

Zhejiang's Advantages, Challenges and Countermeasures for Its Development of the Industries of the Future

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ABSTRACT

Compared with traditional industries, the industries of the future are disruptive, high-growth industries with huge development scope and great potential of explosive growth. In the face of great change not seen in a century, the development of the industries of the future is a new focus of competition. The industries of the future are cutting-edge industries that are found during scientific and technological innovations to have the potential to revolutionize traditional industries, and the high growth potential of those industries will play a critical role in supporting and leading socioeconomic transformation in the future. Many efforts are intended to change the current situation that Zhejiang's research and development in the industries of the future mostly relies on a small number of leading enterprises and improve the basic innovation ability of a large number of small and medium-sized enterprises operating in a wide range of fields.

Keywords: Industries of the Future, Technological Innovation, Zhejiang Province, Competitive Advantages

1. INTRODUCTION

The industries of the future are industries developed on the basis of major scientific and technological innovations and are an emerging concept that comes with new technological change and industrial development. They are forward-looking future-oriented strategic emerging industries that are based on the evolution of major scientific and technological innovations and innovative high-tech industries and determine future industrial competitiveness and economic strength. Future industries are closely related to strategic emerging industries. They are all forward-looking emerging industries formed after the industrialization of major scientific and technological innovations, representing the new direction of future scientific and technological, as well as industrial development. It plays a supporting and leading role in economic and social development. The industries of the future, an outcome of the industrialization of major scientific and technological

innovations, represent the directions of scientific and technological innovations and the development of emerging industries in the future and play a vital role in supporting and driving socioeconomic development and leading industrial development.

The industries of the future, which may serve as a measure of the scientific and technological innovation level and comprehensive strength of a country or region, are a key strategic thought raised by China for its 2035 long-range objectives and an important way for China to change lanes and overtake developed countries. According to the Outline of the Fourteenth Five-Year Plan, China should adhere to the core status of innovation in its modernization drive and develop emerging industries with a view to seizing the development opportunity of the industries of the future, fostering pioneer and pillar industries, and promoting integrated, clustered, and ecological development of strategic emerging industries.

Since the industrial revolution, the research and direction predictions of developed countries on future development has been influencing the science and technology strategic deployment of every country around the world.^[1] The COVID-19 epidemic in 2019 swept the world as a public health emergency, and the epidemic prevention and control in Asian countries, represented by China, has achieved remarkable results. Innovative technologies like cloud computing, big data, Internet of Things (IoT) and 5G played a critical part in preventing and controlling the pandemic and promoting quick economic recovery in China. On the other hand, the development of the pandemic contributed to the progress of science and technology in China. The pandemic has changed people's lifestyle, provided new food for thought and catalyzed the birth of new industry models. Innovative technologies such as artificial intelligence (AI), 5G, big data and IoT have been applied to all aspects of people's work and life more rapidly since the pandemic has become a persistent problem.

The industries of the future are nascent industries based on major technological innovations.^{[2][3]} They are not yet known to general public and require fostering and investment. They are forward-looking industries that have disruptive technologies and can support and lead social development. For the time being, the industries of the future are cutting-edge industries that are built upon new-generation information technologies like digital technology, AI, 5G and IoT and are expected to bring about disruptive change to traditional industries.

The industries of the future are cutting-edge industries that are found during scientific and technological innovations to have the potential to revolutionize traditional industries, and the high growth potential of those industries will play a critical role in supporting and leading socioeconomic transformation in the future. The development of the industries of the future will give rise to new consumer demands and new application scenarios, and this requires leaders and entrepreneurs to make forward-looking judgments on economic and industrial development. Such thinking enables them to make deployments in advance, accurately judge the industrial development directions and the long-term trends of consumer demand upgrade and secure competitive advantages in the future.

Compared with traditional industries, the industries of the future are disruptive, high-growth industries with huge development scope and great potential of explosive growth. In the face of great change not seen in a century, the development of the industries of the future is a new focus of competition.^{[4][5]} The world's major developed countries including the US have been actively preparing for the establishment of specialized research institutes on the industries of the future and making deployments in frontier areas like AI, IoT, quantum science and technology with increased RD investment. The industries

of the future are expected to overtake existing traditional industries as new leading industries and thus lead socioeconomic development in the future.^{[6][7]} Therefore, the industries of the future will become a solid proof of a country's or region's comprehensive strength.

