Analysis of Talent Training Needs Based on Automobile Manufacturing and Assembly Technology Specialty

Huagang Liu[a,*], Zhixin Feng[b] , Hui Yu[c], Ruican Hao[d], Shang Wang[e]

School of Automotive Engineering, Beijing Polytechnic, Beijing, 100176, China

[a]liuhuagang@bpi.edu.cn, [b]fengzhixin@bpi.edu.cn, [c]yuhui @bpi.edu.cn, [d]haoruican @bpi.edu.cn, [e]wangshang@bpi.edu.cn

*Corresponding author

Keywords: Major in automobile manufacturing and assembly technology; Talent demand; Industrial upgrading; Modular curriculum

Abstract: According to the spirit of National Vocational Education Reform Implementation Plan, Construction Plan of High-level Vocational Schools and Professional Groups with Chinese Characteristics and other documents, we will solidly promote the high-quality training of vocational education talents, actively promote the reform of student training mode, continuously optimize the subject curriculum, and promote the integration of science and education and production and education. Seriously investigate and analyze the development and talent demand of automobile industry in Beijing area, especially in Beijing Economic and Technological Development Zone, so as to lay a foundation for the reform of automobile manufacturing and assembly technology talents training and better train talents in automobile industry for us in Beijing.

1. Introduction

A series of new objectives, judgments and requirements were proposed in the National Vocational Education Reform Implementation Plan, which was issued by the State Council of the People's Republic of China on January 24, 2019. The top-level design and construction blueprint for vocational education in the new era was planned in the objective [1]. The Opinions on the Implementation of the Construction Program for High-Level Vocational Colleges and Specialties was called 'Double-high Program", and was issued by the Ministry of Education and the Ministry of Finance on March 29. It focused on concentrating efforts to construct a number of worldclass vocational colleges and specialties with Chinese characteristics that can lead the reforms and support the development. The Technical Innovation Service Platform is an effective measure to deepen the reform of vocational education, strengthen connotation construction, realize high-quality development, and construct a highland for cultivation of technical talents and. For vocational colleges, to create the "Innovation Platform" under the background of the "Double-high Program" is important and meaningful.

In this paper, the research status about the Technical Innovation Service Platform in vocational colleges was investigated and researched both at home and abroad. Then, the research contents on the Innovation Platform were planned including main objective, core concept and main concept. The the research thoughts and methods were planned and the research routine was designed for constructing the Technical Innovation Service Platform.

2. Talents demand analysis

In 1994, China promulgated the Industrial Policy of Automobile Manufacturing Industry, which determined the strategic policy and measures for the automobile manufacturing industry to truly become a pillar industry. China's automobile manufacturing industry was playing an increasingly important role in the national economy. In 2009, Beijing's automobile manufacturing industry has become the first pillar industry of Beijing's modern manufacturing industry. In the first half of the

year, the output value and income of BAIC Holding Company jumped to the first place in Beijing's industrial enterprises for the first time, selling 582,000 vehicles, an increase of 28% year-on-year. Sales revenue was 51.549 billion Yuan, up 14.53% year on year, and profit was 2.5 billion Yuan, up 77.88%[2] year on year. In 2010, the output value, income and other indicators of BAIC Holding Company still ranked first among Beijing industrial enterprises, selling 1,489,865 vehicles. In 2018, Beijing Benz, as the only vehicle factory in Yizhuang area of "three cities and one district", has exceeded 430,000 in sales output[3], and its vehicle factory and its "peripheral industries" had a large space for the demand of automobile talents.

With the adjustment of production mode and industrial structure in Beijing, Tianjin and Hebei, the demand for talents would be adjusted in the future[4]. At present, automobile manufacturing enterprises and parts manufacturing enterprises with a certain scale kept a stable trend in the employment scale. From 2013 to 2019, the number of employees in the automobile industry in Beijing-Tianjin-Hebei region increased by an average of 7% every year. In 2019, the statistical value increased greatly. In accordance with the average educational background in the industry, 60% of the growth rate came from vocational education schools. Considering the reducing effect of intelligent automobile manufacturing on the number of employees in the next five years, the professional talents required by the automobile industry will keep increasing by 5% every year. Taking the automobile manufacturing and assembly technology major of our university as an example, since the personnel training plan was jointly implemented with Beijing Benz Automotive Co., Ltd. in 2006, the graduates are in short supply every year.

