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Impact of COVID-19 Pandemic on Science and Technology Development Worldwide and Its Enlightenment

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Abstract

The COVID-19 pandemic has catastrophically affected the economy, society, security, and health around the world, and it has also put forward the new requirements for the development of science and technology. Since then, many countries and regions, such as the United States, the United Kingdom, Germany, France, Japan, Russia, and European Union, have tried to solve the "dangers" and seek the "opportunities" by applying and developing science and technology. Therefore, these countries and regions are ambitious on scientific and technological strategic arrangements in digital economy, cutting-edge technology, biosafety, climate and environment, in order to accelerate economic recovery. With the introduction of the new trends of science and technology strategies in these countries and regions, this study summarizes the common strategic layouts on paying attention to cutting-edge technologies, advancing the digital economy, focusing on biosafety and health, and emphasizing the protection of the climate and environment, which shows five features, as digital, intelligent, human-oriented, ecological and national. Thus, we put forward suggestions for China's forward-looking strategic layout of science and technology development: getting rid of the impact of the pandemic with the self-reliance and independent development of science and technology; formulating a data strategy to promote economic and social digital transformation; focusing on life and health to vigorously promote the construction of Healthy China; changing the development mode and persisting green development on ecology.

Keywords

COVID-19; science and technology strategy; policy; international pattern; digital technology

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Impact of COVID-19 Pandemic on Science and Technology Development Worldwide and Its Enlightenment

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Abstract: The COVID-19 pandemic has catastrophically affected the economy, society, security, and health around the world, and it has also put forward the new requirements for the development of science and technology. Since then, many countries and regions, such as the United States, the United Kingdom, Germany, France, Japan, Russia, and European Union, have tried to solve the dangers and seek the opportunities by applying and developing science and technology. Therefore, these countries and regions are ambitious on the strategic arrangement of science and technology in digital economy, cutting-edge technology, biosafety, climate and environment, in order to accelerate economic recovery. With the introduction of the new trends of science and technology strategies in these countries and regions, this study summarizes the common strategic layouts regarding cutting-edge technologies, digital economy, biosafety and health, and climate and environment protection, which shows five features: digitalization, intelligentization, human orientation, ecologicalization, and nationalization. Thus, we put forward suggestions for China's forward-looking strategic layout of science and technology development: getting rid of the impact of the pandemic with the self-reliance and independent development of science and technology; formulating a data strategy to promote economic and social digital transformation; focusing on life and health to vigorously promote the construction of Healthy China; changing the development mode and persisting green development of ecology.
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Since the World Health Organization (WHO) announced the global outbreak of COVID-19 on March 11, 2020, the global health and economic development have been facing unprecedented challenges [1]. It is generally recognized that public health crisis can be a constant threat to public health and life, national economy and security, and social and international relations, and life sciences, biosafety, data science, and digital technology are critical to the public health security. The COVID-19 pandemic has accelerated the scientific and technological innovation. The Global Innovation Index (GII) 2021 released by the World Intellectual Property Organization (WIPO) in September 2021 states that the global efficiency of scientific and technological innovation in 2020 is significantly higher than the mean in the past 10 years. Currently, the scientific and technological innovation is in the midst of accelerated adjustment, as manifested by the increasing clear competition pattern among major countries for core technologies and key industries and the updating rules and consensus on science and technology cooperation. These changes have a profound impact on the global science and technology cooperation network and industry supply chain.

In this context, major countries have introduced targeted

policies and measures of science and technology, and emphasized the capacity building for prevention and control of COVID-19 and the forward-looking layout of development priorities to seek for a leading position in science and technology. The Outline of the 14th Five-Year Plan for Economic and Social Development (2021–2025) and Long-Range Objectives through the Year 2035 of the People's Republic of China states that we will adhere to the core position of innovation in China's overall modernization and have science and technology self-reliance and self-improvement act as strategic support for national development. As China ushered in a new stage of science and technology development towards self-reliance and self-improvement, the layout of science and technology development strategies is the basic premise of steadily improving basic research and original innovation, making breakthroughs in key core technologies, and gathering high-level innovative talents/teams, which can guide China's innovative development of science and technology. To achieve the reasonable layout, we need to understand the strategic trends of science and technology in the world, particularly in the countries with strong science and technology.

