Research on Risk Early Warning for the Development of Young Scientific and Technological Innovation Talents in Shanghai in 2035

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Abstract. Young scientific and technological innovation talents are the source of living water for Shanghai's strategic talent force in 2035. In order to analyze the risk situation of the development of young scientific and technological innovation talents in Shanghai, this paper constructs an early warning index system for the development of young scientific and technological innovation talents in Shanghai based on the perspective of "five-in-one" overall layout, which consists of economic, political, cultural, social and ecological components, and uses ANP-fuzzy comprehensive evaluation method to build an early warning model for the development of talents. The research results show that the current risk warning level of Shanghai young scientific and technological innovation talents development is at a serious level and the talents are facing serious ecological risks. It puts forward policy suggestions such as establishing an early warning mechanism for the development of young scientific and technological innovation talents in Shanghai, improving Shanghai's environmental governance capabilities, improving the policy and service system for young scientific and technological innovation talents, accelerating the integrated development of young scientific and technological innovation talents in the Yangtze River Delta region, and improving the cooperative development mechanism for international young scientific and technological innovation talents.

Keywords: young scientific and technological innovation talents; risk warning; towards 2035; analytic network process; fuzzy comprehensive evaluation

1 Introduction

At present, China has entered the stage of high-quality development, and promoting the saving of talent resources, the cultivation of top talents and the high-quality development of talents has become an important strategic direction for building an innovative country. Since the 18th Party Congress, General Secretary Xi Jinping has repeatedly given important instructions to Shanghai's talent work, requesting Shanghai to take advantage of its high degree of internationalization, gather a wide range of outstanding talents in various fields, and accelerate the march towards a scientific and technological innovation center with global influence. Shanghai, as one of China's windows to the world, has a difficult mission, In the face of the unprecedented global changes in a century, the development opportunities and risks of young science and technology

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innovation talents coexist[1]. The research related to the development of young scientific and technological innovation talents mainly revolves around the following three aspects: the first category is the research on the distribution and flow pattern of talents, Zhu Ying et al [2] pointed out that there is a regional imbalance in the flow of scientific and technological talents in China, and a high-quality innovation environment is more attractive to talents. The second category is the research on the evaluation of young scientific and technological innovation talents, for example, Zhou Jianzhong[3] believes that the evaluation mechanism of young scientific and technological talents in China needs to "break the four only"; Wang Sini [4] proposes to establish a multi-dimensional evaluation mechanism and create an innovation platform in line with the law of talent growth. The third category is science and technology talent policy and system research, Kergroach [5] compares science, technology and innovation policies across countries to explore innovation policy mix for technological upgrading and global value chain integration. The research on talent risk early warning at home and abroad mainly focuses on three categories, one is the research on talent development risk early warning and preventive measures, for example, Ma Kangmei [6] pointed out that the total amount of Chinese scientific and technological talent is insufficient, structural imbalance, disorderly flow and other risks; Secondly, talent early warning mechanism research, such as Luo Xingpeng et al [7] systematically analyzed the sustainable development trend of talents and constructed an early warning system for scientific and technological talents to adapt to the needs of innovation drive. Third, talent aggregation early warning studies, such as Lina Zhang et al [8] established a model of scientific and technological talent aggregation based on spatial spillover and threshold effects, and empirically concluded that scientific and technological talent aggregation can promote regional innovation efficiency; Chengwei Cha et al [9] constructed a talent aggregation early warning model from four dimensions: talent early warning measurement system, internal mechanism of aggregation early warning, regulation strategy and alert system. The 18th National Congress of the Party has determined the "five-in-one" overall socialist layout of economic, political, cultural, social and ecological civilization construction of socialism with Chinese characteristics, and this paper analyzes the current situation and risks of young scientific and technological innovation talents development in Shanghai based on the "five-in-one" overall layout. This paper analyzes the current situation and risks of the development of young scientific and innovative talents in Shanghai based on the overall layout of "Five-in-One", and promotes the development of young scientific and innovative talents under the framework of "Five-in-One" to further promote the high-quality development of Shanghai's economy and society and provide an important guarantee for China to achieve the vision 2035.

