



# Research on Innovation Performance Evaluation of Sericulture Science and Technology Organizations in Nanchong City

Jian Tang<sup>1,2</sup>, Jing Chen<sup>1</sup>, Gu Chen<sup>2</sup>(✉), and Yangyang Chen<sup>1</sup>

<sup>1</sup> Chengdu University of Information Technology, Chengdu 610000, China  
jchjoy@cuit.edu.cn

<sup>2</sup> Santai Silkworm Seed Farm in Sichuan Province, Santai 621100, China  
347796055@qq.com

**Abstract.** Sericulture innovation is the driving force for the development of sericulture, and innovation performance evaluation is an important means to promote the innovative development of sericulture technology organizations. This article conducted a questionnaire survey on the innovation performance of sericulture technology organizations in Nanchong City. The evaluation index system for innovation performance of sericulture technology organizations was constructed from five aspects: human capital, policy incentives, technological infrastructure, organizational scale, and research and development funds. The membership conversion algorithm was used to construct an innovation performance evaluation model for sericulture technology organizations. Using the model, it was calculated that the innovation performance evaluation level of the sericulture technology organization in Nanchong City is “average” and has a credibility of over 95%. Finally, a mechanism for improving the innovation performance of sericulture technology organizations is proposed from three aspects: sericulture technology talents, sericulture technology organizations, and government sericulture institutions.

**Keywords:** Nanchong City · Sericulture Technology Organization · Innovation performance evaluation · Membership Conversion Algorithm

## 1 Introduction

Nanchong City is the “Silk Capital of China”, and the sericulture and silk industry is an important pillar industry of Nanchong’s economy [1]. Sericulture is a regional characteristic agriculture in Nanchong City, which has contributed to its economic development. By studying the development of sericulture technology organizations in Nanchong City, reference can be provided for the study of the impact of sericulture development on the economy. A model for evaluating the innovation performance of sericulture technology organizations in Nanchong City was constructed by introducing a membership transformation algorithm. The evaluation of the innovation performance of sericulture technology organizations in Nanchong City was conducted, and a mechanism for improving the innovation performance of sericulture technology organizations was proposed based on

the evaluation results. This article chooses to carry out sericulture technology organizations in Nanchong City, mainly because the sericulture technology organizations in Nanchong City are representative in the province, which also provides reference for future research on innovation performance evaluation of sericulture technology organizations in the province.

## **2 The Development Status of Sericulture Industry in Nanchong City**

### **2.1 Nanchong City Has Obvious Advantages in Sericulture Development**

The development of the sericulture industry in Sichuan Province has a long history and has generated a lot of support for its economic development. It has become an important industry with unique characteristics, and Sichuan Province has always attached great importance to the development of the sericulture industry. The sericulture industry in Sichuan Province has been actively developing under the guidance of the national “the Belt and Road” strategy, making full use of the challenges and opportunities of “moving mulberry from east to west” to achieve its own development, and constantly stimulating the development of sericulture industry in Sichuan Province by stimulating human capital potential, giving play to the role of policy incentives, strengthening the construction of technical infrastructure, moderately expanding the scale of sericulture organizations, providing adequate research funds and other measures, To better adapt to the constantly shrinking situation of the sericulture industry, solve the problems in the development of the sericulture industry at a deeper level, and ensure the sustainable and stable development of the sericulture industry.

Nanchong City has always been a highland for the concentrated development of the sericulture industry in Sichuan Province, and the sericulture industry in Nanchong City plays a very important role in the sericulture industry in Sichuan Province. The implementation of Nanchong City is the “155 Development Strategy”, which integrates the development of the sericulture industry into important agricultural industry development projects for overall development. Nanchong City has included the sericulture industry in the “353” industrial system and simultaneously listed it as one of the five leading industries in the “5 + 5” modern agricultural industrial system. The sericulture industry has formed a relatively complete industrial chain in Nanchong City, providing room for its development. This is mainly due to Nanchong City’s emphasis on the development of the sericulture industry and the formulation of a series of policy measures to support its development. Each district and county in Nanchong City has also introduced detailed measures to support the development of the sericulture industry, enabling the implementation of sericulture industry policies in various regions of Nanchong. Through the policies introduced by the Nanchong Municipal Government, it can be seen that Nanchong City has unique advantages in sericulture characteristic agriculture and occupies an important position in the development of Sichuan Province’s sericulture. Studying the sericulture technology organization in Nanchong City is conducive to promoting the high-quality development of Nanchong City’s sericulture, thereby driving the high-quality development of Sichuan Province’s sericulture.

## **2.2 Transformation and Development of the Sericulture Industry in Nanchong City**

Nanchong City has formed a relatively complete sericulture production system, and the technology and talent allocation in various aspects of sericulture are also relatively mature. In recent years, Nanchong City has continuously guided leading sericulture and mulberry enterprises to build production bases locally, actively researching the rapid breeding technology of mulberry trees, gradually forming a modern agricultural mulberry industrial park, and continuously expanding the domestic and international market scale. Through these methods, the sericulture and mulberry industry has gradually developed in Nanchong City. The sericulture industry has now developed many sericulture by-products and started cultivating independent brands, forming good economic benefits. The sericulture industry in Nanchong City is no longer limited to the basic production and operation mode of planting and raising silkworms. Now, a commodity system has been developed that comprehensively utilizes a series of sericulture by-products such as mulberry leaf tea, silk clothing, and mulberry wine. Based on the production and operation of these sericulture by-products, we are gradually building a brand for comprehensive utilization of sericulture resources, selling them on major e-commerce platforms, and achieving the transformation and development of the sericulture industry. By studying and reading relevant literature on the sericulture industry in Nanchong City, we gradually understand the development process of the sericulture industry in Nanchong City. The sericulture industry has played an important role in the economic development of Nanchong City, and has also given new historical significance to the city, becoming a characteristic business card of Nanchong. Nanchong and sericulture have already integrated into each other, forming a historical and profound Nanchong sericulture. Therefore, Nanchong City has also created cultural products of sericulture, attracting many tourists who pay attention to sericulture to watch, and generating good tourism resource benefits.

