



Construction path of rural tourism talent training system based on rural revitalization strategy

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SUMMARY: *The breeding of rural tourism professionals is a multi-faceted and organized process. The clarification of the hierarchical relationships between the influencing factors and the identification of the main components are critical to enhance the efficiency of talent cultivation in rural tourism. In this paper, the DEMATEL approach is used to find out the degree of centrality and causality and thus identifying the significant factors that influence the study. The system dynamic view constructs, simulates, and analyzes a talent cultivation model of collaborative innovation between industry, universities, and research institutions. Moreover, a novel way of developing rural tourism talent is suggested by combining the concept of fuzzy-set qualitative comparative analysis with the direction of developing high-quality rural tourism talent. It was found that there were eight direct influencing factors, i.e., time demand and national policy support, and twelve indirect factors, i.e., rural tourism attitude and rural tourism platform construction. During the cultivation process, the factors associated with industry-university-research cooperation are highly interdependent and interconnected, creating a tightly-knit decision-making network. Colleges and universities do not directly contribute to the talent cultivation through industry-university-research cooperation, whereas the role of enterprise capital input and research institution participation is significant in ensuring the successful implementation of the collaborative innovation process to develop talents in rural tourism. The cultivation path can also be divided into three groups which are the talent-resource-environment group, comprehensive-focus group and the talent-resource dual-focus group.*

KEYWORDS: *DEMATEL model; system dynamics; industry-academia-research; cultivation path; paste set qualitative comparative analysis method; rural tourism talent*

1 Introduction

The rural tourism has also become a major component of the rural economy, as well as an important part of increasing farmers income and enhancing the urban-rural integration process due to the fast-paced development of urbanization in China and the ongoing upgrade of the country's economy [1-3]. The authors [4], He et al., studied the effect of rural tourism in changing the sustainable income of the farmers through the use of provincial panel data of China in 2003-2020. The results indicate that rural tourism has a very positive effect on the farmer's sustainable income. Luo et al. [5] investigated the effect of integrated agritourism development on the growth of the farmers income using the panel data of the counties and districts in Guangxi between 2005 and 2020 and they concluded that integrated agritourism

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<https://doi.org/10.65102/is2026393>

development could help increase the farmers income. Mugauina et al. [6] talked about the severe consequences of the COVID-19 pandemic on the tourism industry and highlighted that there is a need to strengthen sustainable development of domestic tourism, particularly rural tourism, to change the prevailing pattern of tourism development.

Based on the National Bureau of Statistics report, the rural tourism income in China was 1.2 trillion yuan in 2022, with a year-over-year growth of 10 and it is 15 percent of the total national tourism revenue that clearly indicates that rural tourism has now been one of the significant parts of China tourism market [7-10]. Nevertheless, rural tourism talent cultivation has remained as one of the major bottlenecks restricting its further development [11]. The structure of tourism talents and their influence on tourism economic growth was empirically studied by Liu et al. [12] based on the panel data of the tourism industry in Central China. The findings indicate that in certain areas the talent structure has more influence on the economy, but in the individual regions less influence is observed. Sun et al. [13] addressed the issue of the lack of labor in the Chinese tourist industry, interviewed people by the focus group method, determined the reasons behind such shortages, and gave recommendations in terms of staffing, staff development and compensation.

Talent is the fundamental driving power behind rural development but rural areas continue to encounter various issues in the development of talent such as population outflow, imbalanced educational resources, and lack of skills training [14-16]. The study by Ye and Yu [17] explored the present situation and the causes of brain drain. They used the questionnaire data to examine the family and building structure, as well as the difference between the economic incomes of urban and rural areas in the villages where brain drain is experienced. Their findings indicate that scarce jobs and poor preparation and establishment of rural talent markets are the main causes of brain drain. The study by Guo et al. [18] explored how the division of educational resources affects the rural economy using Southwest China as a case study. Through the examination of how educational resources were distributed over space, it was seen that the relatively small number of educational resources available in Southwest China does not support the development of the rural economy and hence suggestions were made to optimize the situation. Lu et al. [19] studied the background of reducing poverty and related measures to elucidate further the problem of poverty and the distribution of educational resources. It is also discussed how uneven educational resource distribution is related to poverty as one of the potential factors influencing it and the respective solutions. In the rural revitalization framework, the cultivation of a cohort of compound talents familiar with agricultural as well as tourism is highly important to facilitate the high-quality development of the rural tourism industry [20-22].

Rural revitalization strategy is one of the key tasks in the development of China in the new era. It involves various aspects such as economic, social, cultural, and others forms of revitalization. In this context, team building of rural tourism personnel becomes especially significant. The creation of rural tourism needs plenty of specialists, such as tourism planners, guides, homestay operators, and business operators [23, 24]. Xiao [25] pointed to the significance of talent in rural revitalization and observed that the excessive outflow of talent to urban areas has had a detrimental impact on the agricultural sector and rural societies. The adoption of appropriate measures to address the talent deficit, enhance the talent incentive structure, and grow the talent pool will help in promoting rural revitalization. Martínez et al. [26] believed that tourism can play a major role in economic growth, and people are an essential resource to increase the revenue of rural tourism and attain sustainability. They also assessed human resources and capacity of tourism institutions with the aim of upgrading the human resource of tourism and encouraging more development of tourism. According to Zhang et al. [27], the combined development of culture and tourism is a successful type of rural

revitalization. It can also be used as a means of revitalizing the talent in impoverished regions. They explored the features of rural revitalization and proposed the use of talent revitalization policies based on local conditions to address the structural contradictions in rural talent development. Consequently, the lack of sufficiently specialized talent has a direct negative impact on the quality of rural tourism services and on the experience of its visitors [28, 29].

Thirdly, talent introduction also plays an important role in promoting the sustainable growth of rural tourism [30]. Through the attraction and introduction of professionals, management capacity and the service level of rural tourism will be enhanced and thus assist in the healthy and swift growth of the sector [31, 32]. The main obstacles to the development of rural tourism were studied by Wayhuniwrat and Harsanto [33], with recommendations on how to develop human capital. They highlighted the importance of specialized training programs, incentives to work, and promotional activities in the field of tourism. Under the context of intelligent tourism development, Liu [34] examined the present situation and challenges of intelligent tourism. The research has identified issues like poor infrastructure, lack of professional service providers, and poor quality of services offered in developing intelligent rural tourism and also made suggestions about how they could be addressed. Emphasizing that tourism specialists must have a sense of globalism in their minds about improving the quality of service and sustainable development, which is the best approach to offer high-quality tourism services, Martínez et al. [35] affirmed that setting up a service quality improvement system in the tourism sector that should be country-specific was necessary.