2 Risk early warning system and model construction for the development of young scientific and technological innovation talents

2.1 Basis for the construction of the indicator system

The indicator system is constructed based on the following: firstly, to sort out the content of domestic and Shanghai's policies related to the development of science and technology talents, so as to provide policy guidance for the selection of risk warning indicators for the development of young science and technology innovation talents in Shanghai; secondly, to analyze the risks

for the development of young science and technology innovation talents in Shanghai based on the perspective of the "five-in-one" The second is to analyze the risk of Shanghai young scientific and technological innovation talents development based on the general layout perspective, which provides a realistic basis for the selection of risk warning indicators for Shanghai young scientific and technological innovation talents development; the third is to read the domestic and foreign literature on scientific and technological talents development, and organize the selection of scientific and technological talents evaluation indicators from domestic and foreign literature which provides the basis of previous research.

The 18th National Congress of the Communist Party of China (CPC) put forward the concept of "five-in-one" overall layout, standing at the strategic level of history and the overall situation, and set the strategic objectives of the overall layout of "five-in-one" in the new era from five aspects: economic, political, cultural, social and ecological civilization. Most of the existing studies on scientific and technological talents focus on talent input, talent output, external environmental factors and internal factors to select talent evaluation indicators. In this paper, based on the policy orientation, realistic foundation and previous research, we refer to the index selection of Li Xuhui [10],[11] and other authors, the first-level indicators are established from the economic, political, cultural, social and ecological aspects of the overall layout of "five-in-one".The risk warning indicators for the development of young scientific and technological innovation talents in Shanghai in 2035 are shown in Table 1.

2.2 Risk warning model construction based on ANP-fuzzy integrated evaluation method

In 1996, Professor T.L. Saaty, a professor at the University of Pittsburgh, USA, proposed ANP (Analytic Network Process). Network analysis is developed on the basis of hierarchical analysis, which is a decision method to solve complex and internally and externally related decision problems. Network analysis divides system elements into a control layer and a network layer, where the control layer contains at least one decision target and the elements of the network layer are influenced by the control layer and the elements influence each other. In this paper, the risk evaluation of young scientific and technological innovation talents development in Shanghai is the only element of the control layer, 5 primary indicators of economy, politics, society, culture and ecology constitute the set of elements of the network layer, 20 secondary indicators are the elements that interact within the primary indicators, and its structural model is shown in Figure 1.

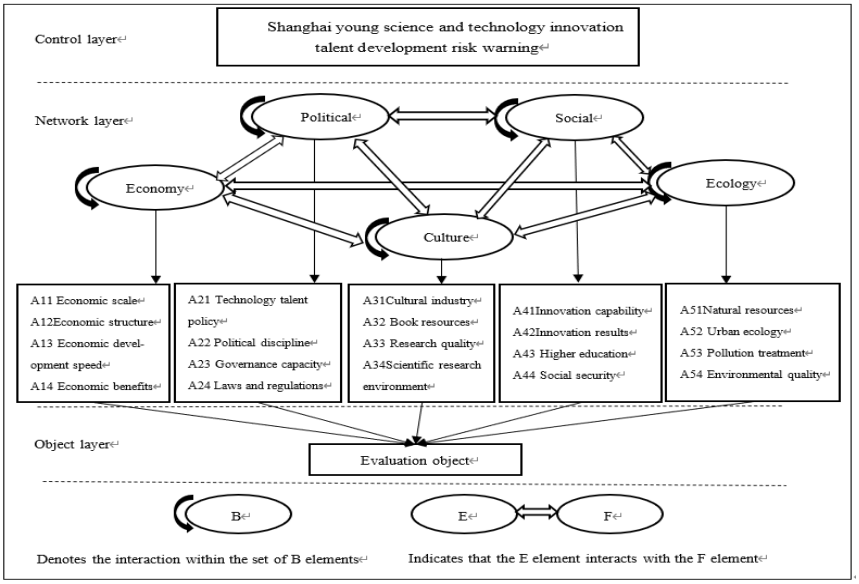

Fig. 1. Network structure of risk warning for the development of young scientific and technological innovation talents in Shanghai

