



# Viewing the Development Strategy of Professional Degree Graduate Education from the Demand of China's Industrial Development

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**Abstract:** China's economy is currently in an important period of transformation from the demographic dividend to technological innovation, and the professional graduate education is significant for the successful transformation. Thus, Chinese professional graduate education is supposed to closely mingle the Belt and Road Initiative (BRI) to meet the change of the demand structure of talents. This research focuses on the law of China's industrial development in the past 10 years from the perspective of BRI by interpreting the opportunities and challenges brought by the strategy; explores the characters of industrial development in both Yangtze River Delta (YRD) and Pearl River Delta (PRD) regions, thereby forecasting the China's industrial development in the next 20 years. The development scales and key futures of major industries in China are also discussed based on the international industry demand and expansion. In addition, this paper analyses the characteristics of demand for high-level talents, discusses the present situation, and analyses the trend of demand for high-end applied talents in various industries in the short and medium term. Finally, this paper forecasts the demand for high-level applied talent in various professions and probes into the development strategy of professional degree and postgraduate education in China to meet the talent demand of industries.

**Keywords:** High-End Applied Talents, Postgraduate Education, Industrial Development Demand

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## 1. Introduction

In the past years, the scale of graduate student professional degree in China has steadily expanded, which has provided a reasonable talent and intellectual support for China's economic and social development [1]. *The 13<sup>th</sup> Five-Year Plan for Economic and Social Development of the People's Republic of China*, pointed out that the modernization of higher education should be further promoted and the ability to train innovative talents in universities should be enhanced. According to the plan, during this period, China's professional graduate education will still shoulder the responsibility of cultivating innovative talents.

In the near future, the development of strategic emerging industries as well as the development of professional graduate education will continue to flourish under the Belt

and Road Initiative (BRI). In particular, the BRI will bring valuable development opportunities to infrastructure construction, economic and trade exchanges, industrial cooperation and cultural exchanges among various countries along the route. Thus, in the process of promoting cooperation construction, talent support and professional graduate education undoubtedly play an important role [2].

Based on the demand for talents under BRI, this paper analyses the characteristics and trend China's industrial development, and studies enterprises' demand for high-level talents, aiming at providing the reference for the development of professional graduate education in the new era.

## 2. China's Strategic plan for Industrial Development

### 2.1. Industrial Development Driven by the Belt and Road Initiative (BRI)

The Belt and Road Initiative (BRI), as China's new international strategic framework will bring many opportunities for China's economic development. The strategic vision can be divided into two levels: in the near future, focusing on "Infrastructure interoperability, financial interoperability, industrial docking, resource introduction"; in the long run, focusing on "trade and cultural exchange, regional economic integration and common prosperity". Specifically, the BRI can bring opportunities and promotion to the Chinese industry in the following types of industries:

#### 2.1.1 Road Network Connectivity

In the construction of B&R, transportation is a priority development area to improve international communications connectivity between China and neighboring countries, thus forming regional transportation integration. Transportation industry (ports, highways, railways, logistics) will be the first direct benefit from the construction of large transport corridors in Asia and Europe, creating conditions for promoting regional economic development, speeding up the interconnection and interoperability of various transport modes such as highways, railways, civil aviation and maritime transport, and the throughput will be significantly increased.

Transportation infrastructure construction and operation development will also drive the growth of railway construction and related equipment, aviation services, equipment and aircraft production industries. China's ports have rich experience in infrastructure construction and operation, and the development of railway construction also provides a good model for other infrastructure companies. At the same time, there is a strong demand for the construction of large ports in Southeast Asia and South Asian countries of the "Maritime Silk Road of the 21st Century", which indicates good prospects for the construction and operation development of high-quality enterprises in these areas. Especially in railway construction, the "Eurasian Railway Network Plan" that breaks through the national boundaries will also stimulate the development of railway construction. According to statistics, the intentional railway project has reached 0.5 million kilometers, and there is still a huge space compared with the planned goal of the 81,000 kilometers of the Eurasian railway network.