At present, the demand for talents in automobile and related industries in Beijing Economic and Technological Development Zone mainly lied in the intelligent manufacturing and service industries of high-end automobiles and new energy vehicles[5]. The employment demand of high-end automobile service industry has become one of the main industries driving the growth of human resources in the development zone. It was estimated that the average annual demand for talents in high-end automobile service industry was more than 2,000. New energy automobile industry was a new industry in the development zone, which was in the initial construction stage. In accordance with the survey results, it was estimated that the average annual demand for talents in this industry is about 10,000. In accordance with the proportion of college, technical secondary school, vocational high school and technical school education personnel accounting for 41.28% of all employees, the average annual demand for vocational education talents was 4,128. In accordance with the survey results, it was estimated that the average annual demand for talents in this industry is about 10,000. In accordance with the proportion of college, technical secondary school, vocational school and technical school education personnel accounting for 41.28% of all employees, the average annual demand for vocational education talents was 4,128. In accordance with this calculation, the annual demand for vocational education talents in automobile and related industries in the development zone is ≥6414 people per year.

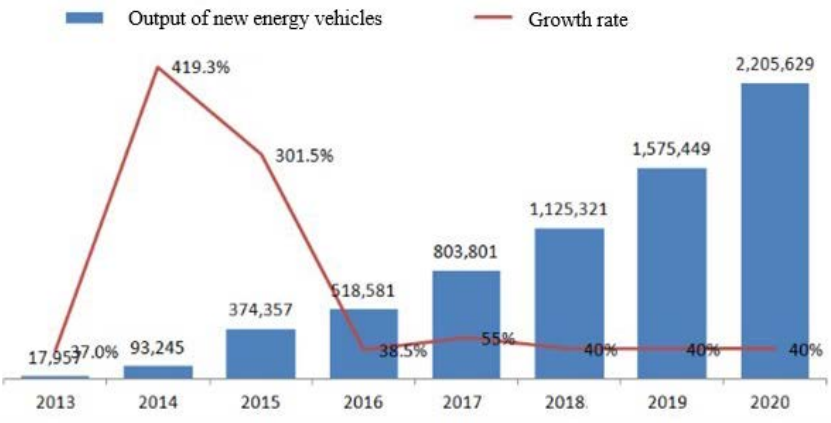

Figure.1 Production forecast of new energy vehicles in China

In accordance with the forecast of relevant institutions, the demand for new energy vehicles in

China will continue to increase, as shown in Figure.1. In Beijing, encouraged by local policies, the popularity of manufacturing and using new energy vehicles and new energy intelligent vehicles will be greatly improved, and the number of skilled personnel engaged in intelligent manufacturing and service of new energy vehicles will continue to increase[6].

Beijing Automotive Group Co., Ltd. was the backbone enterprise of China's automobile industry and one of the world's top 500 enterprises, covering the complete industrial chain of passenger cars, commercial vehicles, new energy vehicles and parts research and development, manufacturing, automobile service, etc.. It was a large state-owned automobile enterprise with the most complete variety, perfect industrial chain and leading new energy vehicle market in China. Beijing Electric Vehicle Co., Ltd. is the largest pure electric passenger car industry in China, with the most complete industrial chain, the largest market sales, the widest user coverage and the greatest brand influence. It was also the first new energy car enterprise with complete service chain, industrial chain and ecological chain in China. In addition to Beijing Automotive Group, which has a complete industrial chain, Beijing Changan Automobile Co., Ltd., a new energy automobile production base in Chang 'an, and a large number of small and micro high-tech enterprises such as auto parts design, R&D and testing. The complete automobile industry chain provides employment guarantee for graduates of high-end automobile intelligent manufacturing and service professional groups.

The high-end automobile and new energy automobile industry is a high-tech industry in Beijing Economic and Technological Development Zone. It will build a new energy intelligent automobile industry system with relatively complete industrial chain, leading competitiveness in China and obvious cluster effect, focusing on new energy vehicles, intelligent vehicles and digital manufacturing. Focus on the development of batteries, motors, Electronic control systems, vehicle sensors, vehicle terminal systems, development of graphene materials for power batteries, rare earth materials for motors and thin silicon steel for new energy vehicles, development of 3D printing equipment, automotive industrial robots, digital factories and intelligent manufacturing systems will provide a large number of employment opportunities for professional groups[7].