## **2.3 Nanchong City Has a Relatively Rich Sericulture Technology Organization**

There are various types of sericulture technology organizations in Nanchong City, covering a wide range of sericulture. There are research-oriented sericulture technology organizations that provide various forms and levels of sericulture vocational school education and sericulture vocational training for junior and high school graduates, cultivate sericulture skilled talents and high-quality workers for society, serve economic and social development, and carry out sericulture continuing education and training, vocational skills, practical techniques, and other training, such as Sichuan Silk School. There are plans for selecting, producing, testing, and promoting silkworm varieties through trial propagation (scientific research), developing techniques for silkworm seed production and micro disinfection, managing cold, soaking, inspection, preservation, and urging, formulating mulberry production plans, and breeding good mulberry varieties; A production-oriented sericulture technology organization responsible for the selection of original varieties and research and development of silkworm varieties, as well as the development of the mulberry industry, as well as the testing and promotion of varieties, as well as the production of mulberry orchards and the construction of original silkworm

bases, such as the Sichuan Langzhong Sericulture Farm. Responsible for protecting the genetic resources of silkworm and mulberry varieties; Breeding of new varieties of silkworms and mulberry; National improvement and experimental identification of silkworm and mulberry varieties; Developing and promoting new sericulture technologies; Breeding and promotion of tertiary silkworm original varieties; Services such as cold storage, inspection, and quarantine of silkworm eggs; Production and research oriented sericulture technology organizations engaged in research and promotion of the comprehensive utilization of sericulture resources, such as the Nanchong Sericulture Seed Farm in Sichuan Province. There are research oriented sericulture science and technology organizations, such as the Sericulture Research Institute of Sichuan Academy of Agricultural Sciences, which are mainly engaged in sericulture breeding and the research and promotion of new sericulture technologies and new sericulture machines. These sericulture technology organizations have played an important role in the development of sericulture in Nanchong City. In the questionnaire survey of this article, the main focus is on conducting research on the above-mentioned sericulture technology organizations, which are very representative among the sericulture technology organizations in Nanchong City and can comprehensively reflect the actual situation of the sericulture technology organizations in Nanchong City.

### **3 Current Situation of Innovation Performance Evaluation of Sericulture Science and Technology Organizations in Nanchong City**

#### **3.1 The Role of Human Capital in Sericulture Technology Innovation Is Not Significant**

At present, the innovation mechanism of the main body of the sericulture industry in Nanchong City is not yet complete, and there are few specialized talents trained in the sericulture industry. There is no relatively complete talent cultivation mechanism in the sericulture industry, the level of promotion and application of sericulture technology organization and technical talents is not high, the training system for sericulture technology talents is not comprehensive, the degree of transformation of sericulture technology achievements is not high, and the methods of sericulture promotion are backward, and other main problems are prominent. There are certain deficiencies in the introduction and cultivation of new advanced sericulture technology talents, and the transformation of new sericulture technology achievements has not yet achieved significant results. There is still a certain gap between the development level of sericulture technology talents in Nanchong City and the talent development level in coastal areas. Some sericulture technology organizations have relatively backward talent cultivation mechanisms, lacking new technology talents and sericulture craftsman masters, and still remain at a lower level of talent demand in production and operation. The deep level technological innovation ability of sericulture is insufficient.

The sericulture technology organization in Nanchong City has a relatively single training method for sericulture technology talents, lacking a relatively complete incentive mechanism for the transformation of scientific and technological achievements. This

results in a small number of sericulture technology talents related to the transformation of sericulture technology achievements, and the role of human capital in the sericulture technology organization is not obvious.

### **3.2 The Incentive Effect of Sericulture Technology Innovation Policies Is Not Strong**

Nanchong City has included the sericulture industry in the “Five Leading Industries” for coordinated development, which has made the sericulture industry play an important role in the industrial layout of Nanchong City. It has cultivated the sericulture industry into a key industry in Nanchong City and assisted in the development of the sericulture industry. Nanchong City has formulated relatively rich policies for the development of sericulture, but the basic sericulture technology system of various districts and counties in Nanchong is still incomplete, and the number of sericulture technology talents is insufficient, making it difficult to promote the technology of the sericulture industry. The development achievements of sericulture technology innovation are also not rich, making it difficult to implement policy incentives and play a limited role.

