Deployment of Future Industries by Major Countries and Regions in the World and Its Implications for China

Su Ning [1, a], Xiao Hu [2, b*], Zhimin Ren [1, c*], Yueyue Zhang [3, d*], Shuyuan Zhang [3, e*]

[1] *School of MBA, Zhejiang Gongshang University, Hangzhou, China.*
[2] *Economic Crop Workstation, Agriculture and Rural Affairs Bureau, Shangcheng County, Shangcheng, China.*
[3] *School of Business Administration, Zhejiang Gongshang University, Hangzhou, China.*
**Corresponding author. Email: [b*] huxiaohnsc@126.com; [c*] rzmin@zjgsu.edu.cn; [d*] zhangyueyuesister@126.com; [e*] zhangsy1981@163.com*

ABSTRACT

Future industries indicate the development of future technology and industries, thus becoming a new competitive field for global economic growth. According to China's 14th Five-Year Plan and the Long-Range Objectives through the Year 2035, it is imperative to develop future industries. In recent years, the world's major developed countries and regions have made the development of future industries part of their national strategies. Based on the planning and development of future industries in developed countries and regions like the United States, the European Union, the United Kingdom, Russia, Japan, and South Korea, this paper aims to summarize their experience in this respect and the implications for China's development of future industries.

Keywords: *future industry, scientific and technological innovation, industrial planning, policy implications*

1. INTRODUCTION

With the development of scientific and technological innovation and high-tech industries, more and more countries and regions have become aware of the importance of developing future industries based on scientific and technological innovation, thus crafting plans for this aspect. According to China's 14th Five-Year Plan and the *Long-Range Objectives Through the Year 2035*, requirements are put forward to develop the future industry, with a focus on forward-looking plans and the layout of the future industry. Developing the future industry and promoting scientific and technological innovation is important for China to foster new drivers of economic growth. The strategic plans are analyzed for the future industry of major countries and regions in the world. This provides suggestions for China to implement new development philosophy, foster new drivers of growth, and cultivate a new competitive edge in the international arena while China develops the new future industry. At the same time, it also lays a solid foundation for accelerating the development of a modern industrial system and promoting high-quality economic growth.

The future industry is a pioneering and forward-looking emerging industry, which supports, drives, and leads social and economic development. [1]. Today's world is now undergoing profound changes unseen in a century and is in the midst of a new round of information technology revolution, and the scientific and technological revolution has associated with political activities. From the perspective of historical political patterns and economic history, each round of scientific and technological revolution will have a profound impact on the economic growth of various regions of the world, so the future industry will be a high ground where countries are competing for. In terms of technology and industry, major countries and regions in the world are now competing in the existing pillar sectors and strategic emergent sectors. These countries and regions have invested more in the cutting-edge fields of science and technology, and have moved faster to craft plans for relevant fields of the future industry, which means they seek to harness the power of science and technology to drive economic growth and take the lead in the value chain of future industries. From an international perspective, the United States has adopted stricter investment censorship while carrying out the return of high-end manufacturing, to reduce knowledge spillover

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to China and inhibit its industrial innovation [2]. At the same time, developed countries led by the United States hope to suppress China's scientific and technological development through hegemony, thus containing China's rise. For China, the new round of industrial revolution represented by the future industry may be an opportunity to overtake those countries. To improve scientific and technological innovation capabilities and layout of the future industry is to allow China to play a more important role in the future international economy and be more competitive in the international arena.

In 2019, when COVID-19 swept the world and hit hard the global economic activities, Asian countries represented by China have made great progress in their response to C OVID-19. To respond to the epidemic, innovative technologies such as cloud computing, big data, and the Internet of Things have played a key role [3]. After the epidemic prevention and control measures become regular, how the future industry relying on emergent technologies can continue to seize the opportunities and advantages and maintain economic growth is an issue that China needs to take into account. Analyzing the plans and arrangements of the future industry in major countries and regions and following the trend of future industries have implications for China's development of the future industry.

