

# Study on the Intention of College Teachers' S&T Transformation

Liyan Lai

Human Resource Department  
Jiangxi Police College  
Nanchang, China

Wu Chen\*

Business College  
Jiangxi Normal University  
Nanchang, China  
\*Corresponding Author

**Abstract**—This paper focus on the issue which is the intention of college teachers' S&T transformation under the background of mass innovation and entrepreneurship. Based on innovation diffusion theory, using the anthropology and statistical methods, it explores the mechanisms of government support, organizational support, and environmental perception affecting the intention of college teachers' S&T transformation under the perspective of core stakeholder of universities, enterprises and teachers. The results show that the support systems, guiding and service polities of government have the positive effect on the behavior of universities giving strong backing to teachers launch secondary innovation, and also affect the willingness of enterprise to absorb and convert S&T. Both the organizational structure and institutional system of college and the technological structure and demand structure of enterprise have the positive effect on the teachers' perception of market/policy environments. So the college and enterprise is an important intermediary of promoting the intention of college teachers' S&T transformation. This study provides references to formulate the innovation entrepreneurship policy and reform the college and enterprise management practice.

**Keywords**—college teacher; the intention of S&T transfer; influence factors; innovation diffusion theory

## I. INTRODUCTION

S&T transformation is a form of innovation diffusion<sup>[1][2]</sup>, can effectively improve social contribution rate of higher education and promote the construction of entrepreneurial universities<sup>[3]</sup>, however, in 2015 the ratio of transfer of patent ownership in Chinese universities to the number of patents for effective invention is only 1.38%<sup>1</sup>, many favorable policies didn't stimulate the enthusiasm of teachers participating in the achievements transformation, why are teachers reluctant to take action to transform it into productivity, even if they hold scientific and technological achievements? What are the factors that affect the intention of teachers' S&T transformation?

The existing research indicates that S&T transformation is closely related to the stakeholders such as universities,

enterprises and government<sup>[4]</sup>, 76.4% of S&T transformation failed due to market reasons<sup>[5]</sup>. Government policies will significantly affect the performance of technological innovation cooperation between enterprises and universities<sup>[6]</sup>. The ability of the enterprises to absorb and convert is an important condition for successful utilization of external technology<sup>[7]</sup>. However, Existing studies mainly focus on universities<sup>[8], [9]</sup>, seldom have researchers deliberate the S&T transformation from a teacher's perspective, but the individual has a great influence on innovation diffusion<sup>[10]</sup>, the supplier of scientific achievements who knows the application fields, approaches, etc. of their research results, undoubtedly, enhancing intention of teachers' S&T transformation can accelerate the application of results, and solve the "second innovation" problem of S&T transformation<sup>[11]</sup>. Therefore, based on innovation diffusion theory, using the anthropology and statistical methods, the study explores the mechanisms of universities, enterprises and government affecting the intention of college teachers' S&T transformation under the perspective of social system elements, it is conducive to promoting the government to strengthen the innovation entrepreneurship policy, guiding the reform of management practices in universities and enterprises, also is helpful to arouse the enthusiasm for teachers' S&T transformation, promote academic capital conversion, form the trend of the technology stimulating innovation and entrepreneurship.

## II. RESEARCH DESIGN

### A. Sample Selection Principle

The S&T transformation involves core and marginal stakeholders. The core subjects are results providers and demanders, while, the marginal subjects mainly refer to the government and intermediary<sup>[12]</sup>. Among them individuals, universities, and enterprises are the core factors affecting the S&T transformation<sup>[13]</sup>. Therefore, the sampling principle of this paper is: ① Representation, universities, individuals and enterprises that have participated in the S&T transformation, and had representative achievements transformation projects must be included; ② universality, 985 colleges and universities, high-end talents and general scientific and technological talents, high-tech enterprises

<sup>1</sup> The data comes from the 2016 China Science and Technology Statistical Yearbook. In 2015, there were 2,192 valid invention patents for Chinese universities and 2,786 patent ownership transfers.

were covered; ③ typicality, local governments have introduced typical policies that encouraged the S&T transformation. The evolution of policy situations is conducive to studying the change process of the intention of teachers' S&T transfer.