### **3.3 Weak Infrastructure of Sericulture Technology Innovation Technology**

The weak infrastructure of Nanchong City is a prominent problem. Especially in the imperfect agricultural irrigation engineering system and the lack of systematic production roads in rural areas, these problems have led to low production efficiency in the sericulture industry. Moreover, the transportation system in rural areas of Nanchong is not perfect, which further makes the construction of technological infrastructure more difficult. Rural roads cannot be built to reach the fields, and the terrain in hilly areas makes it difficult to connect large areas of land, which makes the mechanization rate of sericulture very low and makes it difficult to promote the infrastructure of sericulture technology. The weak technological infrastructure makes it difficult for sericulture technology organizations to promote their technology, making it impossible for them to achieve technological innovation.

The scientific and technological innovation of the sericulture industry in Nanchong City has not formed a good platform, and the cultivation of sericulture talents, research and development of sericulture technology, and transformation of sericulture achievements have not been deeply integrated, resulting in the inability of sericulture technology resources to effectively penetrate the industrial and production chains of the sericulture industry. Therefore, it is particularly urgent to build a technological infrastructure platform. The sericulture technology organizations in Nanchong City still lack technological innovation platforms, and the exchange of technical experience is not sufficient, making it difficult to form innovative synergy.

### **3.4 There Is a Gap in the Scale and Structure of Sericulture Technology Innovation Organizations**

The sericulture industry in Nanchong City still has a traditional industrial structure, with scattered production entities and relatively small production scales. This existing sericulture production structure has existed for a long time, and it is difficult to change these

traditional institutions in a short period of time, which also makes it difficult to promote the modern sericulture production structure. Although Nanchong City has adjusted the production structure of the sericulture industry and made certain changes to its current production status, there is still a gap between the requirements of modern development of sericulture production. There are a large number of sericulture technology organizations in Nanchong City, and their scale is also limited, which cannot meet the needs of high-quality development of sericulture. At present, various sericulture technology organizations are also in a critical period of reform. Continuously improving the efficiency of organizational scale and structure is the goal of the reform of various sericulture technology organizations. There is also a lack of mechanisms for interaction and communication among these organizations, and the efficiency of internal management is not high. All of these have led to a relatively lagging development of sericulture technology organizations.

### **3.5 Insufficient Funding for Innovation and Research and Development of Sericulture Technology**

The research and development funds for scientific and technological innovation in the sericulture industry are mainly funded by the government's financial investment, while other social funds are less invested. The main reason is that the fund recovery period for scientific research innovation in the sericulture industry is relatively long and the benefits are not as significant as in other industries, which restricts the entry of social capital. Most of the sericulture technology organizations in Nanchong City are mainly supported by financial funds. Currently, the sericulture industry is rapidly shrinking, and many social business entities have withdrawn from the market. The economic benefits in society are not obvious, and the generated capital income is very thin. The leading role of sericulture enterprises is not prominent, and the new types of sericulture entities are not yet abundant. These factors have led to insufficient innovation funds for sericulture technology organizations.

## **4 Constructing an Innovation Performance Evaluation Model for Sericulture Science and Technology Organizations**

### **4.1 Construction of Innovative Performance Indicator System**

This article extracts five first level indicators from the influencing factors of innovation performance in sericulture technology organizations, including human capital, policy incentives, technological infrastructure, organizational scale, and research and development funds. Six second level indicators are determined under the first level indicator of human capital, five second level indicators are determined under the first level indicator of policy incentives, four second level indicators are determined under the first level indicator of technological infrastructure, and four second level indicators are determined under the first level indicator of organizational scale, Four secondary indicators were identified under the first level indicators of research and development funds, thus constructing a performance evaluation index system for innovation in sericulture technology organizations. As shown in Table 1.

**Table 1.** Index System for Evaluating the Innovation Performance of Sericulture Technology Organizations

Target layer	Primary indicators	Secondary indicators
Innovation performance of sericulture technology organizations (Q)	Human capital (A)	Strong curiosity towards carrying out innovative work (A <sub>1</sub> )
		Likes to engage in innovative activities that interest oneself (A <sub>2</sub> )
		Doing innovative work can bring a sense of achievement (A <sub>3</sub> )
		Actively participate in various innovative activities (A <sub>4</sub> )
		Having the quality of diligent research (A <sub>5</sub> )
		Having rich imagination and keen observation ability (A <sub>6</sub> )
	Policy incentives (B)	Develop systems to support innovative development (B <sub>1</sub> )
		There are various systems for introducing innovative talents (B <sub>2</sub> )
		Establish a comprehensive and innovative assessment system (B <sub>3</sub> )
		Diversified innovation incentive mechanisms (B <sub>4</sub> )
		Develop innovative talent training and development plans (B <sub>5</sub> )
	Technical infrastructure (C)	Timely update and upgrade experimental equipment (C <sub>1</sub> )
		Pay attention to the cutting-edge information of new technologies (C <sub>2</sub> )
		Organize the development of various innovative equipment (C <sub>3</sub> )

*(continued)*

**Table 1.** (continued)

Target layer	Primary indicators	Secondary indicators
		Building various innovation platforms (C <sub>4</sub> )
	Organizational scale (D)	Many people participate in innovation activities (D <sub>1</sub> )
		Applicable management level (D <sub>2</sub> )
		Adequate allocation of technical personnel (D <sub>3</sub> )
		Reasonable internal structure (D <sub>4</sub> )
	R&D funding (E)	Set up special innovation funds (E <sub>1</sub> )
		Adequate funding for innovation (E <sub>2</sub> )
		Continuously increasing investment in innovation funds (E <sub>3</sub> )
		Rich channels for innovative funding sources (E <sub>4</sub> )

**4.2 Building an Innovation Performance Evaluation Model**

This article mainly introduces the membership transformation algorithm to construct a performance evaluation model for sericulture technology innovation, and combines questionnaire survey data for statistical analysis to calculate the innovation performance evaluation results of sericulture technology organizations. The membership conversion algorithm first calculates the weight values of each indicator, and by calculating the comparability of each indicator, the nonlinear transformation of the membership of each level of indicator to the final target membership is achieved [2]. The main steps are as follows.

