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Strategies for Building a Scientific Research Talent Team Based on Regression Models

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Abstract: As the cradle of talent cultivation, universities have a significant impact on the rise and fall of national development through the production and application of scientific research achievements. Based on data research on the research talent team of Yunnan Open University, statistical methods were used to analyze and process the data materials. Regression models were used to study the relationship between the output of scientific research results in the analysis of industry teaching research cooperation. The relationship between the output of scientific research results and the factors of industry teaching research cooperation, such as teachers' professional titles, research work time structure, as well as the investment in school enterprise cooperation funds, number of cooperative entities, and number of invested cooperative teachers, was tested, so as to provide countermeasures and suggestions for the allocation of various elements, in order to guide the institutional practice of vocational colleges in actual funding investment and talent resource allocation.

1. Introduction

In 2016, the issuance of the "Several Opinions on Implementing a Policy of Distribution Guided by Increasing the Value of Knowledge" allowed in-service university teachers to work part-time and participate in enterprise activities within a reasonable and legal range, carry out cooperation between industry, education, and research, and encourage researchers to engage in part-time work to obtain legitimate income while engaging in university teaching and research. We have fully utilized the regulation and control of income distribution to stimulate the enthusiasm of university teachers in scientific research activities and research innovation practices. In 2017, the General Office of the State Council issued the "Several Opinions on Deepening the Integration of Industry, Education, and Research" (Guo Ban Fa [2017] No. 95), deepening the supply side structural reform of talent cultivation, and promoting the organic integration of education chain, talent chain, industry chain, and innovation chain.

Against the backdrop of China's implementation of the innovation driven development strategy, science and technology are rapidly developing, information technology is deeply influencing economic globalization, and talent mobility is internationalized. The competition in technology is to a certain extent a competition for talents, who have become the driving force for national strength competition. Universities serve as the cradle of talent cultivation. The impact of the scientific

research talent team on the rise and fall of national development is mainly reflected in the application and transformation of scientific research output. The positive impact of university industry teaching research cooperation on the output of university scientific research results determines the positive output of scientific research results, thereby having a positive impact on social production.

2. Survey in the Application of Regression Model in Research on Industry Education Research Cooperation

Since Gauss used the least squares method as an observation estimation method, statistical methods have been applied to scientific econometric research and prediction in specific fields for over 200 years. In specific training fields, by analyzing and studying the attributes and factors that affect specific talent teams, they have been widely applied in the field of economic research internationally and have achieved practical guidance and regulatory guidance. For example, Lower[1] et al By linking patent information, paper publication records, and establishing a database, it was found that university teachers who founded enterprises not only have higher research productivity than their peers, but also do not experience a decrease in their research productivity due to entrepreneurial behavior. Yu Li[2] and others from the Education Science Research Institute of Huazhong University of Science and Technology used the linear regression principle to establish an evaluation model on the impact of off campus part-time jobs on the scientific research output of university teachers. They qualitatively analyzed the impact of off campus part-time jobs and research preferences on the individual output of teachers. They found that off campus part-time jobs have a positive correlation with the scientific research output of university teachers, and research preferences have a moderating effect on the academic achievements of university teachers.

In terms of the research on the impact mechanism of industry education research cooperation on the scientific research output of research talent teams, literature research has found that research frequently involves exploration and research on teaching from the perspective of industry education research, professional simulation and practice research on teaching reform and practice, e-commerce, and professional transformation reform research. However, there is relatively little qualitative and quantitative analysis research on the impact of industry education research cooperation on scientific research output in the context of vocational colleges. In fact, the application of quantitative analysis methods using statistical analysis to clarify the interrelationships of various factors in relevant management fields has penetrated into various fields of economic management. In terms of teaching and research management, implicit knowledge and talent cultivation[3], collaborative innovation and research performance evaluation[4], high-level talent introduction characteristics and quality analysis[5], industry、university、 research and inclusive talent development models[6][7] and innovative behavior Empirical research results have been obtained on the relationship between quality capability and innovation technology efficiency[8], and have been applied to practical decision-making and institutional guidance in universities.

