

Environmental Changes and Strategies for the Development of China's Strategic Emerging Industries

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Abstract: Strategic emerging industries represent the direction for the new round of scientific and technological revolution as well as industrial transformation. They are key areas for China to implement supply-side structural reforms, foster new momentum for development, and gain new competitive advantages. Proposing corresponding development strategies to face major changes in the international and domestic environments in the future has become an urgent need for China's emerging industries. This paper sorts out the current status of strategic emerging industries and adopts principal factor analysis to predict the environmental changes facing industrial development, from the perspectives of emerging technologies, new needs, international environment, and domestic ecology. Studies show that the role of strategic emerging industries in China's national economy is becoming increasingly important, and the 14th Five-Year Plan period will be an important period of opportunities for industrial development. Meanwhile, emerging technologies are expected to boom worldwide and the international environment will undergo a profound adjustment. All these changes will pose significant impacts on the development of strategic emerging industries. Thus, to promote industrial development to adapt to the new macro situation, we propose that China should rationally adjust the development areas, strengthen its innovation capacity, improve the development environment, and optimize the industrial layout, in the follow-up policy design of strategic emerging industries and the formulation of the 14th Five-Year Plan.

Keywords: strategic emerging industry; development environment; predictive analysis; direction optimization; 14th Five-Year Plan

1 Introduction

Strategic emerging industries represent the direction of a new wave of scientific and technological revolution and industrial reform. They are the key areas to implement supply-side structural reform, cultivate new driving forces for economic development, and gain new competitive advantages in the future. Strategic emerging industries have achieved a lot after nearly ten years of development; however, looking at the future, the development space will be broader, the development needs more urgent, and the development challenges more severe, respectively.

In recent years, the relevant academic research has focused on the current development and opportunity adjustment of strategic emerging industries. The research results are shown in the following three aspects: (1) Focusing on the selection of key areas of the industry, a strategic effect prediction model is constructed to guide the adjustment and optimization of industrial structure [1]. (2) Focusing on the problems of industrial innovation ability and industrial layout, a targeted evaluation system of innovation ability is established; the research shows that the overall innovation ability of strategic emerging industries is weak, the regional development imbalance is prominent, some regions have innovation shortcomings, and the gap between the two sides of "Hu Huanyong line" is obvious [2], which necessitate the implementation of policies

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differentiated according to regional characteristics. (3) In view of the problem of industrial environment construction, studies consider that the strategic emerging industries are still in the embryonic stage of the industrial life cycle, and it is imperative to actively create a market environment and cultivate market demand [3]. We should be committed to building a top-level industrial design and governance framework, guiding the healthy development of the industry, coping with various risks associated with the rapid development of emerging industries, and taking the path of high-quality development [4,5]. In addition, problems such as the fragmentation of industrial policy, the incongruity between selective policy and functional policy, and the unsatisfactory effect of policy implementation still exist in varying degrees [6].

In response to the demand and continuation of the current situation, this paper carries out the research on the development environment change of strategic emerging industries during the 14th Five-Year Plan. Taking the 14th Five-Year Plan industrial policy design as the research entry point, this paper summarizes the current situation, analyzes the domestic and international environmental changes, examines the challenges and opportunities, and puts forward countermeasures and suggestions for the 14th Five-Year Plan industrial development, respectively.

2 Industrial development status

In 2010, the *State Council's Decision on Accelerating the Cultivation and Development of Strategic Emerging Industries* first proposed the concept of strategic emerging industries. Based on major technological breakthroughs and major development needs, the strategic emerging industries have a significant leading role in the overall long-term economic and social development with intensive knowledge and technologies, less material resource consumption, great growth potential, and comprehensive benefits. The *13th Five-Year Plan for the Development of National Strategic Emerging Industries* further defines the concept, including the five fields of new-generation information technology, high-end manufacturing, biology, green low-carbon technologies, and digital creativity, which cover eight key industries of new-generation information technology, high-end equipment manufacturing, new materials, biology, energy conservation and environmental protection, new energy, new energy vehicles, and digital creativity, involving artificial intelligence, big data, cloud computing, the Internet of Things, the fifth-generation mobile communication (5G), gene detection, biological breeding, 3D printing, and other emerging technologies, as well as intelligent terminals, intelligent robots, smart grids, aero-engines, fuel cells, live network, and other products and services. Cultivating and developing strategic emerging industries is a major arrangement for national economic development and industrial layout [7]. Strategic emerging industries, involving the primary, secondary, and tertiary sectors, are the most concentrated areas of new technologies, new formats, and new models. They also form an important support for the transformation and upgrading of traditional industries as well as a backbone force for the realization of high-quality economic development.