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This paper introduces the science and technology strategies in the United States, the United Kingdom, Germany, France, Japan, Russia, and European Union since the outbreak of COVID-19. Further, the paper analyzes the impact of the COVID-19 pandemic on the science and technology strategies, and summarizes the common strategic layouts, aiming to provide references for the strategic layout of science and technology development in China.

1 New trends of science and technology development in major economies during the COVID-19 pandemic

1.1 The United States: Focus on building digital health systems

Despite having an advanced health security governance system, the United States failed to prevent and control the COVID-19 pandemic [2]. In the FY 2021 memorandum, the United States government specifically emphasized the urgency and necessity for continuous investment in digital infrastructure. The FY 2022 memorandum [3] included a new priority aimed at American Public Health Security and Innovation in addition to artificial intelligence, quantum information sciences, advanced communications networks/5G, advanced manufacturing, and biotechnology. In March 2020, the White House announced the establishment of the COVID-19 High-Performance Computing Consortium (HPC Consortium) [4] to provide researchers with high-performance computing resources and support the massive computations related to bioinformatics, epidemiology, and molecular modeling. In April 2020, the United States Agency for International Development (USAID) released Digital Strategy 2020–2024 [5], which intends to enhance the openness, inclusiveness, and security of the digital ecosystem at the national level. In May 2020, the Information Technology and Innovation Foundation (ITIF) released Building a Global Framework for Digital Health Services in the Era of COVID-19 [6], stating that digital health—the use of information and communications technology (ICT) to provide and improve health services—holds transformational potential for health care around the world. In September 2020, the Department of Defense of the United States released a new Data Strategy [7] and Competing for Digital Talent: COVID-19 Lessons Learned, which further reflected the emphasis on digital technology. In January 2021, ITIF issued A U.S. Grand Strategy for the Global Digital Economy [8] to ensure that the United States remains the global leader in information technology.

Meanwhile, the United States keeps strengthening its leadership in critical technologies. In October 2020, the United States Department of State released the National Strategy for Critical & Emerging Technologies ^①, which proposes two strategic pillars of promoting the national security innovation base and protecting technology advantage, and identifies 20 technology area priorities: advanced computing, advanced conventional weapons technologies, advanced engineering materials, advanced manufacturing, advanced sensing, aero-engine technologies, agricultural technologies, artificial intelligence, autonomous systems, biotechnologies, chemical, biological, radiological, and nuclear (CBRN) mitigation technologies ^②, communication and networking technologies, data science and storage, distributed ledger technologies, energy technologies, human-computer interfaces, medical and public health technologies, quantum information science, semiconductors and microelectronics, and space technologies. In March 2021, the National Security Commission on Artificial Intelligence (NSCAI) released the Final Report: National Security Commission on Artificial Intelligence, recommending that the United States Congress and the government strengthen competitiveness in domains including artificial intelligence and semiconductor supply chain [9]. In May 2021, the House Science Committee of the United States passed the National Science Foundation (NSF) for the Future Act, which plans to increase the NSF's budget from the current USD 8.5 billion per year to USD 18.3 billion over the next 5 years (2022–2026) and prioritizes funding for the future industries including quantum information science, artificial intelligence, supercomputing, cybersecurity, and advanced manufacturing [10]. In May 2021, the Committee on Commerce, Science, and Transportation, United States Senate passed the Endless Frontier Act, which planned to spend USD 100 billion over the next 5 years to support basic research, frontier research, commercial applications, and education and training in key technology fields such as artificial intelligence, semiconductors, quantum computing, advanced communications, biotechnology, and advanced energy [11].

1.2 The United Kingdom: Focus on intelligent manufacturing, data, and climate change

The United Kingdom proposes to build a future that is greener, fairer, healthier, more resilient, and more innovative than ever before to reinvigorate the economy. In the face of the COVID-19 pandemic, the United Kingdom increased investment in research and development of related drugs and vaccines, and supported the development of intelligent manufacturing. For example, the United Kingdom Research and Innovation (UKRI) has invested GBP 147 million to

① United States Department of State. 2020 National Strategy for Critical & Emerging Technologies. (2020-10-15)[2021-04-10]. <https://nps.edu/web/slamr/-/2020-national-strategy-for-critical-emerging-technologies>.

