Opportunities and Challenges of Technological Innovation in China: Based on the Analysis of China's Big Data Development

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Abstract: This paper discusses the current state of big data innovation in China, highlighting both the opportunities and challenges that come with it. The opportunities include policy support, market demand, human resources, technological progress, and advanced experiences from developed countries. The challenges discussed include data nationalism, ethics, political regulation, monopolization by big companies, incomplete legal frameworks, and intervention by capital. The paper also examines China's innovation strengths and weaknesses, and strategies to overcome the challenges faced.

1. Introduction

Big data refers to the collection of data whose content cannot be captured, managed and processed by conventional software tools within a certain period of time. China's national big data strategy refers to a series of policies and plans formulated and implemented by the Chinese government, aimed at promoting the development of China's big data industry, improving the country's level of digitalization and informatization, and providing support for economic transformation and social development .

According to China's national big data development strategy, the overall goal of China's big data strategy is to build the world's leading big data country by 2020 and become a global big data innovation center by 2025. Specific measures include: Strengthen the construction of data infrastructure, build high-speed, safe and reliable big data transmission, storage, processing, analysis, sharing and other infrastructure. Cultivate the big data industry, support enterprises in developing big data technology and applications, and promote the deep integration of big data and the real economy. Promote big data innovation, strengthen big data technology research and development, cultivate big data talents, and promote innovation and application in the field of big data and so on.

Nowadays, China's big data policy has achieved much development: The scale of the industry continues to expand. According to relevant data, as of 2021, the scale of China's big data industry has exceeded 1 trillion yuan. China has certain technological advantages in the fields of artificial intelligence, cloud computing, and big data analysis, which are widely used in smart cities, smart manufacturing, and digital medical care. Deep integration with the real economy. Big data has become an important force to promote the development of the real economy, promoting digital

transformation in fields such as intelligent manufacturing, digital medical care, and transportation. China's big data strategy also faces some challenges such as data security risks intensify, insufficient data governance, imperfect laws and regulations and so on. Therefore, in order to achieve greater achievements, the joint efforts of the government, enterprises, academia and all parties in society are required[1].

2. Focus on Big Data: Opportunities, Challenges and Countermeasures for Big Data Development

2.1 Opportunities for the development of Big Data in China

The main advantages of China's Big Data development path compared to other countries are the strong government drives to focus on planning and development, the extensive market demand and talent resources and science and technology exchanges.

2.1.1 National policy support

In addition to the national big data strategy mentioned above, the implementation of the "Internet plus" action plan, the "developing the country through science and education", "strengthening the country through talents" and the "Digital China" strategies have provided a lot of back-up support for the development of big data. During the 14th Five-Year Plan period, China entered a critical period of striding from an industrial economy to a digital economy, and the digital transformation of the economy and society has become a major trend, with data becoming a new factor of production. The Ministry of Industry and Information Technology has collaborated with relevant ministries to set up an inter-ministerial joint conference system for the promotion and development of big data as well as to continuously improve the policy system, all under the direction of the Communist Party of China and the State Council. Policy assistance is provided to pertinent businesses to streamline the industrial chain using national macro planning to concentrate on the growth of the big data sector[2].

These regulations encourage the sharing of big data assets and increase the opportunities for governments to use big data to strengthen their capacity for governance.

2.1.2 Extensive market demand

Big data has highly integrated special effects and has rapidly penetrated and integrated into people's production life and learning work. The second great advantage of Big Data development in China is that it has a wide range of application areas, and the advent of the Internet era has also promoted the deep integration of the Internet and the real economy. China's big data market is already among the world's largest.

Big data applications are key to big data value tapping and the big data industry flourishing. (Liu et al.5)For example, it is widely used in urban planning or environmental protection, with China's Ministry of Environmental Protection using big data to establish a "China Species Red List" to promote sustainable development. China has now become the largest core link in the global manufacturing supply chain, meaning huge overseas markets and domestic demand[3].

At the same time, new industrial forms are emerging, with horizontally extended and vertically integrated industrial chains becoming the mainstream of big data development in China in the future. Internet and industrial internet companies such as Xiaomi, Alibaba, and Tencent are presenting a new industrial ecology of composite multi-industries, such as smart home appliances, virtual idols, and other cross-industry joint development paths. The "digital economy" is driving the emergence of new markets by vertical mining and analyzing multiple businesses at the same time[4].