### B. Data Collection

Drawing on the anthropology methods which was used in organizational network research by Uzzi and Lancaster (2003)<sup>[14]</sup>, this article collected data from in-depth interviews and semi-structured questionnaires. In order to prevent research bias, meanwhile, the respondent was requested to provide institutional text files, innovation and entrepreneurship cases, and college-enterprise cooperation cases related to the S&T transformation so as to further verify the interview information. The final collected data includes 15 universities, 60 university talents, high-tech enterprises, of which there were five 985 and 211 colleges and universities, accounting for 33.3%, six 211 colleges and universities, accounting for 40.0%, four other universities, accounting for 26.7%; were interviewed. Among them, 42 were high-end talents, accounting for 70.0%, the general talents were 18, accounting for 30.0%. Referencing to the research of Uzzi and Lancaster (2003), non-parametric chi-square test was used to analyze the frequency of interviews, all the propositions must meet two conditions together: (1) 50% or more of respondents believe that this factor will affect the willingness of college teachers' S&T transformation; (2) the proposition can be supported by the current literature or logical.

## III. FINDINGS

### A. University Level

1) *Institutional environment in universities*: Research data shows that the management system that has the closest relationship with teachers' S&T transformation mainly involves the financial system, the fund system, professional title evaluation system, and the dispute risk management system. There are still major difficulties for college teachers to practice academic ventures through the S&T transfer, teachers don't have good entrepreneurial advantages<sup>[15]</sup> and the ability to find products or services that can bring potential market value, lack of organization and management, strategic planning and relationship processing capabilities. The large potential risks and uncertainties involved in S&T transformation the also deter teachers with achievements from S&T transformation.

The result of the interview shows that: of the 15 colleges and universities interviewed, 14 universities mentioned that setting up full-time results transformation management institutions would increase teachers' willingness to transform S&T, and the proportion of such institutions is significantly higher than 70% ( $\chi^2(1)=3.89$ ,  $p=0.049$ ); 13 universities considered that if universities had a good result transformation dispute risk management system and a special results conversion fund management system that was different from longitudinal fund management system,

teachers were more willing to transform S&T, and the proportion of them is significantly more than 60% ( $\chi^2(1)=4.44$ ,  $p=0.035$ ); 8 universities thought that teachers were more likely to convert S&T, changing the scientific research evaluation system based on vertical subjects. There is no significant difference between the ratio of them and 50% ( $\chi^2(1)=2.13$ ,  $p=0.144$ ). Based on which, proposition 1 was proposed:

*The sounder the policy environment consisting of university management system for the results transformation, the higher the willingness of teachers' S&T transfer.*

2) *Achievement transformation support policy environment*: Universities have a large number of "sleeping" S&T. The factors affecting the achievements of "revitalization" are national innovation guiding policies, in addition to the institutions of higher learning. National policy intervention can significantly inspire university teachers' innovation and entrepreneurial behavior. The teachers' S&T transformation is basically a technology injection into high-growth technology companies. The initial R&D needs a large amount of capital investment<sup>[16]</sup>, so the first problem is the financing problem, while the effective connection between intellectual capital and financial capital plus tax incentives can solve it. Secondly, specialized intermediary services can resolve obstacles in the market of law, consultation, entrepreneurship training, and transaction in the transformation of teachers' S&T.

The result of the interview shows that: of the respondents from 15 universities, 6 universities mentioned that the lower the personal income tax of teachers, the higher the willingness of teachers to transform their S&T, and the ratio was significantly less than 50% ( $\chi^2(1)=3.86$ ,  $p=0.05$ ); 5 universities considered that the more comprehensive the intermediary services provided and the greater the financial support, the higher the willingness of teachers' S&T transformation. The proportion of them was significantly less than 50% ( $\chi^2(1)=5.00$ ,  $p=0.025$ ). Based on which, proposition 2 was proposed:

*The more complete policy environment of tax, capital, and intermediary services for the results transformation, will significantly increase the intention of teachers' S&T transformation. However, the supporting evidence from the university level is weak.*

### B. Teacher Level

1) *Financing environment*: The greater the investment intensity of R&D funds, the more it can promote the S&T transformation<sup>[8]</sup>. The college teachers' S&T transformation is a way of realizing the application through technology injection into enterprise products. The funds spent in the early stage of technology research and product trial production are huge, far beyond the support of the project funding. The huge investment in the previous period often makes teachers to face high risk in the S&T transformation. In addition, the traditional cultural orientation of "seeking

stability” and fierce competition environment lead to the lack of academic entrepreneurial adventure spirit of college teachers. A good in-system work environment and high social status, the balance between income and risk make college teachers take a wait-and-see attitude toward the commercialization of S&T.