1. Calculate indicator weight values

Let goal Q have n levels and m types of indicators, each of which can be divided into P levels. C<sub>k</sub> represents the k-th level, and the C<sub>k</sub> level is divided into C<sub>k</sub> + 1 levels in an orderly manner. If the underlying j indicator of target Q belongs to the C<sub>k</sub> level, the membership degree is  $\mu_{jk}(Q)$ , ( $k = 1 \sim p, j = 1 \sim m$ ), and meet the requirements:

$0 \leq \mu_{jk} \leq 1, \sum_{k=1}^p \mu_{jk}(Q)$ . There are:

$$H_j(Q) = - \sum_{k=1}^p \mu_{jk}(Q) \cdot \ln \mu_{jk}(Q) (j = 1 \sim m) \tag{1}$$



$$V_j(Q) = 1 - \frac{1}{\ln p} H_j(Q) (j = 1 \sim m) \tag{2}$$

$$\alpha_j(Q) = V_j(Q) / \sum_{t=1}^m V_t(Q) (j = 1 \sim m) \tag{3}$$

$\alpha_j(Q)$  is called the indicator weight value, which refers to the degree to which the classification information provided by indicator  $j$  can determine the proportion of the category to which target  $Q$  belongs in all elements, and meet the following criteria:

$$0 \leq \alpha_j(Q) \leq 1, \sum_{j=1}^m \alpha_j(Q) = 1$$

2. Comparable calculation of various indicators

To calculate the comparability of each indicator, the first step is to calculate the weight value of each indicator. In order to obtain more accurate weight values for each indicator, the method used in this article is the entropy method.

$$L_j(Q) = -\frac{1}{\ln p} \sum_{k=1}^p \mu_{jk}(Q) \cdot \ln \mu_{jk}(Q) (j = 1 \sim m) \tag{4}$$

$$\beta_j(Q) = 1 - L_j(Q) / m - \sum_{t=1}^m L_t(Q) \tag{5}$$

$\beta_j(Q)$  is the importance weight of indicator  $j$ , and meet the requirements  $0 \leq \beta_j(Q) \leq 1$ .  $\beta_j(Q) \cdot \alpha_j(Q) \cdot \mu_{jk}(Q) (j = 1 \sim m, k = 1 \sim p)$  is called the K-class comparability of indicator  $j$  with respect to target  $Q$ .

3. Conduct membership calculation for each indicator

The comparable sum of each influencing factor should be first calculated using the following formula:

$$M_k(Q) = \sum_{j=1}^m \beta_j(Q) \cdot \alpha_j(Q) \cdot \mu_{jk}(Q) (k = 1 \sim p) \tag{6}$$

$M_k(Q)$  is called the K-class comparable sum of the target  $Q$ .

Let  $\mu_k(Q)$  be the membership degree of target  $Q$  belonging to  $C_k$  level, then there are

$$\mu_k(Q) = M_k(Q) / \sum_{t=1}^p M_t(Q) (k = 1 \sim p) \tag{7}$$

and  $0 \leq \mu_k(Q) \leq 1, \sum_{k=1}^p \mu_k(Q) = 1$ .

#### 4. Calculate evaluation level results

Using evaluation levels for classification, this article mainly uses the evaluation criteria of credibility to determine the evaluation level of innovation performance of sericulture technology organizations: set up  $\lambda$  ( $0.6 < \lambda < 1$ ) Calculate for credibility

$$K_0 = \min \left\{ k \mid \sum_{i=1}^k \mu_k(Q) \geq \lambda \right\} \quad (8)$$

Then it is judged that Q belongs to the  $K_0$  level and there is no lower than  $\lambda$ . The credibility of.

## 5 Data Statistical Analysis

### 5.1 Questionnaire Survey Situation

120 questionnaires were sent out and 120 were collected, with a recovery rate of 100%. Because of the impact of the COVID-19, this questionnaire is filled out online, and all questionnaires can be submitted only after they are completed, so the effective rate of questionnaire recovery is 100%.

### 5.2 Reliability Test

Reliability testing is a test of the internal design and stability of a survey questionnaire. If the test results show high reliability, it indicates that the measurement error of the survey questionnaire is relatively small, and the measurement results of the questionnaire can be used for research. The reliability analysis of the data collected in this article was conducted using SPSS25.0 software. The reliability of the scale of influencing factors on innovation performance of sericulture technology organizations was 0.969, indicating that the sericulture technology organization innovation performance survey questionnaire used in this study has a high level of reliability and meets the research needs.

### 5.3 Validity Test

Validity testing is to verify whether the questionnaire content design is correct. If the validity test results are good, it means that the content of the questionnaire survey is in line with the psychological thoughts of the respondents. The validity test of the innovation performance evaluation scale for sericulture technology organizations in this study mainly uses factor analysis method. This article mainly uses SPSS software to test the validity of the questionnaire survey data. The validity of the Innovation Performance Influencing Factors Scale (KMO value) is 0.925, with a significance probability of  $P < 0.01$ , indicating that the validity of the innovation performance survey questionnaire used in this study is good.