Moreover, innovative talents are also a critical avenue to implement the rural revitalization plan [36]. The attraction and training of individuals with professional competence and innovative thinking will facilitate the industrial upgrading of the countryside and the simultaneous development of the rural economy and society [37-39]. The emergence of transformational tourism was presented by Vidickiene et al. [40], who viewed transformational tourism business as one of the three paradigm innovations and considered it as a significant aspect of the shift between the industrial paradigm and the post-industrial service economy system. Their research contributed to the already available information about innovative strategies in the development of rural cultural tourism. Wang [41] noted that talents should be brought in to bring into realization the rural revitalization, and he stated that university graduates with specialized information, innovative mindset, and great power of learning could be instrumental in the involvement in the rural revitalization and the advancement of the rural sector. Mariotti and Sasso [42] claimed that innovation is a crucial aspect of rural revitalization, and that speeding up and enhancing the general level of innovation should be a priority in overcoming the current regional division between innovation. Thus, enhancing the overall talent base of rural tourism is of utmost importance towards facilitating the realization of rural revitalization.

The analysis of this paper is intended to enhance the completeness and validity of the influencing factors involved in cultivating rural tourism talent through the application of the Decision Making Trial and Evaluation Laboratory (DEMATEL) methodology in order to determine the interdependence of the various complex factors contributing to the development of rural tourism talents and ultimately an integrated set of 27 influencing factors. Following this, experts were asked to give their first impressions of the significance of each factor. This followed by building a mechanism flowchart of collaborative cultivation of innovative talents using system dynamics and simulation and analysis of the impact of the collaborative cultivation model (universities, industries, enterprises, research institutes) across three aspects, including universities, enterprises, and scientific research institutes. The system dynamics, combined with the current practice of rural tourism talent training under the cooperation between industries and universities, allows this study to eventually take 100 colleges and

universities as a sample of research and use the qualitative comparative analysis (QCA) to identify rural tourism talent training alternatives that may be useful in implementing the rural revitalization strategy.

2 Factors affecting talent development based on the DEMATEL model

2.1 DEMATEL research methodology

(1) Method Theory Decision Laboratory Analysis Method [43] (DEMATEL) is a method based on matrix theory and graph theory and other theories to analyze the complex system of factors, in order to solve complex and intertwined problem groups. In this paper, the obstacles to BIM application in assembly building projects involve various factors such as IT foundation, management, cost-effectiveness, etc. Adopting DEMATEL analysis method to construct a model can observe the correlation between each obstacle factor more intuitively and quantitatively, thus simplifying the complex system.

(2) Methodology Steps

Step 1: Construct the direct influence matrix. The purpose of constructing the direct influence matrix is to identify the direct influence degree among factors through expert scoring. The influence intensity is measured by a four-level scale: 0 represents no influence, 1 represents weak influence, 2 represents moderate influence, and 3 represents strong influence. Based on the expert scoring results, the direct influence matrix a_{ij} is obtained. Here, a_{ij} refers to the numerical influence degree of factor Z_i on factor Z_j . When $a_{ij}=0$, it indicates that factor Z_i has no direct effect on factor Z_j . The direct influence matrix is denoted as n order matrix

$$X = (a_{ij})_{n \times n}, \quad X = \begin{pmatrix} 0 & a_{12} & \dots & a_{1n} \\ a_{21} & 0 & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \dots & 0 \end{pmatrix}.$$

Step 2: Direct influence matrix normalization. Direct influence matrix normalization is obtained by transforming the direct influence matrix obtained in the previous step according to the following formula, and the resulting normalized matrix is denoted as Y :

$$Y = a \times X \quad (1)$$

$$a = \frac{1}{\max_{1 \leq i \leq n} \sum_{j=1}^n a_{ij}}, i, j = 1, 2, \dots, n \quad (2)$$

Step 3: Build the integrated impact matrix. The establishment of the integrated impact matrix is based on the matrix obtained from the normalization of the direct impact matrix, and then the self-multiplication and finally the accumulation of the matrix T . Its formula is as follows:

$$T = Y + Y^2 + Y^3 + \dots + Y^n \quad (3)$$

(When n is sufficiently large, it can be approximated as a composite influence matrix

$$T = Y(E - Y)^{-1}.$$

Step 4: Analyze the influence degree D_i , the influenced degree C_i , the cause degree R_i , and the centrality degree M_i of each influence indicator, and the meaning of each indicator is as follows:

Influence degree D_i : This indicator is obtained by adding up all the elements of each row of the composite influence matrix T . It indicates the total influence exerted by the factor corresponding to that row on the remaining factors.

Influenced degree C_i : The indicator is calculated as the sum of elements in every column of the composite influence matrix T . It can be used to represent the total influence that the factors represented by that column have received due to the actions of other factors.

M_i Centrality: The centrality is derived through addition of influence degree D_i and influenced degree C_i . It indicates the level of position and importance of certain influencing factors in the overall factor system.

Cause degree R_i : The term cause degree is used to indicate the difference between the influence degree D_i and the influenced degree C_i . It is applied in determining if an influencing variable is primarily a cause variable or a result variable within the system.

If R_i is greater than 0, the factor is considered to be a causal factor. If R_i is less than 0, it is categorized as a result factor. The centrality M_i denotes the relative location of each influencing factor in the total factor network. This implies that higher values mean that the factor has greater driving power and is placed in a central position among other influencing factors. Inversely, low centrality value implies that the factor is not so central in the whole influencing-factor system. The four indicators are calculated as follows:

$$D_i = \sum_{j=1}^n t_{ij} \quad (j = 1, 2, \dots, n) \quad (4)$$

$$C_i = \sum_{i=1}^n t_{ij} \quad (i = 1, 2, \dots, n) \quad (5)$$

$$M_i = a_i + b_i \quad (i = 1, 2, \dots, n) \quad (6)$$

$$R_i = a_i - b_i \quad (i = 1, 2, \dots, n) \quad (7)$$

2.2 Importance analysis of factors influencing talent development

2.2.1 Talent development influencing factors and their importance

The variables influencing the development of talent and its significance are listed in Table 1. The mean in the table is the average expert rating of the importance of each factor, whereas the coefficient of variation indicates the variability in expert opinions. It can be seen in the table that there is no positive correlation between the mean scores of the influencing factors in rural tourism personnel training and the respective coefficients of variation. This means that in rural tourism personnel training, even though various evaluators have varying perceptions about the importance of different influencing factors, their evaluation is fairly similar concerning the identification of the most important ones.