#### 2.1.2. Infrastructure Industry Chain

From the demand side, the countries along the Belt and Road (B&R) areas have extremely strong demand for infrastructure construction from the perspective of domestic demand and future regional economic cooperation. Due to financial constraints, these countries have insufficient infrastructure investment expenditures, and generally show the status quo of backward infrastructure. For example, the

per capita GDP, per capita highway mileage, and per capita railway mileage are far lower than that of China. However, the countries in Asia and Africa have 10% and 20% urbanization improvement space respectively compared with China, therefore with regard to the urbanization, the accumulated experience, products and service capabilities that China gained during the past urbanization process can be delivered to these countries. From the domestic point of view, the density of railways, highways and expressways in northwest provinces is ranked behind the whole country. Specifically, Xinjiang, Qinghai and Gansu province ranked the bottom five. Thus, in order to realize the infrastructure docking between the B & R countries, there is plenty of room for investment in infrastructure projects such as urban construction and transportation networks in northwestern China.

From the supply side, with the decline growth rate of fixed asset investment, the problem of overcapacity in China's construction and manufacturing industry is becoming more and more serious, and the "infrastructure output" can greatly alleviate the pressure on product demand in China's construction and manufacturing industry. Therefore, China is involved in the establishment of the BRICS Development Bank and the Asian Infrastructure Investment Bank under the background of the BRI. Besides, China can increase infrastructure investment in following industries: the construction industry (construction and infrastructure engineering), equipment manufacturing (Equipment and supporting equipment manufacturing), and infrastructure materials (steel, building materials, colored, etc.)

#### 2.1.3. Energy Construction Industry

The power consumption level of developing countries along the B&R areas is extremely low, and there is huge room for development. According to the statistics of electricity consumption in 2013, the per capita annual power consumption of non-OECD countries along the B&R areas is only about 1655.52KWH while the consumption of OECD countries is about 7757.49KWH, the former is only 21.84% of the latter. Therefore, from the perspective of electricity consumption, the future electricity consumption level of the non-OECD countries along the B&R areas will have room for growth. And with the increase of electricity consumption, it will inevitably lead to the power investment in these countries, which will bring huge demand for power plant construction and electrical equipment.

#### 2.1.4. Information Industry

All-round infrastructure construction of interconnection and interoperability does not only require the transportation infrastructure like road, railway, aviation, port, but also requires the communication infrastructure such as the Internet, communication network and Internet of things. The deep interoperability between the B&R countries will raise higher requirements for the information infrastructure, which is a great benefit to China's communications industry, especially the communication infrastructure providers such as Huawei, ZTE and Xinwei.

On the one hand, the digital trend of the global economy indicates that there is a growing space for information infrastructure development in the B&R countries. On the other hand, financing institutions such as the Asian Infrastructure Investment Bank and the Silk Road Fund will actively finance overseas information infrastructure. That will be great opportunities for companies like ZTE and Huawei that have implemented the "going out" strategy and achieved a good overseas layout, as well as other companies in the ICT field that have begun to expand overseas.

## **2.2. Interaction Between the Free Trade Area (FTA) Strategy and the Belt and Road Initiative (BRI)**

In addition to the development opportunities of the industry, the FTA strategy will also have a positive interaction with the BRI [3, 4]. Actually, the BRI will promote the construction of economic corridors in the form of promoting the construction of free trade area (FTA). At present, China is promoting a series of negotiations on the FTA, and gradually building a high standard FTA network that covers B&R countries. The construction of BRI and FTA is two mutually complementary aspects of one body, which indicates a new pattern of China's opening up to the outside world. The BRI takes infrastructure as forerunner promoting economic interconnection along the road, the FTA mainly aimed at lowering the trade threshold and improving the level of trade facilitation to accelerate the integration of the economy within the region. And the interaction between the BRI and the domestic FTA is as follows.

The entry point of the Shanghai Free Trade Zone (FTZ) strategy of docking the BRI is to build a new open economic system and establish a sound economic operation mechanism that adapts to the development of an open economy and is compatible with international economic rules. At the same time, the promotion method of financial innovation closely integrated with the construction of Shanghai International Financial Center, including expanding cross-border use of the renminbi, opening up the financial services industry, and building financial markets.