In recent years, China's strategic emerging industries have maintained a high growth rate. From 2015 to 2018, the average annual growth rate of industrial added value reached 10.1%, higher than 30% of the overall national level in the same period; the average annual growth rate of service industry's operating revenue reached 15.7%, higher than 20% of the overall national level in the same period. By 2018, the proportion of strategic emerging industries in the national GDP has exceeded 10%. The main business income of key industries in the "five fields" has reached 7.9 trillion yuan, 2.8 trillion yuan, 1.7 trillion yuan, 1.8 trillion yuan, and 0.7 trillion yuan, respectively [8]. The new-generation information technology and biological industries have become the two largest industries with the highest innovation intensity, and digital creativity is the most dynamic new force.

At present, the state has further put forward the realistic goal of prioritizing the cultivation and vigorous development of strategic emerging industries and building new pillars of the industrial system. The 14th Five-Year plan will be a critical period for the development of strategic emerging industries. We should seize the opportunity, study, and judge ahead of time, accurately analyze the internal and external environment for the development of related industries, and scientifically predict the potentially significant impact of environmental changes.

3 Prediction and analysis of development environment changes in the 14th Five-Year Plan period

In the next five years, the development of science and technology in the world will enter a new stage, and the international environment will continue to be thoroughly adjusted, which is also the key period for China to enter a development mode of comprehensive transformation. Many changes in the development environment will have a potentially significant impact on the development of strategic emerging industries, which should be explored in depth to effectively respond to new challenges.

3.1 Emerging technology breakthroughs bring new impetus

A new round of scientific and technological revolution and industrial reforms is in a critical state of major breakthroughs. Leading-edge technologies show a trend of centralized breakthroughs, and a chain development situation is emerging in an all-round way. The rapid diffusion of many disruptive technological innovations has contributed to the rapid development of strategic emerging industries in various directions and has a comprehensive impact on traditional industries [9]. According to the literature [10], the main categories of current technological progress are information technology, life and health, energy, new materials, advanced manufacturing, and deep space and deep-sea exploration. From the perspective of specific industrial development, global unicorn enterprises, with technological innovation as the main driving force, have become a unique window to observe new industries and new technological breakthroughs, and are expected to play a greater role in the future industrial development. Related technology groups include five categories (Table 1).

Table 1. Overview of global technology-driven unicorns.

Field	Number	Valuation/Billion yuan
New-generation information technology	106	15 71
Biotechnology	45	772
Green technology	25	339
Advanced manufacturing technology	7	197
New space expansion technology	3	277

Source: Hurun Global Unicorn List 2019.

3.1.1 A new generation of information technology

At present, artificial intelligence, big data, cloud computing, virtual reality, and other fields are still hot spots of technology and application innovation, while quantum information, 5G, Internet of Things, blockchain, and other emerging technologies are also accelerating development and popularization. This series of new technologies support each other through group evolution and accelerated breakthroughs, bringing huge industrial increment, promoting the new generation of information technology to gradually become a new generation of general technology, and leading the arrival of a new paradigm of digital economy [11]. Informationization, networking, digitalization, and intellectualization have become the basis for the development of strategic emerging industries.

3.1.2 Biotechnology

Synthetic biology, gene editing, brain science, regenerative medicine, and other technologies explain the essence of life from a more basic point of view, providing more efficient, cheaper and more environmentally friendly options for solving many challenges of human health, environment, energy, food, and so on. Within the biological industry, new growth points such as new drug creation, gene technology application services, new medical device manufacturing, and biological agriculture are emerging and maturing.

3.1.3 Green technology

Distributed power generation, new energy storage, energy Internet, efficient fuel cell, and other technologies are promoting the energy revolution. The ratio of new energy applications, such as nuclear energy, solar energy, wind energy, hydrogen energy, is constantly increasing. The power structure transformation in automobiles, rail transit, and other fields is deepening, and a new low-carbon, clean and efficient energy system is accelerating to form.

3.1.4 Advanced manufacturing technology

Robotics, additive manufacturing, digital twin, industrial Internet, and other technologies are comprehensively promoting the transformation of the manufacturing industry to become intelligent, service-oriented, and green. New materials represented by super materials and micro nanomaterials also provide support for manufacturing innovation. These are the future power sources of the innovation and development of emerging industries.

3.1.5 New space expansion technology

Great breakthroughs have been made in deep space, deep sea, and deep earth exploration technologies, helping the development and utilization of space, ocean and other emerging spaces to mature, and driving the upsurge of emerging industries to expand the space for human survival and development.

