

CULTIVATION AND DEVELOPMENT PATHS OF CHINA'S FUTURE INDUSTRIES

Zhao Liu

School of Business Administration, Baise University, Baise 533000, Guangxi, China.

Corresponding Email: 1014854024@qq.com

Abstract: Future industries based on disruptive technologies can predict future technological development paradigms and guide economic growth directions. Therefore, countries worldwide are actively strengthening their layout for future industries. This paper begins with the definition of future industries, deeply analyzing their characteristics. By drawing on international experiences in fostering future industries, it explores the paths and related policies for cultivating and developing China's future industries. This study enriches the theoretical research on future industries and provides insights for policy formulation regarding the cultivation and development of future industries under digital economy conditions.

Keywords: Future industries; Disruptive technologies; High-quality development; Strategic emerging industries

1 INTRODUCTION

At present, a new wave of technological revolutions, centered on emerging information technologies and driven by digital transformation, is sparking an industrial and economic revolution worldwide. These technological revolutions provide historical opportunities for the rise and development of strategic emerging industries. Scientific and technological advancements are the driving forces behind global economic and social progress. These advancements not only introduce new momentum, methods, organizational models, and technological paradigms for industrial development but also accelerate the transformation and upgrading of industrial structures through innovations in fields such as biomedicine and biotechnology [1]. Furthermore, significant inventions and disruptive innovations foster the emergence of strategic emerging industries, propelling nations toward high-quality and leapfrog economic development.

Implementing industrial foundation reengineering and industrial chain upgrading projects to consolidating the advantages of traditional industries, strengthening the leading position of advantageous industries, and focusing on the layout of strategic emerging industries and future industries. It also called for enhancing the sophistication of the industrial foundation and modernizing industrial chains [2]. Evidently, cultivating and developing future industries play a pivotal role in constructing modern industrial systems, fostering new drivers of high-quality economic development, and safeguarding national economic and social security. It is also a strategic initiative to navigate new international relations and shape the trajectory of industrial development, serving as a key to achieving industrial competitiveness and technological superiority during the 14th Five-Year Plan period.

2 SCIENTIFIC CONNOTATION OF FUTURE INDUSTRIES

What exactly are future industries, and what criteria define them? Although preliminary discussions and predictions have been made in academia, a consensus on the essence and characteristics of future industries has yet to be reached.

Shen Hua et al. [3] define future industries as industries driven by emerging technological innovations aimed at meeting new demands of human and social development. These industries seek to expand human understanding, enhance human capabilities, and promote sustainable societal growth. As emerging industries targeting the future, they not only incubate their own sub-industries but also provide new opportunities and momentum for traditional and strategic emerging industries.

Li Xiaohua and Wang Yifan [4] describe future industries as emerging industries driven by frontier technologies in the exploratory phase. These industries are designed to meet the evolving demands of economic and societal development and represent the long-term trajectory of science and industry. Though currently in their nascent stages, they are expected to mature and transform into key components of the national economy.

Chen Jin [5] views future industries as those formed through the industrialization of major technological innovations. Compared with strategic emerging industries, future industries more accurately represent the new directions of technological and industrial development. They play critical, supportive, and leading roles in driving economic and social transformation.

From the above perspectives, it is evident that future industries aim to secure technological leadership and industrial advancement, maintaining or achieving a dominant position in global high-tech industries [6]. To scientifically define the connotation of future industries, the following aspects should be considered:

First, the technologies driving the development of future industries must possess frontier foresight, significant breakthroughs, and disruptive potential. The foresight of frontier technologies lies in their timeliness and mastery, indicating the trajectory of technological progress. These attributes facilitate industrial upgrading and leapfrog

development. However, frontier technologies are often still in the theoretical or research stage, with some fields yet to achieve commercial-scale production.

Second, future industries must continuously meet the increasing material and cultural needs of humanity as well as the demands of economic and social development. These industries aim to transform foreseeable or latent needs into actual demand, providing products or services that shape human behavior, preferences, and lifestyles. With vast market potential, future industries have the capacity to grow into pillar industries supporting national economic development.