3. Analysis of the Relationship between Industry, Education and Research and the Output of Scientific Research Achievements

Based on data research on the research talent team of Yunnan Open University and existing data materials, statistical methods are used to analyze and process the data materials. Linear regression models are used to study the impact of industry teaching research cooperation on scientific research output, examine the moderating effect of teacher position nature on the impact of industry teaching research cooperation and scientific research output, analyze the specific reasons that affect scientific research output, and verify the quantitative issues of the impact using data models. Take the date of natural science statistics for Yunnan Open University in 2022 as an example.

The research adopts a combination of qualitative and quantitative methods. Based on the general practical situation, industrial demand is oriented towards the direction of scientific research output, and promoting the output of scientific research talent teams in terms of results should present a positive promoting relationship. Multiple linear regression models are applied to analyze. The problem domain is the relationship between industry education research cooperation and scientific research output. There are multiple explanatory variables, which include objective and individual factors. In the problem domain, objective factors include but are not limited to: university level, nature of cooperative enterprise, nature of employment position, etc. Individual factors include but are not limited to: education background, graduation institution, employment location, marital status, marital status, family status, professional title, and job pressure. There is a correlation between job pressure and the nature of the job position in objective factors. In the analysis, the dependence and impact of such specific secondary correlation factors are not considered.

3.1. Analysis on Individual Factors of Scientific Researchers

Taking the 2022 natural science research talent team data as an example, classify and count the professional titles, educational qualifications, and disciplines of scientific researchers. A total of 278 researchers have been invested, including 24 professors, 96 associate professors, 113 personnel with intermediate professional titles, and 26 other personnel. From the perspective of professional title structure, the data distribution diagram is shown in Figure 1, with the main research personnel being intermediate professional title personnel, accounting for nearly 45%. From the perspective of age structure, 52.89% of researchers aged 45 and above are invested in scientific research, and 29% are faculty members aged 30-39.

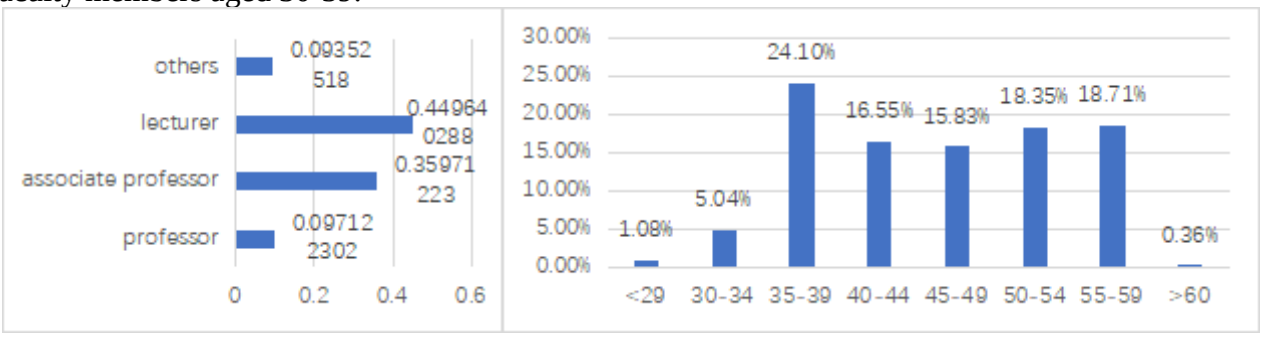

Figure 1: Structure chart of the number of researchers invested by professional title and age in 2022

From the perspective of the professional title structure of each age group, 45% of lecturers under the age of 39 are engaged in scientific research, and 20% of professors over the age of 55 are engaged in scientific research, as shown in Figure 2.