2. DEPLOYMENT AND ARRANGEMENTS FOR FUTURE INDUSTRIES IN MAJOR COUNTRIES AND REGIONS

2.1. The United States: Increase Investment in Scientific and Technological Innovation to Re-flourish the Manufacturing Industry

The U.S. government has always attached great importance to the development of high-tech industries, making the development of the future industry part of its national strategies. In 2019, the U.S. government more precisely divided the future industry into such fields as artificial intelligence, advanced manufacturing, quantum information science and 5G technology, and biotechnology, and gave them definitions in the article America Will Dominates the Industries of the Future [4]. According to Maintaining America's Leadership in Artificial Intelligence and Artificial Intelligence & Quantum Information Science R&D Summary released in 2019, developing future industries such as artificial intelligence and quantum information science is strategically important and they will be key industries to receive R&D budgets. In 2021, the National Science Foundation alone allocated more than $830 million to the research and development of AI and interdisciplinary research institutions, a 70% increase compared to the fiscal 2020 budget. This provides a financial guarantee for the development of future industries based on technological innovation.

The US President's Council of Advisors on Science and Technology, the top think tank of the US government, submitted a consultation report to the White House in early 2021 on the establishment of the Future Industries Institute. According to the report, building Industries of the Future Institutes can integrate the innovation chain of technological industrialization and the process from basic science, and applied research to industrialization. Industries of the Future Institutes addresses the structural problems within the US scientific research system, improves the flexibility of the whole process of management, promotes cross-disciplinary innovations, and improves the innovation efficiency of the technology industry [5]. This indicates that the US government has placed a greater focus on the future industry. In the same year, the U.S. government passed the US Innovation and Competition Act of 2021, the Endless Frontier Act, and the National Science Foundation for the Future Act. These measures all reflect that the United States has elevated the deployment of future industries to a strategic level. Based on the characteristics of multi-field innovations in the development of the future industry, the US seeks to facilitate the cross-border integration of traditional manufacturing, artificial intelligence, digital economy, as well as other fields, and promote the integration of multiple industries to strengthen the deployment of in future industries.

2.2. European Union: Strengthen Digital Development and Energy Transition

In July 2020, the European Union Intellectual Property Office implemented the Strategic Plan 2025. This plan classifies state-of-the-art digital technologies like artificial intelligence, machine learning, and blockchain as the activities of the European Union Intellectual Property Office to increase its innovation capabilities and set uniform and standardized standards in new technologies such as AI and blockchain. Green investment can have a long-term positive impact on corporate performance[6]. The European Union emphasizes green and sustainable development while developing future industries, issuing the European Green Deal and Strategic Plan 2019-2024 and other strategic plans. This aims to drive the European economy through projects such as the circular economy and intelligent energy management and to enable the European Union a leader in terms of the green economy.

Different member states of the European Union also carry out different deployments for the future industry. Germany issued the National Industrial Strategy 2030, and its government worked to adjust the way of establishing cross-enterprise consortia to promote the development of artificial intelligence and the power of new energy vehicles. This allows Germany to be in a leading position in terms of technology to seize the high ground for future industries. In 2020, Germany released

the National Bioeconomy Strategy and National Hydrogen Strategy and revised the new Artificial Intelligence Strategy, all of which plan and deploy the development of Germany's the future industry. Among them, to meet the needs of epidemic prevention and economic recovery, about 50 billion euros are allocated for scientific research innovation and health care, and Germany will focus on scientific research and development in such fields as digitalization and technological sovereignty, pharmaceutical research and climate protection technology. France continues to press ahead with the Plan of Future Industries and emphasizes ecological and energy transformation and digital technology proposed in the "France 2030" investment plan in 2021, hoping to promote the development of the future industry dominated by industries through digitalization.

2.3. UK: Seize the Opportunities of the Times to Drive Development through Technology

In 2017, the UK government released the white paper Industrial Strategy: building a Britain Fit for the Future which defined four major challenges and related industries that the UK will face in future economic growth, including artificial intelligence, clean growth, future transport, and aging society. It endeavors to address these challenges by leveraging the strengths in development and combining artificial intelligence and a data-driven economy.