② It refers to the technologies for mitigating chemical, biological, radiological, and nuclear threats.

support the digitalization of the manufacturing sector and the construction of intelligent innovation center. In July 2020, the United Kingdom government announced the UK Research and Development Roadmap to further strengthen research and innovation in response to the pandemic ^[12]. For this purpose, the United Kingdom has committed to increase the investment on research and development to 2.4% by 2027. Meanwhile, given the important role of geographic data in the pandemic prevention and control, the British Geological Survey (BGS) published the BGS Digital Strategy 2020–2025: Creating a Digital-first Geological Survey in July 2020, which planned to have a unified national location data framework by 2025 to provide data support for events that occur at specific time and a specific place and address future risks ^③. In December 2020, the National Data Strategy ^④ proposed in 2019 was adapted and re-released to create a systematic framework for processing and investing in data, which aimed to support better, safer and more innovative use of data for harnessing the power of data to raise productivity, create new business, deliver jobs, improve public services, and boost the economy in the United Kingdom. In November 2020, the United Kingdom Prime Minister proposed The Ten Point Plan for A Green Industrial Revolution ^[13], which aimed to simultaneously promote environmental improvement and economic recovery.

Meanwhile, the United Kingdom highly concerned and is involved in global competition in science and technology. In October 2020, the United Kingdom's Ministry of Defence (MOD) released the 2020 MOD Science and Technology Strategy ^[14], stating that science and technology is not only a means to solve problems but also the main area of competition among countries. In January 2021, the Artificial Intelligence Council released the AI Roadmap, highlighting the gradual integration of artificial intelligence into people's lives. Artificial intelligence is expected to bring 10% growth in gross domestic product (GDP) to the United Kingdom by 2030, creating significant benefits to economic recovery, environmental improvement, and public life ^[15]. To support high-risk scientific research, the United Kingdom plans to build the Advanced Research & Invention Agency (ARIA), similar to the Defense Advanced Research Projects Agency (DARPA), to vigorously promote research on transformative science and technology.

1.3 Germany: Focus on the technologies related to digitalization, medicine, and climate change

To promote rapid economic recovery from COVID-19 pandemic, Germany emphasizes the strategic layout of the research and development of the technologies related to hydrogen energy, artificial intelligence, and data to enhance the self-reliance of key technologies. In June 2020, the Federal Ministry for Economic Affairs and Energy released the National Hydrogen Strategy of Germany, which planned to invest EUR 9 billion to support the green and sustainable development of hydrogen energy and reshape the European and international markets by 2030 to support Germany's economic development while improving the protection against climate change ^[16]. In December 2020, Germany updated its national strategy for artificial intelligence with an emphasis on sustainable development, environmental and climate protection, and fight against infectious diseases, and expected to increase its investment in artificial intelligence from EUR 3 billion to EUR 5 billion per year by 2025 ^[17]. In November 2020, the Ministry of Education and Research (BMBF) released the action plan for Cosmos and Matter Research: From Big Data to Intelligent Data ^[18], which aimed to exploit the huge potential of basic research data to support the application research and development and promote the rapid development of digitalized basic research. In January 2021, the German Federal Government released the Data Strategy of Federal Government, which intended to promote data use and sharing, especially to harness the power of data in support of the fight against the viruses causing pandemics ^⑤.

1.4 France: Focus on ecological transformation and competitiveness improvement

To address the economic impact of the COVID-19 pandemic, the French government in September 2020 launched the France Relance Recovery Plan ^⑥ with a total investment of EUR 100 billion to support companies in upgrading their production models and infrastructure and investing in training. The Plan includes three core themes. (1) Accelerating the ecological transformation. The plan expects France to be the first in Europe to achieve carbon neutrality by 2050, and provide EUR 30 billion to support activities such as energy transformation, industrial decarbonization, clean transportation, and transformation of the agricultural sector. (2)

③ BGS. BGS Digital Strategy 2020-2025. (2020-07-20)[2021-05-10]. <https://www.bgs.ac.uk/download/bgs-digital-strategy-2020-2025>.