By the end of 2018, the number of cars in China had reached 240 million, an increase of 22.85 million over the same period of last year, among which the number of small passenger cars exceeded 200 million for the first time. Beijing is an international metropolis. By the end of 2018, the number of motor vehicles in Beijing was the highest in China, reaching 6.11 million, including 230,000 new energy vehicles. The number of applications for individual new energy vehicles in Beijing exceeded 420,000. New applicants need to wait until 2026. The huge number of vehicles sharply increased the demand for automotive service talents, providing a large number of jobs for professional groups.

In the next five years, the demand for talents in new energy vehicles is mainly distributed in three aspects: Technical and technical talents in new energy key assembly parts industry, technical and technical talents in new energy vehicle manufacturing industry and technical and technical talents in new energy vehicle service industry. Among them, the total demand for vocational talents was about 20,640. The demand for vocational talents in high-end automobile service industry is about 11,430. Based on this, it was estimated that the number of higher vocational talents needed by automobile and related industries in the next five years was about 32,070.

2.1. Automobile Industry Development General Situation in China

Over the past 20 years, China's automobile industry has made great progress. In 2016, the scale of automobile production and sales exceeded 28 million, as shown in Figure. 2, which has been ranked first in the world for eight consecutive years. Although China has become a real automobile power, it was not a powerful automobile country because of many years of foreign technical barriers. In accordance with the statistics of relevant experts, 70%~80% of the automobile electronic control part of the traditional automobile industry was in the hands of foreign enterprises. With the development of new energy automobile industry, 70%~80% of the automotive electronic control parts of new energy vehicles were independently developed and mastered by Chinese enterprises.

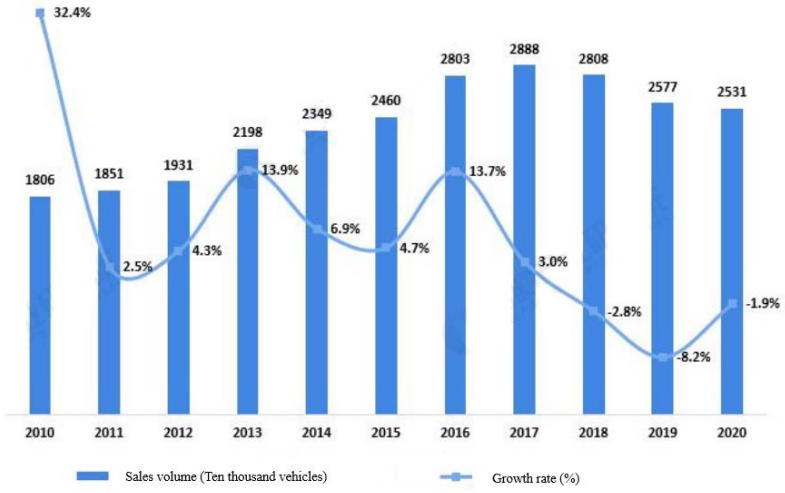

Figure.2 China's automobile sales and growth rate from 2010 to 2020

Over the past 20 years, China's automobile industry made great progress. In 2016, the scale of automobile production and sales exceeded 28 million, as shown in Fig. 2, which has been ranked first in the world for eight consecutive years. Although China has become a real automobile power, it was not a powerful automobile country because of many years of foreign technical barriers. In accordance with the statistics of relevant experts, 70%~80% of the automobile electronic control part of the traditional automobile industry is in the hands of foreign enterprises; With the development of new energy automobile industry, 70%~80% of the automotive electronic control parts of new energy vehicles are independently developed and mastered by Chinese enterprises.

In order to change China's automobile industry from big to weak, and speed up the industrial transformation and upgrading, the Chinese government issued the Energy Saving and Intelligent Networking Automobile Industry Development Plan (2012-2020) in 2012 and Made in China 2025 in 2015, formally proposing the strategy of manufacturing a powerful country. As a result, it was a major strategic mission that China's automobile industry must undertake to officially upgrade itself to a national strategy and realize the transformation from a big automobile country to a powerful automobile country.

In October 2015, the technology roadmap of key areas published in Made in China 2025 generally pointed out the development direction and path of energy-saving cars, intelligent networked cars and intelligent networked car technologies.

On October 26th, 2016, at the annual meeting of China Automotive Engineering Society, Energy Saving and Intelligent Networking Automotive Technology Roadmap was officially released to the outside world, and mapped out the technological development blueprint for China's automobile industry in the next 15 years, as shown in Figure.3. In terms of development direction and path selection, the technology roadmap takes energy-saving cars, intelligent networked cars and intelligent networked car technologies as the main breakthroughs, comprehensively promoting the low-carbonization, informatization, intelligence and high quality of the automobile industry, and forming a "1+7" roadmap, that was, an overall technology roadmap, as well as energy-saving cars, pure electric and plug-in hybrid vehicles, technical roadmaps of seven sub-sectors including hydrogen fuel cell vehicles, intelligent networked vehicles, automobile manufacturing, automobile power batteries and automobile lightweight[8].