3.2 International development environment poses new challenges

At present, the world economic growth has continued to slow down and is in the stage of deep adjustment after the international financial crisis. Pressures brought about by the slowdown of economic growth have been released continuously, the world economic and political patterns have accelerated the evolution, sources of turbulence and risk points have increased significantly, which have brought many challenges to the development of emerging industries.

The pattern of global industrial cooperation is facing reconstruction, and the system of the international division of labor is being adjusted. The industry value chain system is more inclined to R&D and innovation, and the importance of factor price in international competition is continuously weakening. With the gradual decline of traditional cost competitive advantage, the international competition between developed and emerging countries is changing from differentiated competition to positive competition. The technology diffusion dividend brought by globalization, which is the basis of the development of strategic emerging industries in China, will be significantly weakened for a long time, which puts forward an urgent requirement for strengthening the ability of independent innovation.

Major developed countries attach great importance to strategic emerging industries, and the international competition is fierce between different regions. Developed countries and major emerging economies are stepping up the layout of strategic emerging industries: the United States has implemented the “re-industrialization” strategy, launched the “Advanced Manufacturing Partnership Plan,” and other measures; Germany has launched “industry 4.0;” Japan has implemented the “fourth industrial revolution” plan, and the technical level of strategic emerging industries in China has been continuously improved, forming a certain scale. In this context, in order to maintain the advantages of the existing industrial chain and ensure their competitive positions in the future, the developed countries need to strengthen the adjustment of regulatory measures in technology transfer, transnational investment, and other aspects, which will deteriorate the international development environment of China's strategic emerging industries.

The international governance system of strategic emerging industries is not perfect, and there are still many uncertain factors for future development. The development of strategic emerging industries has posed many challenges to the current global governance system: the monopoly identification of Internet platform enterprises, new biotechnologies represented by gene editing, and so on, have brought ethical challenges. Most of the regulatory rules in the privacy protection of personal data lag behind technology development. There are no unified global identification rules and the handling methods of countries are inefficient. There are great differences and these regulatory issues have become a major obstacle for the future development of emerging industries.

3.3 Domestic economic development enters a new stage

China is in the period of transformation of development mode, optimization of economic structure, and transformation of growth power. Strategic emerging industries are facing the following three changes in the process of promoting economic development quality change, efficiency change, and power change.

3.3.1 The innovation stage has changed

China's strategic emerging industries have long adopted the development path of introduction, digestion, absorption, and re-innovation. For example, based on foreign mature technologies, the domestic Internet industry has carried out more application model innovation, and the number of generic drugs in the biomedical industry accounts for the absolute majority. With the steady improvement of domestic technology level and the rapid reduction of the technology generation gap, strategic emerging industries must transform to basic innovation and leading innovation, attach importance to forward-looking basic research and applied basic research, and accelerate the implementation of innovation breakthroughs in key common technologies, leading-edge technology, modern engineering, and disruptive technology clusters.

3.3.2 The market structure has changed

As China's economy enters the stage of high-quality development, the quality requirements of domestic demand for products and services are rapidly improving, and the distance from the advanced international level is rapidly shrinking. The structural change of demand has created a situation in which some strategic emerging industries (such as photovoltaic modules) depend on foreign technologies and market no longer exist. During the 14th Five-Year Plan period, the development process of new industries in China should pay more attention to the role of a strong domestic market and make good use of the comparative advantages of a relatively complete industrial system, the rapid growth of consumer consumption, and deep development [12].

3.3.3 Industrial layout has changed

National cross-regional coordinated development strategies, such as the construction of Guangdong–Hong Kong–Macao Bay area, the development of the Yangtze River economic belt, the regional integration of the Yangtze River Delta, and the coordinated development of Beijing, Tianjin, and Hebei, endow strategic emerging industries with new missions for development and correspondingly put forward new industrial layout requirements. On the other hand, with the rapid expansion of the industrial scale, the level of industrial layout policy focus should also be adjusted. It is not suitable to invest a lot of energy in specific industrial projects, but focus on regional cluster construction. In 2019, the National Development and Reform Commission issued the *Notice on Accelerating the Construction of Strategic Emerging Industry Clusters*, which announced the first batch of national strategic emerging industry clusters, involving 66 clusters in 22 provinces and autonomous regions (Table 2). By encouraging the development of key clusters in key areas, we can promote the overall competitiveness of China’s strategic emerging industries.

Table 2. China’s strategic emerging industrial cluster construction layout.