The interview data shows that: of the 29 respondents, 21 respondents suggested that if the government provided financial subsidies or support for the college teachers’ S&T transformation, it will significantly increase the intention of college teachers’ S&T transformation. The ratio of such teachers is higher than 50% markedly ( $\chi^2(1) = 5.83$ ,  $p = 0.016$ ); there are 20 respondents who stated that the better the government financing services, the stronger the teachers’ willingness to S&T transformation, the ratio significantly exceed 50% ( $\chi^2(1) = 4.17$ ,  $p = 0.041$ ). Based on which, proposition 3 was proposed:

*The sounder financing environment formed by funds support and financing public services, for S&T transformation, will obviously improve the willingness of teachers’ S&T transformation.*

2) *Policy environment for results transformation:* The national innovation and entrepreneurship policies mainly include the results transformation subsidies, the income distribution from the results transformation, the tax preference for independent achievements conversion into business, and fee reductions. At the same time, it is necessary to build a complete intermediary service system that can provide policy consulting, project development, market matching, entrepreneurship training, financing services, and tracking support for college teachers’ S&T transformation.

According the interview data, among the 32 interviewees, 27 of them responded that the more perfect the government’s innovation and entrepreneurship guiding policy, would lead to a significant increase to the intention of college teachers’ S&T transformation. The percentage is significantly more than 65% ( $\chi^2(1) = 5.28$ ,  $p = 0.022$ ); among the 12 respondents, 8 of them pointed out that the more perfect the service system for the results transformation, would significantly increase teachers’ willingness to transform S&T (Fisher’s exact test,  $p = 0.002$ ). Based on this, proposition 4 were proposed:

*The more effective the guiding policy environment formed by income distribution, intermediary services, etc. for results transformation, will significantly enhance the intention of college teachers’ S&T transformation.*

### C. Enterprise Level

1) *Market demand:* The low “industrial practicability” of S&T is the fundamental reason that restricts the S&T transformation in universities, and it is also the “wounded injury” of China’s science and technology industrial chain “upstream”<sup>[17]</sup>. This problem highlights the importance of market demand. The survey found that 75% of enterprise

technology innovation is driven by market demand, and 13% is driven by technology supply<sup>[18]</sup>. The decline in productivity growth of enterprises is mainly caused by stagnation in the rate of technological progress<sup>[19]</sup>. Therefore, whether transforming S&T in universities help enterprises increase the scientific and technological content of existing products, reduce production costs, and meet market demands. It is a prerequisite for enterprises and universities to achieve cooperation.

According to the interview data, 38 out of the 55 enterprises surveyed suggested that when the teachers’ S&T are in line with the enterprise demand, the teachers’ willingness to transform their S&T through the enterprise will be enhanced. the ratio is significantly more than 55% ( $\chi^2(1) = 4.41$ ,  $p = 0.036$ ); there are 35 enterprises who proposed that when teachers’ S&T can significantly improve their current technological level, it will increase the willingness of teachers’ S&T transformation through enterprises. The proportion of them is over 50% markedly ( $\chi^2(1) = 4.09$ ,  $p = 0.043$ ); Forty enterprises raised that when transforming universities’ S&T can strengthen school-industry linkages and enable enterprises to obtain university intellectual resources, teachers’ willingness to transform S&T through the enterprise would be promoted, and the proportion of these is significantly over 55% ( $\chi^2(1) = 11.36$ ,  $p = 0.001$ ). Based on this, proposition 5 was proposed:

*The higher the consistency between the market demand environment formed by enterprise management practice and teachers’ S&T, will significantly increase the willingness of teachers’ S&T transformation*