2. ZHEJIANG PROVINCE'S ADVANTAGES FOR THE DEVELOPMENT OF THE INDUSTRIES OF THE FUTURE

2.1. High economic level and solid foundation for scientific and technological innovation

Zhejiang has laid a solid groundwork for the development of the industries of the future. During the Thirteenth Five-Year Plan period, the value added of the core industries in Zhejiang's digital economy grew at an annual average rate of 15.2%. In 2020, the foregoing indicator reached RMB 702 billion and contributed 34.9% of the local GDP growth. In 2020, the final year of the Thirteenth Five-Year Plan period, Zhejiang surpassed the national average level and led East China by major economic indicators, which means a solid economic foundation for the development of the industries of the future. According to the Report on the Development of the Artificial Intelligence Industry in Zhejiang Province released in 2021, the gross operating income and gross profit of the AI industry in Zhejiang province in 2020 was RMB 269.343 billion (up 11.99% YoY) and RMB 33.741 billion (up 14.84% YoY) respectively. Among others, Zhejiang was in the front rank of Chinese cities in terms of intelligent security, intelligent retail, intelligent manufacturing and intelligent computing and led China in terms of AI chip, AI software and blockchain. Zhejiang, a big province of emerging industries represented by digital economy, has been focusing on core technological innovation and making strides in advancing the development of the industries of the future including the AI industry, which provides a technical foundation for the deployment of the industries of the future in the province.

According to 2020 Zhejiang Economic Development Report, in the first three quarters of 2020, the value added of the core industries in Zhejiang's digital economy is RMB 489.4 billion, which represented 10.7% of the province's GDP. Among industrial enterprises above designated size, the value added of the manufacturing segment of the core industries in digital economy grew by 14.4%, which was 11.4% above the growth rate of industrial enterprises above designated size, leading to a 1.8% increase in the value added of industrial enterprises above designated size. The value added of AI industry, high-tech industries, equipment industry, innovative high-tech industries, strategic emerging industries, and manufacturing segment of energy conservation and environmental protection industry grew by 18.6%,

15.0%, 8.0%, 7.5%, 8.2%, and 6.1%, respectively, all above the growth rate of industrial enterprises above designated size. In Zhejiang where the industries of the future are still in their infancy, the growth rate of the core industries in the digital economy is already higher than that of industrial enterprises above designated size, indicating that the industries of the future in Zhejiang are poised for take-off.

According to 2021 Report on the Development of the Artificial Intelligence Industry in Zhejiang Province, Zhejiang province ranked fourth in China by regional developmental competitiveness in the AI industry. In terms of technological achievements, Alibaba's AI voice technology was named one of "the world's top 10 breakthrough technologies 2019" selected by the MIT Technology Review; Alibaba's AI chip "Hanguang 800" ranked 6th in "2019-2020 Top 100 futuristic technologies in Chinese market"; and the "Tianshu AI Open Source Platform" launched by Zhejiang Lab for developers worldwide attained the international leading level. The China Assessment Report on the Development of Artificial Intelligence Computing Power comprehensively measures and evaluates the development levels of AI industry in China in four aspects including macro economy, technical maturity, AI labor supply, and industry and territory, and Zhejiang province has remained among the top 3 provinces in China's urban AI computing power rankings for four consecutive years starting from 2018. In terms of quantum information, according to Wind global enterprise database, by September 2019, Zhejiang was home to over 300 enterprises engaged in quantum technology, greater than the figure for Shanghai (~150 enterprises). Technical leadership is a core advantage for Zhejiang's development of the industries of the future.

The development of the industries of the future depends on scientific and technological innovation and calls for financial and technological support from government and enterprises.^[8] In terms of scientific research funds, Zhejiang, whose economic situation has remained good, will be an ideal place for the development of the industries of the future. In terms of technological support, Zhejiang has made significant technical breakthroughs and innovations in fields like quantum communication, AI, IoT and cloud computing, which has laid a solid technical foundation for the development of the industries of the future.