In addition, with the transformation and upgrading of China's automobile industry structure and the sharp increase in the number of automobiles, the automobile consumption structure has been greatly adjusted and changed. All kinds of automobile markets (joint venture cars, self-owned brand cars, SUV off-road cars) have developed rapidly and rapidly. The car market develops steadily. The market potential of small and medium-sized buses and pickup trucks appears. The market of automatic transmission cars and hatchback boutique cars was developing rapidly. Automobile culture, automobile tourism, automobile leisure, automobile entertainment, automobile sports and

automobile competition are on the rise[9]. A diversified and high-speed competition, such as auto 4S shops, auto supermarkets, auto cities, online auto markets, auto industrial parks, auto chain stores, auto special maintenance centers, auto parts and auto supplies comprehensive markets, is improving.

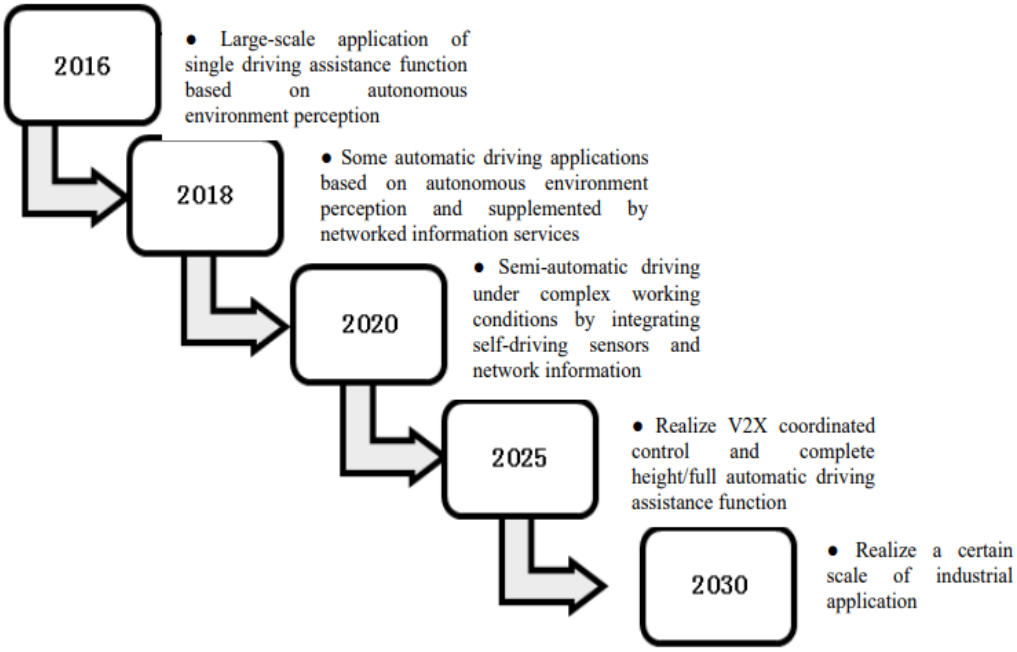

Figure.3 Technical development blueprint of China's automobile industry in the next 15 years.

2.2. General Situation of Automobile Industry Development in Beijing Economic and Technological Development Zone

The transformation and upgrading of automobile industry needs technological innovation as the engine. Beijing, as the national science and technology innovation center, was planning to build "three cities and one district" (Zhongguancun Science City, Huairou Science City, Future Science City and Beijing Yizhuang Economic and Technological Development Zone (hereinafter referred to as the Development Zone)), and strives to build the innovation-driven development frontier represented by the development zone, and build an innovative industrial cluster and a Made in China 2025 innovation leading demonstration zone.