Table 1: Factors affecting talent cultivation and their importance

Influencing factor	Code	Mean	Standard deviation	Coefficient of variation
National policy support	F1	3.296	0.417	0.1348
Local government support	F2	4.392	0.468	0.0028
High school emphasis	F3	2.411	0.457	0.2379
The rural revitalization strategy is urgently needed	F4	3.374	0.47	0.1268
Market demand	F5	3.492	0.425	0.1592
Social needs	F6	3.481	0.352	0.1897
Social identity in rural tourism	F7	3.932	0.467	0.0839
Understanding rural tourism	F8	2.382	0.372	0.2647
Attitude towards rural tourism	F9	3.836	0.465	0.0621
Rural tourism platform and base	F10	3.714	0.491	0.1069
Special funds for rural tourism construction	F11	3.342	0.439	0.1489
Physical interaction space	F12	2.537	0.409	0.2731
Interdisciplinary research team	F13	2.141	0.45	0.2953
Subject Quality	F14	3.484	0.424	0.1664
Rural tourism project	F15	3.787	0.472	0.0904
Adaptability of rural students to tourism learning	F16	4.168	0.415	0.0276
Science and technology development	F17	2.322	0.415	0.1956
Industry-university-research cooperation	F18	3.494	0.378	0.1447
Information sharing mechanism	F19	3.726	0.431	0.1005
Rural tourism atmosphere	F20	3.789	0.461	0.1018
Interdisciplinary communication and interaction	F21	4.078	0.459	0.1042
Rural tourism exchanges and cooperation	F22	3.696	0.371	0.1265
Co-supervision	F23	3.103	0.446	0.1713
College talent appointment system	F24	2.203	0.467	0.2587
Tourism talent training objectives	F25	3.678	0.4601	0.1183
Rural tourism course setting	F26	2.561	0.433	0.2314
Online Course Resources	F27	3.467	0.461	0.1182

2.2.2 Results of DEMATEL analysis of factors influencing talent development

Using this approach, seven indicators that had coefficients of variation less than 0.30 were chosen in the present study, and the analysis was conducted through the Delphi method once more. The invitation was given to 20 experts to assess the level of influence of each factor, where 0 means no influence and 4 means high influence, in order to establish the links between the 20 important influencing factors.

The DEMATEL approach was also applied in this work to analyze the 20 key influencing factors quantitatively. The degree of influence D_i , the degree of influence C_j , the centrality M_i and the cause degree R_i were computed. Table 2 shows the results of the DEMATEL analysis of the factors that influence the cultivation of talents. Of all the influencing factors, the combination of national policy support, urgency of rural revitalization policy, and market demand can be more easily impacted by the other influencing factors. Conversely, rural tourism exchange and cooperation, academic quality, and rural tourism attitude can be more easily influenced by other factors. In terms of centrality, the proportion of university courses, the mechanism of information resources sharing, and the rural tourism platforms and bases have a more significant role in rural tourism talent cultivation practice. On the basis of cause degree,

there are six direct cause factors, including time demand and support of the national policy, and fourteen indirect cause factors, including result factors, such as rural tourism attitudes and rural tourism platforms and bases, during the process of cultivating rural tourism talents.

Table 2: DEMATEL analysis results of factors influencing talent development

Factor coding	D_i	C_j	M_i	R_i	Centered Sort	Factor Properties
F1	3.304	1.317	4.621	1.987	13	Cause
F2	2.747	1.481	4.228	1.266	20	Cause
F4	3.203	2.34	5.543	0.863	1	Cause
F5	3.286	1.043	4.329	2.243	18	Cause
F6	3.037	1.239	4.276	1.798	19	Cause
F7	2.945	1.408	4.353	1.537	17	Cause
F9	2.139	2.921	5.06	-0.782	7	Outcome factor
F10	2.378	2.883	5.261	-0.505	3	Outcome factor
F11	2.383	2.29	4.673	0.093	12	Cause
F14	2.283	2.955	5.238	-0.672	4	Outcome factor
F15	2.23	2.242	4.472	-0.012	15	Cause
F16	2.36	2.857	5.217	-0.497	6	Outcome factor
F18	1.727	2.699	4.426	-0.972	16	Outcome factor
F19	2.653	2.834	5.487	-0.181	2	Outcome factor
F20	2.033	2.659	4.692	-0.626	11	Outcome factor
F21	2.033	2.87	4.903	-0.837	8	Outcome factor
F22	2.04	3.106	5.146	-1.066	5	Outcome factor
F23	2.093	2.711	4.804	-0.618	9	Outcome factor
F25	2.232	2.291	4.523	-0.059	14	Outcome factor
F27	2.164	2.611	4.775	-0.447	10	Outcome factor

2.2.3 Attribute distribution of talent development influences

In an attempt to better illustrate the factors that influence the rural tourism talent development, this paper compares 20 major factors. Centrality value is taken as a horizontal coordinate and cause degree as a vertical coordinate. The results of the attribute distribution of the influencing factors are shown in Figure 1 on this basis. In terms of the overall importance and influence, eight main factors are found in the rural tourism talent cultivation such as national policy support, local government support, urgent need of national strategy, market demand and interdisciplinary research team.

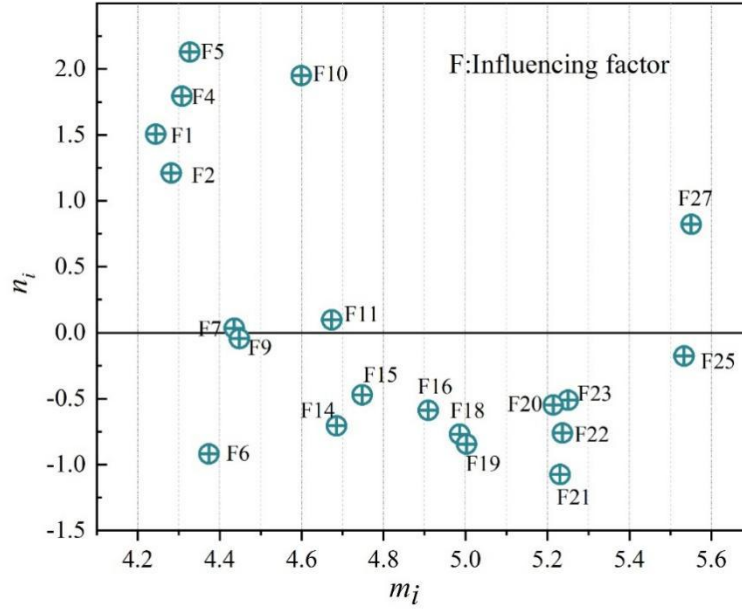


Figure 1: Results of attribute distribution of factors affecting talent cultivation

3 System dynamics personnel training mechanism based on industry-university-research collaboration

3.1 Industry-university-research collaborative talent cultivation causality

The theory of system dynamics provides the theoretical base and practical analytical methods of solving complicated issues of social and economic system management. The incorporation of a variety of resource factors into the development of innovation talents is a complex and non-linear process. Hence, system dynamics simulation model can be applied to investigate the complex causal relationships underlying the collaborative talent cultivation between industries, universities, and research institutions. The present paper examines the particular effect of universities, companies, and research institutions on the cultivation of rural talents in three different perspectives and different channels of influence.