Taking ports as the hub, we will open up Northeast Asia and Southeast Asia and connect Eurasia through the Indian Ocean and the South Pacific. Therefore, speeding up the establishment of Guangdong, Tianjin and Fujian Free Trade Zones (FTZ) is a major move to speed up the realization of the Belt and Road Initiative (BRI). The functions of Guangdong FTA are mainly to strengthen cooperation between Guangdong, Hong Kong and Macao, aiming at promoting the development of the Pearl River Delta region. With more resources, Guangdong FTA has more investment opportunities in high-end services; the functions of Tianjin FTA are mainly facing the Northeast Asian market, with strong advantages in shipping and financial leasing; and Fujian FTA mainly develops Taihai trade. It has advantages in carrying out in-depth exchanges and cooperation with enterprises in Taiwan, China.

## **3. China's Industrial Development Trend**

For a long time, China's industrialization development path is characterized by high resource consumption, high pollution and low output. Exploring new industrialization roads has become the direction of the government's efforts in recent years [5]. In October 2010, the State Council officially issued the "Decision on Accelerating the Cultivation and Development of Strategic Emerging Industries", proposing a basic pattern of healthy development and coordinated promotion of strategic emerging industries by 2015, which should significantly enhance the promotion of industrial structure upgrading, and the added value should account for about 8% of the GDP. By 2020, the ratio of added value of strategic emerging industries to GDP will reach about 15%, and the development goals of absorbing and promoting employment ability will be significantly improved.

### **3.1. Yangtze River Delta Region**

The development of the Yangtze River Delta (YRD) region has shown obvious constraints from the aspects of resources, space and cost. Accelerating the transformation of the development mode, from manufacturing to intelligence, has become the choice for the YRD region to achieve leapfrogging and sustainable development [6]. Although Shanghai has long since set service economy as its leading industrial structure target, Jiangsu and Zhejiang provinces have accelerated the pace of service industry development in recent years. However, the real economy is still the most important foundation and support. In terms of changing the mode of development, development of strategic emerging industry is undoubtedly the key measure in the field of industrial industry. Local governments at all levels have proposed to cultivate and develop strategic emerging industries, and this has become an important engine for economic development during the 12th Five-Year Plan period. When formulating development plans and related policies, we should not only take into account the local conditions but also analyze the development environment and situation of large regions. And the cooperation between the governments and enterprises has already started.

Strategic emerging industries in the Yangtze River Delta are also facing more challenges and constraints, mainly including strong intra-regional competition, such as the Internet of Things, cloud computing, new energy vehicles. Some areas in the new energy industry are highly homogenized, and some areas have excessive competition. At the same time, there are still some shortcomings, such as low-end industrial chain, high dependence on core technology and less independent brands.

### **3.2. Pearl River Delta Region**

Since the reform and opening up, the Pearl River Delta (PRD) region has formed an industrial development model of "high consumption, low cost and quantity expansion" in the process of industrialization. This development model shows

the characteristics of "six high and six low", namely, high output growth, high market share, high factor input, high industry structure, high export-oriented dependence and high agglomeration level; low output efficiency, low cost expansion, low price competition, low chain level, low scale level and low rooting degree.

With the transformation of the PRD industry, the industrial structure of the PRD has also undergone great changes:

1). The proportion of the three industries tends to be balanced. The proportion of the three industries shows the trend of continuous decline of the primary industry, basic stability of the secondary industry and the gradual rise of the tertiary industry. The performance of industrial structure has achieved benign development in the process of industrialization.

2). The pillar industry has an obvious driving effect. From the perspective of changes in the internal industrial structure, the development of nine pillar industries has formed and accelerated in the process of transformation of industrial structure.

3). The high-tech industry is developing rapidly and the trend of re-emphasis is accelerating. The manufacturing industry in the PRD region is still dominated by light industry, but the heavy chemical industry has also achieved great development, and gradually established many heavy chemical industrial enterprises.

4). The tertiary industry has developed rapidly. The tertiary industry in the PRD has developed rapidly and its proportion has been continuously improved. However, the traditional component of the tertiary industry is large. The traditional service industries such as wholesale, retail, trade, catering, transportation, storage, posts and Telecommunications continue to develop rapidly. While the new service industries such as modern logistics, information services, finance, insurance, real estate and community services develop slowly and have a small proportion, far from the needs of the development and upgrading of the first and second industries.