Automobile industry was one of the four leading industries in the development zone (electronic information, equipment manufacturing, biomedicine, automobile transportation), and it is also an important force to build a sophisticated economic structure. At present, there were more than 30 world top 500 or well-known automobile and parts manufacturers in the development zone, such as Beijing Benz, Delphi, Cummins, Johnson & Johnson, Lierlei, etc. In accordance with the Implementation Opinions of Beijing Economic and Technological Development Zone on Accelerating the Development of Four Leading Industries, by 2022, the total output value of the four leading industries will reach 600 billion Yuan. The new generation of information technology, high-end cars and new energy smart cars will reach 200 billion Yuan respectively, and the biotechnology and great health, robots and intelligent manufacturing will reach 100 billion Yuan respectively. Among the high-end cars, Beijing Benz has become the leader in driving the economic development of the development zone with an output value exceeding 100 billion and a profit exceeding 10 billion.

The new energy vehicle was a systematic project for the coordinated development of people, vehicles, roads, environment and energy. Compared with traditional gasoline vehicles, it had a wider cross-border field and more complex industrial chain coordination, and the overall market scale in the future can reach 10 trillion[10]. Since Beiqi New Energy Global R&D Center entered the development zone, the development of new energy automobile industry had entered a period of

rapid development. In March, 2017, the Development Zone established the "An Peng China New Energy Automobile Industry Development Fund" with a scale of 100 billion Yuan, which incited social capital to participate in promoting the development of new energy automobile industry, mainly investing in the upstream and downstream related industries of the whole new energy automobile industry chain and the related fields of intelligent network connection, making every effort to promote the rapid development of China's new energy automobile industry and accelerate the pace of electrification, intelligence and sharing of the automobile industry. The development zone were built into a highland of new energy automobile industry.

During the 13th Five-Year Plan period, the development zone relied on Beijing Benz to gather Beiqi Lear, Delphi and other supporting enterprises to form industrial chains such as vehicle integration, high-end engine research and development, and intelligent networked vehicles. At the same time, it focused on promoting Alte Automobile R&D and Design Center, Mercedes-Benz MFA Phase II, Mercedes-Benz Engine No.2 Factory and other projects to build and develop advanced driverless technology, Key technologies and products such as laser radar and traffic big data application, improve vehicle production layout, and promote the integration and development of smart car manufacturing, mobile communication, car networking and other related industries through the construction of smart car and smart transportation industry innovation demonstration zone.

2.3. Human Resources Situation of Automobile and Related Industries

Analysis on Human Resource Structure of Automobile and Related Industries in Development Zone. At present, there were 20,735 people engaged in the automobile industry in the development zone, accounting for 8.81% of the employees in the development zone.

(1) Age Structure. The contribution should contain no more than four levels of headings. Figure.4 shows a summary of all heading levels.

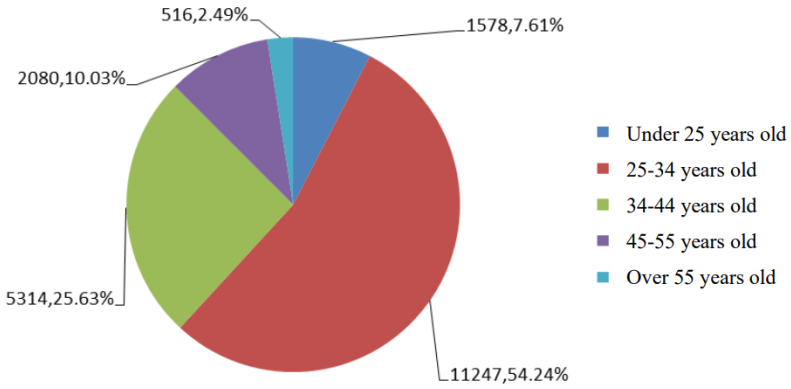

Figure.4 Age structure.

(2) Post Structure. The post structure was shown in Figure.5.

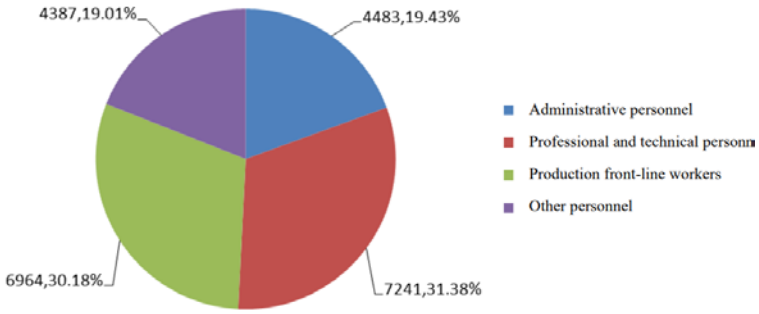

Figure.5 Post structure

(3) Educational Background Structure. The Educational background structure of the staff members is shown in Figure.6.