3.1.1 Causality of Higher Education Influencing Rural Talent Development

Both colleges and universities are important locations of scientific research talent as well as large-scale incubators of innovative talent. They have a crucial position in the development of rural talents. The causal mechanism by which colleges and universities influence rural talent cultivation is given in Figure 2. Participating in the construction of the resources necessary to implement industry-university-research cooperation, universities engage in receiving government financial support and investing more in this cooperation, particularly in boosting investment in rural talent cultivation. It contributes to developing a positive innovation and cultural environment, enhancing the creativity of the students and their critical thinking, and offering professional education and training in innovative thinking strategies. Such tasks and functions can satisfy the needs of enterprises in innovative talents and increase the economic efficiency of enterprises. In return, the enhancement of the enterprise benefits leads to the growth of the national macroeconomy and eventually impacts the financing of colleges and universities by the government. Innovative cultural environment consists primarily of the

amount of innovative teachers, the quality of the teachers, and the climate of innovative education.

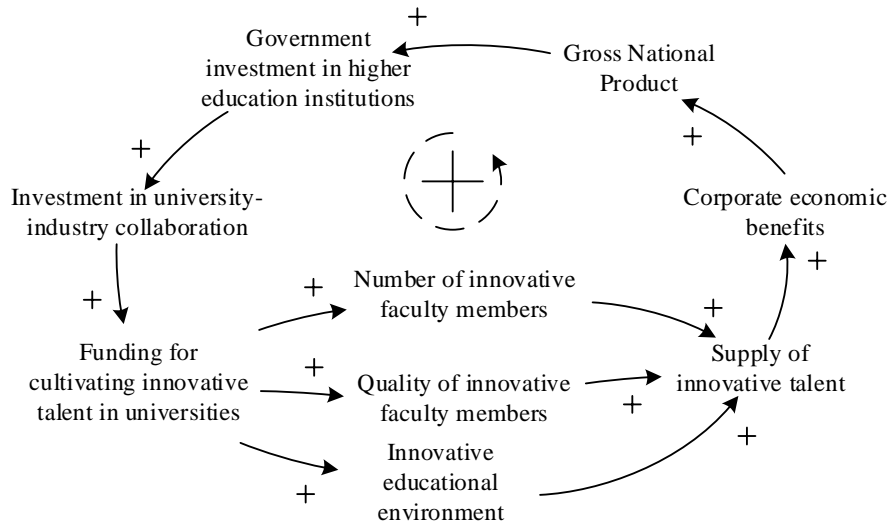


Figure 2: The cause and effect of colleges and universities on rural talent training

3.1.2 Cause and effect of business influence on rural talent development

The investments made by enterprises in the field of research and development as part of industry-university-research collaboration is an underlying condition that facilitates the successful implementation of the collaborative cooperation. The correlation of cause between enterprises and rural talent training is presented in Figure 3. To enterprises, the increasing intensity of market competition and the increasing output value of new products are directly incentives towards technological innovation. On average, more investment in technology innovation results in more output value of new products. With better management capacity, the economic gains of enterprises also rise. At a more advanced stage of enterprise development, the need to have innovative talents is felt more and universities are supposed to produce more high quality innovative talents. The increased demand of enterprises subsequently causes universities and research institutes to invest more and eventually it affects investment in technology innovation by enterprises.

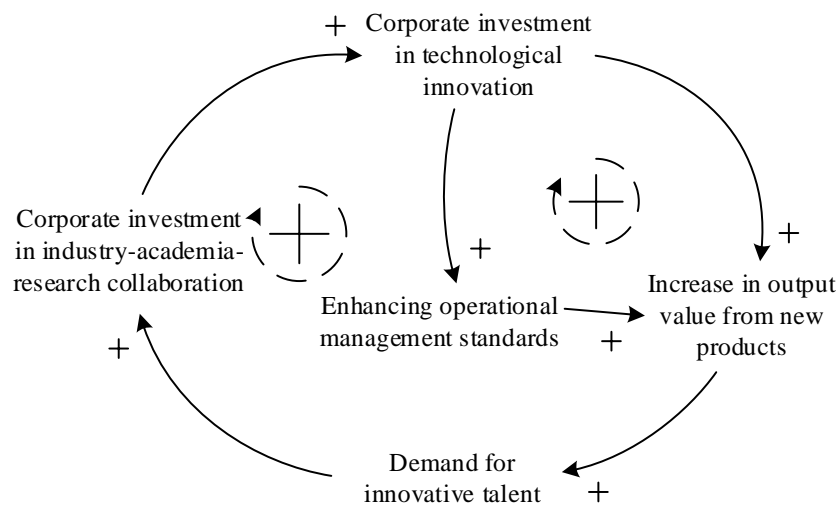


Figure 3: The causal relationship between enterprise and rural talent training

3.1.3 Causality of scientific research institutions affecting rural talent development

The reason why scientific research institutions should invest in the cooperation with industry-university-research is the advantages that they gain by engaging in such cooperation. The cause and effect relation of scientific research institutions and the development of rural talent is presented in Figure 4. Universities, industries, and research institutions may have better economic returns as a result of university-industry-research cooperation, and this can drive them to invest more in collaborative cooperation. With the rising demand of innovative talents, there is also an increased investment. Talent, particularly innovative talent, is the most valuable resource in scientific research. Human resource is a powerful tool to create scientific research outputs, attract teachers and students into the project, and boost the quantity of the basic research outcomes, and enhance the rate of converting scientific results. The rate of conversion of scientific research results will be higher, and the level of industrialization and the amount of economic gains made by research institutions will be higher. These advantages are likely to motivate research institutions to invest more in the industry-university-research cooperation.