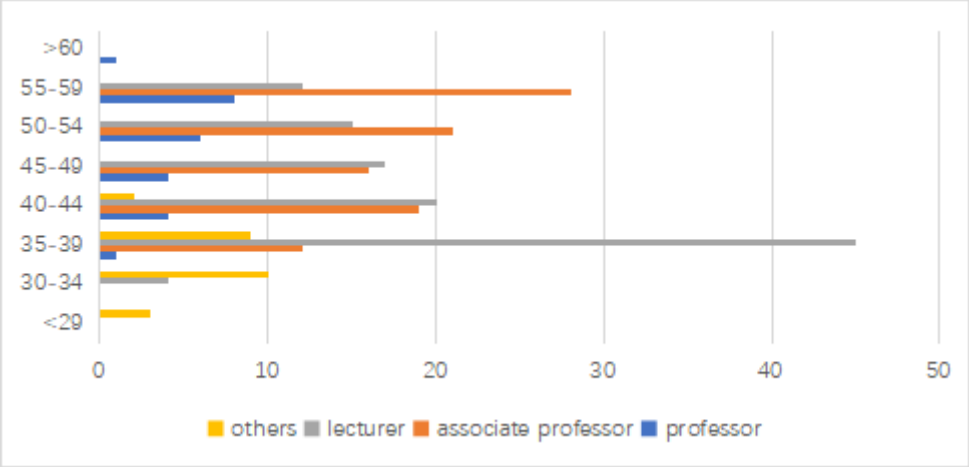

Figure 2: Distribution of Age Structure of Researchers Invested in 2022

In terms of the time invested by researchers in scientific research work, there are 150 part-time researchers who work part-time each year, equivalent to only 34.5 full-time researchers. Based on the total number of 800 researchers in the university, the number of full-time researchers is only 4.3%. The proportion of research personnel invested is extremely low, and there is a significant gap compared to the standard allocation of education teachers and research investment in high-level universities. (Table 1)

Table 1: Statistical Table of Natural Science Investment in Scientific Research Work Time in 2022

category	Equivalent to full-time personnel	Number of part-time personnel
professor	8	2
associate professor	34	8.2
lecturer	83	17.8
assistant	20	5.6
primary	4	0.7
Doctoral graduation	7	2.1
Master's degree	115	27.2
Undergraduate graduation	22	4.6
Other educational qualifications	6	0.6

From the perspective of the professional titles of the personnel invested, lecturers have the longest time invested in scientific research work, accounting for 83 part-time workload of self-disciplinary scientific research personnel in the school. The cumulative time invested in scientific research work by associate professors and professors and other high-ranking personnel is 42; From the perspective of the educational background of the personnel invested, 78.84% of the faculty members have a master's degree in scientific research work, while the cumulative amount of time invested by highly educated personnel such as doctoral students is less than 8%, as shown in Figure 3.

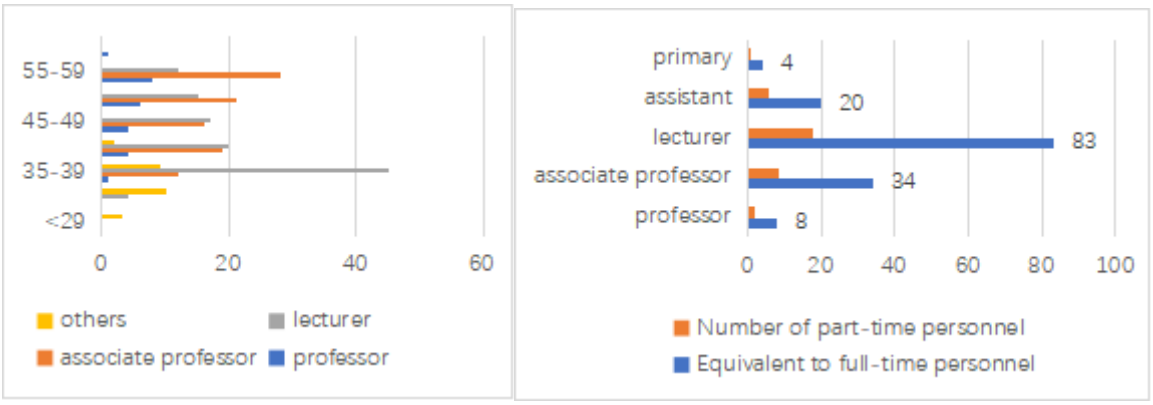

Figure 3: Statistical Chart of the Work Time, Professional Title, and Education Structure of Natural science Personnel in 2022

Based on the above, there are the following problems in the structure of the research talent team: the main output of the school relies on research personnel with intermediate professional titles and master's degrees, and the investment structure of research personnel in professional titles is unreasonable. There are many people with high professional titles but very little investment time, and the main investment in research personnel is over 45 years old. The age structure of the research team is unreasonable.