2.2. Strong policy support for the industries of the future

To date, Zhejiang has been taking unconventional measures to establish manufacturing, innovation platform and talent attraction advantages, accelerate the construction of the world's leading hub for scientific innovation in "Internet Plus", life health, and new

materials, and practically advance the construction of a high-level innovative province.

Zhejiang is constructing the innovation and entrepreneurship ecosystem with an open-minded and inclusive attitude and proactively advancing the integrated development of the Yangtze River Delta region. Zhejiang is now working with Shanghai, Jiangsu and Anhui on the construction of G60 Science and Technology Innovation Corridor in order to deepen the layout of industrial clusters, strengthen infrastructure interconnectivity, advance collaborative innovation and promote in-depth cooperation and industry-finance integration of key industrial parks. Zhejiang is actively building the platform for the development of the industries of the future in the Yangtze River Delta region. As an important part of the Yangtze River Delta G60 Science and Technology Innovation Corridor, Jinyi Science and Technology Innovation Corridor University-Institute Innovation Alliance was founded to build a bridge of communication between colleges/universities and enterprises and provide platform and intellectual support for the development of the industries of the future. The alliance has created a number of major scientific and technological innovation platforms including Smart Industry Park, New Materials Innovation Center and Zhejiang University Research Institute. With Loongson Technology incubated by Institute of Computing Technology, Chinese Academy of Sciences as the industry leader, Zhejiang Smart Industry Park integrates the three major links of the industrial chain including CPU, complete machine and system integration and has so far introduced more than 40 information technology innovation enterprises, thus basically forming a closed loop of industrial ecology. Through the core node city construction of the Science and Technology Innovation Corridor, the Science and Technology City in Jindong District, Jinhua City, Zhejiang Province has so far launched over 70 key science and technology projects, it plans to introduce 100 hi-tech enterprises engaged in three industries including information technology, new materials and intelligent manufacturing within five years' time in order to develop the IT industry cluster and new material industry cluster worth hundreds of billions of yuan.

Zhejiang's counties and cities engaged in the construction of the G60 Science and Technology Innovation Corridor faced up to pain points restricting the counties' scientific and technological innovation and talent attraction and grasped firmly the historic opportunity of building the G60 Science and Technology Innovation Corridor. In line with the needs of their local competitive industries, cities and counties including Quzhou, Jiaoshan and Rui'an actively established laboratories, innovation centers, specialized scientific and technological incubators and other public platforms, such as Shanghai Zhangjiang (Quzhou) Biopharmaceuticals Incubation Base, Jiaoshan

International Innovation Center (Shanghai) and Rui'an (Anting) Enclave Innovation Port. Those efforts explored a collaborative innovation approach of "research and development in Shanghai and manufacturing in Zhejiang" for the provision of one-stop business services for innovative and entrepreneurial elite both home and abroad.

Within the province, a series of innovation bases including Hangzhou West Innovation Corridor, Hangzhou Yunqi Town, Eye Valley (e.g., Wenzhou Ophthalmology International Innovation Center) and Shaoxing Binhai New Area are actively constructed as a pioneer area for the industries of the future. Xiaoshan District of Hangzhou City, Haishu District of Ningbo City, Rui'an in Wenzhou City, and Changxing County of Huzhou City are actively involved in the creation of "Innovation China" provincial pioneer counties/cities/districts in Zhejiang province. According to the Fourteenth Five-Year Development Plan of Hangzhou West Innovation Corridor, in 2016-2020, the value added of innovative high-tech industries in the pioneer area grew at an annual average rate of 22.6%, and the output value of strategic emerging industries as a proportion of Zhejiang's GDP and the value added of industrial enterprises above designated size per mu was 2.5 times and 5.5 times the provincial average level, respectively. The value added of the core industries in the area's digital economy accounted for over 30% of the province's total. All this showed the area's remarkable development results.

From the policy perspective, Zhejiang is energetically building inter-province and intra-province platforms for scientific and technological innovation and development of the industries of the future, strengthening scientific and technological and talent exchange within the Yangtze River Delta region and building the bridge of communication between colleges/universities and enterprises to create an atmosphere for scientific and technological innovation and set up the platforms for the development of the industries of the future. The province is determined to promote the high-quality development of the regional economy through the research, development and incubation of innovative industries and construction of "enclaves for science and technology innovation".

