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EVALUATION AND ANALYSIS ON THE COMPETITIVENESS OF INNOVATIVE SCIENTIFIC AND TECHNOLOGICAL TALENTS IN SHENZHEN

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Abstract

With the advent of the era of knowledge economy, which city master knowledge, technology, talent, which city has a competitive advantage, can seize the development opportunity. According to the national medium and long-term talent development plan, talents are the strategic resources to realize national rejuvenation and win the initiative of international competition. At present, the competition situation of attracting talents at home and abroad is increasingly fierce, which makes Shenzhen City face the competition situation of "there are pacesetters in front and soldiers in pursuit after". Therefore, it is urgent for Shenzhen to understand the competitiveness level of innovative scientific and technological talents and take corresponding measures to maintain and enhance the competitiveness. In order to analyze the competitiveness level of innovative scientific and technological talents in Shenzhen, this paper first introduces the research background, problem statement, research objectives, research significance, premise hypothesis, research scope, operation definition and paper organization of innovative scientific and technological talents in Shenzhen. Secondly, literature research is carried out to review the relationship between dependent variables and four independent variables, relevant management theory, research hypothesis and research framework. Thirdly, it introduces the research design, analyzes the overall and sample, data sources and data analysis, constructs the evaluation model, and makes an empirical study on the competitiveness of innovative scientific and technological talents in Shenzhen. Based on this, this paper selects four secondary indicators, namely, innovative science and technology talent resources, talent investment, talent performance and talent environment, with a total of 31 three-level indicators, and constructs the competitiveness evaluation index system of innovative scientific and technological talents. Based on the relevant yearbook data of Shenzhen from 2010 to 2018, this paper uses factor analysis method to extract three main factors: resources and investment, environment and efficiency, and

constructs an evaluation model for the competitiveness of innovative scientific and technological talents, and uses factor analysis to evaluate the competitiveness of innovative scientific and technological talents in Shenzhen from the quantitative level. Finally, through the discovery and discussion of the evaluation results and the summary of the research objectives one by one, this paper puts forward personal subjective evaluation on the competitiveness level of innovative scientific and technological talents in Shenzhen, and further puts forward suggestions and Countermeasures to help improve the competitiveness of innovative scientific and technological talents in Shenzhen.

Keywords: Shenzhen, Innovative scientific and technological talents, Competitiveness, Evaluation system

INTRODUCTION

Background of Study

In today's era of knowledge economy, the international competition is fierce, and innovative scientific and technological talents, as an important source of promoting economic growth, have been paid more and more attention (Yan et al. 2019; Chen et al. 2018; Huang 2018). The major countries in the world regard the essence of international competition as the competition of innovative scientific and technological talents, and focus on the development of innovative scientific and technological talent resources. As the leading demonstration area of socialism with Chinese characteristics and the core city of Guangdong, Hong Kong and Macao Bay area, Shenzhen will have a great demand for innovative scientific and technological talents. Innovative scientific and technological talents will be the most important strategic resources in the development of Shenzhen and the bay area. In order to promote the construction of innovative scientific and technological talents in Shenzhen, it is necessary to clarify the current situation of the competitiveness of innovative scientific and technological talents in Shenzhen, and correctly understand its advantages and disadvantages. It is of great practical significance to improve the independent innovation ability of Shenzhen and even Guangdong, Hong Kong and Macao Bay area and maintain sustainable competitiveness. (Abd-Elsalam, 2020; Feng et al., 2020; Möbius et al., 2020)

Qian Xuesen, a famous scientist, is highly concerned about the problem of talents. He once said: what I want to talk about is not the cultivation of ordinary talents, but the cultivation of scientific and technological talents. I think this is a big problem for the long-term development of our country. It can be seen from Qian Xuesen's words that although the country has many innovative projects and programs, it can not cultivate first-class talents. He thinks that it is a problem of the current education system. Entering the new stage of the new century, the CPC Central

Committee and the State Council have made a major decision to implement the strategy of strengthening the country with talents, which has become a basic strategy for China's economic and social development. In the outline of the national medium and long term talent development plan (2010), the central government of China has scientifically determined the strategic objectives, guidelines and major measures for China's talent development at present and in the future, and put forward the talent development policy of "service development, talent priority, use-oriented, high-end leading and overall development". In 2007, the Chinese Academy of Engineering launched a scientific and technological personnel training program. After two years of research, a comprehensive research project report has been formed. The report introduces the relevant issues of project science and technology personnel training, and puts forward important suggestions to promote the cultivation of innovative engineering and technical talents in China. (Cui et al., 2020; Wei, 2020)