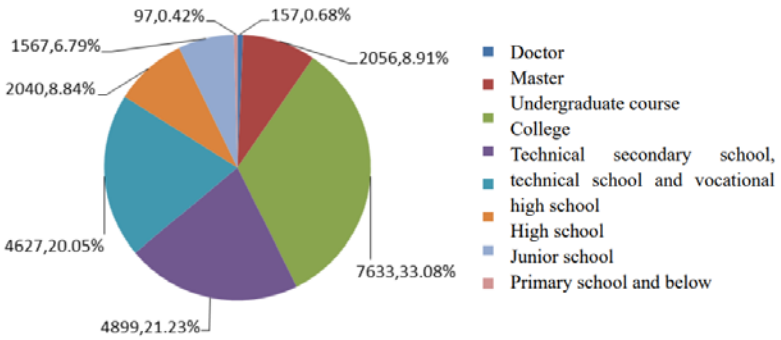

Figure.6 Educational Background structure

(4) Personnel Structure--Professional and Technical Personnel. The personnel structure in the professional and technical personnel was shown in Figure.7.

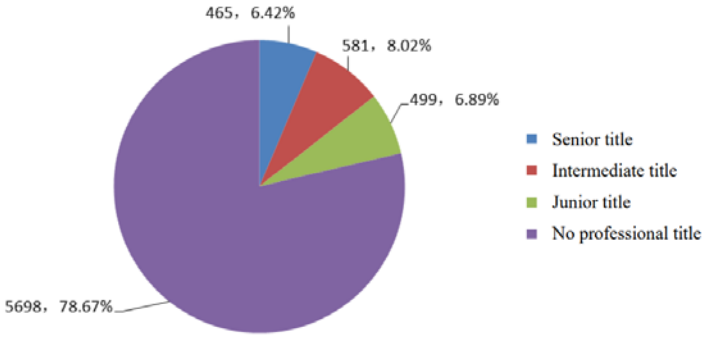

Figure.7 The personnel structure in the professional and technical personnel

(5) Personnel Structure-- Distribution Structure of Production Front-line Skilled Talents. The personnel structure in the professional and technical personnel was shown in Figure.8.

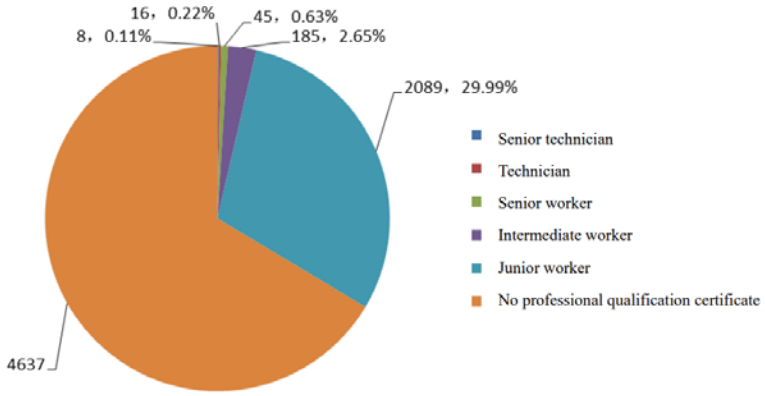

Figure.8 Personnel structure-distribution structure of production front-line skilled personnel

Analysis on the Overall Situation of Human Resources in Automobile and Related Industries in Development Zone. The overall growth of human resources was slow, and the foreign household registration personnel were still the main source of employees. In terms of academic qualifications of employees, the proportion of doctoral students, master's students and undergraduate students in the total number of employees showed an obvious upward trend. The proportion of employees with college degree in the total number increased slightly. The proportion of employees with academic qualifications in technical secondary schools, technical schools and vocational high schools in the total number of employees showed a significant downward trend. In terms of the age structure of employees, the number of employees under 25 years old increased significantly, while the proportion of employees aged 45-55 in the total number decreased significantly. In terms of

professional titles and professional qualifications, the proportion of those who had obtained professional titles and professional qualifications is on the rise slowly. In terms of employment demand, in the new generation of information technology industry, automobile, new energy, intelligent manufacturing and other key industries, the demand for highly educated and highly skilled personnel was increasing by 10-30% every year, while the demand for low-end labor is gradually decreasing. From the overall trend, with the deepening of industrial structure upgrading, the demand for highly educated and professional and technical personnel will be further expanded.

