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Research Article

Relationship between Dual Innovation Ability and Scientific Research Performance of High-level Talents in Colleges and Universities *

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Abstract

There is a close relationship between dual innovation ability and scientific research performance of high-level talents in colleges and universities. This paper uses the method of empirical research and uses SPSS21.0 for questionnaire analysis. The research results show that the dual-innovation ability of high-level talents in colleges and universities consists of two dimensions: exploratory innovation ability and utilization innovation ability. The research performance consists of two dimensions: subjective performance and objective performance. The dual innovation ability of high-level talents in colleges and universities is significantly related to scientific research performance; the exploratory innovation ability and utilization innovation ability are also closely related to scientific research performance; dual innovation ability is also significantly related to subjective performance and objective performance.

Keywords

High-level Talents in Colleges and Universities • Dual Innovation Ability• Scientific Research Performance

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The national "13th Five-Year Plan" proposal puts forward "promoting the construction of high-quality universities and research institutes with distinctive characteristics" and "emphasizing disruptive technological innovation". As the main research subject of scientific and technological innovation in colleges and universities, high-level talents are one of the most important strategic resources in the national science and technology innovation system and play the role of the main force of technological innovation (Givati, & Hatton, 2015).

The innovation ability of high-level talents in colleges and universities can be described by dual innovation. The dual innovation ability includes exploratory (Lin, Gao, & Zhang, 2016) innovation and utilization innovation (Oliver, 2004). The former highlights search, change and risk taking, while the latter emphasizes optimization, efficiency and execution (Turner, & Lee-Kelley, 2013). Studies have shown that the most important characteristic of scientific research performance is innovation and the innovation in scientific research performance will directly affect the survival and development of colleges and universities. Therefore, how to use the dual innovation ability of high-level talents in colleges and universities to facilitate the scientific research performance and how to obtain the promotion effect (Xi, Peng, & Li, 2016) are worthy of further discussion.

Research Hypothesis and Theoretical Model

Dual innovation ability

In 1996, Tushman and Reitly proposed the concept of "Ambidexterity innovation". Scholars use exploratory innovation and exploitative innovation to represent dual innovation. Dual innovation refers to the balance or combination of exploratory innovation and exploitative innovation. Exploratory innovation uses divergent thinking, yielding original results with greater impact and thorough technological change; utilization innovation uses aggregate thinking, outputting improvement results based on a breakthrough technology.

The Ambidexterity (Li, 2014) ability refers to that individuals can be engaged in the utilization innovation activities that focus on the use of existing competitive capabilities and the exploitative innovation activities that foster future competitive capabilities, making it coordinate and complement each other to achieve the sustainable development of individuals (Hughes, Martin, Morgan, & Robson, 2010).

Scientific research performance

Scholars pay less attention to the connotation and essence of scientific research performance and most researches focus on the objective setting of and the evaluation of scientific research performance (Mcallister, & Wagner, 1981). However, it has not been fully understood what mechanism and factor that lead to differences in the level of scientific output (Rosing, Frese, & Bausch, 2011).

The domestic mainstream researches on scientific research performance are mainly based on the view of "results". Sun Haihua and Qu Yong believe that scientific research performance mainly includes three aspects: scientific research output, scientific research efficiency and scientific research effect and the evaluation mainly focuses on academic papers, books, awards, patents obtained and other scientific research results.

Dual innovation ability and scientific research performance

The development of dual-innovation ability at the individual level depends not only on the improvement of existing experience and learning ability, but limited by the development trajectory of individual cognition

(Zhang, Zhang, & Fan, 2016). Only the innovation ability that conforms to its cognitive mode will be applied (Xi, Peng, & Li, 2016).

The dual innovation capability can promote the improvement of innovation performance in organizations, especially in enterprises from different perspectives (Han, Luo, & Zhong, 2016). Scholars believe that the exploratory innovation is to discover and try new things, focusing on organizational strategy initiative and bringing new profit and development opportunities for organizations; the utilization innovation is the expansion of existing knowledge and skills and the improvement of existing designs, products and services, which can bring economic returns to organizations in a short period of time.