### **3.3. China's Overall Industrial Development Trend**

#### **3.3.1. Energy Construction Industry**

At present, the traditional industrial clusters represented by heavy chemical industry in China are slowing down, and the emerging leading industrial clusters represented by high-end manufacturing industry and modern service industry are growing rapidly [7, 8]. This differentiation is in line with the general experience of similar stages of development in a catch-up economy. In the next ten years, China is in a critical period of transition in the growth phase.

#### **3.3.2. Key Industry Development Trend Forecast**

According to the general rules of typical industrialized countries and the evolution trend of China's industrial structure, changing trend of the proportion of China's industrial sectors can be predicted in the next decade. The proportion of capital-intensive and technology-intensive industries such as metal products industry, machinery

manufacturing industry, transportation equipment manufacturing industry, electrical machinery and equipment manufacturing industry, electronics and communication equipment manufacturing industry continues to rise, and tends to stabilize around 2020.

While the rate of industrialization declines, the internal structure of the industry will continue to optimize and upgrade, the proportion of labor-intensive industries and heavy chemical industries will continue to decline, and the proportion of capital and technology-intensive industries will continue to rise.

## **4. Analysis of the Demand for High-Level Talents in China's Industrial Development**

Talent is an important factor in the growth of the technology industry. Under the influence of the global financial crisis, the contribution of high-tech industry development to China's economic growth and employment is even more significant [9]. The study of high-level industrial talents has a strong practical significance for guiding the sound development of China's technology industry and realizing industrial scale, integration, cutting-edge and innovative development.

### **4.1. Main Characteristics of Demand for High-Level Talents**

With the development of science and technology, the technological composition of the high-tech industry in China is often based on computer technology, information technology, management technology and the integration of related modern technology. The technological sophistication represented by aerospace manufacturing industry reflects the trend of technological development of China's high-tech industry in recent years. Electronic communication and equipment manufacturing, computer and office equipment manufacturing, represented by technology timeliness and high investment, are the pillar industries of high-tech industry at this stage. Pharmaceutical manufacturing and medical equipment and instrument manufacturing, which require high technology monopoly and complexity, are the future development directions of high-tech industry in China. The emergence of new technologies such as new processing equipment, new equipment and new technology has made China's high and new technologies develop towards integrated and comprehensive technology. The demand for talents also presents the following characteristics:

1). From the perspective of talent demand, some industries in China (such as electronic computer and office equipment manufacturing) are actually engaged in labor-intensive processing and assembly work, rather than high-tech industries. Due to the different allocation of talents in the industry, the talent demand of different industries also varies. Thus, China's high-tech industries have a strong demand for unique, innovative, complex, diverse and matching talents at

different levels.

2). From the perspective of professional and technical personnel, the increasing precision and complexity of China's high-tech products and process equipment (such as aerospace manufacturing) make the theoretical application of technical problems relatively complex, and the technical integration of production equipment and process flows deepens. R&D personnel are also major players in technology. Thus, high-tech industry have the demand for the professional and technical talents who have the following three characteristics: (1) have solid the technical theoretical foundation, the corresponding knowledge, and the ability of applying comprehensive technology; (2) master a variety of skills, have high creativity and a strong job resilience; (3) have the ability of on-site supervision and management and quality improvement, therefore technical personnel's skill can be directly reflected in the product quality; (4) have a global perspective, and have high self-requirements for the uniqueness and professionalism

3). From the perspective of high-level talents including R&D personnel and scientists and engineers, high-level talents are the main implementers of technological innovation. R&D personnel are also major players in technological innovation and technological breakthroughs. They play an indispensable role in innovative activities that transform scientific and technological achievements into real productive forces. Therefore, China's high-tech industry needs high-level talents, including high-intelligence, innovation, compound and multi-functional talents, as well as R&D full-time personnel and scientists and engineers. At the same time, it also requires a combination of scientists from different industries.