## 5.4 Innovation Performance Evaluation

### 1. Determine indicator membership and differentiation weights

The questionnaire survey data on human capital, policy incentives, technological infrastructure, organizational scale, and research and development funds in Table 1 can determine the membership degree of each indicator. The scale used in this article is divided into 5 levels, and each option in the survey questionnaire is marked as C1-C5. Based on the data obtained from the questionnaire survey, calculate the proportion of scores corresponding to different evaluation levels for secondary indicators such as human capital, policy incentives, technological infrastructure, organizational scale, and R&D funding as the indicator membership. Construct a membership matrix based on indicators of human capital, policy incentives, technological infrastructure, organizational scale, and R&D funding, denoted as  $U(A)$ ,  $U(B)$ ,  $U(C)$ ,  $U(D)$ , and  $U(E)$ , respectively.

$$U(A) = \begin{bmatrix} 0.5083 & 0.3917 & 0.0917 & 0.0083 & 0 \\ 0.6083 & 0.3167 & 0.0667 & 0.0083 & 0 \\ 0.6083 & 0.3250 & 0.0584 & 0.0083 & 0 \\ 0.5250 & 0.3250 & 0.1500 & 0.0000 & 0 \\ 0.4750 & 0.3500 & 0.1667 & 0.0083 & 0 \\ 0.3917 & 0.3833 & 0.2167 & 0.0083 & 0 \end{bmatrix}$$

$$U(B) = \begin{bmatrix} 0.4667 & 0.2583 & 0.1750 & 0.0750 & 0.0250 \\ 0.4333 & 0.2417 & 0.2250 & 0.0833 & 0.0167 \\ 0.3917 & 0.2500 & 0.2500 & 0.0916 & 0.0167 \\ 0.3583 & 0.2917 & 0.2500 & 0.0833 & 0.0167 \\ 0.3917 & 0.2500 & 0.2167 & 0.1166 & 0.0250 \end{bmatrix}$$

$$U(C) = \begin{bmatrix} 0.3667 & 0.2583 & 0.2833 & 0.0500 & 0.0417 \\ 0.4417 & 0.2833 & 0.2167 & 0.0500 & 0.0083 \\ 0.3667 & 0.2167 & 0.3083 & 0.0667 & 0.0416 \\ 0.3167 & 0.2750 & 0.3000 & 0.0917 & 0.0166 \end{bmatrix}$$

$$U(D) = \begin{bmatrix} 0.3000 & 0.2833 & 0.2750 & 0.1083 & 0.0334 \\ 0.3333 & 0.3417 & 0.2417 & 0.0667 & 0.0166 \\ 0.3333 & 0.2750 & 0.2667 & 0.1167 & 0.0083 \\ 0.3083 & 0.3750 & 0.2500 & 0.0584 & 0.0083 \end{bmatrix}$$

$$U(E) = \begin{bmatrix} 0.2917 & 0.2333 & 0.3333 & 0.1000 & 0.0417 \\ 0.1667 & 0.2000 & 0.3666 & 0.1667 & 0.1000 \\ 0.2000 & 0.2500 & 0.3500 & 0.1333 & 0.0667 \\ 0.1917 & 0.1833 & 0.3500 & 0.1417 & 0.1333 \end{bmatrix}$$

According to U (A) - U (E) and formulas (1)–(3), the differentiation rights of secondary indicators for human capital, policy incentives, technological infrastructure, organizational scale, and R&D funding can be calculated as follows:

$$\alpha(A) = (0.1695, 0.1915, 0.1951, 0.1647, 0.1457, 0.1335);$$

$$\alpha(B) = (0.2317, 0.2170, 0.1941, 0.1930, 0.1642);$$

$$\alpha(C) = (0.2296, 0.3369, 0.2134, 0.2201);$$

$$\alpha(D) = (0.1750, 0.2740, 0.2363, 0.3147);$$

$$\alpha(E) = (0.3889, 0.1973, 0.2663, 0.1475).$$

## 2. Calculate the weight of evaluation indicators

According to formulas (4) and (5), the weight values of each indicator data in Table 1 can be obtained. The weight values of each secondary indicator under the primary indicators of human capital, policy incentives, technological infrastructure, organizational scale, and research and development funds are:

$$\beta(A) = (0.2956, 0.3340, 0.3402, 0.2872, 0.2542, 0.2328);$$

$$\beta(B) = (0.2317, 0.2170, 0.1941, 0.1930, 0.1642);$$

$$\beta(C) = (0.0932, 0.1367, 0.0866, 0.0893);$$

$$\beta(D) = (0.0686, 0.1074, 0.0926, 0.1234);$$

$$\beta(E) = (0.0874, 0.0444, 0.0599, 0.0332).$$

## 3. Calculate comparability and target membership

According to formula (6), the comparable sum of secondary indicators for human capital, policy incentives, technological infrastructure, organizational scale, and R&D funding can be calculated.