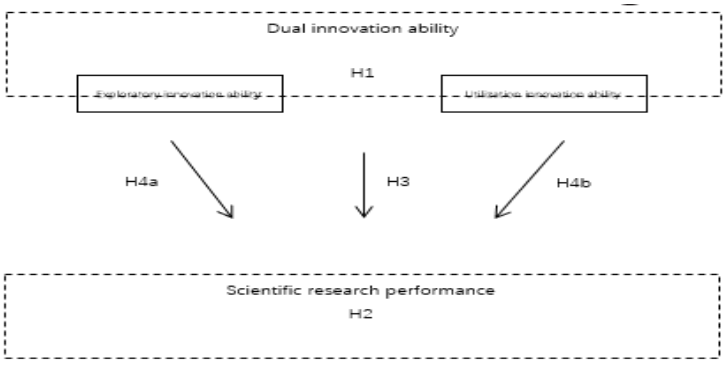

Figure 1. Conceptual model.

Construction of theoretical model

The research object of this paper is high-level talents in colleges and universities. This paper takes the relationship (Cheng, & Prusoff, 1973) between dual innovation ability and scientific research performance under the innovation-driven strategy as the main research line and studies the impact (Li, Gui, & Liu, 2014) and mechanism of dual innovation ability of high-level talents on scientific research performance in colleges and universities in China based on the interviews of certain scales and questionnaires. Based on the research content of this paper, the following assumptions are proposed.

H1: The dual innovation ability of high-level talents in colleges and universities consists of two dimensions: exploratory innovation ability and utilization innovation ability;

H2: The scientific research performance of high-level talents in colleges and universities is multi-dimensional;

H3: The dual innovation ability of high-level talents in colleges and universities is significantly related to scientific research performance;

H4: The two dimensions of dual innovation ability of high-level talents in colleges and universities are significantly positively related to each dimension of scientific research performance.

Based on relevant research literature and theoretical assumptions, the conceptual model of this study is determined, as is shown in Figure 1.

Research Design

This study designs a questionnaire based on the relevant literature on the dual innovation ability and scientific research performance of high-level talents in colleges and universities. The questionnaire is mainly divided into three parts. The first part, basic information, including gender, age, highest education level and professional title, which is used to understand the basic characteristics of the surveyed high-level talents of the universities. The second part is the part of dual innovation ability, which includes a total of 9 items to understand the composition of the dual innovation ability of high-level talents in colleges and universities. The third part is the part of scientific research performance, which includes a total of 9 items to understand the scientific research performance of high-level talents in colleges and universities.

Variable measurement

In order to ensure the validity and credibility of the questionnaire, this study draws on more mature scales at home and abroad and makes appropriate modification in combination with the research purposes. The questionnaire of dual innovation ability and scientific research performance of high-level talents are produced and measured by the 5-point Likert scale, as is shown in Table 1.

Sample selection

Table 1
Questionnaire on the dual innovation ability and scientific research performance of high-level talents in colleges and universities

Measurement dimension	Measurement items	
Dual innovation ability	SY1	Actively adopt new skills and knowledge for scientific researches
	SY2	Be able to take the risk of adopting new ideas for scientific researches
	SY3	Brave enough to enter a brand new research field with no relevant experience
	SY4	Be able to search for new information and start researches in the new research area
	SY5	often try new methods to conduct researches in the new research field
	SY6	actively use the information and skills acquired to improve the quality of researches
	SY7	Attach great importance to improving mature technology to improve the efficiency of scientific research output
	SY8	Committed to increasing scientific research experience to expand the number of scientific researches
	SY9	Strive to reflect existing advantages to reduce research costs
Scientific research performance	KY1	I often attend academic conferences
	KY2	I am always actively applying for and participating in research projects
	KY3	I am working hard to write high-level academic papers.
	KY4	I have invested a lot of energy in scientific research
	KY5	I always maintain a rigorous research attitude
	KY6	I often help others solve scientific research difficulties.
	KY7	I have a certain number of high-level academic papers
	KY8	The number and level of research projects I applied for exceeded the average number of the position
	KY9	I have won many research awards

In order to improve the validity and credibility of the empirical (Ge, Tan, & Sheng, 2016) data, this study takes three steps to collect relevant data. First of all, according to the needs of research, the high-level talents of colleges and universities is determined as the object of information acquisition. Secondly, in order to improve the recovery rate, this study contacts the personnel departments of the universities in Nanjing to explain the purpose of the survey and agree on the specific time of sample collection and research. Finally, in October 2017, 300 questionnaires were distributed and 283 questionnaires were returned. A total of 277 valid questionnaires were obtained after excluding unqualified questionnaire and the effective recovery rate of the questionnaire was 92.33%. The results are shown in Table 2.