4). From the perspective of sub-industries of high-tech, each industry has its special technological characteristics and development mode. Their overall shortcomings lie in the lack of independent innovation ability and core technology. Therefore, although there are a lot of differences in the demand for talents, there are also common qualities in demand for talents: the desire for talents engaged in high-level scientific and technological activities. As the technological level of all industries is in the growth stage, the demand for scientists and engineers engaged in research and development of core technologies in all industries has an upward trend.

#### **4.2. The Present Situation and Development Trend of the Demand for High-Level Talents**

Compared with the requirements of the development of the high-tech industry, the current shortage of human resources in China's high-tech industry is both in quantity and quality [10, 11]:

1). The total number of talents is the most insufficient, and the existing talent stock is insufficient either. China has a huge talent team and a large total of human resources, but the total amount of human resources and high-level talents account for only a small amount of human resources. According to the China Statistical Yearbook 2014, the total

number of scientific and technological personnel and R&D personnel in the whole high-tech industry in 2014 was 582,974, accounting for 7.8% of the high-tech industry employees in the same year. Although it is slightly higher than the number of professional and technical personnel in the three major industries, the international talents among the senior talents are lacking. At the same time, the aging of high-tech talents in China is more severe, and the reserve talents are insufficient.

2). From the perspective of the professional structure of talents in various industries, the distribution of industries is unreasonable. The professional structure of talents is unreasonable, which makes the distribution of talents unreasonable in various industries, resulting in the incompatibility of talents' specialty in various industries and the disparity in the proportion of talents. The proportion of pillar industries and emerging industry talents in high-tech industries is generally low, and there is also a shortage of professionals. Most of the talents are mainly distributed in relatively mature industries, such as aerospace manufacturing, while industries that are in urgent need of development, such as information industry and pharmaceutical manufacturing, are seriously under-represented, and the proportion of specialized talents in the professional structure of talents is relatively low. The structural contradiction of talents in China's high-tech industries is very prominent.

3). Lack of innovative and compound talents. China has not yet formed an innovative talent team that is compatible with the high-tech industry innovation system. The situation in the modern biological and pharmaceutical industry are taken as an example to state that there are few drugs that can be independently developed in China. A considerable part of drug depends on technology introduction, intellectual property purchase. The number of talents who can independently conduct research is small. The information industry lacks chip design and system integrators, and the software lacks research and design personnel and the pharmaceutical industry lacks compound talents who understand both technology and management, and both manufacture and marketing. These all reflect the lack of innovative and compound talents in China's high-tech industries.

4). The problem of brain drain is serious. On the one hand, the existing incentive mechanism allows high-tech talents to flow to high-paying Philippine high-tech enterprises or to go abroad; on the other hand, due to industry obstacles and technical discrimination, the students who graduate from colleges with knowledge of high-tech industries, flow to non-high-tech industries in large numbers, resulting in brain drain. As a result, the reserve forces of high-tech industries are not replenished in time, which restricts the development of high-tech industries.

According to the industrialization stage standard of Chennai, the current Chinese economy is in the middle stage of industrialization, and the rapid change of industrial structure is one of the crucial characteristics of this stage. By 2020, China will achieve a leap in per capita GDP from

\$3,000 to \$7,000 and enter the ranks of industrialized countries. It is foreseeable that this is a period of great changes in China's industrial structure and employment structure. During this period, all kinds of resources will gradually gather in the tertiary industry, and the industrial structure will evolve from labor-intensive industries to resource-intensive industries and then technology-intensive industries.

At the same time, in the context of the rapid development of information technology, industrial integration will be further strengthened, mixed industries will develop rapidly, and the demand for public services will be further expanded. Professional and technical personnel will gather in the following key areas:

1. High-tech industry. In the process of developing high-tech industries, it is necessary to strive to develop information, biomedicine, new materials, new energy, aerospace and other industries. In the process of developing information industry, according to the general trend of digitalization, networking and intelligence, core industries should be vigorously developed such as integrated circuits and software, mainly on cultivating information industry clusters, strengthening the development and sharing of information resources, and promoting the popularization and application of information technology. Bio-industry should give full play to its unique advantages in resources and technology, face the significant needs in health, agriculture, environmental protection, energy and materials, and strive to achieve breakthroughs in the development of key technologies and important products. Therefore, talents in the fields of information, biomedicine, new materials, new energy and aerospace will be the focus of demand.