2.3 Principle of calculating the weights of early warning indicators by ANP method

2.3.1 Constructing a supermatrix by indirect dominance degree

The dominance of ANP method refers to the comparison of the degree of influence of two elements on the sub-criteria under a given criterion to construct a two-by-two judgment matrix of early warning indicators, Using Saaty1-9 scaling method to construct two-two judgment matrices between and among the sets of elements with interdependence and feedback relationships, Saaty1-9 scaling method takes the values shown in Table 6, and the normalized eigenvector weights are obtained by applying the network hierarchical analysis software yaanp, and the consistency test is performed on the judgment matrix to obtain the supermatrix C.

$$C = \begin{bmatrix} c_{11} & \cdots & c_{1n} \\ \vdots & \ddots & \vdots \\ c_{n1} & \cdots & c_{nn} \end{bmatrix} \tag{1}$$

2.3.2 Construction of weighted supermatrix

Using a two-by-two comparison of the importance of the first-level early warning indicator A_i to the other elements A_j in the element group, we can obtain the cluster weight matrix w of early warning indicators for the development of young scientific and technological innovation talents in Shanghai.

$$w = \begin{bmatrix} w_{11} & \cdots & w_{1n} \\ \vdots & \ddots & \vdots \\ w_{n1} & \cdots & w_{nn} \end{bmatrix} \tag{2}$$

The super matrix C is weighted and the weights of the secondary warning indicator A_{ij} are weighted using equation (3) with the corresponding cluster weight matrix w elements to obtain the weighted supermatrix $\overline{W_{te}}$ of the secondary warning indicator A_{ij}, where $i = (1,2,\ldots,n; j = 1,2,\ldots,n)$.

$$\overline{W_{te}} = w_{ij} * C \tag{3}$$

$$\overline{W_{te}} = \begin{bmatrix} w_{11}c_{11} & \cdots & w_{1n}c_{1n} \\ \vdots & \ddots & \vdots \\ w_{n1}c_{n1} & \cdots & w_{nn}c_{nn} \end{bmatrix} \tag{4}$$

2.3.3 Calculating the limiting supermatrix

Equation (5) is used to perform stability processing on the weighted supermatrix $\overline{W_{te}}$ to test the stability of the weighted supermatrix. If the limit is convergent and unique, the column vector of the final obtained limit supermatrix W is the weight vector of the secondary index A_{ij} of the risk warning for the development of young scientific and technological innovation talents in Shanghai.

$$\lim_{k\to\infty}\left(\frac{1}{n}\right)\sum_{k=1}^{n}(c^k) \tag{5}$$

2.4 Fuzzy integrated evaluation steps

2.4.1 Establish risk warning evaluation level.

Referring to the classification of the warning levels in the National Emergency Response Plan, the risk warning for the development of young talents in science and technology in Shanghai is divided into four levels: very serious, serious, relatively serious, and generally serious, with the colors of "red, orange, yellow, and blue" representing the seriousness of the matter respectively, assign values of 4, 3, 2 and 1 points respectively , the evaluation criteria for establishing the risk warning for the development of young scientific and technological innovation talents in Shanghai for 2035.

2.4.2 Calculation of fuzzy evaluation matrix

Fuzzy comprehensive evaluation method, also known as FCE method, is a comprehensive analysis of various indicators, converting the qualitative evaluation of experts into a quantitative evaluation method, and finally a clear overall evaluation can be obtained. The main steps of fuzzy comprehensive evaluation are as follows.