Britain remains an important member of NATO after Brexit. Although NATO is not a political organization, it established an Advisory Group on Emerging and Disruptive Technologies in 2020 to conduct research on emerging and disruptive technologies and offer suggestions to NATO. According to the Science & Technology Trends 2020-2040 published by NATO, NATO's innovation activities are now focused on seven key areas identified as priorities including big data, artificial intelligence, autonomous technologies, space, hyper-sonics, quantum information, biotechnology, and materials. In June 2021, NATO created an innovation accelerator— Defense Innovation Accelerator for the North Atlantic and established the NATO Innovation Fund. In October 2021, seventeen NATO allies launched the NATO Innovation Fund. NATO responds to global social and economic changes by starting with the innovative development of emerging and disruptive technologies.

2.4. Russia: Position Gaps to Strengthen Innovation

As early as 2014, the Russian government pointed out its huge gap with the world's leading countries in the Long-Term Forecast of Scientific and Technological (S&T) Development in Russia until 2030, especially in the fields of key core technologies and frontier technologies closely related to the new round of scientific and technological revolution and industrial transformation. Russia has tried to close the gap through policy and economic means. According to the Scientific and Technological Development of the Russian Federation for 2030 released by the Russian government in 2019, Russia aims to promote scientific and technological development at the national level by ensuring intellectual capital, integrating scientific research resources, etc., to ensure the sustainable competitiveness of the Russian economy and the development of the future industry [7]. Russia regards technological innovations such as artificial intelligence, big data, and 5G as the core driving force of a new round of industrial transformation, with the hope of propelling social and economic development by strengthening the research and development of innovative technologies.

Due to the current conflict between Russia and Ukraine, Russia is subject to a s eries of technological sanctions from Western countries including the United States, especially regarding artificial intelligence and digitalization, which impedes the development of Russia's future industry.

2.5. Japan: Promote the Development of the "Society 5.0 Initiative"

Based on the current societal problems, Japan proposed the "Society 5.0" initiative, intending to meet the needs of society and national economic growth through the future industry such as big data, intelligent Internet of Things, and artificial intelligence and to resolve the problems caused by aging population and labor shortage [8]. Especially in the prevention and control of the COVID-19, the notable advantages of big data, intelligent Internet of Things, artificial intelligence, and other technologies have prompted the Japanese government to revise the Basic Law for Science and Technology and Science and Technology Innovation Policy and other relevant laws, and to formulate new scientific and technological innovation strategies such as the Integrated Innovation Strategy 2020 and the White Paper on Science and Technology 2020 to optimize Japan' scientific and technological innovation environment and promote the innovation and development of emergent technologies including artificial intelligence, biology, materials and quantum technology. To promote the development of the future industry is to achieve the "Society 5.0 Initiative.

2.6. South Korea: Promote the Development of Advantageous Industries

South Korea is the first country in the world to announce the commercial use of 5G communication technology. In April 2020, South Korea released the

Status Quo and Future Draft Plan of 5G+ Strategy and Development which has detailed the strategic blueprint and realization path of South Korea's 5G development. In the same year, the "Korean New Deal" is announced by the South Korean government to invest 220 trillion KRW by 2025, with a focus on the development of "digital" and "green" industries. South Korea takes emergent vehicles such as ordinary electric vehicles, hydrogen-powered vehicles, and driverless vehicles as "future vehicles" to be an important part of promoting the New Deal.

