

Industries of the Future: Top-level Design and Action Roadmap by the U.S. Government

Xiangli Kong

University of Chinese Academy of Social Sciences, Beijing 102488, China.

Abstract: To seize the initiative in global industrial evolution, major countries around the world are intensifying their forward-looking arrangements in Industries of the Future. The U.S. government, adopting a strategic framework of emerging technologies driving Industries of the Future, has embarked on a series of innovative measures in alignment with both domestic and international realities. The specific measures of the U.S. government include: augmenting funding, optimizing talent policies, innovating cooperative models, improving infrastructure, and updating regulatory measures.

Keywords: Industries of the Future; Technological Development; Strategic Choices

1. Introduction

As a new concept in the field of public policy research, industries of the future has attracted wide attention in recent years. Its first-mover advantage determines the priority of making rules in the future global science and technology field.

Based on the collation and analysis of official public documents, this paper aims to summarize the commonalities of the recent two U.S. governments in formulating the strategy of industries of the future, and summarize specific improvement measures.

On the one hand, based on a process-oriented perspective, fully recognizing the interdisciplinary nature of emerging technologies, the industries of the future are deployed in a holistic manner. On the other hand, based on the results-oriented perspective, it emphasizes the application value of the development of emerging technologies, specifically referring to the predictable impact on economic benefits and the spillover effect of the overall national benefits.

2. Concept and Characteristics of Industries of the Future

Industries of the Future are technological clusters formed based on cutting-edge technological innovations, holding significant potential influence for the future, and playing a decisive role in the national development process ahead. As a policy-oriented concept, the definition of Industries of the Future has dynamic attributes, with the policy and academic circles often providing personalized definitions and expansions based on specific research needs.

In a narrow sense, Industries of the Future specifically refer to the list of key emerging technologies acknowledged in official government documents or public speeches as having significant impact on the nation's future development. The policy realm, based on comprehensive assessments of domestic and international environments along with technological development statuses, updates the list content in step with the times. The concept first appeared in the book "The Industries of the Future" by technology policy expert Alec Ross (Ross, 2016).

In a broad sense, Industries of the Future are characterized based on a common description of industry traits from an empirical perspective, including cyclical nature, risk involvement, and integrative tendencies. Firstly, the conversion of technological advantages into economic benefits requires a cycle, with financial investment planning spanning at least five to ten years; Secondly, revolutionary and disruptive technologies usually come with uncertainties during the initial stages, pointing to unpredictability in processes and outcomes, encompassing risks in technology pathway choices, technology design, and technology application; Lastly, the trend of various technologies intersecting and integrating is increasingly pronounced, necessitating a holistic view in the formulation of future industry policies.

3. Top-level Design: Strategic Framework of "Emerging Technologies Driving Industries of the Future"

As pioneering industries that determine future development directions, Industries of the Future play a global leading role in economic and societal development, heralding the course of the new wave of technological revolutions and industrial transformations.

Since the inception of the Trump administration, the United States elevated Industries of the Future to the national strategic level, articulating the government's vision for future industry policies in official documents for the first time. The Office of Science and Technology Policy (OSTP) publicly released a report titled "America Will Dominate the Industries of the Future" in February 2019, listing four key technologies including Artificial Intelligence, advanced manufacturing, quantum information science, and advanced communication networks (OSTP, 2019). The President's Council of Advisors on Science and Technology (PCAST) issued two public reports themed on Industries of the Future, offering constructive proposals from strategic framework and action roadmap perspectives, centralizing on establishing future industry research institutes, and enhancing support and layout in key technological domains (PCAST, 2021).

During the Biden administration, the policy framework of "emerging technologies driving Industries of the Future" continued, with further amplification of investment in the technological domain. Besides the \$300 billion federal R&D funds promised during the campaign stage to propel future industry development, several influential technology bills including the "CHIPS and Science Act of 2022" were passed with the joint promotion of the executive and legislative systems, primarily encompassing budget planning and development suggestions for key emerging technologies under the future industry framework.

Both Trump and Biden recognized the transformative role of key emerging technologies, striving to devise clear development plans, accelerating the deployment of emerging technology clusters to maintain the United States' leading edge in the global technological arena.

4.Action Roadmap: Specific Measures of the U.S. in Advancing Industries of the Future Development

4.1 Strengthening Budget and R&D Investment

The U.S. federal government has set the development of emerging technologies under the framework of Industries of the Future as a priority in the R&D budget memorandums for fiscal years 2020 to 2024, especially in the memorandums for 2021 and 2022 where the phrase "Industries of the Future" is explicitly mentioned. Various bills in each sub-domain delineate medium to long-term development plans, amplifying funding commitments in cutting-edge technological fields like artificial intelligence, quantum computing, and life sciences. For instance, in the domain of artificial intelligence, the National Science Foundation plans to allocate \$140 million to establish seven national AI research institutes to bolster R&D efforts in artificial intelligence.