2.3. Painsstaking efforts in introduction of high-caliber personnel

Scientific and technological innovation platforms always hold great appeal for talented people.^{[9][10]} For example, Hangzhou West Innovation Corridor has attracted on a cumulative basis more than 450,000 talented people, 59 full-time academicians, 8531 overseas top-notch personnel, over 500 experts under the national and provincial Thousand Talent programs, and has set up 19 Nobel laureate and academician

workstations. The annual number of newly introduced experts under the national and provincial Thousand Talent programs represents 1/3 of Zhejiang's total, and the number of people covered by the National Science Fund for Distinguished Young Scholars and National Excellent Young Scientists Fund represents more than 80% of Zhejiang's total. According to the "2021 rankings of Chinese cities by talent attractiveness" report prepared by a team led by Soochow Securities' chief economist Zeping Ren in cooperation with Zhaopin (a Chinese Internet job board), Hangzhou ranked second among Chinese cities by talent attractiveness and all prefectural-level divisions within Zhejiang were included in the top 55 list. High-quality platforms attract a large number of high-level personnel, and high-level personnel promote the development of Zhejiang's scientific and technological innovation platforms. Such a virtuous cycle provides constant momentum for the development of the industries of the future in Zhejiang.

Zhejiang province constantly attaches great importance to talent introduction. Take Hangzhou as an example. In 2021, Hangzhou granted living allowances to fresh graduates of colleges and universities worldwide with a bachelor's or higher degree working at Hangzhou (including overseas returned students within 5 years of graduation and overseas talents), and the amount of allowances for bachelor's degree holders, master's degree holders and doctor's degree holders is RMB 10,000, 30,000 and 100,000 respectively. In addition to Hangzhou, cities including Ningbo, Wenzhou, Shaoxing, Jinhua and Huzhou offer talent allowances, a supplementary post provided by the local government to attract talents including forms of giving houses, cars, and money, in different amounts. According to information disclosure in the 2021 government work report of Hangzhou, the number of newly introduced college/university graduates aged 35 or younger was 436,000 in Hangzhou in 2020, thus consolidating the city's No.1 position in China by net rate of talent influx. As we all know, talent is the first factor for the development of the industries of the future. Over recent years, Zhejiang has been continuously advancing its talent attraction policy to give full play to the key role of talent in scientific and technological development and capture the commanding height of scientific and technological competition and future development.

3. CHALLENGES DURING ZHEJIANG'S DEVELOPMENT OF THE INDUSTRIES OF THE FUTURE

3.1. Impacts of the persistent pandemic

The COVID-19 pandemic quickly raged through the country and Zhejiang was also hard hit. In particular, cities like Wenzhou became key regions in epidemic prevention and control. The pandemic forced the country

to press the pause button. On the one hand, temporary shutdown or delayed resumption of work triggered by the pandemic put pressure on the operations of enterprises. On the other hand, rigid costs including house rent, employee payroll and interest still existed. The stagnation of trade caused by the pandemic and loss of orders in large quantities after resumption of work and production put great pressure on Zhejiang-based enterprises. Due to the persistent pandemic, some enterprises have no sufficient strength and confidence to participate in the deployment and development of the industries of the future.

3.2. Zhejiang enterprises are mostly small and medium-sized private enterprises with relatively poor foresight and anti-risk capability

Data from All-China Federation of Industry and Commerce show that the 2021 list of top 500 Chinese private enterprises included 96 Zhejiang-based private enterprises, thus making Zhejiang No.1 in China by this measure. Most of Zhejiang enterprises are private enterprises, which tend to have a relatively poor anti-risk capability. Due to their limited business size and own conditions, private enterprises generally have less accurate foresight for future development.

