innovation ability of universities will affect the performance of university-industry collaboration through the resource matching in the process of university-industry collaboration. It can be seen from Table 2 that the technological innovation ability of colleges and universities also has a direct impact on the university-industry collaboration performance.

Recommendations**:** The operational efficiency of university-industry collaboration performance is inseparable from the university's science and technology innovation capability. This study reveals and verifies the inherent logical connection between the two through detailed research on the specific manifestations of the university's science and technology innovation capability in the context of university-industry collaboration. When university-industry collaboration performance is not high, managers can first check what is the key factor of the collaboration process step out of the question, and then find the related university's science and technology innovation capability defect, finally find the direction of adjusting and optimizing the technical innovation ability, in order to raising the level of university-industry collaboration performance in the future.

8. References

Agrawal, A. K. (2010). University-to-industry knowledge transfer: Literature review and unanswered questions. *International Journal of Management Reviews, 3*(4), 285-302.

Baldwin, W. I., & Link, A. N. (1998). Universities as research joint venture partners: Does size of the joint venture matter? *International Journal of Technology Management, 15*(8), 125-144.

Chen, Q., & Shi, S. X. (2013). Evaluation and differential analysis of scientific and technological innovation capability of Chinese universities. *Journal of Inner Mongolia Agricultural University: Social Science Edition, 15*(4), 50-55.

Deng, Y. X. (2011). *Research on the impact of absorptive capacity on university-industry collaboration performance*. (Dissertation, South China University of Technology).

Dill, D. (1990). *University/industry research collaborations: An analysis of interorganizational relationships*. *R&D Management, 20*(2), 123-132.

Gao, Q. (2021). *Research on efficiency and influencing factors of scientific and technological innovation efficiency in universities: From the perspective of university-industry collaboration*. (Doctoral dissertation, University of Science and Technology Beijing).

Geisler, E. (1995). Industry-university technology cooperation: A theory of interorganizational relationships. *Technology Analysis & Strategic Management, 7*, 217-229.

Geng, D. (2013). *University of science and technology innovation ability evaluation research*. (Doctoral dissertation, Wuhan University of Technology).

Lee, Y. S. (2000). The sustainability of university-industry research collaboration: An empirical assessment. *Journal of Technology Transfer, 25*(2), 111-119.

Li, J. H. (2019). *Research on collaborative governance of new R&D institutions jointly built by the university and the local government*. (Doctoral dissertation, Huazhong University of Science and Technology).

Mora-Valentin, E. M., Montoro-Sanchez, A., & Guerras-Martin, A. (2004). Determining factors in the success of R&D cooperative agreements between firms and research organizations. *Research Policy, 33*(3), 17-40.

Okamuro, H. (2011). Determinants of R&D cooperation in Japanese start-ups. *Research Policy, 40*(5), 728-738.

Powers, J. B. (2003). Commercializing academic research: Resource effects on performance of university technology transfer. *The Journal of Higher Education, 74*(1), 26-47.

Wang, R. H. (2018). Construction of performance evaluation index system of public scientific research institutions based on balanced scorecard. *Science & Technology Economic Market*, (8), 118-120.

Zhou, E., & Liu, G. X. (2017). Research on the cultivation strategy of new R&D institutions in Hubei Province under the background of innovation. *Hubei Social Sciences*, (7), 52-58.