Third, future industries, as strategic emerging industries, have the potential to evolve into leading or pillar industries. Strategic emerging industries are characterized by significant technological breakthroughs, high knowledge intensity, low material consumption, substantial growth potential, and excellent overall efficiency [7]. Future industries are distinguished by their forward-looking and benchmark-setting roles, driving industrial and economic development.

Lastly, future industries are nascent, emerging industries currently in the incubation or initial stages. They exhibit small scales, immature technologies, and limited commercial viability. Nevertheless, their potential for growth is substantial, and their development trajectory is long-term. Key challenges include overcoming technological deficiencies, creating appropriate market applications, and fostering complementary technologies or products.

In summary, future industries refer to emerging industries driven by frontier, breakthrough, and disruptive technologies. These industries aim to address the rapidly growing material and cultural needs of society and the demands for sustainable and efficient economic and social development. Representing the future directions of technology and industry, they are poised to become leading or pillar industries, though they currently remain in the incubation or initial stages.

3 CHARACTERISTICS OF FUTURE INDUSTRIES

3.1 Discontinuity or Leapfrogging

Future industries, supported by frontier technologies, differ fundamentally from industries that evolve through continuous technological innovation. They disrupt existing technological trajectories, exhibiting discontinuity or leapfrogging characteristics that enable transformative changes in technology or development models. For example, the replacement of traditional film cameras by digital cameras and the substitution of chemotherapy by targeted biological therapies illustrate such disruptions. Most of these disruptive innovations originate outside the existing industries, creating new technological trajectories or business models [8].

3.2 Uncertainty in Future Industry Development

The development of future industries faces significant uncertainties in terms of technological paradigms, application scenarios, business models, and timelines for large-scale industrialization. These uncertainties complicate the selection and definition of future industries. Moreover, technological achievements' transition to commercialization depends on factors such as policies, market demand, product acceptance, and financial capital models, which are inherently unpredictable. The risks and uncertainties associated with future industries also justify government interventions. However, industrial policies may inadvertently amplify such uncertainties. For instance, regional governments' plans and industrial policies for fields like 5G, cloud computing, and artificial intelligence have sometimes led to homogeneous competition and resource inefficiency.

3.3 Forward-Looking and Predictive Nature

Although future industries are unpredictable in terms of technological paradigms and timelines, they demonstrate forward-looking and predictive qualities regarding technological development directions and human needs. Basic human needs remain constant but evolve with technological advancements, such as the demand for autonomous driving and telemedicine. However, relying solely on existing paradigms can hinder innovation; entrepreneurs must adopt forward-looking strategies instead of retrospective analyses [9]. Technologies driving future industries possess frontier characteristics, breakthrough potential, and disruptive capabilities. While theoretical research in some areas has matured, large-scale industrialization remains unrealized. For example, advancements in deep-sea exploration technologies, high-performance computing, and bioengineering represent significant breakthroughs [10].

3.4 Initial Stage of Industry Development

Industrial development is inseparable from technological progress. In its early stages, an industry typically exhibits immature technology, slow progress, and limited pilot-scale production. As knowledge accumulates and investment in research and development continues, the technology matures, leading to industrialization and gradual expansion of industry scale. However, as technology advances, the pace of new technological innovations peaks at a certain point, after which their occurrence diminishes, and industry expansion slows [11].

Although future industries are forward-looking and emerging, their development trajectories are generally defined or clear. Nonetheless, their technologies are still in the initial incubation stage of the industrial lifecycle, characterized by low technological maturity and small-scale pilot production. These industries are in their infancy, but they hold enormous growth potential.

4 INTERNATIONAL EXPERIENCES IN CULTIVATING AND DEVELOPING FUTURE INDUSTRIES

Since the 21st century, science and technology have achieved continuous progress and significant breakthroughs, spreading and developing rapidly worldwide. Especially after the 2008 financial crisis, as international technological competition intensified, major global economies began placing increasing emphasis on future industries. The United States, the European Union, and Japan have prioritized future industries, proactively planning their industrial layouts, introducing intensive industrial policies, and optimizing development directions to fuel new economic drivers.