2.1.3 Talent resources and science and technology exchanges

China has made significant progress in the cultivation of strategic scientific and technological talents; the quality of talents is constantly improving, the overall strength of the talent pool is growing, and China, in general, has an overall advantage in the resource pool of strategic scientific and technological talents.

The reserve of talent is increasing rapidly. The country's total talent resources grew from 120 million in 2010 to 220 million in 2019, with professional and technical talent growing from 55.504 million to 78.398 million, and the full-time equivalent of all types of R&D personnel reaching 4.8 million person-years, ranking first in the world. [5]

The report of the 20th Party Congress proposed "implementing the strategy of promoting the country through science and education, and strengthening the support of talents for modernization", which integrates education, science and technology, and talents into a whole arrangement, and clarifies the scientific connotation and mission of the strategy of promoting the country through science and education in the new era. China has further developed the concept of education first, increasing financial investment to ensure the development of education and the cultivation of innovative talents.

China starts international conferences and consortiums for the use of big data in science. One of the key strategies to raise the calibre of scientific big data research is to conduct bilateral or multilateral international exchanges and collaboration while also improving research on the methodology, theoretical underpinnings, and technology of scientific big data in real-world applications.[6]

2.2 Challenges and Countermeasures of Big Data's Development in China

2.2.1 Government Governance

➤ **Challenges:**

Big Data in government affairs generally refers to all kinds of external data related to public relations management activities and business data within government departments that can be collected by the government in the process of public administration activities and in the process of performing administrative functions, involving economic, social, cultural and many other fields (Ye, 2021).[7]

It is specifically reflected in three aspects: First, the lack of support for the aggregation and storage of big data in government affairs. Data resources are the basis of data governance, and the aggregation of big data for government affairs is an important cornerstone of data governance. However, due to the late start of China's digital government construction and uneven regional development, the government database systems in various regions are working separately from each other, and it is difficult to gather and share the rich data resources. Second, there is a serious blockage in the flow of big data in government affairs. Currently, many government department leaders and cadres have a weak awareness of data sharing, and they departmentalize, exclusivism, and benefit government data resources out of consideration of factors such as the interests and power of their departments. They are resistant to the open sharing of data, and their closed and conservative mindset restricts the open sharing of big data in government affairs. Third, the application of big data in government affairs is still insufficient and unintelligent. At present, domestic government departments at all levels have deposited a large amount of government affairs data, but they have failed to be fully utilized.

➤ **Countermeasures:**

Specifically: First, the construction of a unified platform to support the effective aggregation of data resources. The government big data center must adopt a top-down, integrated planning and

unified construction approach. At the national level or at the provincial level, a unified storage and arithmetic system need to be established. Second, promote data sharing to strengthen the synergistic capacity of government governance. China needs to establish and improve the dynamic adjustment mechanism of data opening, clarify the content scope, ways and means, supervision and guarantee and legal responsibility of data opening and sharing, and improve the system specification of platform operation, matter management and business synergy.　Third, expand the service application channels and scenarios based on big data. Including but not limited to building a network public opinion monitoring system based on big data analysis, promoting the construction of emergency command system based on big data, etc.[8]

2.2.2 International Competition

➢ **Challenges:**
Existential threat: TikTok has certain security risks in terms of algorithmic operation strategies.
TikTok's product operation is mainly based on intelligent algorithm technology such as "data mining" and "machine learning". Through intelligent matching between "user needs" and "information supply", TikTok dispenses videos to meet specific needs according to the basic path predetermined by users' preferences.

This kind of platform construction model, which relies heavily on scenario adaptation and user data supply, has already been included in the U.S. data security laws in the key review sequence. This means that TikTok's operation mode of relying on scene data collection and establishing personal data images has already become a key target of U.S. data security monitoring, which has undoubtedly laid the groundwork for its security allegations.[9]

Trump administration's construction of a security discourse on the TikTok issues
Some elites in the U.S. political and business sectors have tried to convey the basic discourse of "TikTok is a security threat" to the American people and even other power elites through means such as "inciting public opinion" and "commercial smearing"

Actively inciting public opinion:
From August 2019 to August 2020, TikTok has been involved in dozens of separate but identical user lawsuits. Numerous U.S. parents have complained that TikTok "fails to deploy appropriate protections" and allows adults to contact underage children through the app, send them inappropriate messages, and even engage in stalking.[10]

In addition, the plaintiffs allege that the software violated their data privacy rights by "collecting information about their facial features, location and close contacts and sending it silently to servers in China."