For a region or city, innovative scientific and technological talents and their determined regional or urban scientific and technological strength not only have an extremely important impact on its comprehensive competitiveness and its development and change, but also the quantity and quality of innovative scientific and technological talents themselves are an important part of the comprehensive strength of a region or city. It affects the development potential of a region or city to a great extent. According to the "opinions on supporting Shenzhen to build an advanced demonstration zone of socialism with Chinese characteristics" issued by the CPC Central Committee and the State Council, by 2025, Shenzhen's economic strength and development quality will rank among the world's top cities. The R & D investment intensity and industrial innovation ability are world-class. Cultural soft power has been greatly improved, the level of public service and the quality of ecological environment have reached the international advanced level, and a modern, international and innovative city has been built. In order to achieve this goal, Shenzhen must increase the investment in talents, introduce and cultivate a number of innovative scientific and technological talents, and build a talent highland.

Innovative scientific and technological talents are a kind of human resources with high innovation ability. At present, there is no systematic and comprehensive definition for the competitiveness of innovative scientific and technological talents. Based on the concept of talent competitiveness, this paper holds that the competitiveness of innovative scientific and technological talents refers to the overall strength of various talent factors such as the quantity, quality, structure, proportion, flow and environment of innovative scientific and technological talents in the competition, game and competition of social and economic life. It is the organic synthesis and high cohesion of various talent factors, and the most important and effective index to measure the development degree of innovative scientific and technological talents from a macro perspective under the conditions of market economy.

Therefore, according to the relevant management theory and the actual situation of Shenzhen, this paper analyzes the competitiveness of innovative scientific and technological talents in

Shenzhen, finds out its advantages and disadvantages, and constructs and evaluates the competitiveness index system of innovative scientific and technological talents. It is hoped that the research results will help Shenzhen government, enterprises and other stakeholders to reasonably define their own talent situation, optimize talent policies, establish and improve the introduction and training mechanism of innovative scientific and technological talents, and constantly improve and enhance the competitiveness of innovative scientific and technological talents.

1.2 Problem Statement

Innovation has become the power and source of long-term economic and social development. As the most active and active factor in innovation activities, innovative scientific and technological talents are worthy of becoming the most valuable social resources in the world. Whether a region or city can obtain and occupy an active and dominant position in the future competition largely depends on the scale and level of its innovative scientific and technological talents.

As a pioneer of reform and opening up, Shenzhen special zone is the best choice for the demonstration zone of socialism with Chinese characteristics. It is a new strategic orientation for Shenzhen to build a leading demonstration area of socialism with Chinese characteristics. In recent years, more than 20 cities in China have issued new talent policies, and Shenzhen has also introduced and implemented a series of talent policies. Judging from the level of economic development, Shenzhen maintains a leading position in the first tier cities. In 2019, the GDP of Shenzhen has exceeded 2.7 trillion yuan, and has made rapid development in the fields of independent innovation and innovative economy in recent years. However, in terms of high-level innovative scientific and technological talents, Shenzhen's science and technology talent resources are the most abundant in the Pearl River Delta, but due to the development of the Pearl River Delta and the Bay Area in recent years, the number of R & D talents has decreased by 5.72% year-on-year since 2014. At present, Shenzhen economy is transforming from "capital driven" to "innovation driven", and the key to innovation is talents. The serious shortage of human resources, especially innovative scientific and technological talents, has become the key restricting factor and prominent bottleneck of Shenzhen leading the innovation of regional open cooperation mode and the transformation of development momentum, which is a major strategic issue to be solved urgently.

For Shenzhen, it will face a dynamic, complex and competitive environment for a long time in the future. Therefore, it is a serious problem for Shenzhen to acquire, gather, develop, use and maintain a competitive team of innovative scientific and technological talents. The previous research on the competitiveness of innovative scientific and technological talents in Shenzhen can not meet the needs of the rapid development of Shenzhen, nor can it provide sufficient reference for the new positioning of Shenzhen as the core city of Guangdong, Hong Kong and

Macao Dawan district and the leading demonstration area of socialism with Chinese characteristics in recent years. In order to make up for this academic gap, this paper makes a new research and Exploration on the competitiveness evaluation system of innovative scientific and technological talents in Shenzhen.