### D. Support Policy Environment for Enterprise Achievements Transformation

The interview data shows that government subsidies, tax preference, financial support, construction projects, and rewards for results conversion are the main policy contents that constitute incentives for enterprises to transform universities’ S&T. Some studies have shown that 7% of enterprise technology innovation are driven by government policy orientation and support<sup>[18]</sup>, and government subsidies can significantly increase enterprises’ innovation investment and innovation output<sup>[20]</sup>. Enterprises without financing support will find it difficult to obtain sufficient space for development and innovation, and productivity growth will tend to slow down<sup>[19]</sup>. Research data displays that the vast majority of enterprises hope that the government can provide financial support and tax preference during the transformation process of S&T in universities, and reduce the risk and uncertainty of transforming S&T in universities.

According to the interview data, 47 out of the 55 interviewed enterprises suggested that the higher the national financial subsidies for S&T transformation, the higher the willingness of teachers’ S&T transformation. The ratio is significantly higher than 75% ( $\chi^2(1) = 6.56$ ,  $p = 0.01$ ); 42 enterprises proposed that the higher the national tax preference for S&T transformation, the greater the intention



of teachers' S&T transformation. The ratio of such enterprises is significantly higher than 60% ( $\chi^2(1)=6.14$ ,  $p=0.013$ ). 47 interviewees raised that when the country provided project support for S&T transformation, the willingness of teachers' S&T transformation would be improved, and the proportion of them is higher than 75% markedly ( $\chi^2(1)=6.56$ ,  $p=0.01$ ); 42 enterprises thought that when the country provided incentive policies for S&T transformation, the intention of teachers' S&T transformation would be enhanced, and the proportion of them is significantly higher than 60% ( $\chi^2(1)=6.14$ ,  $p=0.013$ ). Based on the interview data, proposition 6 was proposed:

*The more effective the support environment formed by tax incentives, project support, etc. for S&T transformation, will significantly improve the willingness of teachers' S&T transformation.*

In summary, all the above propositions are summarized in the theoretical framework of "Fig. 1".

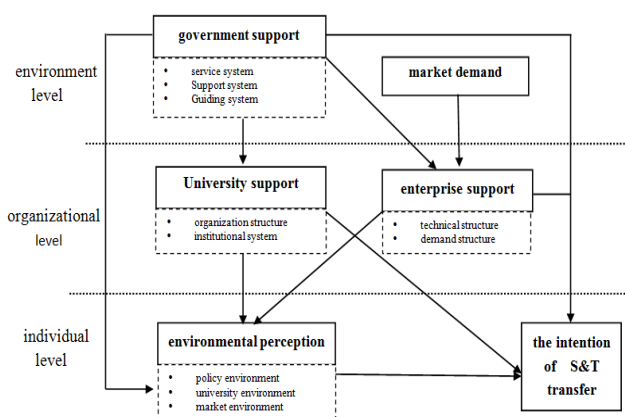


Fig. 1. Theoretical framework of factors affecting the intention of college teachers' S&T transformation.

#### IV. CONCLUSION

Based on innovation diffusion theory, using the anthropology and statistical methods, the paper explores the mechanisms of government support, organizational support, and environmental perception affecting the intention of college teachers' S&T transformation under the perspective of core stakeholder of universities, enterprises and teachers. The results show that the support systems, guiding and service policies of government have the positive effect on the behavior of universities giving strong backing to teachers launch secondary innovation, and also affect the willingness of enterprise to absorb and convert S&T. Both the organizational structure and institutional system of college and the technological structure and demand structure of enterprise have the positive effect on the teachers' perception of market/policy environments. So the college and enterprise are an important intermediary of promoting the intention of college teachers' S&T transformation.