Field	Number of clusters
Artificial intelligence	4
Integrated circuit	5
Organic light emitting diode	3
Next-generation information network	3
Information technology services	7
Cyber security	1
Biomedicine	17
Energy conservation	3
Advanced structural materials	5
New functional materials	9
Intelligent manufacturing	7
Railway transportation equipment	2

3.4 People’s need for a better life brings new demands

China’s economic and social development has entered a new era. The contradiction between people’s growing needs for a better life and an unbalanced as well as inadequate overall development has reached a new height. The new demands for a better life are mainly reflected in the fields of education, medical health, old-age care, foster care, home economics, culture, tourism, sports, and other social services. New technologies are urgently needed to meet the emerging demands with higher efficiency and better quality. On the other hand, emerging demand is an important driving force for the development of strategic emerging industries, and strategic emerging services represented by digital culture, digital education, and digital health care are on the rise. By encouraging technological innovation and cross-border integration, we will promote the digitalization, networking, intelligence, diversification, and coordination of social services.

The education sector needs to develop toward people’s current learning and lifelong learning. We need to build a more open and flexible educational system using “Internet +” and “Ai +,” and enhance the comprehensiveness, availability, and pertinence of educational resources, laying the technical foundation for building a learning society in an all-round way.

The health care sector needs to emphasize higher requirements for efficiency and accuracy. We need to develop labor substitution and enhancement technologies, and greatly improve supply efficiency through new technologies and equipment such as artificial intelligence and service robots. We should also improve the technological level of elderly services and use precision medicine, smart communities, and other technical means to significantly improve the supply quality.

The demand for culture and tourism reflects a more distinctive demand of the time. Digital technologies, such as content presentation, channel communication, supply and demand exchange as well as interaction, are comprehensively transforming the cultural and tourism industry system. Digital technology has become an important means to promote the development of the culture and tourism industry, to realize creative transformation and innovative development, and also a key link to narrate Chinese stories truthfully, stereoscopically, and comprehensively.

Sports demand has entered a new stage of integration, innovation, and development. To improve the consumption experience, we need to innovate the service mode and strengthen the practice and integration of big data, Internet of Things,

biological monitoring, and other new technologies in the sports industry. "Internet plus sports" can promote the integration of the sports industry and other industries, stimulate market vitality, and achieve industrial chain extension.

4 Development proposals

According to the prediction and analysis results of the changes in the development environment of strategic emerging industries, combined with the basic national conditions and industrial status quo, the following four suggestions for strengthening or adjusting are put forward, which can provide theoretical reference for the design of strategic emerging industry policies and the formulation of the 14th Five-Year Plan while promoting the industrial development to meet the needs of the times.

4.1 Readjustment of industrial development

During the 13th Five-Year Plan period, the development of emerging industries in related fields focused on major equipment fields. However, with the development of technology, all kinds of resources in these new development spaces will be further utilized effectively. Relevant emerging products and services are obviously insufficient only from the perspective of equipment. It is suggested that during the 14th Five-Year Plan period, new development space fields such as deep space, deep ocean, and deep earth should be integrated into a new first-class field, which includes not only the research and development of major equipment such as "large aircraft" that has already been implemented but also the exploitation of new marine resources, new space-based services, and other new contents, to fully realize the new progress.

During the 13th Five-Year Plan period, strategic emerging industries only involved information services, culture, design, and other service industries in the fields of new-generation information technology and digital creativity. With the transformation of China's economic structure and people's demand structure, the importance of sports, tourism, education, pension, and other social services industry is increasing; there is a huge space for integration and development with the emerging technologies. It is suggested that the concept of digital creativity in the original primary field can be further enriched in the social services field during the 14th Five-Year Plan period. In addition to the existing digital culture, digital design, and other fields, important social services that improve people's lives should also be included.

With the acceleration of breakthroughs in various emerging technologies, the integration of various technologies has become the normal development of emerging industries. At present, the automobile industry has increasingly become the integrated development field of digital technology, advanced manufacturing technology, and green technology. In this context, the new energy automobile industry in the 13th Five-Year Plan period is insufficient to describe the future automobile industry using only the perspective of green technology. It is suggested that the concept of new energy vehicles and other fields should be further clarified during the 14th Five-Year Plan period, such as electrification, intelligence, sharing, and interconnection, to reflect the development trend of multi-technology integration in the field.

4.2 Strengthening the construction of industrial innovation capability

In order to cope with the major challenges and opportunities brought about by the domestic and external environment changes during the 14th Five-Year Plan period, it is suggested to combine the industrial development foundation and the development needs in the new era as well as focus on the overall promotion from the following three aspects to drive the rapid development of strategic emerging industries with innovation.