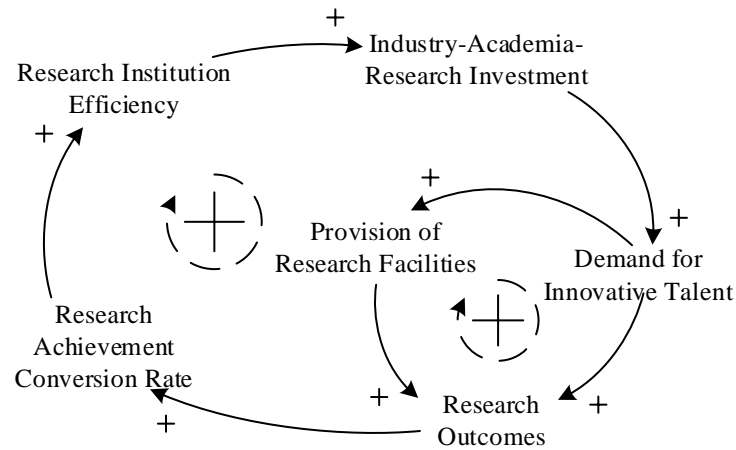


Figure 4: The causal influence of scientific research institutions on rural talent training

3.2 Flowchart of Industry-University-Research Collaboration to Cultivate Innovative Talents

The rural talent training system in terms of industry-university-research collaboration is presented in Figure 5. The findings also show the following:

(1) The behavior of the colleges and universities influences the subsystem of rural talent cultivation.

The model supposes that the contribution of colleges and universities to the development of rural talent depends largely on the role of the government in investing in rural regions. Government departments, as well as universities, should make sure they invest enough in the development of rural talent and increase the availability of innovative talents.

(2) Enterprise behavior influences rural talent cultivation subsystem

Enterprises are the most important demand side of innovative talents. In the face of increasingly fierce market competition, technological innovation helps enterprises form core competitiveness and dominate in the market. The demand for innovative talents is mainly affected by the growth rate of demand for innovative talents and the obstruction rate of demand for innovative talents. The growth rate of innovative talent demand is related to the economic benefits of enterprises. The obstruction of innovative talent demand mainly comes from the cost of introducing innovative talent in enterprises, which is reflected in the model as the obstruction

factor of innovative talent demand.

(3) Scientific research institutions affect the rural talent cultivation subsystem.

These institutions are an additional source of innovative talents. More investment in industry-university-research alliances by scientific research institutions may bring more innovative talents to the table and enhance the overall output of scientific research. The development of scientific research infrastructure influences the speed of transformation of scientific research results. With increasing numbers of scientific research achievements, the conversion rate is enhanced and the level of industrialization increased. Consequently, the economic advantages of research institutions increase hence more innovating talents are attracted and motivated in their work.

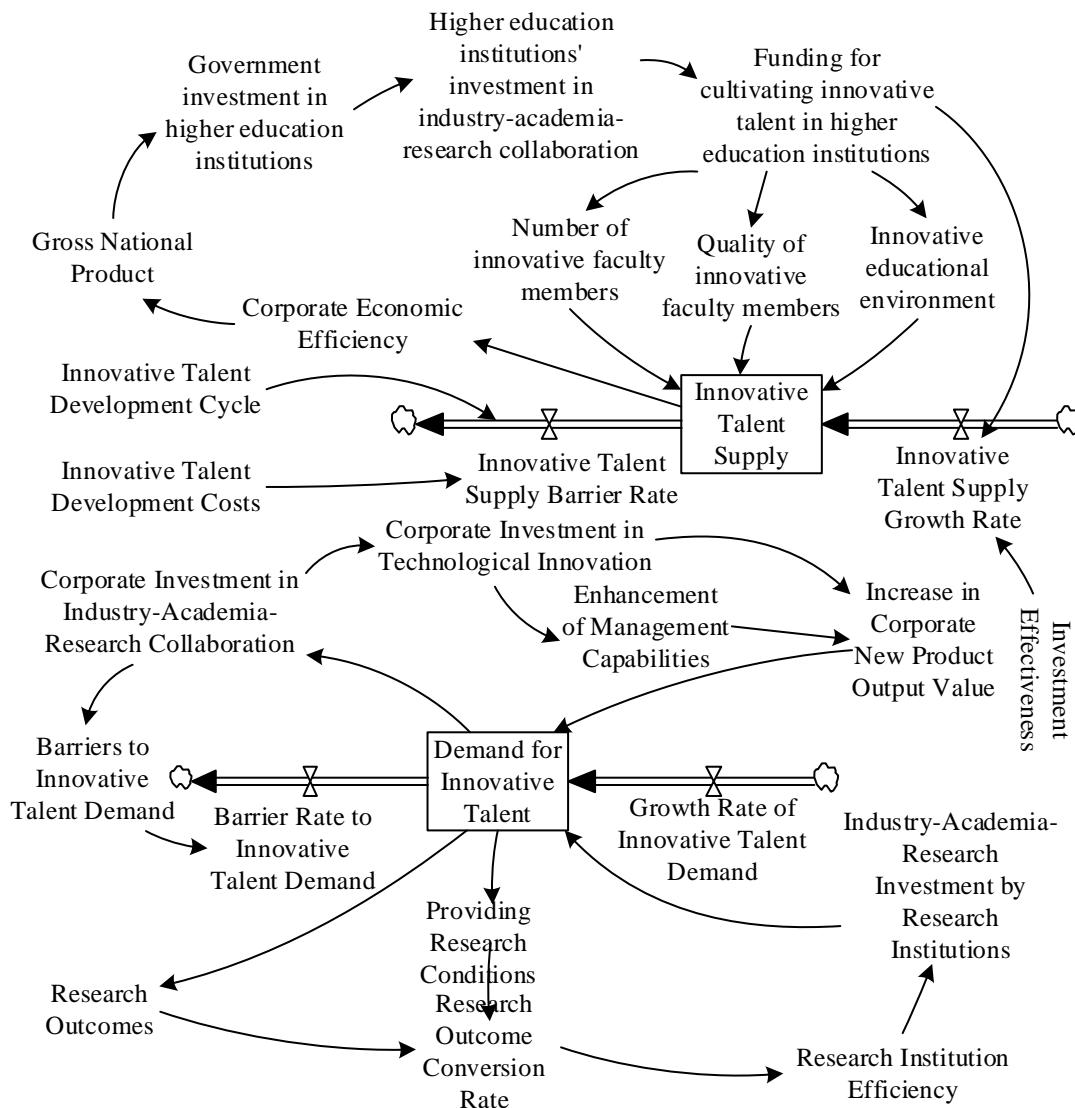


Figure 5: A talent training system integrating industry, university and research

3.3 Model simulation results of industry-university-research collaborative talent cultivation

3.3.1 Model testing

The testing of the established model mainly includes the test of the established model for the

consistency of the scale and the test of the integration error. In this study, the model software is used to test and report the error by itself. The model of industry-university-research talent cultivation system involves many kinds and numbers of variables, and here adopts its own measure consistency test, which shows that there are 16 variables with inconsistent measures, and after the test, these variables are mediated to maintain the consistency of the measure.