3.2. Analysis of the Relationship between the Investment of Industry & Education Personnel and the Output of Research Achievements

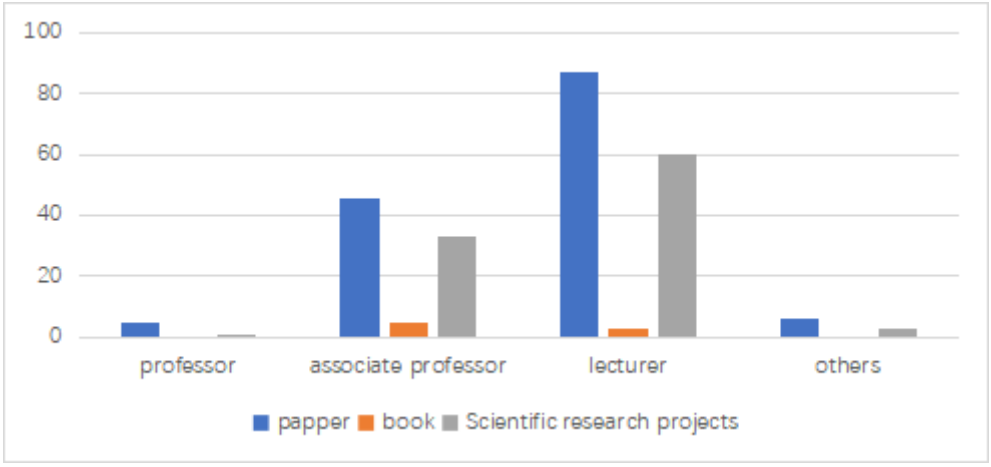

Figure 4: Statistical Chart of Scientific Research Personnel Invested by Educational Structure in 2022

From the perspective of scientific research output in terms of professional titles, lecturers mainly focus on papers and projects. Vice professors produce more in terms of works than lecturers, while professors and other junior personnel produce very little in various aspects of scientific research output. (Figure 4)

The dependent variable is the number of academic papers, published monographs, invention patents, and soft works by research teachers. Here, the number of patents is used as the explanatory variable, and the control variable selection of research teams and research funding investment factors remains unchanged. The regression equation is as follows:

$$y_{ij} = \beta_0 + \beta_1 x_{ij} + \beta_2 p_{ij} + \beta_3 q_{ij} + \ldots + \varepsilon_{ij}$$

I is the i-th data in n sample sizes, and j is the j-th variable in sample observations. According to Kendall's research in "Multivariate Analysis", it is necessary to select more than 10 times the number of explanatory variables to ensure the effective parameter estimation of the research and analysis model. Our university has a research talent team of around 200 people, and the key preset explanatory variables do not exceed 10. Therefore, a sample size of around 100 is considered effective. Among them, y is the dependent variable of the dependent variable, x is the situation of cooperation with enterprises in industry, education, and research projects, p is the investment of teachers in industry, education, and research cooperation, and q is the horizontal funding input or output of the sample. Due to the difficulty in obtaining samples at the university level, this explanatory variable can be increased or decreased based on actual research and data conditions, which may have an impact on the estimation reliability of parameter models. However, only comparative studies are conducted on different departments within the school, and the impact can be ignored.

Due to the difficulty in obtaining samples, the samples are only data on the scientific research achievements of our school's teacher research talent team, which has certain limitations. The obtained data samples are based on empirical positive correlation assumptions. This study only tests the model for the relationship between the problem domain and the cooperation between industry, education, and research and the output of scientific research teams. It only explains key variables for some control variables, and only applies linear fitting to the regression model for the professional title and investment workload of the team, as well as the number of projects and horizontal funding in school enterprise cooperation.The results are shown in Table 2：

Table 2: Statistical Table of Linear Regression Parameters for Industry & Education Cooperation Data

category	Number of signed technical contracts	Number of collaborative development projects with enterprises	Jointly building projects with enterprises	Contract transaction amount (unit: ten million)	Total number of patents	Total number of full-time teachers
Number of signed technical contracts	1					
Number of collaborative development projects with enterprises	0.764	1				
Jointly building projects with enterprises	0.210	-0.210	1			
Total number of patents	0.330	-0.330	0.799	1		
Total number of patents	0.178	-0.459	0.737	0.953	1	
Total number of full-time teachers	0.034	-0.102	0.894	0.449	0.381	1
Number of participating teachers	-0.119	-0.672	0.788	0.876	0.94	0.53