3. CHARACTERISTICS OF THE DEVELOPMENT OF FUTURE INDUSTRIES IN MAJOR COUNTRIES AND REGIONS

Concerning the deployment of the future industry by major countries and regions, the new trend in global competition is to make arrangements in advance and take the initiative in developing industries, which mainly shows the following characteristics. ① Strengthen investment in science and technology. Future industry draw on major scientific and technological advances. The plans, made by major countries in the world, for developing the future industry reveal that the priority of deployment is to invest more in the capital of scientific and technological innovation. The capital investment greatly helps to create a new environment for scientific and technological innovation, thus driving the development of the future industry. ② Develop a knowledge-intensive manufacturing industry. Hit hard by the COVID-19, the manufacturing industry, as a pillar industry of the national economy, has been added to important strategies by many countries and regions. As the future industry are closely associated with other industries, developed countries represented by the United States have dominated high-end manufacturing industries and aimed to develop knowledge-intensive industries with high added-value products by taking advantage of the further integration of the future industries to combine the manufacturing industry with emergent technologies. ③ Develop advantageous areas. Major countries and regions in the world have placed the development of the future industry on the agenda of national development. Countries have varied from each other in their priorities over the development of the future industry. In contrast, developed countries in Europe and the United States pay more attention to taking the lead in advanced industries and technologies through leading science and technology and multiple dimensions; Japan and South Korea, restricted by science and technology and economy, attach greater importance to providing high-quality products and services to meet the needs of social development and solving social problems such as aging population and labor shortage while maintaining economic growth.

4. IMPLICATIONS FOR CHINA'S DEVELOPMENT OF FUTURE INDUSTRIES

4.1. Provide Policy Guidance to Stress the Importance of Developing Future Industries

As China is now facing a strategic opportunity to develop future industries, it must attach great importance to the development of the future industry. The future industry has the potential to become leading industries or pillar industries in the future [9]. With the guidance of industrial policy, resources bound to be soundly allocated can be promoted so that future industries will register rapid growth [10]. Informed of relevant policies, more enterprises, as well as the capital, will pay attention to the boom of the future industry. There will be problems of unbalanced development of industries. Thanks to policy guidance, a balance will be achieved between profit and problems in the development of the future industry, which prompts relevant enterprises to pay more attention to innovations and eliminate bottlenecks in technological breakthroughs.

4.2. Provide Support to Help the Development of Industries

The development of the future industry requires a large number of scientific research funds. In China's economic environment, most small and medium-sized private enterprises are less motivated to pursue scientific and technological innovation in the future industry. Restricted by factors such as capital, technology, talents, and teams, small and medium-sized private enterprises cannot resist risks. Therefore, they will be more cautious in technological innovation in the future industry. In addition, investment in scientific and technological innovation of the future industry will bring about high risks including the difficulty in industrializing scientific and technological advances, the uncertain external market, and insufficient technology market, which will dampen enterprises' motivation to develop future industries. Industrial policy can help solve these problems by establishing ties between universities and enterprises, enhancing the pioneering role of leading enterprises, and providing financial subsidies and tax incentives to enterprises related to the future industry. At the same time, the government can also function as an information intermediary to assist foreign-invested enterprises in overcoming information gaps, which will help reduce the risks faced by investment enterprises, promote cooperation between multinational enterprises, and help Chinese enterprises strengthen the breadth and depth of reverse knowledge spillovers [11]. As a result, this will lower uncertainties and risks for enterprises related to the future industry to better develop future industries.

4.3. Formulate Unified Standards to Standardize the Development of Industries

Due to the nature of the future industry, they are often in their infancy. As an emergent industry in its early days undoubtedly faces irregular operations, whether sound industry norms can be established promptly is important for the further development of the industry. Therefore, it is imperative to formulate unified standards for the industry. In the development of a new industry. Standards play a leading and driving role, for unified standards help to regulate the industry, reduce the risks of investors and practitioners, and guide the investment and R&D in the industry.

4.4. Adopt Region-Specific Measures to Promote Industrial Innovation

At present, some developed regions in China have deployed the future industry and made progress. For example, Shenzhen issued the Shenzhen Policy on the Development of the Future Industry as early as 2016. Shenzhen, one of the most innovative cities in China, has taken the lead in developing the future industry. Shenzhen had crafted plans for five future industries including satellite manufacturing and application industry, aerospace industry, robotics industry, wearable device industry, and new health technology industry, and regional development priorities have been refined. This breathes new life to cities when they develop and takes the lead in the future industry. In addition, Beijing, Shanghai, Zhejiang, and other cities in different provinces build on their economy and technology to deploy strategic emerging industries and future industries, thus becoming the leaders and sources of China's the future industry. Drawing on developed regions' experience and scientific and technological advances of future industries, different regions can develop their distinctive industries to help other latecomers in China to develop the future industry. When the future industry are deployed in different regions, it is of importance to adapt region-specific measures based on local conditions to give full play to their characteristics and avoid homogeneous competition between regions.