Step 1: Determine the set of evaluation target factors U, with k representing the number of relevant indicators.

$$U = \{u_1, u_2, \cdots, u_k\} \tag{6}$$

Step 2: Identify the indicator rubric set V.

$$V = \{v_1, v_2, \cdots, v_k\} \tag{7}$$

Step 3: Determine the evaluation index weight vector W. Here the weights can be obtained by the ANP method.

$$W = \{w_1, w_2, \cdots, w_k\} \tag{8}$$

Step 4: Determine the affiliation matrix, calculate the integrated affiliation vector, the fuzzy mapping between the set of factors and the set of evaluations is the affiliation, and quantify the evaluated affairs.

Step 5: Fuzzy comprehensive evaluation, using R to denote the single-factor fuzzy comprehensive evaluation matrix, calculate the fuzzy comprehensive evaluation result H, and perform single-factor and overall fuzzy comprehensive evaluation.

$$H_k = W_k \times R_k \tag{9}$$

3 Empirical analyses

3.1 Sample source and data selection

The Delphi method was used to collect the risk warning evaluation of Shanghai young science and technology innovation talents development from relevant authoritative experts. 11 questionnaires were issued and 11 valid questionnaires were collected, and the experts filling in this questionnaire involved 5 enterprise human resources, 3 senior researchers in related fields, 1 human resources expert and 2 high-end human resources technicians.

3.2 ANP network hierarchical analysis

There is a certain connection between the elemental indicators of the ANP network structure model, and the specific influence relationships of the secondary indicators of the risk warning for the development of young scientific and technological innovation talents in Shanghai were obtained by collecting questionnaires from experts through the Delphi method. Using yaanp analysis software to connect the association cases of each secondary warning indicator, the ANP network structure model of Shanghai young science and technology innovation talent development risk warning is constructed as shown in Figure 2.

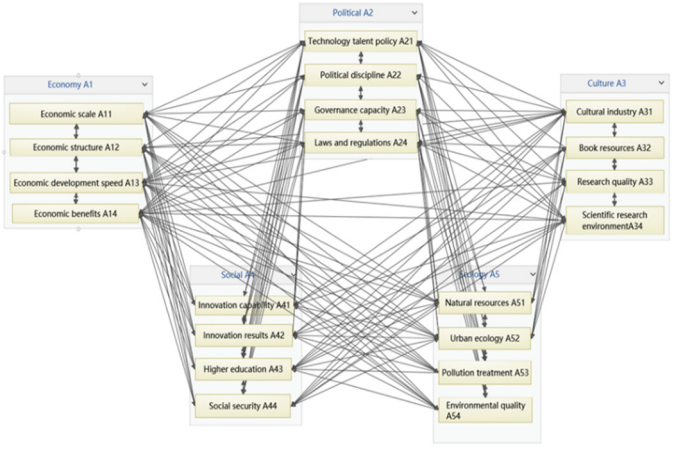

Fig. 2. ANP network structure model of risk warning for the development of young scientific and technological innovation talents in Shanghai

After determining the interrelationship of the secondary warning indicators, the collected data are analyzed and brought into the software for data processing, and the corresponding supermatrix and weighted supermatrix can be obtained, in which the consistency ratio of each judgment matrix is less than 0.1, which satisfies the consistency test, and finally the generalization is done to obtain the weight of each indicator under the perspective of the overall layout of "five-in-one". The weights of each index of the risk warning of Shanghai young scientific and technological innovation talents development in the perspective of "five-in-one" are shown in Table 1.