$$M(A) = (0.1593, 0.1017, 0.0327, 0.0021, 0);$$

$$M(B) = (0.0841, 0.0523, 0.0446, 0.0176, 0.0041);$$

$$M(C) = (0.0412, 0.0280, 0.0276, 0.0064, 0.0024);$$

$$M(D) = (0.0327, 0.0340, 0.0260, 0.0081, 0.0014);$$

$$M(E) = (0.0155, 0.0146, 0.0218, 0.0077, 0.0040).$$

Calculate the current target membership degree using formulas (7), and the calculation result is the membership degree of primary indicators such as human capital, policy incentives, technological infrastructure, organizational scale, and research and development funds, namely:

$$\mu(A) = (0.5386, 0.3438, 0.1106, 0.0070, 0);$$

$$\mu(B) = (0.4151, 0.2579, 0.2199, 0.0871, 0.0200);$$

$$\mu(C) = (0.3901, 0.2650, 0.2617, 0.0607, 0.0225);$$

$$\mu(D) = (0.3199, 0.3332, 0.2541, 0.0791, 0.0137);$$

$$\mu(E) = (0.2438, 0.2291, 0.3434, 0.1207, 0.0630).$$

The evaluation index matrix is constructed based on the membership degree of A-E indicators, which is the innovation performance evaluation matrix  $U(Q)$  of sericulture technology organizations.

$$U(Q) = \begin{bmatrix} 0.5386 & 0.3438 & 0.1106 & 0.0070 & 0.0000 \\ 0.4151 & 0.2579 & 0.2199 & 0.0871 & 0.0200 \\ 0.3901 & 0.2650 & 0.2617 & 0.0607 & 0.0225 \\ 0.3199 & 0.3332 & 0.2541 & 0.0791 & 0.0137 \\ 0.2438 & 0.2291 & 0.3434 & 0.1207 & 0.0630 \end{bmatrix}$$

Repeating the above calculation process can obtain the differentiation weight, weight value, and comparable sum of innovation performance of sericulture technology organizations.

$$\alpha(Q) = (0.3972, 0.1707, 0.1788, 0.1707, 0.0826)$$

$$\beta(Q) = (0.3972, 0.1707, 0.1788, 0.1707, 0.0826)$$

$$M(Q) = (0.1205, 0.0815, 0.0420, 0.0087, 0.0021)$$

Membership level of innovation performance of sericulture technology organizations:

$$\mu(Q) = (0.4729, 0.3198, 0.1647, 0.0342, 0.0084)$$

By using the requirement of credibility to calculate the evaluation results,  $\lambda$ . If the value is 0.9, according to formula (8), there is  $0.4729 + 0.3198 + 0.1647 = 0.9574 > 0.9$ , then  $K_0 = 3$ .

Through calculation, it can be concluded that the innovation performance level of the sericulture technology organization in Nanchong City is “average” and has a credibility of over 95%.

## **6 Mechanism for Improving Innovation Performance of Sericulture Science and Technology Organizations in Nanchong City**

### **6.1 Promoting the High-Quality Development of Human Capital in Sericulture Technology Organizations**

In terms of sericulture science and technology talents, affected by the superposition of the COVID-19 and the economic downturn, it is a special period of intense talent competition. Sericulture science and technology talents must have excellent skills to stand out in the fierce talent competition. Scientific and technological talents in sericulture should timely adapt to the requirements of sericulture development, take the initiative to learn scientific and technological knowledge of sericulture, continue to maintain a good state of learning and struggle, be able to actively keep pace with the times to update and improve their knowledge system, actively do a good job in sericulture innovation knowledge reserves, and invest in various work of sericulture scientific and technological innovation in a more spirited state of mind. Sericulture technology talents actively increase their opportunities to participate in sericulture technology training, enhance their sericulture technology innovation ability, increase their sericulture innovation ability added value, and gradually form their own sericulture innovation concept in various sericulture technology innovation practices, find their own position in sericulture technology innovation, establish correct sericulture technology innovation values, and combine their self-value with the social value of sericulture innovation, Strive to achieve high-quality development in one's own life.

In terms of sericulture technology organizations, human capital is an important foundation for the development of sericulture technology organizations. The development of sericulture technology talents directly affects the development of sericulture technology organizations, and the development of sericulture technology talents should be placed in an important position. Sericulture technology organizations should attach importance to the cultivation of talents, continuously improve the innovation ability of sericulture technology talents, so that the individual talents of sericulture technology talents can be fully demonstrated, and the sericulture technology organizations can have a continuous development momentum. Sericulture technology talents are the primary resource and productivity of sericulture technology organizations. Attracting and retaining sericulture technology talents has become an important means for sericulture technology organizations to achieve high-quality development. Sericulture technology organizations should provide more opportunities for the development of sericulture technology talents, so that they have a strong sense of belonging to the organization and can actively participate in the innovative development of sericulture technology organizations. Sericulture technology organizations should also actively guide sericulture technology talents to strive to improve their innovative skills, increase training opportunities related to innovative business, and promote the high-quality development of sericulture technology talents.

In terms of government sericulture institutions, the development of sericulture technology organizations cannot be separated from government support. Government sericulture institutions provide a good social environment for the development of sericulture technology organizations, guide the development of sericulture technology talents in sericulture technology organizations, increase talent support for sericulture technology

organizations, and provide a relaxed environment and good development opportunities for the development of sericulture technology talents. Government sericulture institutions should attach importance to the cultivation of talents and cultivate corresponding talents according to the needs of national strategies, in order to better promote social and economic development.