4.5. Develop Specific Policies to Support Industries

The government, when developing the future industry, must be competent and create a market that is more conducive to the future industry by formulating relevant industrial policies [9]. According to the "14th Five-Year Plan" and the Long-Range Objectives Through the Year 2035, the government should support them by introducing specific policies while taking into consideration the current trend of China's development of the future industry. Drawing on the experience of the world's major countries as well as regions and China's developed provinces and cities in developing the future industry, the government can establish demonstration projects of cross-border industrial integration, create scenarios for applying future technologies, move faster to cultivate the future industry, and develop high-tech, knowledge-intensive manufacturing industry.

Developed countries led by the United States give priority to advanced manufacturing and future technologies, carrying out forward-looking plans for deployment. According to the "14th Five-Year Plan", it is important to keep the proportion of the manufacturing industry stable, consolidate the foundation of the real economy, and create a favorable environment for the manufacturing industry and the real economy. To integrate the future industry, China must unswervingly follow the path to building its strength in product quality, work harder to improve the national innovation system, promote the high-quality development of China's manufacturing industry, and continuously expand its influence in the global value chain.

4.6. Establish a Scientific and Technological Innovation Platform to Cultivate and Introduce Talents

The future industry stems from scientific and technological innovation, while scientific research and development can't be achieved without high-level talents. To seize the strategic opportunity for China to develop the future industry and take lead in this respect, more high-caliber talents are needed. The experience of developed countries led by the United States and China's developed regions in developing the future industry indicates that to cultivate and introduce talents is to provide an inexhaustible impetus for the development of the future industry. Establishing a scientific and technological innovation platform is an important means to cultivate and introduce high-level talents. To attract more high-level talents, it is essential to build platforms for scientific and technological innovation by strengthening cooperation between universities and enterprises as well as social entities. With the help of the colleges and universities, enterprises can improve their ability to effectively identify and process knowledge in new fields, refine the areas of concern, make the reverse knowledge spillover deeper in investment-oriented enterprises [11], and promote faster learning and updating to pursue more scientific and technological innovation. At the same time, guided by the needs of the future industry, enterprises, on the one hand, are encouraged to cultivate versatile, innovative professionals by jointly building industrialization bases and technical laboratories with universities and, on the other hand, make continued efforts to introduce talents which ensures the R&D and layout of key technologies in the future industry.

5. CONCLUSION

The future industry is an important strategic idea proposed in China's Long-Range Objectives Through the Year 2035, playing an important role in helping China catch up with other countries. General Secretary Xi Jinping said during his inspection tour in Zhejiang in 2020, "We must seize the opportunities brought by industrial digitalization and digital industrialization, to accelerate the building of new infrastructures such as 5G networks and data platforms. We must work to deploy strategic emergent industries and the future industry such as digital economy, life and health, and new materials, and redouble our efforts to promote scientific and technological innovation, with the focus on fostering new growth areas to gather momentum in development [4]."

Developing the future industry can not only bolster China's economic growth but also improve people's well-being. The development of digital technology can help improve the efficiency of regulating food safety [12]. A combination of technologies in the field like life and health, digital economy, big data, and artificial intelligence can upgrade the standard of national health. The improvement of the average health of residents in the community has a positive impact on individuals' self-assessment of health [13]. From the perspective of people's well-being, promoting the development of future industries can create better lives for people.

However, compared with developed countries, China is still weak in current basic scientific research. For example, China still needs to improve the ability to make independent innovations and transform scientific and technological achievements; enterprises lack the enthusiasm to invest in technological innovation, and some key core technologies have been dominated by other countries for a long time [14]. Reference to deployment and plans for developing the future industry in major countries and regions in the world will help China to take the initiative to participate in the global innovation network, and make use of complementary advantages in scientific and technological innovation, thus optimizing the deployment and plans for developing the future industry.

AUTHORS' CONTRIBUTIONS

NS is responsible for the research and writing of the paper. Other authors provided the research theme, designed the research frameworks, and assisted in writing and translating papers. All authors have read and approved the manuscript for publication.

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