Research on the Countermeasures for High-end Talent Development in the New Material Industry from the Perspective of Four-dimensional Subject—With Hunan Province as an Example

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Abstract. In the context of the increasingly severe international economic situation, the new material industry is as one of the seven strategic emerging industries, and its development has become a major strategic decision of China that should be insisted at present and in the future. The implementation of this strategic decision cannot be achieved without talents. Based on the actual situation of Hunan Province, this paper points out the four major problems in high-end talent development of Hunan Province, namely, immaturity of industry development, unreasonable talent structure, imperfect training mechanism and unscientific incentive measures, and purposes the countermeasures in the perspective of four-dimensional subject involving government, enterprises, schools and students.

1. Introduction
The research of new materials means the entry of human’s understanding in the nature of materials and the application thereof to a deeper level. The research level and industrialization scale have become an important symbol to measure the economic development, technological progress and national defense strength of a country and region. At the same time, the domestic and foreign new material industry is showing new development tendencies, such as the deep integration between new material technologies and other high technologies, speed-up of technology innovation and product upgrading, cooperative development of the industry chain driven by the interdisciplinary and cross-industry integration, as well as intellectualization and greenization under the sustainable development constraints. Developing the new material industry in a creative way is an important entry point to vigorously cultivate a new economic growth point for Hunan Province.

However, China's economy is currently in the “three-period superimposed” stage. A new normal like overall overcapacity, growth slowdown, structural change and power conversion has appeared. Although the gross scale of Hunan's new material industry comes out in front, it is big but not strong. Especially in recent years, the growth rate of the output of new materials above the specified scale has decreased to 17.3% in 2013 and to 15.5% in 2014 from the previous average annual growth rate of 28%. The challenge to enhance the general development of the new materials industry and improve the development quality is becoming more and more difficult. The problems such as lack of industrial leading talents, weak ability of enterprises in technology research and development and industrialization, poor independent innovation and restraints in key core technology have been a major
factor restricting the development of Hunan’s new material industry. The number of high-end talents does not match with the industrial structure and development, which has been a bottleneck for the continuous development of Hunan’s new material industry.

2. Development Situation of High-end Talents of the New Material Industry in Hunan Province

2.1. Definition of High-end Talents

The new material industry is a strategic emerging industry. The talents of the new material industry refer to the talents who have deep professional knowledge and innovative awareness, and are able to contribute to the development of this strategic emerging industry. On this basis, this paper divides the high-end talents into three categories: the first category covers the senior management personnel who have rich work experience and hold a post of management position at middle-level or above; the second category covers the senior professional and technical personnel who have sub-senior professional and technical titles or above; and the third category covers the personnel who are skilled and qualified at the senior level.

2.2. Analysis on the Current High-end Talent Situation of the New Material Industry in Hunan Province

The data from the Report of Analysis on the High-end Talent Supply and Demand of the Strategic Emerging Industries in Hunan Province (2017 to 2018) from Zhaopin shows that:

- Overall Demands for Talents

As shown in Figure 1, the new materials industry is at the middle level. The industrial talent gap is estimated as 433 persons in the next two years, which is larger than the new energy industry and the cultural and creative industry but the advanced equipment manufacturing industry has the largest talent gap.

As shown in Figure 2, the gap of senior professional and technical talents who master the core technology and have research ability and experience is the largest, accounting for 55% of the overall talent gap, followed by senior management talents, and the highly-skilled talent gap is relatively small.
Requirements for Work Experience of High-end Talents

It can be seen from Figure 3 that enterprises pay more attention to the work experience compared to the education level in the recruitment process. The talents with work experience of more than 5 years and undergraduate education are still particularly needed in an enterprise. The next two years, the enterprises’ demand for the talents with work experience of more than 10 years ranks second. However, they have less strict work experience requirements on doctors. According to further analysis, it is found that there are higher education requirements on senior professional and technical talents.