④ UK Government. National Data Strategy. (2020-12-09)[2021-04-10]. <https://www.gov.uk/government/publications/uk-national-datastrategy/national-data-strategy>.

⑤ German Federal Government. Datenstrategieder Bundesregierung. (2021-01-27)[2021-05-18]. <https://www.bundesregierung.de/resource/blob/992814/1845634/45aee6da9554115398cc6a722aba08cb/datenstrategie-der-bundesregierung-download-bpa-d ata.pdf?download=1>.

⑥ France Diplomacy. France Relance recovery plan: building the France of 2030. (2020-09-03)[2021-05-10]. <https://www.gouvernement.fr/france-relance>.

Improving competitiveness. It plans to invest EUR 34 billion in upgrading production facilities, investing in future technologies (including green technologies), reducing production taxes, and supporting research, training, and development of expertise. (3) Improving cohesion. To curb the rising inequality, it plans to invest EUR 36 billion by 2030 to provide support such as training for young people and vulnerable groups in France. In December 2020, the Health Campus Project in Paris was proposed to support future medical research and industry-academia-research collaborative innovation based on health data and platforms to address the challenges to the health and public health policy posed by pandemics such as COVID-19 ^[19].

1.5 Japan: Steadily lay out digital technology and intelligent society

The COVID-19 pandemic exposed the delayed digitalization and informatization in Japan, which strengthened Japan's determination in the development of digital market. The Japanese government has adopted Society 5.0 as the target social form ^[20]. Society 5.0 refers to a human-centered society that balances economic advancement with the resolution of social problems by a system that highly integrates cyberspace and physical space and provides personalized products and services based on artificial intelligence.

Like the United States and the United Kingdom, Japan also focuses on the cutting-edge technologies and designates quantum technology, artificial intelligence, and life sciences as the three strategic technologies in addition to targeted scientific and technological planning in response to the COVID-19 pandemic. In January 2020, the Japanese government introduced the Quantum Technology Innovation Strategy, which regards quantum technology as the national strategy of Japan for the next 10–20 years and identifies four basic fields: quantum computer/quantum simulation, quantum measurement/sensing, quantum communication/cryptography, and quantum materials ^[21].

In addition, Japan expects to make a difference in the development and promotion of next-generation communication networks. In March 2020, Japan launched commercial 5G communication services and planned to achieve nationwide 5G signal coverage by around 2023. Meanwhile, Japan expected to take over the lead in the communication field through the development of 6G communication technology. In April 2020, Japan announced the Beyond 5G Promotion Consortium to support enterprises in the development of 6G communication technologies, with the goals of fully mastering key 6G communication technologies by 2025,

commercializing 6G communication by 2030, and increasing the global market share of Japanese companies in communication infrastructure from 2% to 30% and the global share of 6G communication technology patents from 5.5% to more than 10% ^[22]. In July 2020, Japan released the Integrated and Comprehensive Innovation Strategy 2020 ^[23], which strategized basic research fields such as artificial intelligence, biotechnology, quantum technology, and materials, as well as their application in the environment, health care, and agriculture.

1.6 Russia: Protect biosafety and strengthen basic research and technology development by legislation

In November and December 2020, Russia released the Action Plan for the Implementation of the Health Development Strategy of the Russian Federation by 2025 ^[24] and the Russian Law on Biosafety ^⑦. The release of the two documents intended to prevent biological threats and safeguard biosafety, establish a biosafety monitoring system, improve the quality of medical services, prevent the spread of infectious diseases, promote the research and development of medical technology and drugs, and strengthen international cooperation on biosafety. Meanwhile, Russia is ambitious on the strategic arrangement in new technologies. For example, the Concept of Regulatory Development of Artificial Intelligence and Robotics in Russia by 2024 was released in August 2020, aiming to promote the development and application of artificial intelligence and robotics in various fields ^⑧. As an energy exporter, Russia released the Action Plan for the Development of Hydrogen Energy in the Russian Federation by 2024 in October 2020, which intended to develop highly productive and export-oriented hydrogen energy via new technologies ^[25]. In December 2020, Russia released the Program of Basic Research by 2030, which aimed to improve the overall strength of Russian comprehensive research through the development of basic research in various fields ^[26].