## **6.2 Give Full Play to the Policy Incentive Role of Sericulture Technology Organizations**

In terms of sericulture technology talents, the policy incentives of sericulture technology organizations have a direct impact on the development of sericulture technology talents, which is related to the vital interests of sericulture technology talents. The role of policy incentives has a significant impact on sericulture technology talents. Sericulture technology talents should carefully understand the policy incentive content of sericulture technology organizations, understand the relevant requirements for the development of sericulture technology organizations, and find the optimal solution suitable for their own development in various policies and systems of sericulture technology organizations. Sericulture technology talents should fully utilize the policy incentive system of sericulture technology organizations, so that the policy dividends of sericulture technology organizations can truly play a role. Sericulture technology talents can not only enjoy the convenience brought by the policy incentive system, but also continuously promote the innovation and development of sericulture technology organizations.

In terms of sericulture technology organizations, sericulture technology organizations should continuously improve various innovation support systems, provide targeted policy incentives for sericulture technology talents, stimulate their potential, and attract more sericulture technology talents to participate in innovation research work. Sericulture technology organizations should also fully understand the needs of sericulture technology talents, strive to meet the requirements of sericulture technology talents, solve the worries of sericulture technology talents, and enable them to fully devote themselves to innovative work. Sericulture technology talents should promptly implement reasonable and effective policy incentive measures, actively fulfill the welfare benefits of sericulture technology talents, collect the problems in the existing policy incentive system, loosen the constraints on sericulture technology talents, truly achieve a virtuous cycle of policy incentives serving sericulture technology talents, and sericulture technology talents contributing to the innovative development of sericulture technology organizations.

In terms of government sericulture institutions, government policy incentives provide strong impetus for the development of sericulture technology organizations, and are also the foundation for sericulture technology organizations to formulate policy incentive systems. The government has introduced policies and incentive systems based on the needs of the national development strategy. Nanchong has a good foundation for the development of sericulture, and has formed a long sericulture culture. In the context of the national strategy of “moving sericulture from east to west” and “the Belt and Road”, Nanchong also has the need to develop sericulture science and technology organizations, and has also formulated many policy incentive systems for sericulture science and technology organizations. It provides a good development environment for the development of sericulture technology organizations in Nanchong City. After the government has

formulated a policy incentive system, it should focus on its implementation and ensure that the policy incentive system is implemented effectively in order to play its role.

### **6.3 Improving the Technical Infrastructure Level of Sericulture Technology Organizations**

In terms of sericulture technology talents, technological infrastructure is the foundation for sericulture technology talents to carry out innovation, and a good technological infrastructure can promote sericulture technology talents to produce more innovative results. Sericulture technology talents should make full use of existing technologies and facilities, leverage the advantages of existing technologies and facilities, and actively develop new technologies and equipment on this basis, so that more innovative achievements can be transformed into actual productivity and generate corresponding economic benefits. At the same time, sericulture technology talents should also actively adapt to the requirements of new equipment and environment, improve the efficiency of innovative new technologies and equipment usage, focus on the promotion of new technologies and equipment, and enable more sericulture technology organizations to receive support from new technologies and equipment.

In terms of sericulture technology organizations, ensuring a good technological infrastructure is essential to continuously improve their innovation capabilities. Organizing sericulture technology talents to carry out new technology research and equipment development is an important task for sericulture technology organizations. Sericulture technology organizations should promptly absorb and utilize new technologies and equipment, improve their innovation capabilities, and create more new innovative achievements based on advanced technology and excellent equipment. Sericulture technology organizations should attach importance to the application and promotion of new sericulture technologies, promote the transformation of scientific research achievements into social productivity, and contribute sericulture strength to social and economic development. Sericulture technology organizations also improve the efficiency of using existing technology and equipment, continuously improve the relevant systems of technological infrastructure, and promote more sericulture technology talents to use existing technology and equipment to create more research results.

In terms of government sericulture institutions, the government should introduce guidelines to guide sericulture technology organizations to continuously break through the system of new sericulture technologies and equipment, provide opportunities for sericulture technology exchange among various sericulture technology organizations, organize sericulture technology forums for various sericulture technology organizations, build more sericulture technology platforms, and provide support for sericulture technology research and development by sericulture technology organizations, Focus on rewarding sericulture technology talents who have made significant contributions to the research and development of new technologies and equipment, vigorously promote new sericulture technologies and equipment, and create a good atmosphere for sericulture development in the whole society. The level of technological infrastructure of sericulture technology organizations will also have a driving effect on the development of technological infrastructure in Nanchong City, creating a good atmosphere for creating new technologies and constructing new facilities at the entire social level of Nanchong City.



#### **6.4 Reasonably Setting Up the Organizational Scale of Sericulture Technology Organizations**

In terms of sericulture technology talents, organizational scale can provide more job positions and career development channels for sericulture technology talents. Reasonable organizational scale with reasonable facilities can effectively improve the identification of sericulture technology talents with professional positions, and smooth development channels for sericulture technology talents can enhance their work enthusiasm. Sericulture technology talents should also have a correct view of their career development, actively adapt to the organizational scale adjustment of sericulture technology organizations, adjust their mindset for job promotion and job transfer, and timely play their role in new positions. They should truly love and respect their job, actively support the transformation and development of sericulture technology organizations, obey the organization's work arrangements, and continuously improve their professional literacy.