Table 2
Statistics of basic information of the survey questionnaire

Measurement dimension	Measurement items	Number of people	Proportion (%)
Gender	Male	182	65.70%
	Female	95	34.30%
Age	Under 30	30	10.83%
	31-40 year	144	51.99%
	41-50 year	74	26.71%
	51-60 year	29	10.47%
	Above 61	30	10.83%
Highest education level	Bachelor	7	2.53%
	Master	38	13.72%
	Doctor	172	62.09%
	Postdoctor	60	21.66%
Title	Intermediate title	111	40.07%
	Deputy senior title	123	44.40%
	Senior title	43	15.52%

Empirical Research

Project analysis

In order to analyze the discrimination, the item, the t-test in the project analysis method is used to analyze the difference of items between the high and low group and those items with low discrimination are deleted to ensure the validity of the data analysis.

The analysis results of the items in the questionnaire in this study are shown in Table 3. In the t-test statistics of the questionnaire item of dual-innovation ability and scientific research (Zhang, & An, 2015) performance of high-level talents, the t-test of the average difference test of all items in high and low groups has reached the significant level of 0.005. Therefore, the discrimination of all items is good.

Table 3
t Test Analysis Results of the Survey Questionnaire

Item	t	Sig (bilateral)	Item	t	Sig (bilateral)

Homogeneity test

In order to test the correlation between the item score and the total score, the homogeneity test method is used. In general, any two items with correlation coefficient higher than 0.8 need to be combined.

In this study, the Pearson correlation analysis method is used and it has been discovered that there is a high correlation between any item and the total score and the correlation coefficient of any two items does not exceed 0.8. The results are shown in Table 4. According to the statistical results, all the items in the questionnaire of dual innovation ability and scientific research performance of high-level talents in colleges and universities are retained and further analysis is conducted.

Table 4
Homogenization test analysis results of the survey questionnaire

Item	Coefficient related to the total score	Item	Coefficient related to the total score

Note. ** is significantly correlated at the .01 level (both sides).

Exploratory Factor Analysis

In order to obtain the construct validity, the exploratory factor analysis is used to extract the common factor among variables so that the complex data structure can be represented by less factors.

Exploratory Factor Analysis of Dual Innovation Capability

In terms of the KMO and Bartlett test results of the dual innovation ability of the questionnaire, the KMO value is 0.931, which is greater than 0.5. The significance of the Bartlett's sphericity test statistic value is 0.000. Therefore, it can be said that the dual innovation ability of high-level talents in colleges and universities in the questionnaire is suitable for factor analysis.

Table 5 is the result of the partial rotation component matrix of the dual innovation ability in the questionnaire. It can be extracted as two factors through factor analysis. According to the specific meaning of the questionnaire items and the referring to relatively mature scales in China and abroad, they are named as exploratory innovation ability and utilization innovation ability. The exploratory innovation ability includes SY1, SY2, SY3, SY4, SY5 and the utilization innovation (Wang, Li, & Tao, 2016) ability include SY6, SY7, SY8, and SY9.

Table 5
Result of the Partial Rotation Component Matrix of the Dual Innovation Ability

Factor	Component	
	1	2

The explanatory variation of exploratory innovation ability is 37.009% and the explanatory variation of utilization innovation ability is 35.186%. The cumulative explanatory variation of these two accounts for 72.195%. There is a certain structural validity in the above description of the dual innovation ability of the questionnaire. Through exploratory factor analysis, it can be seen from the results that the dual innovation ability of high-level talents in colleges and universities is multi-dimensional, which can be extracted as two factors: exploratory innovation ability and utilization innovation ability.

Exploratory Factor Analysis of Scientific Research Performance

In terms of the KMO and Bartlett test results of the scientific research performance part of the questionnaire, the KMO value is 0.870, which is greater than 0.5. The significance of the Bartlett's sphericity test statistic value is 0.000. Therefore, it can be said that the scientific research performance part of high-level talents in colleges and universities in the questionnaire is suitable for factor analysis.