Remuneration Situation of High-end Talents

Based on the analysis of remuneration information given by enterprises, 3% of the talents have an annual salary of less than RMB 100,000, and only 29% have the annual salary of more than RMB 300,000. Viewing from different types of jobs, the senior management positions provide the highest annual salary, and the high-end management positions with the annual salary of more than RMB 300,000 account for 42%. The average annual salary for highly-skilled posts is the lowest and concentrated in the range of below RMB 200,000 (Figure 4).
High-end talent Supply Situation

Hunan has a number of key universities and research institutions including Central South University, National University of Defense Technology, Hunan University, Changsha Research Institute of Mining and Metallurgy and Hunan Rare Earth Metal Material Research Institute, more than 10 academicians within the industry, two national engineering centers, more than six state-level enterprise technology centers, over 60 provincial (department) level innovation platforms and more than 20,000 staff engaged in the new material research and development.

According to the data from January to October 2016 (Figure 5), Hunan’s job opening rate (the number of recruits / the number of job seekers) is 1.33, higher than other provinces except for Liaoning and Shaanxi, so the recruitment difficulty is high. This reflects that Hunan’s economic development has brought about a large demand for talents on the one hand, and that the talents here is short in supply on the other hand.
3. Main Existing Problems

The supply of high-end talents for Hunan’s new materials industry is in short, the quantity and quality of research achievements urgently need improvement, and the conversion efficiency of research achievements should be increased as well. In the process of building high-end talent system of the new materials industry, there are some weak links in different degrees, which mainly include the following four aspects:

3.1. Immature Industrial Development

As the new material industry itself is not yet fully mature, the specific requirements on the talents required by the industry are not clear, and the talent structure and quantity are difficult to define. And even, the way of introducing and training high-end talents is still vague. Therefore, one of the main problems to be solved at present is how to define the talents of the new material industry required by the state, thus clarifying the way of introducing and training high-end talents.

3.2. Unreasonable Talent Structure

The problem is embodied in the mismatching between the knowledge structure and the experience structure and the development of new materials industry, and the structural adjustment is seriously lagging behind. On the one hand, the distribution of talents among industries is unreasonable. The research and development talents are concentrated in the education and health industries, accounting for more than 80% of the total number. 90% of high-level professional and technical talents are concentrated in public institutions, while the proportion of enterprises or the R & D institutions with the nature of enterprise, which are the main battlefield of the economic construction is low; and on the other hand, with the agglomeration enhancement of strategic emerging industries, the high-end talents meeting the enterprises’ high-end talent requirements mainly flow to the core cities of the Yangtze River economic belt, Beijing-Tianjin-Hebei region and Pearl River Delta area. Within Hunan Province, the number of talents in Changsha, Zhuzhou and Xiangtan account for more than 60% of the total number of the whole province, and 80% of the high-level talents of Hunan are gathered there, including all academicians.

3.3. Incomplete Training Mechanism

Compared with the advanced regions at home and abroad, there is a general deviation in the concept of talent development in Hunan province, and the sustainable talent training mechanism has not yet formed. Although all sectors of the community pay more and more attention to talents, and they continuously employ talents with high salary, attract and retain talents through various preferential policies and other means, but few of them are willing to invest money and energy to train talents. Considering from benefits and efficiency, enterprises are more willing to directly recruit experienced and competent talents rather than invest time, money and human capital to train talents.

3.4. Unscientific Incentives

With the talents having 4 to 6 years of work experience and annual salary of more than RMB 100,000 as an example, the proportion of talents in Changsha only accounts for 7.5% compared to the four first-tier cities and four new first-tier cities, just higher than that of Wuhan. In terms of the average salary of job seekers in different cities, the difference between Changsha and Beijing, Shanghai and Guangzhou is 37%, and the difference between Changsha and its adjacent new cities is 11%. The gas is big in the senior management and biopharmaceuticals positions, and small in mechanical design and automobile manufacturing posts.
4. Proposals on the High-end Talents Development from the Perspective of Four-dimensional Subject