The first one is "mending board." The international competition situation is constantly changing. We should emphasize the core shortboard problem in China's relevant industrial chain, and guarantee the national economy and national defense security with key core technology breakthroughs. During the 14th Five-Year Plan period, in view of the key directions of IC production, such as basic process, core equipment, and high-end functional materials, we should give full play to the advantages of the national system, increase investment, and focus on tackling key problems to make breakthroughs.

The second one refers to "longboard." Strategic emerging industries play an active role in the transformation of domestic economic development mode and the promotion of international industrial competitiveness. We should speed up the formation of a key "longboard" that can check and balance the international industrial chain system. During the 14th Five-Year Plan period, we will focus on 5G, artificial intelligence, new energy, new energy vehicles, and other fields with certain competitive strength, strengthen the construction of technological innovation system, and accelerate the formation of industrial standards and certification systems that reflect the industry's leading ability.

Third, "strong foundation." Strategic emerging industries reflect their long-term strategy. Strengthening the basic industrial ability and promoting the sustainable development of the industrial market, basic materials, and basic technologies are the keys to industrial development. During the 14th Five-Year Plan period, we will maintain stable investment in key

fields and technical directions such as new materials, quantum information, controllable nuclear fusion, and continue to accumulate the technical foundation for the long-term development of the industry.

4.3 Improve the industrial development environment

During the 14th Five-Year Plan period, the development goal of strategic emerging industries in China is to create a development environment that matches the current industrial development stage as well as to encourage and guarantee innovation through the establishment of good ecology.

Create a macro environment conducive to the development of strategic emerging industries. We will deepen the innovation system reforms, remove all kinds of institutional barriers that are not conducive to innovation, and accelerate the removal of institutional bottlenecks that have long plagued industrial development, such as new drug approval, airspace management, and digital property rights confirmation. We will also actively promote agile governance and participatory governance, and form an inclusive and prudent adaptive regulatory system.

Promote resource guidance. The development of strategic emerging industries is inseparable from resource investment. In the field of market failure, such as basic research, we will further increase government investment, strive to form a subversive breakthrough, and ensure the continuous play of the strategic emerging industries' role. We will also further implement the innovation-related tax reduction and fee reduction work, guide the gathering of social resources in the innovation field by market-oriented means such as finance, and provide sufficient support for the emerging fields of strategic emerging industries.

Promote development through opening up. "Import" and "going global" are both emphasized, and the simultaneous development of China's strategic emerging industries and global innovation system is sought. We will increase opening up, establish an innovation policy system that is in line with international rules, encourage the rational flow of all kinds of innovation factors, and create conditions for enterprises to introduce global innovation resources, especially international high-end talents. We will also formulate rules for participating in international cooperation, put forward China's solutions based on the foundation and the actual situation in hot areas such as global digital trade rules and platform economic governance, and seek a more favorable international development environment.

4.4 Optimizing the layout of industrial development

At present, China has initially established a policy system for the construction of strategic emerging industrial clusters. In the following two aspects, we can enrich the specific content and form a complete industrial layout system: (1) Further improve the cluster construction system. In the list of the first batch of national strategic emerging industrial clusters, only about half of all the industrial fields are involved, and the fields that have high clustering development conditions, such as digital creativity and new energy vehicles, are not involved. (2) Further improve the adjustment mechanism of cluster evaluation. At present, the entry/exit mechanism of national strategic emerging industry clusters has not been clarified. From the perspective of entry mechanism, the *National Strategic Emerging Industry Development Plan of the 13th Five-Year Plan* proposes to cultivate more than 100 advantageous industrial clusters and industrial chains with distinctive characteristics and coordinated development of large and medium-sized enterprises, and there is still a large space for subsequent development. From the perspective of exit mechanism, the overall construction cycle of national clusters is relatively long; thus, it is necessary to formulate an exit mechanism to dynamically update the catalog in order to effectively adjust the layout of industrial development and better adapt to the dynamic development changes.

5 Summary

At the same time, China's strategic emerging industries are facing opportunities and challenges that are expected to accelerate development; they are also playing their due strategic role. Through the research on the development of strategic emerging industries in the 14th Five-Year Plan, we can master the changes of the industrial development environment, and put forward countermeasures and suggestions, to better promote the growth of relevant industries as the "new engine" of China's economic development and the "vane" of economic vitality.

With a view to the future, as a dynamic system, strategic emerging industries still have many academic issues to be explored in terms of development strategy, policy innovation, technology research and development, business model, and so on. In view of the great value and innovative nature of the industry, the relevant research should be closely monitored and practically promoted by all sectors of society to provide a new theoretical basis for economic and social development as well as a scientific and technological innovation system.

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