Table 6 is the result of the partial rotation component matrix of the scientific research performance part in the questionnaire. It can be extracted as two factors through factor analysis. According to the specific meaning of the questionnaire items and the referring to relatively mature scales in China and abroad, they are named as subjective performance and objective performance. Subjective performance includes KY1, KY2, KY3, KY4, KY5, KY6 and objective performance includes KY7, KY8, KY9.

Table 6
Result of the Partial Rotation Component Matrix of Scientific Research Performance

Factor	Component	
	1	2

The explanatory variation of subjective performance is 39.923% and the explanatory variation of objective performance is 25.347%. The cumulative explanatory variation of these two accounts for 65.271%. The above shows that there is a certain structural validity in the above description of the scientific research performance of the questionnaire. Through the exploratory factor analysis, it can be seen from the results that the scientific research performance of high-level talents in colleges and universities is multi-dimensional, which can be extracted as two factors: subjective performance and objective performance.

Reliability Analysis

The reliability analysis is used to test the reliability and validity of the scale. This study measures the Cronbach'a reliability coefficient of the internal consistency of each part of the questionnaire. As is shown in Table 7, the Cronbach'a reliability coefficient of each part is above 0.7. Therefore, the internal consistency of the questionnaire of the dual innovation ability and scientific research performance of high-level talents in colleges and universities is relatively high.

Table 7
Reliability Analysis Test Results of the Questionnaire

Factor	Number of items	Cronbach's a coefficient
Exploratory innovation ability	5	.889
Utilization innovation ability	4	.885
Subjective performance	6	.867
Objective performance	3	.773

Relevant analysis

The Pearson correlation analysis method is used to analyze the dual innovation ability and scientific research performance of high-level talents in colleges and universities. The results are shown in Table 8. The correlation between these two is 0.690. It can be concluded that the dual innovation ability of high-level talents in colleges and universities is significantly related to the scientific research performance.

Table 8
Relevant Analysis Results of Dual Innovation Ability and Scientific Research Performance of High-level Talents in Colleges and Universities

		Dual innovation ability	Scientific research performance
Dual innovation ability	Pearson relevance	1	.690**
	Significance (two sides)		.000
	N	277	277
Scientific research performance	Pearson relevance	.690**	1
	Significance (two sides)	.000	
	N	277	277

Table 9
Relevant Analysis Results of Two Dimensions of Dual Innovation Ability and Two Dimensions of Scientific Research Performance of High-level Talents in Colleges and Universities

		Subjective performance	Objective performance
Exploratory innovation ability	Pearson relevance	.657**	.524**
	Significance (two sides)	.000	.000
	N	277	277
Utilization innovation ability	Pearson relevance	.638**	.486**
	Significance (two sides)	.000	.000

Conclusion

Based on relevant literatures, this study builds a conceptual model of the relationship between dual innovation ability and scientific research performance of high-level talents in colleges and universities. Through the reasonable assumption and empirical research, the following conclusions and enlightenments are obtained.

(1) There are significant positive correlation between the two dimensions of dual innovation ability of high-level talents in colleges and universities, namely the exploratory innovation ability and utilization innovation ability, and scientific research performance. This shows that the generation of the scientific research performance is the manifestation process of the dual innovation ability of high-level talents in colleges and universities. The exploratory innovation ability and utilization innovation ability will both an impact in the process of generating scientific research performance by high-level talents in colleges and universities.

(2) There are significant positive correlation between the two dimensions of scientific research performance, namely subjective scientific research performance and objective scientific research performance, and dual innovation ability of high-level talents in colleges and universities. The main driving force for high-level talents in colleges to enhance scientific research performance from subjective initiative lies in dual innovation and objectively the improvement of scientific research performance is also inseparable from the improvement of dual innovation ability.

(3) The dual innovation ability of high-level talents in colleges and universities is significantly related to scientific research performance. In order to obtain the competitive edge of scientific research, colleges and universities need to seize the opportunity to give full play to the dual innovation ability of high-level talents and rapidly develop and deepen the achievements in scientific research.