As for how to objectively evaluate the competitiveness of innovative scientific and technological talents in Shenzhen, there are still several problems as follows:

(1) How to evaluate the advantages and disadvantages of Shenzhen in the competitiveness of innovative scientific and technological talents.

(2) There are a lot of works on the evaluation of talent competitiveness at home and abroad, but the evaluation on the competitiveness of innovative scientific and technological talents is a relatively new research topic, and there is no mature theoretical results for reference.

(3) The evaluation of the competitiveness of innovative scientific and technological talents is a complex and fuzzy systematic problem, which includes not only the evaluation of the quantity and structure of the input of innovative scientific and technological talents, but also the evaluation of the quantity and quality of their output, as well as the evaluation of the environmental conditions required for the growth of innovative scientific and technological talents. The scientific selection of evaluation index and the weighting method of evaluation index are not well solved.

(4) Innovative scientific and technological talents are mainly R & D personnel, whose innovation activities and R & D achievements can not be quickly transformed into real market products, so the output is difficult to be measured by simple economic method. This is also a difficult point to evaluate the competitiveness of innovative scientific and technological talents.

(5) To evaluate the competitiveness of innovative scientific and technological talents, it is necessary to consider how to combine single index with comprehensive index, how to combine static evaluation with dynamic evaluation.

Research Questions

In order to promote the comprehensive strength of science and technology and economy of Shenzhen in the new round of regional competition, this paper systematically analyzes and studies the competitiveness of innovative scientific and technological talents in Shenzhen through scientific and reasonable research.

LITERATURE REVIEW

Dependent Variables: Evaluation on the competitiveness of innovative scientific and technological talents in Shenzhen

The competitiveness evaluation of innovative scientific and technological talents in Shenzhen refers to the research on the competitiveness index system of innovative scientific and technological talents in Shenzhen on the basis of summarizing the theoretical literature, and analyzing the relevant data by establishing a model. According to the competitiveness index of innovative scientific and technological talents in Shenzhen, it reflects the current situation of the competitiveness of innovative scientific and technological talents in Shenzhen. (Kang & Jinag, 2020; Hu et al., 2020)

There are two key words to understand and define innovative scientific and technological talents: "innovation" and "talents". So what is innovation? What is "talent"?

The connotation of innovative scientific and technological talents

The concept of innovation

As for "innovation", scholars at home and abroad have elaborated from different angles. In foreign countries, some scholars define innovation as "introducing new or improved products, processes or services into the market"; some scholars think that innovation is "the process of using knowledge or relevant information to create and introduce some useful new things", or "acceptance of changes in an organization or related environment". Among them, Schumpeter's view is the most widely adopted. Schumpeter pointed out that the so-called innovation is to establish a new production function, that is to introduce a new combination of production factors and production conditions into the production system to obtain "entrepreneur's profit" or "potential excess profit". Therefore, Peter Drucker thinks that innovation is to endow resources with new ability and behavior to create wealth, and it is a process of integrating new things.(Chen et al,2018; Yan et al. 2019)

METHODOLOGY

Research Design

On the whole, this paper follows the idea of raising problem analysis solving problem, uses descriptive research to clarify the current situation and characteristics of the competitiveness of innovative scientific and technological talents in Shenzhen, uses interpretative research to analyze the reasons for the evaluation obstacles of innovative scientific and technological talents in Shenzhen, and adopts normative research to propose solutions to the problems. It combines

theoretical research with method research, system development and application research, and carries out theoretical research on the basis of empirical research. Combining qualitative research with quantitative research, there are thematic research and empirical research. In the process of research, we use the latest management science theory, combined with information technology, decision-making evaluation technology and SPSS statistical analysis tools, under the guidance of comprehensive evaluation model theory, combination evaluation theory, factor analysis theory and data theory, to build the competitiveness evaluation model of innovative scientific and technological talents in Shenzhen.

Ideas of research design

(1) According to different talent competitiveness index systems put forward by domestic and foreign scholars, this paper constructs an innovative scientific and technological talent competitiveness index system by using questionnaire survey and factor analysis method.