In terms of sericulture technology organizations, the size of the organization is a key indicator for the development of sericulture technology organizations. It is now a period of comprehensive deepening reform, and sericulture technology organizations are also in a critical period of transformation and development. They should adapt to the new requirements of organizational scale transformation and development in a timely manner. Maintaining a moderate organizational scale can effectively promote the development of sericulture technology organizations, handle internal contradictions, and maintain internal stability of sericulture technology organizations. Sericulture technology organizations must adjust their organizational scale in a timely manner to achieve their existing tasks and goals, which is also an inevitable requirement for high-quality development in the new era. A reasonable and effective scale of sericulture technology organizations can improve their innovation efficiency and enhance their core competitiveness. The sericulture technology organization further improves its internal organizational structure, establishes reasonable management levels, and forms a healthy development within the sericulture technology organization.

In terms of government sericulture institutions, ensuring the organizational scale of sericulture technology organizations can promote the overall development of sericulture. The government should formulate detailed institutional plans for the organizational scale of sericulture technology organizations, reasonably set the organizational scale of sericulture technology organizations, and provide support for the scale of sericulture technology organizations. Maintaining a certain scale of sericulture technology organizations in Nanchong City is conducive to the development of sericulture in Nanchong City. It has also promoted the economic development of Nanchong City. The sericulture industry in Nanchong City is an industry with Nanchong characteristics, which has deeply rooted in Nanchong and has a subtle impact on all aspects of Nanchong City. Sericulture has become a part of Nanchong City's regional culture. Maintaining the scale of sericulture technology organizations can better promote the development of sericulture and thus promote the vigorous development of Nanchong City's regional culture.

## 6.5 Continuously Increasing Research and Development Funding for Sericulture Technology Organizations

The investment in research and development funds will have a decisive role in the development of innovation. In terms of sericulture technology talents, research and development funds are the foundation for sericulture technology talents to carry out innovative research. Each research project requires support from research and development funds, and the treatment of sericulture technology talents also needs to be guaranteed by research and development funds. Increasing investment in research and development funds can improve the innovation enthusiasm of sericulture technology talents. According to the amount of research and development funds, the number of research and development projects can be determined. Sericulture technology talents need to adjust their research goals and tasks accordingly, and develop detailed research plans around research and development funds in order to better achieve innovative tasks. Sericulture technology talents should also improve the efficiency of using research and development funds, reduce the waste of innovative research and development funds, and fully leverage the important role of research and development funds in promoting innovation.

In terms of sericulture technology organizations, providing research and development funds for sericulture technology talents is a basic requirement for sericulture technology organizations and a prerequisite for achieving their goals and tasks. Having sufficient research and development funds can guide more sericulture technology talents to invest in innovative work. Actively raising research and development funds, continuously improving the system of fund utilization, expanding the source channels of research and development funds, ensuring basic research and development funds, improving the treatment standards of sericulture technology talents, creating a good innovation work atmosphere, and providing a better innovation environment for sericulture technology talents. Adequate research and development funds can enable sericulture technology organizations to undertake various innovative tasks. With the support of research and development funds, innovation weaknesses can be better improved, and the scientific research motivation and level of sericulture technology organizations can be fully utilized.

In terms of government sericulture institutions, they should actively serve the innovation work of sericulture technology organizations, encourage them to apply for national and provincial sericulture projects, and actively apply for more sericulture research and development funds for sericulture technology organizations. The government should also set up special sericulture research and development funds to provide funding support for innovation research of sericulture technology organizations, formulate corresponding R&D investment plans, continuously increase R&D investment of sericulture technology organizations, and promote sericulture technology organizations to better play a leading role in sericulture innovation.

## 7 Conclusion

Scientific and technological talents are the core elements of economic and social development, and the fundamental way to enhance the core competitiveness of a region or even a country [3]. The evaluation of scientific and technological talents is the core content of scientific and technological evaluation, and is an important basic research work to build

a scientific and technological talent management system [4, 5]. The evaluation of the innovation performance of the sericulture technology organization in Nanchong City is an important means to promote the innovative development of the sericulture industry in Nanchong City. The innovation performance improvement mechanism proposed based on the evaluation results for sericulture technology organizations provides a development path for the innovation performance of sericulture technology organizations in the future, which can also promote sericulture technology organizations to better play the role of innovation performance.

## References

1. Mao Yeyang, Liu Zeting, Deng Weidong, Gong Zinan. Research on the Transformation and Development of the Sericulture Industry in Nanchong City[J]. *China Sericulture*,2021,42(2):38–43.
2. Guo Caiyun, Liu Zhiqiang, Cao Xiuli. Construction and Evaluation of Innovation Performance Indicator System for Technological Innovation Talents - Based on SPSS and Membership Conversion Algorithm[J]. *Journal of Industrial Technological Economics*,2016,270(4):3–8.
3. Zhang Yi, Ni Jihui Construction of the Evaluation Index System for Technological Innovation Talents [J]. *Management Decision*,2022,604(16):172–175.
4. Wang Shao. The Status, Adherence, and Essential Requirements of Scientific and Technological Talent Evaluation [J]. *Scientific Management Research*,2019,37(4):142–145.
5. Zhang Li, Yu Zhao. Research on the Evaluation System of Technological Talents Based on the Innovation Chain [J]. *Scientific Management Research*, 2020,38 (1):139–142.

**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