As the world's sole superpower, the United States has identified emerging industries with cutting-edge technologies according to its developmental needs and national strengths. In the latter half of the 20th century, the U.S. increased investments in information technology, biomedicine, and new materials, securing a global leadership position. In the early 21st century, driven by heightened environmental awareness and the depletion of fossil fuel resources, the U.S. introduced various laws and regulations to establish renewable energy as a cornerstone of future industry development. In January 2021, the U.S. outlined future industries encompassing five key fields: artificial intelligence, quantum information science, advanced manufacturing, biotechnology, and advanced communication networks [12].

In response to economic crises, EU countries have sought sustainable growth paths by actively planning for the cultivation and development of future industries. Unlike the U.S., which focuses on renewable energy, the EU leverages its existing advantageous industries to enhance green energy utilization through low-carbon technologies. For instance, Germany leads globally in solar photovoltaic technologies and has increased investments in electric vehicles through related policies. The United Kingdom has exploited its geographic advantages to develop tidal energy, offshore wind energy, nuclear energy, and electric vehicles, ensuring its leadership in these domains. Similarly, France has invested in strategic enterprises related to clean energy, autonomous driving, aerospace, and national defense through dedicated funds. The Netherlands has included sustainable energy investments and support in its economic stimulus policies [13].

As a technological powerhouse, Japan has long been laying the groundwork for future industries. The economic crisis of the 1990s compelled Japan to transition and upgrade its economy, prioritizing the development of energy-saving technologies and clean energy. In the early 21st century, Japan focused on emerging industries such as information technology applications, low-carbon green industries, life sciences and medical technologies, renewable energy (mainly solar energy), and high-end equipment manufacturing. Currently, Japan has explicitly identified artificial intelligence, aerospace technologies, new materials, and renewable energy as priority areas for cultivating and developing future industries [14].

From an industrial planning perspective, the United States, the EU, Japan, and South Korea share common goals, pathways, and strategies for future industry development. These include aligning with contemporary needs, leveraging national strengths, and enacting relevant laws and regulations to bolster the cultivation and development of future industries. Key lessons from their experiences include:

Firstly, future industry development should align with national economic needs and scientific and industrial foundations. By prioritizing industries in which they hold competitive advantages, these nations foster technological progress and exert a leading influence on the global economy.

Secondly, comprehensive legal frameworks and conducive business environments are essential. Sound legal systems protect intellectual property and promote technological advancements while guiding investments toward cultivating and developing future industries. Favorable business environments stimulate innovation in high-tech companies, thereby accelerating future industry growth.

Lastly, the development of future industries must emphasize indigenous intellectual property. The technologies driving future industries are characterized by cutting-edge and disruptive qualities. Mastery of core technologies ensures sustained industry growth, grants the ability to set standards for technological applications and industrial development, and facilitates global economic leadership.

5 PATHS FOR CULTIVATING FUTURE INDUSTRIES IN CHINA

5.1 Strengthening Basic Research and Promoting Original Innovation

Basic research forms the foundation for other technological innovations and serves as the source of all innovation activities. Countries that prioritize basic research often achieve groundbreaking advancements in fundamental sciences, fostering the development of epoch-making technologies. Over more than four decades of reform and opening up, China has transitioned from a “follower” to a “companion” and even a “leader” in fields such as 5G, aerospace, and deep-sea exploration. However, in areas like integrated circuits and chip technologies, China lags significantly, facing risks of reliance on imports. To address this, it is essential to increase investment in basic scientific research, strengthen demand-driven basic research, and optimize the innovation model that integrates government, industry, academia, and research. This will promote the development and application of original technologies.

5.2 Providing Policy Support in the Early Stages of Development

Future industries are in their incubation or initial stages, characterized by long development cycles and uncertainties, necessitating industrial policy support. Industrial policies involve government interventions in industrial activities aimed at enhancing resource efficiency, optimizing resource allocation, and guiding resource distribution within or across industries. Such policies serve to support, assist, and accelerate the development of future industries.

Additionally, industrial policies can promote industrial upgrading, facilitate the adjustment of industrial layouts, encourage cluster-based and integrated development of future industries, and enhance market competitiveness.

5.3 Improving Innovation Systems and Mechanisms

The development of future industries requires robust systems for scientific investment and dynamic risk management. It also depends on integrating innovation resources from government, industries, universities, and research institutions. Improving intellectual property protection mechanisms, implementing incentive measures, and establishing talent mobility systems are crucial. Through reforms and innovations in institutional mechanisms, diversified investment channels can be created, and regulatory measures strengthened to meet funding needs for future industries. Furthermore, the digestion and utilization of research achievements and the protection of intellectual property can shorten the research and development cycle of new technologies, driving the growth of future industries.