(2) Through the construction of the competitiveness index system of innovative scientific and technological talents and consulting the literature, this paper makes an empirical analysis on the competitiveness index data of innovative scientific and technological talents in Shenzhen, reflecting the competitiveness of innovative scientific and technological talents in Shenzhen;

(3) According to the evaluation results, this paper provides Shenzhen municipal government, relevant departments and various enterprises with the index data of absolute advantage, relative advantage and relative weakness of the competitiveness of innovative scientific and technological talents, as well as the short board index data hindering the development of innovative scientific and technological talents.

The specific technical route of this study is shown in the figure: (see Figure 3-1)

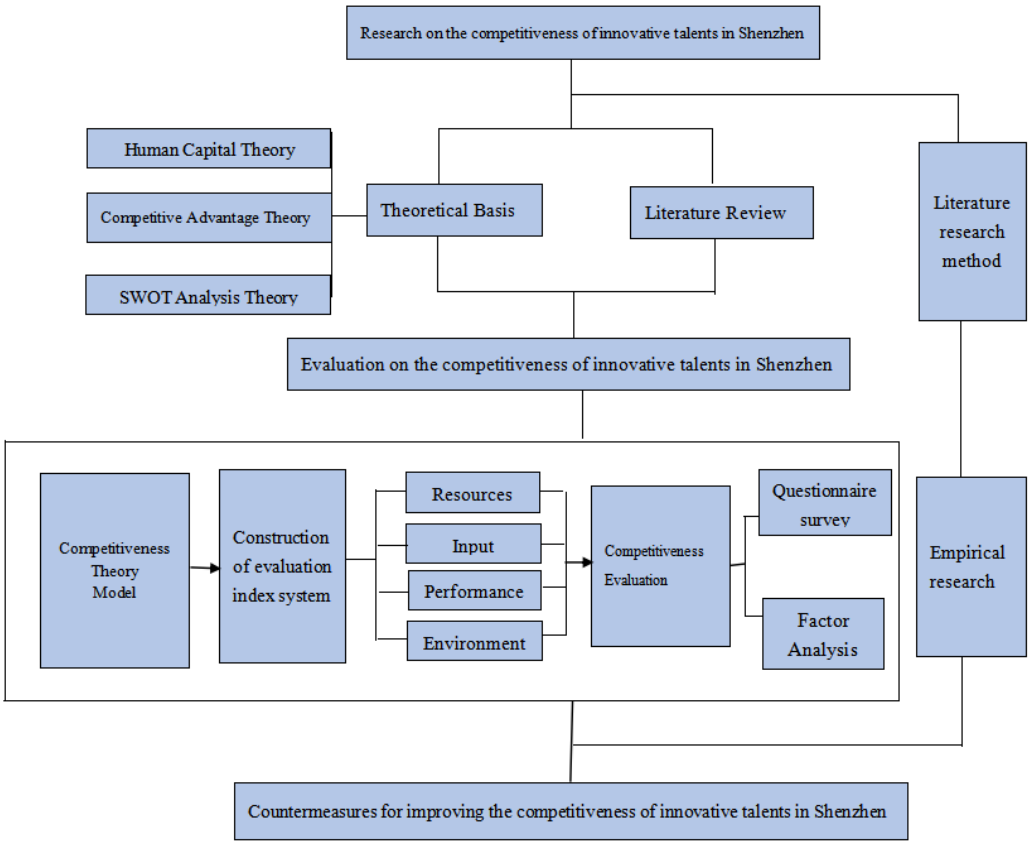

Figure 3-1 The specific technology roadmap of research
Source: Author

Main research methods

(1) Literature research method. By systematically consulting the relevant literature at home and abroad, making a comparative analysis from the existing research results and mining new things, the paper systematically grasps the current situation of the evaluation of innovative scientific and technological talents in Shenzhen, clarifies the connotation, characteristics and significance of the evaluation of innovative scientific and technological talents in Shenzhen, and outlines its strategic objectives and measures.

(2) Questionnaire survey method. Firstly, through literature research, the questionnaire about innovative scientific and technological talents in Shenzhen is designed. Secondly, we interviewed experts, scholars and enterprise R & D managers from relevant departments of Shenzhen municipal government, some scientific research institutes and scientific and technological innovation enterprises, and obtained opinions on the revision of the questionnaire to improve the validity. Thirdly, we carry out a small-scale and small sample questionnaire survey, refine the design indicators and items of the questionnaire through the analysis of individual overall correlation and exploratory factor, and obtain the questionnaire for large-scale

and large-scale samples; finally, 200 questionnaires are distributed and collected through online as the main line and supplemented by offline, and the results are summarized and analyzed to obtain the effective information and data needed for the investigation and research.