In the extreme-case experiment of the constructed system dynamics model of industry-university-research cooperative innovative talent cultivation [44], it is aimed at establishing if the model may represent change in extreme condition. In this test, the model responses to shocks and so-called shocks are checked by changing some chosen parameters to either a value of "0" or infinity. The model randomly chooses two variables, which are the conversion rate and the strength of university-industry cooperation and gives them the values of 0 and 1 respectively. Figure 6 shows the test results, with (a) and (b) referring to the scientific research capacity of research institutions and the talent cultivation capacity of the cooperation platform, respectively. Even though the achievement transformation rate and the strength of industry-university-research cooperation are at extreme values, the two variables, i.e., the scientific research strength of the research institution and the talent cultivation capacity of cooperation platform, exhibit realistic variation trends. This confirms that the model built in the present study is working properly.

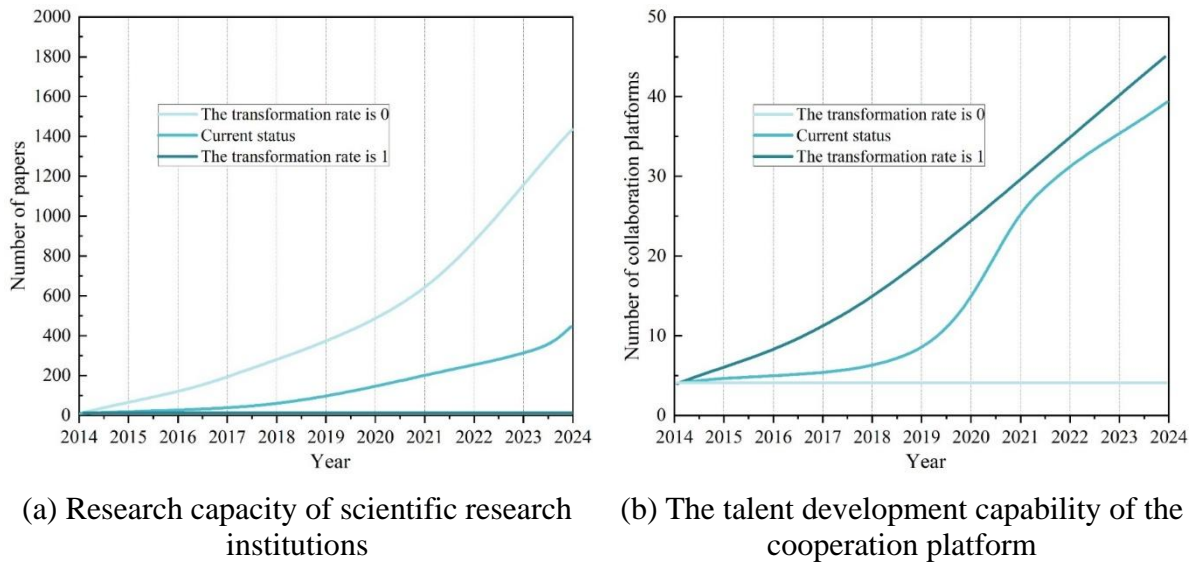


Figure 6: Extreme test results

3.3.2 System dynamics simulation results

(1) Role of higher education institutions

The higher education institutions are one of the three key participants of cooperation and innovation in the process of industry-university-research association. In order to further study the role of the colleges and universities in the development of talents with various input distributions in collaborative innovation, the simulation is focused on studying the impact of higher education institutions on the change in the training of talents, only the value of a certain parameter to be analyzed is changed when analyzing, and other parameters are kept unchanged. Capital investment ratio: set the model step as 1 year, the time is set as 2014-2024, do not change other parameters, increase the capital investment ratio of colleges and universities to the industry-university-research cooperation platform by 2% and 5% respectively, and you can get the results of the changes in the innovation capacity of the cooperation platform. The effect of capital input ratio on talent cultivation ability of cooperation platform is shown in Figure 7.

The results show that changing the school capital input ratio does not make a big difference in the talent cultivation ability of the cooperation platform. Relatively speaking, the contribution of universities in the simulation to the talent cultivation of industry-university research is not significant.

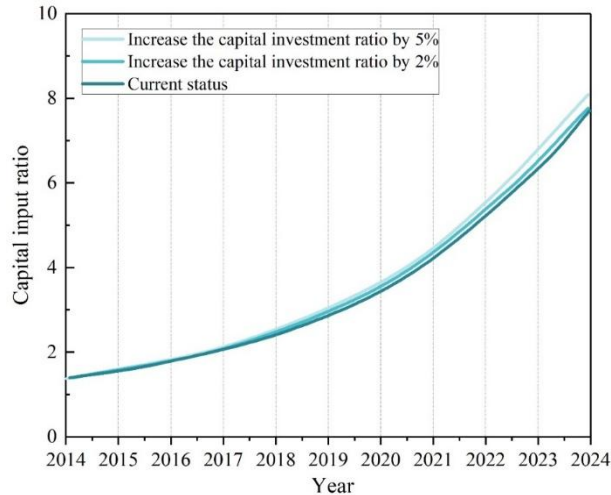


Figure 7: The influence of capital input ratio on talent training ability

(2) Role of enterprises

Companies are not only the consumers but also consumers of the innovative abilities. They play a significant role in the process of converting human resources into actual productivity and promoting the growth of industries. The dynamic model of the industry-university-research system is used to assess the interrelation between the contribution of enterprise inputs and the development of talents in cooperative cooperation by modifying the intensity of enterprise contributions to the process of talent development. Through simulation of cooperation intensity, the talent cultivation capacity of the cooperation platform can be derived by increasing the cooperation coefficient of industry-university-research collaboration by 3% and 6 percent respectively. The effects of the industry-university-research collaboration on the talent cultivation capacity of the cooperation platform are illustrated in Figure 8. The findings reveal that cooperation intensity is the principal factor that influences the talent cultivation capacity of the cooperation platform as opposed to capital investment.