Table 1. Risk warning index weights for the development of young scientific and technological innovation talents in Shanghai under the perspective of "five-in-one" overall layout

Tier 1 Indicators	Weighting of primary indicators	Secondary indicators	Local weighting of secondary indicators	Normalized weights of secondary indicators	Sort
Economy A1	0.200 8	Economic scale A11	0.297 3	0.059 7	6
		Economic structure A12	0.203 8	0.040 9	13
		Economic development speed A13	0.230 4	0.046 3	10
		Economic benefits A14	0.268 5	0.053 9	8
Political A2	0.243 3	Technology talent policy A21	0.311 7	0.075 9	3
		Political discipline A22	0.194 3	0.047 3	9
		Governance capacity A23	0.240 9	0.058 6	7
		Laws and regulations A24	0.253 1	0.061 6	5
Culture A3	0.116 8	Cultural industry A31	0.280 3	0.032 7	18
		Book resources A32	0.124 3	0.014 5	20
		Research quality A33	0.265 9	0.031 1	19
		Scientific research environmentA34	0.329 5	0.038 5	14
Social A4	0.177 5	Innovation capability A41	0.203 6	0.036 1	17
		Innovation results A42	0.215 0	0.038 2	16
		Higher education A43	0.364 7	0.064 7	4
		Social security A44	0.216 7	0.038 5	15
Ecology A5	0.261 6	Natural resources A51	0.303 9	0.079 5	2
		Urban ecology A52	0.370 0	0.096 8	1
		Pollution treatment A53	0.168 0	0.043 9	11
		Environmental quality A54	0.158 1	0.041 4	12

The ANP method calculates that among the first-level risk warning indicators for the development of young scientific and technological innovation talents in Shanghai, the weight of the ecological, political, economic, social and cultural warning indicators are 0.261 6, 0.243 3, 0.200 8, 0.177 5 and 0.116 8 respectively, among which the ecological warning indicator has the highest weight, indicating that the ecological risk for the development of young scientific and technological innovation talents in Shanghai is more serious. ecological dimension will have a greater impact on the sustainable and high-quality development of young scientific and technological innovation talents. The weight of political warning indicators is higher than that of economic warning indicators, indicating that the risk warning of young scientific and technological innovation talents development focuses more on the modernized governance system of the city, relevant talent development policies and laws and regulations, while Shanghai's economy continues to grow steadily, bringing less risk to talent development; among the secondary risk warning indicators, the top three indicators are urban ecology, natural resources and scientific and technological talent policies, indicating that urban facilities and ecology, natural

environmental resources and talent funding and reward policies do not meet the needs of high-quality development of young scientific and technological innovation talents in Shanghai, generating a higher risk warning, to which the local government and relevant departments should pay attention.

3.3 Fuzzy integrated evaluation based on ANP

The evaluation factor set U={economy, political, cultural, social, ecology} is established, and the indicators U_k are the secondary indicators corresponding to the primary indicator, i.e. U1={economic scale, economic structure, economic development speed, economic benefits }, … , and U5={natural resources, urban ecology, pollution treatment, environmental quality}. The score vector of the evaluation set is set as V={4, 3, 2, 1}. Through the given risk warning level and evaluation criteria, the risk warning evaluation of Shanghai young science and technology innovation talents development is conducted by experts.

From the evaluation summary table of Shanghai young science and technology innovation talent risk warning indicators, we can calculate the single-factor fuzzy comprehensive evaluation matrix, multiply the corresponding weights of the warning indicators with the single-factor fuzzy comprehensive evaluation matrix, and then carry out the overall fuzzy comprehensive warning of Shanghai young science and technology innovation talent development risk, and get the comprehensive evaluation vector weight summary of the first-level indicators and the overall fuzzy comprehensive evaluation weight value as shown in Table 2.

Table 2. Summary of fuzzy comprehensive evaluation weights of early warning indicators

Tier 1 Indicators	Very serious	Serious	Relatively serious	Generally serious
Economy	0.115 3	0.427 5	0.405 7	0.051 4
Political	0.227 3	0.308 1	0.225 6	0.239 0
Culture	0.315 6	0.346 8	0.231 5	0.106 2
Social	0.357 4	0.352 9	0.237 1	0.052 7
Ecology	0.124 5	0.279 9	0.462 7	0.132 9
Overall comprehensive evaluation	0.211 3	0.337 1	0.326 5	0.125 0