The theoretical framework of Figure 1 constructed in this paper expands the previous research from two aspects: firstly, we summarize the elements of the social system that affect the intention of teachers' S&T transformation, from the perspective of multi-subjects. Previous research mainly focused on the ability of enterprises transforming and absorbing S&T<sup>[21]</sup>, and the logical mechanism<sup>[22]</sup> of universities promoting S&T transfer, such as college capital investment, teacher evaluation mechanisms, and intellectual property management, etc. While this paper proposes and validates the core elements that affect the willingness of teachers' S&T transformation from three core stakeholder of universities, enterprises and teachers' perspective. It can fully demonstrate and examine the attitudes of different subjects on the same issue, and make up for the deficiencies of past scattered research. Secondly, the new mechanism for promoting the S&T transfer is expanded from the perspective of the willingness of suppliers of S&T. There have been studies that proposed the teacher-to-employment entrepreneurship policy<sup>[15]</sup> that would strengthen the transformation of S&T. However, as the core suppliers of S&T and the players in secondary innovation, teachers' willingness to transfer S&T has been neglected. The paper explores the mechanisms of government support, organizational support, and environmental perception affecting the intention of teachers' S&T transformation under the perspective of teachers. The conclusions and findings of this study have the following theoretical and practical implications for improving the willingness of teachers' S&T transformation.

- Colleges can make full use of makerspace of universities to release the institutional vitality to help teachers implement secondary innovation. The business startup and innovation development strategy has prompted universities to build their own makerspace to promote innovation and entrepreneurship education, S&T transfer, and transformation of the governance model of university science parks<sup>[24]</sup>. Therefore, colleges should rely on the opportunities of makerspace, and integrate innovative development policies, such as innovation and entrepreneurship, with the university institutions. Meanwhile, they should adopt a corporate governance model to fully release institutional vibrancy, for example, if teachers use makerspace to transform their S&T into entrepreneurship, they can enjoy support policies such as the transfer of intellectual property and the right to control funds. On one hand, it solved the embarrassing situation of S&T transfer in universities from the "policy pool", "fund pool", "institution pool" and "talent pool"; on the other hand, it eliminates the institutional barriers that constrained teachers' S&T transfer and injected system dynamics for their secondary innovations in S&T.
- Enterprises can absorb social network resources by constructing a mass innovation platform and crack the dilemma of supply and demand of S&T. The vigorous development of business startup and

innovation promotes the transformation of enterprise organizations to a platform, and boosts organizations can respond more flexibly to market changes and achieve low-cost innovation<sup>[24]</sup>. For this purpose, enterprises can integrate their characteristics to build mass innovation platform, and form a multidimensional embedded relationship with the government, market, and entrepreneurs, and thus acquire institutional and market resources. Institutional resources can reduce the risks and costs of transforming S&T. Market resources can effectively support the supply-demand collaboration between the technology/demand structure and teachers' S&T. Therefore, the mass innovation platform approach can not only form a "resource pool" for enterprises to transfer and transform S&T, but also can set up "test pools" for teachers to carry out secondary innovations in S&T, and fundamentally solve the difficulties in supply and demand collaboration of S&T.

- Teachers can carry out interactive innovation and reengineer innovation and entrepreneurship by means of open platform. This article points out that the lack of market operation experience and product testing funds are the core factors that inhibit the intention of college teachers' S&T transformation. To this end, teachers can rely on open innovation and entrepreneurship platforms built by enterprises and scientific research institutions to obtain innovation and entrepreneurial resources such as achievements conversion funds, entrepreneurial partners, entrepreneurial leadership, enterprise management, and product display platforms, in order to increase teachers' sensitivity of accessing to technology and markets, reshape the ability to innovate and start up business. And also it can effectively solve the predicament of unsound institutions for universities' S&T transformation and the shortage of specialized talents.

#### REFERENCES

- [1] H.Y. Zhang, Z.W. Shi, Fuzzy Cognition Research of the Influencing Factors During Scientific and Technological Achievement Transformation Based on the Perspective of Innovation Diffusion[J]. *Science of Science and Management of S. & T.* 2013(5): 28-35.(Chinese journal)
- [2] W. Chen, Y.P. Li, The Evolution of the Driving Forces for Innovation Development [J]. *Science and Technology Management Research.* 2017(14): 1-5. (Chinese journal)
- [3] B.J. Fu, The Academic Capital Transformation:Organizational Characteristics of Entrepreneurial University[J]. *Educational Research.* 2016(2): 89-95.
- [4] A. D. Heher, Return on Investment in Innovation: Implications for Institutions and National Agencies[J]. *Journal of Technology Transfer,*2006, 31(4):403-414.
- [5] Q.S. Pang, K.F. Xu, On the Barriers and Measures to the Transformation of S&T Achievements in High Institution[J]. *R & D Management.* 2003(3): 89-93. (Chinese journal)
- [6] H.R. Liu, The Influence of Government Policy on the Performance of Corporate Cooperative Innovation Based on Chongqing's Empirical