1.7 European Union: Implement green plans and digital strategy with emphasis on civil-military integration

To promote the recovery of the European Union economy from COVID-19 pandemic, the European Union has developed the Recovery Plan for Europe ^⑨, intending to invest EUR 15 billion in 2021–2027 to support economic recovery, advance public health strategy, and raise the overall capacity to respond to major pandemics by formulating a common health policy, promoting the self-reliance of the pharmaceutical industry, improving the stockpiling of medical supplies, and strengthening the research and development of vaccines. Special emphasis is placed on accelerating the ecological and

⑦ Российская Федерация. О биологической безопасности в Российской Федерации. (2020-12-25)[2021-04-25]. <https://docs.cntd.ru/document/573249393>.

⑧ Правительство Российской Федерации. Национальную стратегию развития искусственного интеллекта на период до 2030 года. (2019-10-10)[2021-05-16]. <https://www.zakonrf.info/pdf/?url=/ukaz-prezident-rf-490-10102019/&format=A4>.

⑨ Publications Office of the EU. The EU budget powering the recovery plan for Europe. (2020-05-27)[2021-04-10]. <https://op.europa.eu/en/publication-detail/-/publication/e0956910-a0c9-11ea-9d2d-01aa75ed71a1>.

digital transformation and modernizing the European economy through the implementation of green plans and digital strategy, with investment priorities covering key areas from 5G communications to artificial intelligence and from clean hydrogen to offshore renewables. In February 2020, the European Commission published A European Strategy for Data ^[27], aiming to ensure European Union as a role model and leader in a data-driven society that uses data to benefit society, raise productivity, and improve the health of citizens, while enhancing environmental protection and increasing data transparency and security. Meanwhile, a White Paper on Artificial Intelligence and Shaping Europe's Digital Future was published to clarify the European Union's strategic deployment to promote the development of artificial intelligence with the aim of accelerating economic recovery and driving Europe's digital transformation. In March 2021, the European Commission released the 2030 Digital Compass: the European Way for the Digital Decade, intending to construct a sustainable digital society with enhanced digital competitiveness to break away from the digital dependence on the United States and China, and make Europe one of the regions with the most advanced digital economy in the world ^[28]. Moreover, to learn lessons from the COVID-19 pandemic, the European Union is considering the establishment of a large-scale risk forecasting center to ensure robust risk assessment and management. The establishment of the European Crisis Map will improve the rapid response capability and help to organize and distribute public data to develop targeted solutions for emergencies.

Subject to the huge impact of the COVID-19 pandemic, the European Union civil sector is becoming a technology driver for the aerospace and defense industries. In response, the European Union developed the EU Security Union Strategy in July 2020 ^⑩, which emphasizes the cross research involving space industry, defense, and civil technologies. In February 2021, the European Commission introduced the Action Plan on Synergies between Civil, Defense and Space Industries ^[29], which is dedicated to promoting the integration and creating synergies between civil, defense, and space industries to accelerate technological innovation in the European Union of 27 Member States.

2 Common strategic layout and characteristics of international science and technology development since the outbreak of COVID-19

2.1 Common strategic layout

The strategic layout of international science and technology development since the outbreak of COVID-19 has four common aspects.

(1) Focusing on cutting-edge technologies to compete for

future technological advantages. Although the major countries of science and technology are still in the midst of the COVID-19 pandemic, they are as active as ever in the development of cutting-edge technologies such as artificial intelligence and quantum information. The competition among them for advanced technologies has not been changed by the pandemic. The United States has listed four science and technology priorities including basic science, 5G, artificial intelligence, and biotechnology, with special emphasis on chip technology as a pillar. The Japanese government has issued a series of strategic plans and policies supporting high-tech fields such as quantum technology and the construction of next-generation communication networks (6G) in an attempt to accelerate medium- and long-term layouts and strengthen strategic competitiveness. The European Union strengthens its digital capabilities in the fields of digital technology, quantum computing, artificial intelligence, 5G communication, cyber security, etc., and reduces its technological dependence on the United States and China.