3. Problems and causes of talent supply and demand

3.1. Dislocation of Automobile Industry Structure and Talent Demand

Synchronous upgrading of industrial structure and talent demand structure has become the consensus of social and economic development. However, at the micro level, the relationship between industrial development and talent flow was sometimes "misplaced" in different stages of development, different industry characteristics and different ways of transformation and upgrading.

3.2. Huge Space for Vocational Skills and Training Needs

At present, the development was in an unprecedented historical development period, and the rapid development of key industries makes a lot of jobs and vocational skills training have huge demand space. However, there was insufficient strength in training vocational talents in resident schools, and there is no talent training and training system with the characteristics of development zones in the field of vocational education at present.

3.3. Quantity and Quality of Personnel Training Can not Meet the Demand

The quantity, quality and characteristics of personnel training in vocational colleges were far from meeting the urgent needs of development zones. At present, most graduates majoring in automobile and machinery can't meet the needs of enterprises quickly, and they often meet the basic needs of enterprises after several months of training. For positions with high technical skills, the training cycle was longer. Therefore, many enterprises are more willing to recruit technicians or technicians with certain technical skills from the society.

4. Suggestions on talent demand

4.1. With the increasing demand for professional talents and the shortage of local students, it is recommended to let go of Hebei students

With the transformation of Beijing's capital function, society, parents and students generally have prejudice against traditional manufacturing majors, which made related majors unattractive. In recent years, the number of school-age population was low, and the number of professional enrollment is insufficient.

As a high-tech product, the automobile industry was socialized, large-scale, collectivized and networked, and the demand for talents is particularly prominent, especially the high-skilled talents and compound automobile technical talents are very scarce. At present, less than 20% of employees in the development zone have received professional systematic training. A large number of elite talents, repair and maintenance talents, insurance service talents and network market talents in the development, production, sales and service of manufacturing, circulation and service industries are in short supply.

On the one hand, there were insufficient local students, and on the other hand, the demand for automotive talents in Beijing is increasing. The newly added demand for automotive manufacturing and assembly technical talents in Beijing Benz is at least 300, while the current order class with Beijing Benz is about 60 people per year, which is far from meeting the needs of enterprises. It was suggested that the enrollment index of automobile manufacturing and assembly technology specialty should be increased to recruit high-quality students from neighboring provinces, mainly

Hebei Province.

4.2. Set up Vocational Undergraduate Majors to Adapt to High-skilled Jobs

The talent demand for new energy vehicles in the future mainly falls into three categories: Technical and technical talents in key assembly parts industry of new energy, technical and technical talents in whole vehicle manufacturing industry of new energy and technical and technical talents in service industry of new energy vehicles. Among them, the key assembly components are the high-tech integration products of machinery, electricity and liquid, and the demand for mastering electrical knowledge and skills was much higher than that of traditional automobile majors. To adapt to the work related to the production of key assembly of new energy vehicles, they should have higher ability requirements. For employees engaged in automobile manufacturing equipment maintenance, they should not only master the principles of specific brands and models of robots or equipment, Programming, operation, maintenance and debugging, but also know the relevant knowledge of automobile manufacturing technology, so you should learn PLC, electrical control, electronic foundation, hydraulic and pneumatic, robot language programming and so on many courses; Vehicle companies require employees to have a higher degree of understanding of the whole vehicle, such as understanding the four manufacturing processes of stamping, welding, painting and final assembly, and also attach great importance to vehicle technology; The main employment channel of new energy vehicle higher vocational talents is the new energy vehicle aftermarket. Because of the need to solve new faults and communicate with different people, the professional ability, social ability and method ability are required.

It was suggested to set up a 7-year vocational undergraduate course for students majoring in automobile manufacturing and assembly technology and a 4-year vocational undergraduate course for college entrance examination students majoring in automobile manufacturing and assembly technology.

4.3. Speed up the Reform of Talent Training Mode because of New Talents are Urgently-needed Caused by Industrial Transformation and Upgrading

Beijing has intensively deployed major projects in the fields of automobile intelligent manufacturing and new energy vehicles, and concentrated on building a national science and technology innovation center in the automobile field. Automobile manufacturing enterprises are in urgent need of cultivating compound and innovative talents because of accelerating industrial transformation and upgrading and improving the application of intelligent automobile manufacturing system.

It is suggested that the personnel training mode should be reformed, the curriculum should be optimized, the integration of science and education and production and education should be promoted, and modular teaching should be realized to meet the needs of enterprises.