- Analysis [J]. *Reformation & Strategy.* 2006(3): 129-132. (Chinese journal)
- [7] Q. Guo, X.Y. Xia, L. Zhao, On the Influencing Factors and Countermeasures to the Transformation of S&T Achievements in Universities [J]. *Science & Technology Progress and Policy.* 2012(6): 151-153. (Chinese journal)
- [8] T. R. Anderson, T. U. Daim, F. F. Lavoie, Measuring the efficiency of university technology transfer [J]. *Technovation,*2007,27(5):306-318.
- [9] J. G. Thursby, S. Kemp, Growth and productive efficiency of university intellectual property licensing[J]. *Research Policy,*2002,31(1):109-124.
- [10] J. E. Perry-Smith, Social Yet Creative: The Role of Social Relationships in Facilitating Individual Creativity[J]. *Academy of Management Journal,*2006,49(1):85-101.
- [11] H. Zhang, L. Yang, W. He, Present Situations and Crux of Transformation of Scientific and Technological Achievements in Colleges [J]. *Science Research Management.* 2017(S1): 676-679. (Chinese journal)
- [12] M. Clarkson, A risk based model of stakeholder theory[C]. *Proceedings of the second Toronto conference on stakeholder theory,* 1994.
- [13] Y.Z. Cai, Research Commercialization :Content ,Boundary as Well as Statistics and Measuring[J]. *Studies in Science of Science.* 2015(1): 37-44. (Chinese journal)
- [14] B. Uzzi, R. Lancaster, Relational embeddedness and learning: The case of bank loan managers and their clients[J]. *Management Science,*2003,49(4):383-399.
- [15] B.Q. Chen, W. Wang, Q. Sheng, M. Zhang, Properly Handling the Relationship Between Teacher's Leaving for Startups and Transformation of S & T Achievements in Universities [J]. *R & D Management.* 2016(5): 132-136. (Chinese journal)
- [16] H.M. Wei, Analyzing the Institutional Environment of University Teachers' Entrepreneurship: The Perspective of the 3-Dimensional Frame of Institutional Environment [J]. *Research in Educational Development.* 2015(17): 68-73. (Chinese journal)
- [17] G. Hu, X.H. Zhang, W.W. Liu, D. Hu, Local Institutes: A New Exploration of the Transformation Mode of S & T Achievements in Universities [J]. *R & D Management,* 2014(3): 122-128. (Chinese journal)
- [18] C.D. Zhang, Y. Wang, Innovating Motivation of Firms: From a Spurring of Market Demand——Based on a Questionnaire Analysis of the Full Sample of National Innovation-oriented Enterprises [J]. *Forum on Science and Technology in China.* 2014(4): 74-79. (Chinese journal)
- [19] X.X. Liu, Y.B. Wu, Enterprises Productivity and Its Sources: Innovation or Demand Push ? [J]. *Economic Research Journal.* 2009(7): 45-54. (Chinese journal)
- [20] C.F. Zou, S. Liu, Q. Xie, Research on the Relationship between Market Demand, Government Subsidy and Corporate Technology Innovation[J]. *Statistics & Decision.* 2014(9): 179-182. (Chinese journal)
- [21] W. M. Cohen, A. D. Levinthal, Absorptive Capacity: A New Perspective on Learning and Innovation[J]. *Administrative Science Quarterly,*1990,35(1):128-152.
- [22] J. G.Thursby, S. Kemp, Growth and productive efficiency of university intellectual property licensing[J]. *Research Policy,*2002,31(1):109-124.
- [23] Y.P. Li, W. Chen, The Research Actuality and Future Prospect of Crowd Innovation Space [J]. *Forum on Science and Technology in China.* 2017(5): 12-18. (Chinese journal)
- [24] Y.P. Li, W. Chen, Jianan Chen. Research on the Ecological Network Elements and Capacity Generation of Maker-oriented Platform Organization [J]. *Business Management Journal.* 2017(6): 101-115. (Chinese journal)