After the lawsuit became public, the elite of the U.S. press focused more on TikTok's "Chinese heritage" than on the case itself, implicitly suggesting that the app had "assisted the Chinese government in spying on the American public" and "provided various data information to the Chinese government".

Investing in the implementation of "commercial smearing":
Since entering the North American market in August 2018, TikTok has not only rapidly surpassed the traditional social giant Instagram in the global app market, but also repeatedly set new records for North American app downloads in terms of user growth, which has caused the U.S. Internet companies represented by Facebook to have a serious sense of crisis.

Since the beginning of mid-2019, Facebook CEO Mark Zuckerberg has constantly played up the threat posed by TikTok to the U.S. on multiple occasions, trying to arouse the vigilance of the U.S. society on TikTok's commercial expansion.

In October 2019, Zuckerberg publicly declared in a speech delivered at Georgetown University

that TikTok would pose a threat to U.S. values and technological dominance. [11]

In a July 2020 interview with an antitrust hearing in Congress, he re-emphasized TikTok's data security issues, while touting his company as "critical" to winning the cyber arms race with China.

➢ **Countermeasures:**

From the government's perspective, China should take the lead in unifying its basic position on the U.S. big data policy, comprehensively clarify the responsibilities and tasks of various ministries and commissions, and build up a complete set of orderly and hierarchical administrative response systems with national scientific and technological progress and market development as the core orientation. In addition, relevant departments such as the Cyberspace Administration of China, the Ministry of Industry and Information Technology, the Ministry of Commerce and the Ministry of Justice should make adequate plans to facilitate China's science and technology enterprises to intervene in a timely manner in the face of unfair competition by improving the "unreliable entity list" and other means, so as to ensure the legitimate rights and interests of China's science and technology enterprises.[12]

From the perspective of enterprises. Firstly, enterprises need to establish a professional compliance management system internally and make efforts to improve the basic ability to detect the risks of various businesses. Second, enterprises also need to revise the specific standards of their own R & D, procurement, production, sales and other links in combination with the control and compliance policies of the target country control, and internalize abstract regulatory regulations into real operating processes and systems. Third, all kinds of overseas enterprises should regularly implement enterprise personnel training, and implement relevant laws and regulations popularization education for key departments such as procurement, research and development, sales, etc., so as to firmly establish legal awareness within the enterprise, and avoid unnecessary disputes caused by the lack of clarity of the laws of the target country.

2.2.3 Personal Information Security and Data Privacy

➢ **Challenge:**

The original meaning of privacy is the right of citizens to conduct private activities in their homes or correspondence. In the context of big data, however, the concept of privacy goes far beyond the boundaries of the physical or spatial place controlled by an individual, and also encapsulates the right of an individual to control and possess the data he or she generates and is unwilling to share with the larger community.

In the era of big data, human beings generate a large amount of data in daily life and enjoy the convenience of life brought by data, whether it is refreshing microblogging, chatting on WeChat, sending electronic red envelopes, doing online shopping and other life behaviors, or seeing a doctor, buying a car, buying a house and other big life events will leave data "footprints", user information is leaking with these "footprints".[13]

Users voluntarily cede personal data privacy

From a personal perspective, personal information sharing can not only create economic value for enterprises, but also create value for users. In return for giving up personal information, e-commerce can provide a more personalized transaction experience for customers, the government can provide certain services, and search engines can provide more targeted and accurate results. In addition to these benefits and conveniences, Internet users in the Big Data era are happy to live in a world where information is highly connected and disseminated, and they are happy to share ideas and experiences because it allows them to access more opportunities and trade efficiently. Their work and life are closely tied to the Internet.[14]

People will only react if this approach exposes them to some real and significant threat, exposes them to a serious challenge to their privacy, and violates their bottom line in protecting personal

information.

Companies use big data technologies to mine private user data.