5.4 Accelerating Military-Civil Integration

The military industry is a national strategic high-tech sector and an important source of advanced civilian technologies. Military technologies, as the most reliable and secure frontier technologies, hold significant value for civilian applications. To foster future industries, efforts should be made to further integrate military technologies into civilian sectors. Establishing innovation mechanisms for military-civil integration and encouraging military research institutions and universities to enhance the development of advanced technologies are vital steps. Accelerating the transition of military technologies to civilian applications can facilitate rapid growth in civilian industries.

5.5 Reshaping Business Models for Rapid Development

The cultivation and development of future industries depend not only on cutting-edge disruptive technologies but also on adaptive new business models. By reforming research institutions and eliminating barriers between enterprises, universities, and research institutions, a government-industry-academia-research collaboration model can be established to accelerate the industrialization and commercialization of new technologies. Additionally, constructing a financial model led by the government with diversified funding channels and establishing technology transaction platforms for future industries can lower innovation costs, share risks, and expedite the development of future industries.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

REFERENCES

- [1] Yang M X, Niu S R. Peripheral blood lymphocyte culture and G-banding karyotype analysis of 5309 couples with adverse pregnancy history. *J Youjiang Med Univ Natl*, 2019, 41(05): 520-522.
- [2] Li J. Future industries: The core competitiveness of regions and areas (I). *Huanggang Daily*, 2021, (006).
- [3] Shen H, Wang X M, Pan J F. Opportunities, challenges, and policy recommendations for China's development of future industries. *Bull Chin Acad Sci*, 2021, 36(05): 565-572.
- [4] Li X H, Wang Y F. Evolution mechanism and industrial policy choices of future industries. *Reform*, 2021, (02): 54-68.
- [5] Chen J. Focus on future industries and explore management innovations. *Tsinghua Manag Rev*, 2020, (09): 1.
- [6] Li X H, Wang Y F. Evolution mechanism and industrial policy choices of future industries. *Reform*, 2021, (02): 54-68.
- [7] Huang Q H. Background, policy evolution, and case evidence of strategic emerging industries. *Reform*, 2011, (09): 39-47.
- [8] Huang N, Liu Y P, Xu Z F, et al. Relationship between TCM syndrome differentiation, tongue characteristics, and gastroscopy in active stages of peptic ulcer. *J Youjiang Med Univ Natl*, 2018, 40(05): 466-468+471.
- [9] Zhao J B. "Three effects" accelerate the emergence of future industries. *Tsinghua Manag Rev*, 2021, (Z1): 73-81.
- [10] Zhao W J, Chen J, Zhu Y, et al. Clinical application analysis of paclitaxel combined with cisplatin neoadjuvant chemotherapy in early and mid-stage cervical cancer treatment. *J Youjiang Med Univ Natl*, 2018, 40(05): 438-440.
- [11] Schilling M A. Strategic management of technological innovation. Translated by Xie W, Wang Y. Beijing: Tsinghua University Press, 2005: 35-36.
- [12] Wang X Y. Future Industry Research Institute: The U.S. version of "new-type R&D institution". *Sci Tech Think Tank*, 2021, (02): 12-17.
- [13] Shi D. The development trends of emerging industries in developed countries post-financial crisis and their implications. *China Trade Guide*, 2010, (03): 32-33.
- [14] Luo Z C, Fan W. International comparison and experiences in developing strategic emerging industries. *Sci Tech Manag Res*, 2011, 31(07): 35-38.
- [15] Jiang A L. Discussion on strengthening the construction of science and technology innovation systems. *Chin Tobacco Sci*, 2002, (02): 23-24.

-
- [16] Gong H Q, Huang C, Wang Y S. Growth patterns, cultivation experiences, and implications of strategic emerging industries. *Sci Tech Prog Countermeasures*, 2011, 28, (23): 78-81.
- [17] Zhao G. Key focus on business model innovation in strategic emerging industries. *China Sci Tech Fortune*, 2010, (23): 4-5.