References

Cheng, Y. C., & Prusoff, W. H. (1973). Relationship between the inhibition constant (K_I) and the concentration of inhibitor which causes 50 per cent inhibition (I_{50}) of an enzymatic reaction. *Biochemical Pharmacology*, *22*(23), 3099-3108. http://dx.doi.org/10.1016/0006-2952(73)90196-2

Ge, B. S., Tan, L. F., & Sheng, F. (2016). An empirical study on the relationship among innovation culture,ambidextrous learning, and dynamic capabilities. *Scientific Research, 34*(5), 630-640. http://dx.doi.org/10.3969/j.issn.1003-2053.2016.04.018

Givati, A., & Hatton, K. (2015). Traditional acupuncturists and higher education in britain: the dual, paradoxical impact of biomedical alignment on the holistic view. *Social Science & Medicine, 131*, 173-180. http://dx.doi.org/10.1016/j.socscimed.2015.03.003

Han, Y., Luo, J. L., & Zhong, J. (2016). The research on the effects of ambidextrous leadership on team innovation performance: from the perspective of routine practice. *Management Science, 29*(1), 70-85. http://dx.doi.org/10.3969/j.issn.1672-0334.2016.01.006

Hughes, M., Martin, S. L., Morgan, R. E., & Robson, M. J. (2010). Realizing product-market advantage in high-technology international new ventures: the mediating role of ambidextrous innovation. *Journal of International Marketing, 18*(4), 1-21. http://dx.doi.org/Li, J. H. (2014). Research on operational mechanism of ambidexterity based on three-dimensionality integration of knowledge-technology-organization. *Research on Science and Technology Management, 34*(5), 149-154. http://dx.doi.org/10.3969/j.issn.1000-7695.2014.05.031

Li, Y., Gui, W. L., & Liu, Y. (2014). The impact of paternalistic leadership on ambidextrous innovation: matching with business strategy. *East China Economic Management, 1*, 113-118. http://dx.doi.org/10.3969/j.issn.1007-5097.2014.01.023

Lin, Y., Gao, X., & Zhang, M. (2016). Knowledge-based enterprises innovation performance by exploitative and exploratory ambidexterity driving. *Soft Science, 5*, 59-63. http://dx.doi.org/10.13956/j.ss.1001-8409.2016.05.13

Mcallister, P. R., & Wagner, D. A. (1981). Relationship between r&d expenditures and publication output for u.s. colleges and universities. *Research in Higher Education, 15*(1), 3-30. http://dx.doi.org/10.1007/BF00976546

Oliver, A. L. (2004). On the duality of competition and collaboration: network-based knowledge relations in the biotechnology industry. *Scandinavian Journal of Management, 20*(1), 151-171. http://dx.doi.org/10.1016/j.scaman.2004.06.002

Rosing, K., Frese, M., & Bausch, A. (2011). Explaining the heterogeneity of the leadership-innovation relationship: ambidextrous leadership. *The Leadership Quarterly, 22*(5), 956-974. http://dx.doi.org/10.1016/j.leaqua.2011.07.014

Turner, N., & Lee-Kelley, L. (2013). Unpacking the theory on ambidexterity: an illustrative case on the managerial architectures, mechanisms and dynamics. *Management Learning, 44*(2). http://dx.doi.org/179-196.10.1177/1350507612444074

Wang, Y. G., Li, R., & Tao, Q. (2016). Intelligent capital attributes and environmental turbulence on dual innovation capabilities. *Economic and Management Research, 37*(3), 86-93. http://dx.doi.org/10.13502/j.cnki.issn1000-7636.2016.03.011

Xi, L., Peng, C., & Li, D. Q. (2016). The effect of ambidextrous learning on the synergy of dual innovation: the adjustment of transformational leadership. *Science and Technology Management Research, 8*, 210-215. http://dx.doi.org/10.3969/j.issn.1000-7695.2016.08.040

Xi, L., Peng, C., & Li, D. Q. (2016). The effect of intellectual capital on the synergy of dual innovation: the adjustment of the behavior integration of the senior management team. *Technological Progress and Countermeasures, 33*(6), 142-148. http://dx.doi.org/10.6049/kjjbydc.2015110266

Zhang, M., Zhang, Y., & Fan, P. P. (2016). The game between "I" self cognition and "Me"self cognition of entrepreneurs: a new cognitive perspective of ambidextrous innovation path. F*oreign economy and management, 38*(2), 3-15. http://dx.doi.org/10.16538/j.cnki.fem.2016.02.001

Zhang, X. T., & An, L. R. (2015). Ambidextrous innovative search, contextual separation and innovation performance. *Scientific Research, 33*(8), 1240-1250. http://dx.doi.org/10.3969/j.issn.1003-2053.2015.08.014