4.1. To improve the high-end talent development policies under the governmental support
The leadership of government departments at all levels should establish the concept of “human resources is the first resource”, set up the strategy layout of “the talent development takes the priority in the economic and social development”, and increase the support for the development of high-end talents of the new material industry. Set up the special funds for the development of industrial high-end talents, and implement the appropriate policies to guarantee the priority of investment in high-end talents. Set up the entrepreneurial support funds and special research funds for the introduction of high-end talents of the new material industry, establish and perfect the research and entrepreneurial credit guarantee systems for the high-end talents, increase financial discounts and tax incentives and strengthen the incubator construction to provide support and create conditions for high-end talents’ research and entrepreneurship. Implement the targeted policies for introduction of industrial high-end talents. Allow relaxation of restraints on the personnel establishment and position conditions as well as title assessment conditions for the introduced personnel who hold professionaland technical positions in enterprises or institutions.

4.2. To promote the formation of high-end talent growth mechanism under the leading of enterprises
Enterprises should do their best to improve the talent growth mechanism to promote the development and progress of high-end talents. Further improve the industrial high-end talent evaluation system, establish the evaluation based on the technical level, innovation ability and work performance; actively promote the title system reform, strengthen the autonomy of professional and technical personnel in the title evaluation; continuously implement the industrial innovation talent incentive mechanism, improve the achievement incentive policies for technological personnel, such as technology shareholding, options, dividends and equity; increase the attraction to the domestic and foreign high-level management talents and professional and technical talents; enhance the protection of intellectual property; perfect the use and evaluation rules of intellectual property rights; and increase the conversion of technological achievements and the proportion of income for the main inventor after application of such technological achievements.

4.3. To promote the reform of high-end talent training mode under the support of colleges and universities
Colleges and universities should carry out reform on some specialties, combining with the development of the market and the actual needs of Hunan Province so that the education and teaching talent closely match with the market demands. Further promote the reform of talent training mode, optimize the curriculum system, enhance the comprehensive and interdisciplinary features of courses, and broaden students' knowledge; train students’ ability to find, analyze and solve problems via the comprehensive use of the heuristic and flipping teaching models and methods; speed up the international pace of high-end talent training, strengthen the cooperation with multinational corporations, international organizations and internationally-renowned universities; actively promote the production-education-research integrated talent training, and the establishment of the strategic alliance of universities, research institutions and enterprises with complementary advantages, resource sharing and close cooperation; jointly build a batch of talent development bases, and cultivate talent groups in the "talent + project + base" and "talent + team + base" mode.

4.4. To achieve the self-improvement of high-end talents with participation of students
According to the quality iceberg model proposed by McClelland, a famous American psychologist, the performance of an individual's personality is divided into the part above iceberg, which is presented on the surface, such as basic knowledge and skills; and the part below iceberg, which is hidden deeply, such as social role, characteristics and motives. The latter plays a key role in human behavior and
performance, and it is the resource with the most development potential, and is also the key for contemporary college students to achieve self-improvement of high-end talent. Therefore, they should: firstly establish scientific goals, which should be not only consistent with the advantages of individual quality, but also based on the times and the economic and social situation and set strict requirements on themselves; secondly, adhere to the combination of theoretical learning and practice and the knowledge economy era requires an individual to firmly set up the lifelong learning concept; and thirdly, actively participate in innovation and entrepreneurship research projects of college students, create more research opportunities, and enhance their own innovative spirit and research ability.

Acknowledgments
This paper is the result of the related research on the subject of Research on the Construction and Application of the Evaluation System for Teachers’ Performance in Application-oriented Undergraduate Colleges and Universities from the Perspective of Four-dimensional Subject (XJK016BGD045) under the 13th Five-Year Plan of Hunan Province, the subject of Research on the Support Policies for the Industrial Technology Innovation Alliance of Hunan (16JCWC002) under the project of Social Science Foundation of Hunan Province, and the subject of Research on the Evaluation of Collaborative Innovation Efficiency of the Industrial Technology Innovation Alliance of Hunan Province(XSPYBZC043) under the project Social Science Achievement Appraisal Committee of Hunan Province.

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