(3) Factor analysis. Firstly, the global factor analysis method is used to screen the indicators, and the evaluation indicators are divided into four categories: talent resource index, talent input index, talent performance index and talent environment index. After determining the evaluation index, the factor analysis method in mathematical statistics method is used to determine the index weight.

(4) Empirical analysis. The first step is to use the evaluation index system and evaluation model, according to the 2010-2018 statistical yearbook and various public data of Shenzhen, to obtain the evaluation results of the competitiveness of innovative scientific and technological talents in Shenzhen. The second step is to compare the evaluation results with the actual situation of Shenzhen's talent competitiveness over the years to verify the scientificity, feasibility and operability of the evaluation index system and method.

(5) Statistical analysis software aided analysis method. In this paper, SPSS and other statistical analysis software are used to conduct statistical analysis on the obtained data information, sort out the indicators, and build a scientific, reasonable and effective evaluation model for innovative scientific and technological talents. And the former evaluation strategy of innovative scientific and technological talents is the benchmark, and their best practices are used for reference in the specific practice of competitiveness evaluation of innovative scientific and technological talents in Shenzhen.

(6) System model analysis method. Using the method of system theory, this paper constructs the competitiveness evaluation system and model of innovative scientific and technological talents in Shenzhen, and excavates the relevance and effectiveness of the evaluation system elements.

Population/Sampling/Unit of Analysis

The establishment of the evaluation index system of innovative talents' competitiveness in Shenzhen should follow the principles of comprehensiveness, systematicness, comparability, operability and dynamic, and construct the index system according to certain logic.

In order to obtain effective data information, 200 questionnaires were issued, including 50 government departments, 50 scientific research institutes and 100 enterprises. A total of 126 questionnaires were recovered, the recovery rate was 63%, 95 of them were valid, and the effective sample rate was 47.5%. The results show that the evaluation index scale of innovation talents' competitiveness is suitable for factor analysis.

FINDINGS AND DISCUSSIONS

Profile of Respondents

In order to collect relevant data and information, field interviews, telephone consultation, questionnaire survey and other forms were used to communicate with relevant personnel. The interviewees include experts and scholars from relevant departments of Shenzhen municipal government, scientific research institutes and scientific and technological innovation enterprises, as well as R & D management personnel of some high-tech enterprises. They are all groups closely related to the competitiveness evaluation of innovative scientific and technological talents, involving policy formulation, scientific and technological research and development, talent data, project management, etc. From the analysis of 95 valid questionnaires collected, we can see that,

Educational characteristics of interviewees. 13 people (13.9%) had professional education. There were 45 undergraduates (47.4%) and 23 postgraduates (24.2%). 14 (14.7%) had doctorate degree or above.

Age characteristics of interviewees. There are 7 people under 30 years old, accounting for 7.4%; 51 people aged between 31-40 years old, accounting for 53.4%; 19 people aged 41-45, accounting for 20%; 18 people over 45 years old, accounting for 18.9%.

Characteristics of working years of respondents. 9 people have worked for less than 5 years, accounting for 9.5%; 22 people have worked for 6-10 years, accounting for 23.2%; 51 people have worked for 11-20 years, accounting for 53.4%; 13 people have worked for more than 20 years, accounting for 13.4%.

The impact of resources on the competitiveness of innovative science and technology talents in Shenzhen

According to the statistical yearbook and public data of Shenzhen from 2010 to 2018, the number and distribution of innovative scientific and technological talents engaged in various scientific and technological activities in Shenzhen are counted as follows: (Table 4-1)

Table 4-1 Resources table of innovative scientific and technological talents in Shenzhen

	Index	Unit	Year								
			2018	2017	2016	2015	2014	2013	2012	2011	2010
Talent Resources	R1	10,000 people	55.00	48.00	39.00	39.00	36.00	36.00	34.00	31.00	28.82

R2	%	73.04	72.92	70.36	71.73	67.05	71.54	70.98	70.41	66.82
R3	People	53.19	45.16	36.88	35.45	30.11	27.76	26.74	24.16	22.21
R4	People	77.73	76.34	74.7	74	73.4	72.8	71.81	70.11	69.19
R5	People	69	64	67	68	67	53	46	44	41

Source:Shenzhen statistical yearbook (2010-2018)

From the above Table 4-1, we can see the specific changes in the number and distribution of innovative science and technology talent resources in Shenzhen from 2010 to 2018.