(2) Advancing digital technology for digital economy. The digital economy has become a new engine to accelerate the optimization and integration of global innovation, industry, and value chains, as well as an important momentum to promote global economic recovery. The COVID-19 pandemic forced the digital transformation of industries ^[30], and the digital economy grew rapidly during the pandemic. Many countries have developed or updated their strategies about digital technology in the context of the pandemic to strengthen the openness, inclusiveness, and security of the digital ecosystem at the national level, promote digital technology applications, expand the digital technology market, create new businesses and jobs in the digital economy, and improve social services. According to the statistics, global GDP declined by 4.4% year-on-year, while the digital economy achieved the positive growth of 0.5% in 2020 ^[31].

(3) Focusing on health and biosafety. The outbreak of COVID-19 has forced countries around the world, especially those with strong science and technology, to increase their investment in the research and development of vaccines and drugs to control the pandemic and protect public health. Meanwhile, countries have increased their attention to the research, development, and application regulation of modern biotechnologies, laboratory biosafety protection, prevention and control of emerging infectious diseases as well as animal and plant diseases, and biodiversity conservation to build their own national biosafety systems. For example, the United States government has taken the lead in incorporating biosafety into its national security strategy and has launched a series of national strategies on biosafety since 2004. The United Kingdom, France, Russia, and European Union have also released biosafety strategic plans at the national level to address biosafety issues such as biological warfare, bioterrorism,

⑩ EU. EU Security Union Strategy. (2020-07-24)[2021-04-10].
TXT/PDF/?uri=CELEX:52020DC0605&from=EN.

(2020-07-24)[2021-04-10].

<https://eur-lex.europa.eu/legal-content/EN/>

infectious diseases, laboratory biosafety, and biotechnology misuse with consideration to their own characteristics.

(4) Protecting climate and environment and enhancing risk resilience. The COVID-19 pandemic is a reminder of human vulnerability to systemic risks. Climate and ecological degradation and reduced biodiversity pose potential threats to human development and life security. Therefore, decarbonizing the economy and building resilience to the effects of climate change is one of the great challenges in front of human beings in addition to overcoming the devastating impacts of the COVID-19 pandemic as soon as possible. Most countries have put forward the concept of green recovery while promoting economic recovery, and carbon neutrality is rapidly becoming a global consensus. For example, the United Kingdom has made the development of a green hydrogen economy as one of the key initiatives to boost its economy. Germany plans to realize carbon neutrality by 2045. Japan has announced net zero emissions of greenhouse gas by 2050. The European Union has made the green transformation as one of the cores of the economic recovery plan, and many other countries have also proposed the goal of carbon neutrality to curb global warming and enhance the resilience and sustainability of economic growth.

2.2 Layout characteristics of science and technology strategies

In the context of the COVID-19 pandemic, the strategic layout of science and technology development in different countries and regions shows five features.

(1) Digitalization. With the increasing role of digital technology in the prevention and control of COVID-19, as well as in promoting employment and economic recovery, countries around the world are accelerating the digital transformation. The increasing scale highlights the status and importance of digital economy in the overall economic system.

(2) Intelligentization. The role of artificial intelligence in the prevention and control of COVID-19, auxiliary diagnosis and treatment, social governance, and other application scenarios has been given to full play. The pandemic has accelerated the innovation and application of artificial intelligence and the evolution of the human society to an intelligent society.

(3) Human orientation. The outbreak of COVID-19 has highlighted the vulnerability of human life to major health crises, and biosafety and health have become a global concern. The development and application of virus detection methods and vaccines highlights the value of long-term layout and investment in life sciences and biotechnology, and further validates that technology is the most significant, forward-looking, and decisive field for strategic investment.

(4) Ecologization. The raging SARS-CoV-2 has sounded the alarm for the sustainable development of the global ecology. The harmony between human and nature should be valued even in the era with accelerated evolution of human

civilization. Developing bio-economy, taking the path of green development, and protecting the eco-environment are not only in line with the laws of scientific and technological development but also fit the public's demand for ecological development.