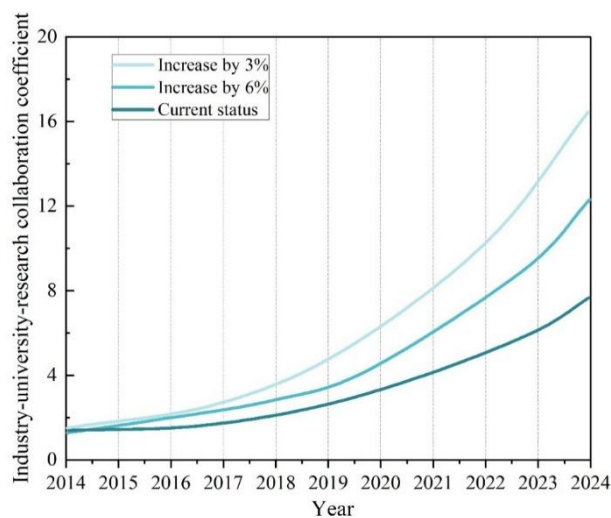


Figure 8: The influence of industry-university-research on talent training

(3) Role of Research Institutions

The scientific research institutions are playing a vital part in the collection of high-quality scientific and technological resources, cultivation of higher-end talents, promotion of achievements industrialization, and enhancement of regional innovation capability in industry-university-research cooperation. Within the system dynamics model, the role of research institutions is explored through two main ways, i.e., the percentage of capital invested by research institutions and the rate at which the achievements are transformed. These two variables are employed to analyze the influence of research institutions on the innovation capacity of the university-industry-research cooperation platform. To get the capacity changes of scientific research institutions, the other parameters are kept constant and the achievement transformation rate is raised by 1 and 5, respectively, with the model step being set to one year and the period between 2014 and 2024. The influence of the research institution capacity on the talent cultivation ability is depicted in Figure 9. It is observed that the scientific research capacity of the research institutions has greatly changed depending on whether the conversion rate increases by 1% and 5%. This proves the validity of the control factor that is used to measure the scientific research capacity of the research institutions. The conversion rate of scientific research achievements is a much more significant factor in influencing the talent cultivation ability than the capital input.

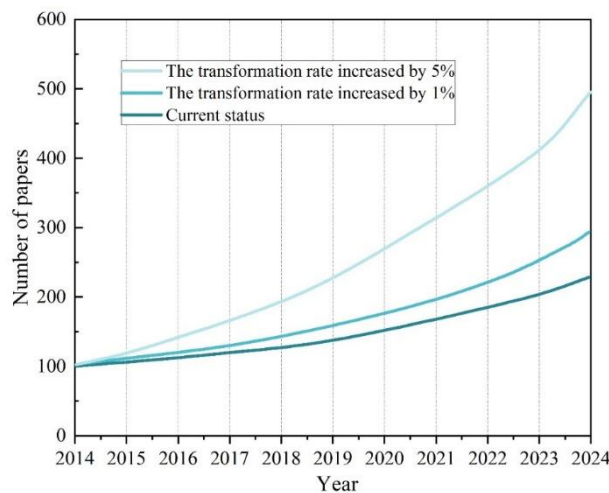


Figure 9: The influence of scientific research ability on talent training ability

4 Path system for cultivating innovative talents based on rural tourism

4.1 Study design

4.1.1 Research methodology

Qualitative Comparative Analysis (QCA) is a case study method that combines qualitative and quantitative, the core of which lies in the use of the idea of set theory to identify the influencing factors and causal groupings that produce multiple and complex social phenomena. There are two reasons for choosing fuzzy set qualitative comparative analysis (fsQCA) in this paper: firstly, the factors affecting talent cultivation are multiple and complex, subjective and objective factors coexist, and the factors may influence each other and interact with each other, and the QCA method is able to take into account the influence of multiple conditional variables, so as

to identify the causal groupings behind the effects of high-level talent cultivation; Second, the conditioning variables involved vary in degree, but are not qualitatively different, making the simple binary division method of clear sets unsuitable, while the non-binary division of fuzzy sets is more in line with reality.

4.1.2 Questionnaire design and data collection

The data in this research was gathered on the basis of a questionnaire that contained two parts. In the first part, it was intended to gather elementary personal data such as respondent age, school background, and length of work experience. The second part comprised questions based on five conditional variables, including school support, training programs, teaching staff, industry demand, and school-enterprise cooperation, and one outcome variable, which is talent cultivation effect. The questionnaire was administered in a five-point Likert scale. A value of 1 indicated completely inconsistent, 2 indicated relatively inconsistent, 3 indicated average, 4 indicated relatively consistent, and 5 indicated very consistent.

The questionnaire was completed and then sent to teachers and educational administrators of rural revitalization-related majors in colleges and universities throughout China via the Questionnaire Star platform. A sum of 50 valid questionnaires were gathered. Out of them, 18 were obtained in comprehensive colleges and universities, 16 in polytechnics and 16 in colleges and universities of finance and economy. The reliability tests revealed that the overall Cronbach alpha value of the scale is 0.9839 and the Cronbach alpha values of all subscales are greater than 0.85 which are strong and have good internal consistency.

4.1.3 Variable calibration

Every school in this research was considered as a single case. To minimize errors, in cases where more than one teacher of the same school filled in the questionnaire, the average value was taken to be the final data of that school. Once the data organization was done, variables were calibrated. The calibration process is the conversion of variables into sets and changing values of cases on variables to membership values of variables as fuzzy sets. Direct calibration method was used in this study with three thresholds which are full membership, crossover point and full non-membership. Particularly, 0.95, 0.05 and 0.5 were set as the full membership threshold, full non-membership threshold and crossover point respectively.

4.2 Analysis of empirical results of talent cultivation pathway

4.2.1 Prerequisite Analysis

Following the calibration of the study variables, fsQCA software was applied in order to produce the relevant truth table and all possible configurations of the variables. Prior to conducting the truth table analysis, there should be carried out a necessity test on the study variables. It is mostly used to identify whether one conditional variable can establish a sufficient or necessary connection with an outcome variable.

The outcomes of the necessity analysis concerning the quality of rural tourism talent training are presented in Table 3. As it can be seen from the results, consistency scores of training system, geographical location, and international competitiveness are the only ones lower than 0.95, whereas consistency scores of all the rest conditional variables are lower than 0.95. Thus, the three indicators mentioned above can be viewed as the necessary conditions to explain the high quality of top-level rural tourism talent training. Nevertheless, the coverage of teacher resources alone exceeds 0.9 and all consistency values of conditional variables are less than 0.9. This implies that no other conditional variable can independently enhance the development of high-quality top-level rural talent cultivation. It is demonstrated that the quality

of rural tourism talent training is not defined by a single variable, but it is defined by the combination of several variables. To put it in another way, the question of whether the quality of rural tourism talent cultivation can be enhanced cannot be addressed in isolation, but should be evaluated within the context of the joint conditions of talent structure, resource endowment, and social environment.