(1) The number of people engaged in scientific and technological activities increased from 28.82 in 2010 to 55 in 2018.

(2) The proportion of scientists and engineers was only 66.82% in 2010 and 73.04% in 2018.

(3) The total number of personnel engaged in scientific and technological activities increased from 222100 in 2010 to 531900 in 2018.

(4) The number of students in Colleges and universities per 10000 population increased from 69.19 in 2010 to 77.73 in 2018.

(5) The number of academicians increased from 41 in 2010 to 69 in 2018.

Results

According to the quantity and distribution of innovative science and technology talent resources in Shenzhen in table 4-1, the data of the quantity, quality, structure and distribution of innovative scientific and technological talents in Shenzhen have changed greatly from 2010 to 2018. This change has directly affected and boosted the competitiveness index of innovative scientific and technological talents in Shenzhen from 39.3 in 2010 to 96.86 in 2018. The analysis results show that as an independent variable, innovative science and technology talent resources in Shenzhen can affect the dependent variable competitiveness evaluation of innovative scientific and technological talents in Shenzhen, which is in line with the set research question and research objective.

Discussion and Conclusion

Innovation

In this paper, when carrying out the research and analysis, read a wealth of various types of literature, research methods and data collection and analysis, in-depth and detailed research and analysis. To sum up, the innovation of this paper and previous studies are as follows:

According to different talent competitiveness index systems put forward by domestic and foreign scholars, and according to the actual situation of Shenzhen City, a competitiveness index system of innovative scientific and technological talents is successfully constructed. Combining theory with practice, this paper makes an empirical analysis on the competitiveness of innovative scientific and technological talents in Shenzhen.

This paper evaluates the competitiveness index data of innovative scientific and technological talents in Shenzhen and puts forward corresponding suggestions. At the macro level, it provides guidance and help for the development of talents in Shenzhen to maintain the existing competitive advantages, form new competitive advantages, improve the competitive weakness and make up for the short board of competitiveness. At the micro level, it provides a reference for Shenzhen government departments, scientific research institutions, universities, enterprises, intermediary institutions in the competitiveness analysis, evaluation, selection, introduction, training and use of innovative talents, so as to enhance the competitiveness of innovative talents. (Liu & Chang, 2020; Chan et al., 2020)

Deficiencies

Although there are still some deficiencies in this report, there are still some deficiencies in this report:

This paper only evaluates the competitiveness of innovative scientific and technological talents in Shenzhen. Although it can be found that the competitiveness of innovative scientific and technological talents in Shenzhen from 2010 to 2018 can be compared vertically, there is no horizontal comparison with other cities, so it is difficult to find the advantages and disadvantages of Shenzhen in the horizontal aspect.

Although we try our best to take into account the breadth of evaluation indicators in the selection of evaluation indicators, the impact of policy environment and humanistic environment on the competitiveness of innovative scientific and technological talents has not been reflected. This is also the limitation of the current research methods, which needs to be innovated in the future research. (Löfsten et al., 2020; Son et al., 2020)

Implications

A more macroscopic understanding of Shenzhen's talent policy

Through the research on the competitiveness evaluation of innovative scientific and technological talents in Shenzhen, this paper illustrates the irreplaceable role of talents, especially innovative scientific and technological talents in social and economic development. In the process of data collection, whether through interviews with government departments or scientific research institutions, or consulting various policies and information, we have a deep feeling that Shenzhen, as a young city, is full of vitality and innovation. In addition, we can also deeply feel the importance of innovative scientific and technological talents in Shenzhen. We have formulated detailed policies and implementation measures in the aspects of the introduction, training, development, incentive and service guarantee of innovative scientific and technological talents, so as to form a long-term guarantee mechanism for innovative scientific and technological talents in terms of work, life and learning in the form of various "green channels". Although it needs to be improved in some aspects, it is still better than many cities in China.(Adecco 2018; Chen et al. 2018; Huang 2018; Yan et al. 2019)

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