4.2 Optimizing STEM Talent Policies, Fuelling Industries of the Future' Workforce

The National Science Board, in its "Vision 2030" report, outlined two major pathways to building a powerhouse of STEM talents to maintain U.S. competitiveness: enhancing domestic talent cultivation and attracting global talent (National Science Board, 2020). On the domestic front, emphasis is placed on bolstering STEM education at the K-12 level, higher education level, and vocational education level, focusing on nurturing skills aligned with Industries of the Future. Regarding international STEM talent policies, easing visa restrictions and immigration policies are targeted. The U.S. Immigration and Customs Enforcement (ICE) along with the Department of Homeland Security (DHS) regularly update the "STEM Designated Degree Program List," lowering the barriers for STEM talents to enter and stay in the U.S., and inviting overseas research talents (ICE, 2023).

4.3 Platform Establishment and Model Innovation Under Multi-entity Collaboration

Beyond setting clear technological strategic goals, U.S. policy circles are hastening the refinement of organizational processes and policy execution systems connecting the academic and industrial sectors, intending to enhance the efficiency in executing technological strategies. Taking the Future Industry Research Institutes conceived by PCAST as an example, while thoroughly considering the involvement of federal government, academia, industry, and non-profit organizations, efforts are directed towards creating a robust technological collaboration ecosystem, advancing the construction of technological innovation systems, improving the synergy among government, academia, and industry, and accelerating the efficiency of translating research outcomes.

4.4 Enhancing New Infrastructure, Guiding the Aggregation of Industries of the Future

Strengthening infrastructure construction lays a solid foundation for Industries of the Future, with emerging technologies seen as part of the new infrastructure in the U.S. The released “Outline for Rebuilding America’s Infrastructure Legislation” and “Infrastructure Investment and Jobs Act” aim at boosting investment and construction in basic infrastructure like broadband networks. In terms of guiding the aggregation of Industries of the Future, technology collaboration zones are established, fostering a relaxed policy environment. Support is provided through tax incentives and talent subsidies to realize optimal regional industrial allocation and iterative updates, leveraging the collaborative advantages of industrial aggregation, and harnessing the spillover effects of industrial diffusion.

4.4 Updating Accompanying Regulatory Measures, Controlling Emerging Technology Risks

With the rapid development of emerging technologies, enhanced control over these technologies facilitates the healthy growth of Industries of the Future. Taking artificial intelligence as an example, being a technology with significant impact on future economic development and national security, it frequently appears in official reports. The general path followed by the U.S. government in regulating AI involves the president laying out a macro policy blueprint, with various departments reviewing potential risks in their respective domains. President Biden has repeatedly mentioned the opportunities and risks associated with AI in public, and in October 2022, released the “Blueprint for an AI Bill of Rights” revolving around five basic principles, further strengthening the governance framework for AI (OSTP, 2022).

5. Conclusion

In strategic planning and policy formulation for Industries of the Future, the U.S. policy realm took early steps, now having formed a relatively mature strategic framework and a comprehensive policy system. This paper sorts out and summarizes the directions of Industries of the Future under the recent two U.S. administrations, hoping that countries, while integrating their own national conditions, can learn from the U.S. experience, balance the interests of all parties, and fully consider the comprehensiveness, phasal nature, and flexibility of policies during the process of future industry policy formulation.

References

- [1] Immigration and Customs Enforcement (2023). DHS STEM Designated Degree Program List. Available at: <https://www.ice.gov/doclib/sevis/pdf/stemList2022.pdf> [Last accessed on 2023 Oct 2].
- [2] National Science Board (2020). Vision 2030. Available at: <https://www.nsf.gov/nsb/publications/2020/nsb202015.pdf> [Last accessed on 2023 Oct 10].
- [3] Office of Science and Technology Policy (2019). America Will Dominate the Industries of the Future. Available at: <https://trump-whitehouse.archives.gov/briefings-statements/america-will-dominate-industries-future/> [Last accessed on 2023 Oct 13].
- [4] Office of Science and Technology Policy (2022). The Blueprint for an AI Bill of Rights. Available at: <https://www.whitehouse.gov/wp-content/uploads/2022/10/Blueprint-for-an-AI-Bill-of-Rights.pdf> [Last accessed on 2023 Oct 5].
- [5] President’s Council of Advisors on Science and Technology (2021). Industries of the Future Institutes: a new model for American science and technology leadership. Available at: https://science.osti.gov/-/media/_pdf/about/pcast/202012/PCAST---IOTFI-FINAL-Report.pdf [Last accessed on 2023 Sep 26].
- [6] Ross, A. (2016). The Industries of the Future. New York: Simon & Schuster.