2. Advanced Manufacturing Industry. In the process of developing advanced manufacturing industry, it is necessary to further insist on promoting industrialization by information technology, widely applying high technology and advanced applicable technology to upgrade manufacturing industry, and form more well-known brands with independent intellectual property rights. Equipment manufacturing industry should rely on essential construction work, adhere to the combination of independent innovation and technology introduction, and focus on the development of shipbuilding, petrochemical industry, transportation equipment, high-end CNC machine tools, automation control, integrated circuit equipment and advanced power equipment, etc. The demand for engineering and technical personnel will be greatly enhanced.

3. Modern service industry. The level of development of modern service industry is an important indicator to measure the degree of modern social economic development, mainly including service-oriented service industry and service industry oriented to people's livelihood. The service-oriented service industry mainly includes: transportation industry; information service industry, software industry, e-commerce and e-government; financial service industry; technology service industry, technology research and development, technology promotion, industrial design and energy-saving

service industry; Business services such as legal consultation, accounting and auditing, engineering consulting, certification and accreditation, credit evaluation, advertising exhibitions, etc.; upgrading and transforming the commerce and trade circulation industry, and promoting modern business methods and new formats such as chain operations and franchising. People's livelihood-oriented service industries mainly include municipal public utilities, real estate and property services, community services, household services and social pension services; education, health care, press and publishing, postal, telecommunications, radio, film and television services; tourism, culture, sports and leisure and entertainment services.

## 5. Forecast of Demand for High-Level Talent in Various Professions

To determine whether to set up a professional degree for the country's shortage of talents, social needs, adherence to development orientation should be considered; at the same time, due to the professional nature and characteristics of the profession, the following factors should be taken into consideration: whether it is different from ordinary occupation, whether a professional meets the professional characteristics, whether the practitioner needs special and systematic education and training to be qualified for the occupation.

With the continuous advancement of China's industrial modernization process and the adjustment of industrial structure, China's demand for high-tech talents, scientific and innovative talents in modern high-tech industries, modern manufacturing industries, and specialized talents in modern service industries continues to grow; the development of industry towards technology-intensive stage also raises the demand for talents, and the demand for high-level application talents continues to increase [12]. Compared with foreign countries, the training scale and structure of Chinese professionals and high-level talents cannot meet the requirements of industrial restructuring. The setting of professional degrees and professional qualifications is relatively small, and there is a lack of people who develop from labor-intensive stage to technology-intensive stage. Therefore, the training system of the professional talents wanted by key supporting industries should be set up, especially in the secondary and tertiary industries. Corresponding professional degrees and professional qualifications are also should be built to adapt to China's economic development and fundamentally solve the problem of social employment.

Combined with the status quo of China's professional setting and the trend of high-level talent demand, some types of majors developed in China in the next 10 years are proposed.

- (1) Information technology industry require some professional degrees as following: electronic and communication engineering, computer technology,

control engineering, and software engineering.

- (2) High-tech manufacturing industry require some professional degrees as following: mechanical engineering, aerospace engineering, aerospace engineering, optical engineering, instrumentation engineering, power engineering, material engineering and industrial engineering.
- (3) Marine engineering equipment and high-tech shipbuilding industry require some professional degrees as following: ship and marine engineering.
- (4) Electrical equipment and electrical engineering industry require some professional degrees as followings: integrated circuit engineering.
- (5) New energy industry require professional degrees As following: nuclear energy and nuclear technology engineering.

## 6. Conclusion

The BRI has bred major worldwide opportunities that have injected vitality into new forms of globalization, and the orientation of this initiative—extensive consultation, joint contribution and shared benefit—can be better fulfilled by the full support of professional graduate education. Thus, the BRI also provided opportunities for deepening the comprehensive reform of professional graduate education, improving the quality and promoting the internationalization of professional graduate education in China. It is the time that we should focus on setting up professional degrees and corresponding qualifications for talents in short supply and cultivating specialized talents for important industries, thereby promoting the construction of BRI.

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