The overall comprehensive evaluation results are multiplied with the corresponding evaluation set scores to obtain the comprehensive risk warning value F for the development of young scientific and technological innovation talents in Shanghai.

$$F = [0.2113,0.3371,0.3265,0.1250] \times [4,3,2,1]^T \approx 2.634\,8 \tag{10}$$

The maximum affiliation of the overall comprehensive evaluation is 0.337 1, which corresponds to the warning level of serious, and the comprehensive risk warning value of Shanghai young science and technology innovation talents development is 2.634 8, which is between the more serious and serious levels, and more inclined to the serious warning level, indicating that the risk warning level of Shanghai young science and technology innovation talents development is at the serious level, which is judged as an orange signal, that is, the risk warning reaches the serious stage, causing partial adverse effects on Shanghai's science and technology talent development team and possibly generating risk spillover effects and spreading to other cities, the Shanghai municipal government and relevant departments should make prompt and rapid responses to the risk warning and take corresponding risk prevention measures.

4 Conclusions and policy recommendations

This paper establishes a risk warning model for the development of young scientific and technological innovation talents in Shanghai from the perspective of the general layout of "five-in-one", and analyzes the risks of the development of young scientific and technological innovation talents in Shanghai in 2035 through ANP-fuzzy comprehensive evaluation method, and draws the following three conclusions: (1) Among the first level of risk warning indicators for the development of young scientific and technological innovation talents in Shanghai, the weight of ecological construction warning indicators and political construction warning indicators is higher. (2) Among the indicator weights, the ecological construction early warning indicator and the political construction early warning indicator have higher weights, and the conclusion of the study is consistent with the general layout of "five-in-one" in China, which indicates that there are certain shortcomings in the foundation of ecological civilization construction and legalized governance system for talent development, reflecting the development needs of young scientific and technological innovation talents in Shanghai. (3) Among the secondary warning indicators, the weight of urban ecology, natural resources and science and technology talent policies ranked the top three, indicating that the urban ecosystem in the development of young science and technology innovation talents is not perfect, natural resources are not rich enough, and the development and funding policies related to science and technology talents have not yet met the needs of high-quality development of talents; (4) the fuzzy comprehensive evaluation results show that the risk of Shanghai young science and technology innovation talents development for 2035 The risk is in orange warning status, i.e. the risk level of talent development is serious, which indicates that the development of young science and technology innovation talents in Shanghai faces internal environmental risks in Shanghai and external risks of fierce talent "competition" among provinces and cities.

Through the conclusions of the study, recommendations are made for the development of young scientific and technological innovation talents in Shanghai in 2035: (1) to establish an early warning mechanism for the development of young scientific and technological innovation talents in Shanghai, to strengthen the top-level design of talent development risk prevention, to clarify the key points of risk management in each stage of talent development, to strengthen the monitoring and early warning of talent development risks, and to improve the ability to resolve risks. (2) To enhance Shanghai's environmental governance capacity, accelerate the improvement of a multi-faceted environmental governance system, promote the green and high-quality development of Shanghai's cities, create a good ecological environment, and lay a good ecological foundation for the high-quality development of young scientific and technological innovation talents (3) To improve the policy and service system for young scientific and technological innovation talents, respect the law of growth of talents, accelerate the development of a practical Shanghai talent policy system, and coalesce a good rule of law environment that uses the law to gather talents, protect them, cultivate them, and develop them. (4) Accelerate the integrated development of young scientific and technological innovation talents in the Yangtze River Delta region, encourage the collaborative training and development of young scientific and technological talents in the Yangtze River Delta region, realize the common construction and sharing of resources, and create a benign competition atmosphere for talents; (5) Improve the internationalized cooperation and development mechanism for young scientific and technological innovation talents, vigorously introduce overseas scientific and technological talents, gather a

group of world-class top scientific and technological talents, form an environment for the development of scientific and technological talents in line with international standards, and further enhance the risk prevention ability of Shanghai's young scientific and technological innovation talents development.

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