As a typical big province of export-oriented economy, Zhejiang province's foreign trade dependence and export dependence was approximately 50% and 40% respectively in 2019, 20 percentage points above the national average. The global spread of the pandemic has caused great uncertainty over Zhejiang, a province relying mainly on export-oriented economy. A decline in the number of overseas orders, closed overseas borders and faltering demand have led to frequent occurrences of rejection, returned cargo, delayed payments, and even refusal to receive the goods at the cost of down payment. This has produced a negative effect on the development of private enterprises in Zhejiang. According to statistics, although the indexes corresponding to tax burden and financing difficulty of private enterprises continually fall, rising labor cost, surging material prices, sharply rising container logistic cost and exchange rate fluctuations become main bottlenecks for those enterprises. Most of Zhejiang enterprises are small and medium-sized private enterprises, and their anti-risk capability is rather weak. The ongoing pandemic has seriously affected the survival and development of Zhejiang enterprises and adversely affected their enthusiasm for scientific and technological innovation and exploration into the industries of the future.

3.3. Enterprises' lack of impetus to conduct scientific and technological innovation in the industries of the future

Enterprises have no adequate impetus to carry out scientific and technological innovation in the industries of the future. Due to great restrictions of factors like capital, technology, talent and team, small and medium-sized private enterprises have relatively poor anti-risk capability. Therefore, they tend to be more cautious about scientific and technological innovation in the industries of the future. In addition, it is highly risky to invest in scientific and technological innovation and development of the industries of the future. Various problems like difficulty in industrialization of scientific and technological achievements, uncertainty in external markets and less developed technology market will restrict the driving force of enterprises to develop the industries of the future.

4. CONCLUSION

The industries of the future depend on the development of major scientific and technological innovations and require strong support from large quantities of scientific research funds.^[5] If any country or region wants to take the lead in the industries of the future, it is imperative to increase scientific research funds. In particular, Zhejiang, where local enterprises are mostly small and medium-sized private enterprises, needs to offer individualized tax preferences and fiscal subsidies to support enterprises to accelerate technological innovation, transformation and upgrading, accelerate the replacement of traditional drivers of growth by new ones, and foster and develop the industries of the future. Those efforts are intended to change the current situation that Zhejiang's research and development in the industries of the future mostly relies on a small number of leading enterprises and improve the basic innovation ability of a large number of small and medium-sized enterprises operating in a wide range of fields.

Zhejiang should bring into play the advantages of leading enterprises. As Zhejiang's leading forces in the development of the industries of the future, leading enterprises such as Alibaba and Hikvision shall give play to their leading role by accelerating their independent innovation in their competitive fields. The government shall continually promote the cooperation between colleges/universities and enterprises and cooperation among enterprises, build a high-level scientific and technological innovation platform system aimed at the frontiers of the world's science and technology, strengthen the construction of high-level disciplines and research institutions in the field of the industries of the future, and establish a batch of innovation platforms supporting the development of the industries of the

future. Additionally, the government shall truly pay attention to the concerns and pain points of Zhejiang enterprises on the development of the industries of the future, and launch policies intended to solve problems such as high technology transfer fees and unclear ownership of scientific and technological achievements in order to help establish the order of the ecosystem of the industries of the future and create a good market environment for the industries of the future.

Zhejiang leads the country in talent attraction. However, compared with world-class sources of innovation like the Silicon Valley, Seattle and Boston in the United States and domestic science centers including Beijing Huairou Science City, Shanghai Zhangjiang Science City, Hefei Binhu Science City and Shenzhen Guangming Science City, Zhejiang lags behind due to a limited number of sophisticated, leading or master-level talented personnel and fundamental, original or disruptive core scientific and technological achievements in the frontiers of the world's science and technology. In order to take the lead in the development of the industries of the future and establish Zhejiang's competitive edges, many more sophisticated personnel are required. Firstly, Zhejiang should strengthen and deepen university-enterprise cooperation. Given the needs of the industries of the future, it is very important that Zhejiang province should continue to strengthen the construction of enterprise technology centers and university technology innovation platforms and encourage enterprises and colleges/universities to join hands in the construction of industrial technology laboratories, pilot test and industrialization bases and the development of versatile and practical personnel with innovation capability. Secondly, Zhejiang should continue to beef up its efforts to introduce talented people. Special support funds shall be set up to target high-caliber professional and technical personnel needed for the development of the industries of the future. Zhejiang should also perfect the talent service mechanism and enhance the happiness index of introduced talent to boost the province's continual appeal for talented people.

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