(5) Nationalization. The role of science and technology in the response to the COVID-19 pandemic has been highlighted. Especially in the context of intensified competition between countries in science and technology, and major countries have emphasized government-led development and enhanced the planning and investment in science and technology. For example, in the frontiers of digital technology and quantum computing, ITIF points out that the United States government should develop a grand strategy based on digital realpolitik for the global digital economy^[32] and invest heavily in quantum computing applications to strengthen the economic competitiveness and protect the national security of the United States^[33].

3 Enlightenment and suggestions

(1) Getting rid of the impact of the COVID-19 pandemic with the self-reliance and independent development of science and technology. The COVID-19 pandemic has intensified global competition in science and technology, and the fundamental strategy to cope with such competition is to realize self-reliance and independent development of science and technology^[34]. The core of scientific and technological competition lies in cutting-edge technologies. Only by mastering the cutting-edge technologies, improving the infrastructure, and strengthening the strategic coordination of different sectors can China enhance the independent innovation of science and technology, improve international competitiveness, and get rid of the impact of the pandemic on the innovative development of science and technology. The United States has identified China as its most important competitor in information technology and digital economy^[35]. The Endless Frontier Act and the Innovation and Competition Act of 2021 have made it a strategic intent to improve the United States' technological competitiveness to manage the "China Challenge." In view of this, China should adhere to the core position of innovation in science and technology development, persist in the open, competitive, systematic, and safe concept of science and technology development, and promote the modernization of the governance system and capacity for science and technology^[36].

(2) Formulating a data strategy to promote economic and social digital transformation. The new-generation digital information technology has played a key role in the scientific and precise control of COVID-19 and maintaining the economic and social order, which has at the same time accelerated the digital transformation of China's economy and society^[37]. In the future, one of the main competition fields among major countries is the digital economy supported by

new technologies. At present, the new industries, new types of business, and new models supported by digital technology are emerging. China needs to promote the innovative development of big data, artificial intelligence, Internet of Things, blockchain and other frontier digital technology as well as the digital industrialization to create digital industry clusters. Meanwhile, China should stimulate the new drivers of digital economy and accelerate the digital transformation of the economy and society with the goal of building a great country in manufacturing and cyber.

(3) Focusing on life and health to promote the construction of Healthy China. China has always put people's life safety and physical health in priority and has achieved significant strategic results in the fight against COVID-19. The *Outline of the Healthy China 2030 Plan* was implemented in 2016, the core of which is to significantly improve the health level and health equity. This requires comprehensive improvement of medical services, optimization of medical and healthcare processes, and a sound medical security system, as well as strengthening the management of environmental issues affecting health and enhancing the defense against biosafety risks. In addition, China highly concerns about the significant slowdown in population growth and aging. It has been estimated that fertility rate will remain low in most countries and will be below the population replacement level (fertility rate of 2.1)^⑪. Population decline will lead to dramatic changes in the age structure of the country's population, economic development, laboring population, and immigration policies^[38]. It is evident that accelerating the reform of childbearing policy, raising the fertility rate, maintaining a reasonable growth rate of population, especially maintaining the size of laboring population at a considerable size, and slowing down the aging are crucial to the long-term development of a country.

(4) Persisting the green development of ecology and the harmony between human and nature. The biggest warning to human being from the COVID-19 pandemic is that there is only one earth and the human being is an integral part of the earth's natural ecosystem. Without the ecological security of the earth, there will be no security for human beings. Without the ecological security of the country, there will be no health security for the population. Only when human and nature live in harmony can there be a future for human beings. To curb global climate change and protect the eco-environment, human beings must achieve the strategic goal of carbon neutrality as early as possible, which requires vigorous development of new energy technologies, transformation of economic development, and adherence to green development. China needs to insist on green, inclusive, and sustainable development while constructing a new development pattern with the domestic grand cycle as the main body and the domestic and international double cycles promoting each

other. The insistence on promoting green production methods, advocating green lifestyles, establishing green consumption patterns, and raising the people's awareness of green living will promote the sustainable development of economy in China.

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