Table 3: The necessary condition for the quality of rural tourism talent training

Condition variable	High quality of cultivating outstanding innovative talents		Low quality of cultivating outstanding innovative talents	
	Consistency	Coverage	Consistency	Coverage
Enrollment	0.8903	0.8519	0.3018	0.311
Student Quality	0.8704	0.8486	0.3038	0.2957
Cultivation System	0.9949	0.7612	0.3049	0.2991
Funding	0.7879	0.7669	0.3061	0.2994
Academic Strength	0.6542	0.8814	0.3026	0.2973
Teacher resources	0.8793	0.9014	0.3089	0.3043
Course development	0.8694	0.8137	0.3013	0.2964
Geographic position	0.9931	0.8685	0.3037	0.2944
Innovation application	0.5212	0.8293	0.3049	0.2987
International competitiveness	0.9663	0.8256	0.297	0.2914

4.2.2 Conditional configuration analysis

The fuzzy-set qualitative comparative analysis method of analyzing the truth table tends to result in three kinds of solutions: complex solution, intermediate solution, and simple solution. This paper chose a simple and intermediate solution to differentiate between the core and marginal conditions in each configuration. Core conditions were identified in the conditional variables that appeared in both the simple and intermediate solutions, whereas marginal conditions were found in the ones that appeared in the intermediate solution only. Counterfactual analysis, i.e., the assumption of the existence of the possibility of improving the quality of rural tourism talent development under the occurrence of each conditional variable, was used to derive an intermediate solution.

The rural talent cultivation quality pathways are shown in Table 4, where: ● indicates a core condition, ● indicates a marginal condition, × indicates that the condition does not occur, and blank indicates that the condition is not significant to the outcome. The results show that the fuzzy set analysis results found that the driving paths used to explain the higher quality of rural tourism talent training are diversified, with a total of four paths. Where each vertical column represents a possible condition grouping state. The total consistency is 0.9284, which indicates that 92.84% of the university cases that meet these four conditional groupings show a higher quality level of rural tourism personnel training quality. The total coverage is 0.8837, which indicates that the four conditional groupings of states explain about 88.37% of the cases of high pull-out rural talent cultivation quality. Both the total consistency and total coverage satisfy the critical value, proving that the analysis is valid.

Conditional Pattern 1 verifies the path of “High-quality top-notch rural talents cultivation = Student source quality * Cultivation system * Teachers' resources * Curriculum construction * Geographic location * International competitiveness”, which indicates that promoting the optimal allocation of teachers' resources and seeking more educational support from the local government can promote the cultivation quality of rural tourism talents.

Conditional configuration 2 verifies the path of “high-quality top-notch rural talents training

= enrollment scale * student source quality * training system * discipline strength * geographic location * international competitiveness”, which indicates that high-quality rural tourism talents training can be realized under the conditions of larger enrollment scale and higher quality of student sources.

Conditional pattern 3 validates the path of “high-quality top-notch rural talents training = enrollment scale * training system * funding * scientific strength * teacher resources * curriculum construction * geographic location”, indicating that under the conditions of larger enrollment scale and abundant teacher resources, high-quality training of top-notch rural talents can be realized in the countryside.

Conditional configuration 4 verifies the path of “high-quality top-notch rural talent cultivation = quality of student sources * cultivation system * financial input * academic strength * teacher resources * curriculum construction * geographic location * international competitiveness”, which indicates that if villages can ensure high-quality sources of students and strengthen the input of financial resources, etc., it will be able to promote the cultivation of rural tourism talents. The quality of rural tourism talents cultivation can be promoted if villages can ensure quality student sources and strengthen the investment of funds.

Table 4: Path of innovative talent training quality

Conditional configuration	Group 1	Group 2	Group 3	Group 4
Enrollment		●	●	
Student Quality	●	●		●
Cultivation System	●	●	●	●
Funding			●	●
Academic Strength		●	●	●
Teacher resources	●		●	●
Course development	×		●	●
Geographic position	●	●	●	●
Innovation application				
International competitiveness	×	●		●
Native coverage	0.1727	0.7115	0.443	0.4139
Unique coverage	0.0898	0.3232	0.0711	0.0036
Consistency	0.9255	0.9788	0.9198	0.9666
Coverage of solutions	0.8837			
Consistency of solutions	0.9284			

5 Conclusion

The present paper has also used the DEMATEL model to analyze the variables affecting rural tourism talent cultivation. It further developed a rural tourism talent development mechanism through industry-university-research cooperation by combining system dynamics. Lastly, qualitative comparative analysis (QCA) was used to investigate the path system of innovative talent development in rural tourism. The key points have been:

In a program of rural tourism talent cultivation, there are eight main influencing factors that could be identified, such as national policy support, local government support, pressing need to meet the strategic goals of the country, market demand, interdisciplinary research teams.

(2) The rural talent cultivation system can be seen as consisting of three subsystems, when viewed in terms of industry-university-research collaboration: university behavior, enterprise behavior, and research institution behavior. The subsystems are very well interconnected and

interrelated to each other.

In comparison to the capital investment, the intensity coefficient of industry-university-research cooperation is the key variable that influences the talent cultivation capacity of the cooperation platform. Moreover, the conversion rate of the achievements of scientific research is another critical factor that determines the potential of the talent cultivation.

(4) The quality of rural tourism talent training is affected by a variety of variables, and we should consider whether the quality of rural tourism talent training is improved from the aspects of “talent structure, resource endowment and social environment”.

(5) The driving paths explaining the higher quality of rural tourism personnel training are diversified, with 92.84% of the rural tourism personnel training quality presenting a higher level of quality; This paper summarizes the four grouping paths of rural tourism talent development into three development modes: “(talent)-resource-environment type, comprehensive focus type and (talent)-(resource) double focus”. The suggestions for the three development paths are as follows:

(a) Promoting the scientific approach to assessment. Continuous support will be provided to students who have demonstrated expertise and innovative potential in rural tourism, and coordination and joint assessment will be made with their studies; an expert committee will examine the knowledge base and ability structure of candidates who have passed the admissions process, so as to select students who are truly capable of revitalizing rural tourism.

(b) Develop a system for the cultivation of top-notch innovative talents; earmark funds for cultivation; emphasize discipline construction and curriculum construction; establish a high-level teaching team; and provide all-around support to promote the mastery of students' basic knowledge and the development of their research ability.

(c) Colleges and universities should focus on the growth needs of talents, soften the boundaries between teaching, research and social services, and commit themselves to tapping the positive factors in the environment of revitalizing the cultivation of innovative talents in rural tourism.

Funding

This work was supported by Jiangsu Institute of Educational Science under Grant B-b/2024/02/04.

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