Taking patents as an example for analysis of scientific research output, it can be seen from the above relationship that there is a negative correlation between the number of collaborative open projects with enterprises and the number of patents in scientific research output. However, there is a

strong positive correlation between the number of collaborative open projects with enterprises and the number of collaborative open projects with enterprises. The phenomenon of a negative correlation between the number of corporate entities and the number of collaborative projects reveals a fact: the fields and directions of cooperation with enterprises have little investment in scientific research output, the cooperation methods are single, or cooperation is more important than teaching and less important than research, and the contribution to the scientific research output of cooperation is very small, neglecting the driving role of scientific research or technological cooperation in the development of schools and the leadership of talent teams. In the traditional sense, the effectiveness of using economic indicators to serve the local economy and industries in Yunnan has been very small.

4. Countermeasures for the Construction of Scientific Research Talent Team under the Cooperation of Industry, Education and Research

From the perspective of scientific research output, taking the natural sciences field of Yunnan Open University as an example, based on the research talent team and current status of scientific research achievements during the school's 13th Five Year Plan period, the school currently has about 800 faculty members, including 420 with master's degrees or above, 234 with associate high or above professional titles, and about 300 double qualified teams practicing on the front line of enterprises, accounting for approximately 50%. From the perspective of academic participation, most of them have scientific research literacy and research abilities, and have participated in teaching activities and scientific research. From the perspective of scientific research output, during the 13th Five Year Plan period, one national level project was approved, 1096 papers were publicly published, only 249 core journals were published, 34 monographs were publicly published, 96 patents were authorized, and the conversion rate of scientific and technological achievements reported for 5 consecutive years was 0.

4.1. Strengthen the leading and demonstration role of high professional title talents, and match the evaluation of achievements with social contributions

For five consecutive years, research funding has been invested in tens of millions, including incentives and research funds. The data to some extent reflects the imbalance between our school's high professional titles and low-level achievements, and there is a trend of low production of research achievements among high-performance individuals. We should strengthen the leading role of talents with high professional titles in the contribution of scientific research and school development, take scientific research as a breakthrough point, drive the cultivation and stability of talent teams, and promote the updating and iteration of school development.

4.2. Strengthen the construction of the scientific research "mentoring" team and attach importance to the scientific research cultivation of young teachers

According to data analysis, the output of scientific research achievements in vocational colleges mainly comes from personnel with intermediate professional titles. Personnel with senior professional titles and below devote less than half of their research work time to the entire school, and their proportion in scientific research output also shows the same trend. The construction of personnel with high professional titles should focus on talent cultivation and social contribution. In cultivating high-level projects, the cultivation and development of the talent team should be strengthened through "mentoring", leading the scientific research talent team to form a stable and disciplinary advantage structure; At the same time, attention should be paid to the support of young teachers, regardless of seniority or professional title. Academic background and actual scientific research

contributions should be used as evaluation factors for scientific and technological talent project applications and achievement evaluations, forming a good academic ecological environment.

4.3. Strengthen the cooperation between schools and enterprises led by the "dual teacher" model, and build diversified research demonstration projects for cooperation

From the perspective of the breadth and scope of school enterprise cooperation, there are very few explorations in the field of scientific research, and there are very few long-term stable school enterprise cooperation projects or horizontal scientific research topics. Higher vocational colleges should strengthen the construction of win-win and mutually beneficial cooperation between schools and enterprises. Schools should be guided by enterprise needs, strengthen the output of scientific research achievements and transform them into practical production applications. Enterprises should build diversified collaborative research demonstration projects，which can cultivate a talent team suitable for production, management, and application .At the same time, enterprises should strengthen the cultivation of a dual qualified talent team, guided by scientific issues, and strengthen diversified cooperation in the development of teachers, enterprises, positions, and students. Using scientific research demonstration projects as a carrier, we aim to enhance the quality of the "double qualified" scientific research talent team in vocational colleges and provide feedback for the application and development of enterprise bases.

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