Big Data has impacts on the collection, analysis, processing, and utilization of personal information. These impacts become objective conditions that threaten the privacy of personal information. Personal information such as age, gender, address, consumer records, medical and educational records, and Internet traces are recorded and stored without permission, and when combined with other personal information or similar information in society, the information is analyzed and processed to make predictions or conclusions that, to some extent, compromise personal privacy. [15]

Hackers steal users' private data

In addition to users' active leakage and enterprise mining, some unscrupulous elements or hackers will also use their own big data technology to attack the loopholes in enterprise or government applications, illegally steal the privacy of users' personal information.

➢ **Countermeasures:**

At the individual level, users should strengthen their awareness of personal privacy protection. Users should be to enhance the awareness of privacy security protection and privacy leakage rights awareness, always prevent the means of illegal criminals to violate personal privacy, so as to eliminate the invasion of privacy from the source of things happen.

At the government level, it is necessary to provide corresponding rules in laws and regulations as soon as possible. At present, there is a lack of special legislation for comprehensive privacy protection in China's legal system. Government departments should improve various regulations on big data application and privacy protection, and fulfill their responsibilities and obligations to maintain the security and stability of users' information. The government should also establish regulatory authorities to comprehensively supervise and govern the use of big data technology.

At the enterprise level, on the one hand, relevant companies should strengthen their own industry self-discipline and ideological and moral construction, achieve legal compliance when using user data, and take the protection of users' personal information as the top priority; Second, it is necessary to establish an accountability mechanism and promptly investigate the problems of information leakage; The industry can also set up a special complaint channel. On the other hand, while emphasizing the innovation and development of big data technology and application, we should also pay attention to innovative data security protection technology, which is an indispensable and important content in privacy protection.

3. Opportunities and challenges for China's innovation

3.1 Advantages of China's innovation

China's advantages in innovation can be attributed to its government policies and financial support, huge market demands, population advantage and talent resources, technical progress, and international exchange and cooperation. These factors have enabled China to develop a strong national system for innovation and to leverage its domestic and international markets to create new opportunities for collaboration and growth. As a result, China is well-positioned to become a leading player in the global innovation landscape.

3.1.1 Government policies and financial support

Because of China's certain institutional advantages, it can take advantage of the planning advantages of centralized resources and forces in a planned economy, and it is relatively more efficient to develop science and technology innovation with a national system.

For example: China's high-speed train technology. Over the last 15 years, China's high-speed rail network has expanded rapidly thanks to generous government funding. It now boasts more than 37,900 km of high-speed rail lines, the longest in the world, with cutting-edge technology such as autonomous train operation and advanced signaling and control systems. Despite the enormous challenges posed by China's varied terrain and climate, the country's railway engineers have successfully overcome them. The high-speed rail network is a source of pride for China's ruling Communist Party, demonstrating the country's economic might, technological prowess, and improved living standards. (Chang, Yuan ; Lei, Shuhua ; Teng, Jianjian ; Zhang, Jiangxue ; Zhang, Lixiao ; Xu, Xiao., 2019) This shows that China has made significant progress in developing its high-speed rail network over the past 15 years, thanks to substantial government funding and the ability to overcome numerous challenges. The success of its high-speed rail network is a testament to China's economic strength, technological prowess and rising living standards.

3.1.2 Huge market demands

China's huge domestic market and its active exploration of overseas markets through initiatives such as the Belt and Road Strategy and the Going Global Strategy provide significant opportunities for institutional innovation. The large customer base and testing ground for new products and services allow companies to rapidly scale up and refine their offerings based on feedback from a large and diverse population. Additionally, the size of the market provides opportunities for economies of scale, making it easier for companies to invest in research and development and bring new products and services to market.

Large domestic market: China's institutional innovation is driven by its huge domestic market, allowing companies to scale up and refine their offerings based on feedback from a diverse population, and take advantage of economies of scale.

Exploring overseas markets: China is exploring overseas markets through initiatives such as Belt and Road and Going Global, promoting international cooperation and economic development through trade and investment, and engaging in global economic forums.

3.1.3 Population advantage, talent resources

"The Strategy of Promoting the Country through Science and Education" is a policy that emphasizes the importance of science, technology, education, and productivity growth for economic and social development in China. "The Strategy on Developing a Quality Workforce" aims to build China into a major center for talent and innovation by developing a high-caliber talent team and improving its strategic sci-tech strength.