4.4. Deepen the Integration of Production and Education, Optimize the Existing Curriculum System, and Propose to Set up New Modular Courses

As the leading industry in the development zone, the high-end automobile industry presented the advanced technology of intelligent manufacturing and new production methods, and derived a large number of new technologies, new processes, new specifications, and a large number of new posts, new standards and new requirements, so the training of technical and technical personnel must adapt to it. On the basis of in-depth investigation, with the participation of enterprise technicians, a structured curriculum system is established, in which the teaching standards of automobile manufacturing and assembly technology were connected with the vocational skill level standards, and vocational education and vocational training are integrated, and the 1+X certificate system is implemented in the vocational skill module courses and the compound/innovative module courses.

The vocational and technical skills courses and modular courses take automobile manufacturing and assembly technology as the leading major, and are coordinated by other three majors such as "mechatronics technology", "automobile inspection and maintenance technology" and "machinery manufacturing and automation major". Students can obtain vocational skill level certificates such as

automobile assembly and adjustment workers and automobile inspection workers after completing their studies, which achieved the training purpose of cultivating compound/innovative talents.

5. Conclusion

The main crux of the contradiction between supply and demand was the supply-side structural reform. Promoting structural reform on the supply side requires both supply and demand to exert their strength at the same time. Industry and vocational education were the main bodies of both supply and demand of skilled talents. The current outstanding problem lied in the dislocation between supply and demand, which was mainly caused by the contradiction between the current situation of "two fast", "two highs" , "dilemma" and the lagging development. "Two fasts" means that the development of science and technology was changing with each passing day, the process of social development and the pace of industrial transformation are accelerating, the renewal of personnel's ideological concepts and the growth of spiritual and cultural needs are accelerating, and many jobs cannot keep up with the rapid development. The "two highs" means that the labor cost and the scale of selecting people in enterprises increased, and the standards of selecting materials and educating people in vocational education have improved. However, enterprises and vocational education had not yet formed effective measures and usual working ways in reducing costs and increasing efficiency, docking standards and improving levels. The "dilemma" is that it is difficult for enterprises to develop new markets by production and operation and creating new kinetic energy, and it is difficult for vocational education to recruit students and cultivate qualified talents. However, both industry and university are seeking solutions and measures, and no effective means and mechanism have yet been formed.

At the same time, it was a long-term task under the new normal for industries and enterprises to realize transformation, efficiency, quality and upgrading, which requires perseverance and gradual progress. However, the implementation of education reform and the development of modern vocational education cannot be accomplished overnight, and educating people involves slow work in all aspects, which objectively creates a gap between industry and education.

Acknowledgements

Thanks to the funds and supports from Beijing Polytechnic (2020 z041 - SXZ).

References

[1] Zhang Yanhua. research on curriculum development based on working process-taking electronic technology application major of Hengshui secondary vocational school as an example [D]. Hebei normal university, pp.1-62,(2017).

[2] Wei Na, Liao Tianjian. Problems and countermeasures in the development of Beijing automobile manufacturing industry [J]. Economic perspective: The first volume, (2010).

[3] Liu Huiqin, Wang Xiaohong. The combination of morality and technology, and the construction of education mechanism by combining work with study [J]. China Higher Education, (21), (2018).

[4] Guiding Opinions of the Ministry of Education on Promoting the Coordinated Development of Secondary and Higher Vocational Education, January 16, (2015).

[5] Chu Guoqing, Sun Shanxue. Thoughts and measures to deepen the integration of production and education in vocational education —— Taking Beijing Vocational College of Electronic Technology as an example [J]. Beijing Education (Higher Education Edition), vol.819(05), pp. 17-19. (2018)

[6] Ding Ning. On the strategy of creating a new situation in the reform and development of vocational education [J]. Curriculum Education Research, 18, (2018).

[7] Feng Zhixin, Liu Huagang and other automobile manufacturing and assembly technology majors (groups) construction plan, (2019).

[8] Tang Wei, Zhang Xiancai ,Li Limin. Research and practice of heuristic, inquiry, discussion and participatory teaching [J]. Cultural Industry, (04), (2015).

[9] Shuang Chen. Exploring the teaching method of "task-driven, project-oriented" based on working process —— Taking "Project Management" as an example [J]. Modern Enterprise Education, vol. 20(20), pp. 399-399,(2014).

[10] Notice of the Ministry of Education on Printing and Distributing the National Vocational College Teachers' Teaching Innovation Team Construction Plan. May 13, (2019).