The implementation of these strategies will open up new fields for development and shape new momentum and advantages. Education, science and technology, and talent are the basic and strategic support for building a modern socialist country. The report calls for prioritizing education, self-reliance in science and technology, and talent-led development to accelerate the building of a strong nation in education, science and technology, and talent.

3.1.4 Technical progress

US economic and technological sanctions against Chinese companies, such as Huawei and ByteDance, have created a challenging environment for these companies, but it has also spurred them to develop their own core technologies and become less dependent on the US. This has led to a growing trend of Chinese companies investing in research and development to strengthen their independent innovation capabilities and to expand their global market share.

Furthermore, China has taken a proactive approach to responding to these sanctions by enacting

policies to support domestic innovation, such as the "Made in China 2025" initiative and "Internet Plus" strategy, which aim to foster the development of strategic emerging industries and integrate traditional industries with the internet and other new technologies.

Despite the challenges presented by US sanctions, Chinese companies have continued to grow and innovate, with Huawei becoming a leading player in the global 5G market and ByteDance dominating the short-video market with its popular app, TikTok. These companies' success highlights China's increasing ability to compete with the US and other developed countries in the tech industry, and its commitment to investing in research and development to drive innovation and growth.

3.1.5 International exchange and cooperation

Some countries have strengthened their economic and trade cooperation with other sanctioned countries, bypassing traditional US-dominated markets. Additionally, countries like China, the EU, and Japan are investing in the big data industry to gain a competitive advantage. US economic sanctions have created both challenges and opportunities, driving other countries to explore new partnerships and strategic industries for growth and competitiveness.

National cooperation against economic sanctions provides a political basis for enterprise cooperation, and enterprise cooperation against economic sanctions provides a constant economic impetus for national cooperation, jointly providing valuable political experience and economic accumulation for the further deepening of international cooperation against economic sanctions.

3.2 Weaknesses of China's innovation

In spite of China's many strengths in innovation, including government policies, a huge market, talent resources, technical progress, and international cooperation, the country also faces several weaknesses. These include imperfect intellectual property protection, an immature culture of innovation, an improper funding structure, an imperfect regulatory environment, and the impact of the political game. Addressing these weaknesses will be crucial for China to continue to build a sustainable and thriving innovation ecosystem, and to overcome the challenges posed by its rapidly changing economic and technological landscape.

3.2.1 Imperfect intellectual property protection

China's intellectual property protection system is not yet perfect. Some innovative achievements are prone to infringement and plagiarism, and there is a lack of effective legal protection. In addition, some companies and individuals may not pay enough attention to IPR protection, or may not have the appropriate technology and experience to protect their innovations. Some Chinese companies have been accused of plagiarism and infringement in the past, such as the patent dispute between Huawei and Qualcomm of the United States.

3.2.2 The culture of innovation is not mature

In traditional Chinese culture, people generally pay more attention to efficiency and stability than to innovation and creation. In addition, China's education system also has certain problems. Some schools and teachers still follow the traditional teaching mode and lack methods to inspire students' innovative thinking and practical ability. This may lead to the lack of innovation awareness and innovation ability of students.

3.2.3 Improper funding structure

In China, some large enterprises may rely on government subsidies and financial support to

innovate. These enterprises may lack real competitive pressure in the market, which may lead to their lack of innovation motivation and innovation ability. In addition, China's venture capital market is relatively immature, which can lead to a lack of funding for some innovative projects. Some large Chinese enterprises rely on government subsidies and financial support to innovate, such as China's state-owned enterprises, which may result in their lack of real market competitive pressure and innovation motivation.

3.2.4 Imperfect regulatory environment

China's regulatory environment is relatively imperfect, with some industries and sectors suffering from lack of or weak regulation. This may lead to non-compliance or unethical behaviors of some enterprises or individuals, such as infringement of intellectual property rights, false publicity, etc., which has a negative impact on innovation. There have been some cases of lack of supervision in China, such as the 2018 "long life biological vaccine incident", which led to non-compliance or unethical behaviors by some enterprises or individuals, such as false publicity and production of fake and shoddy products.

3.2.5 The impact of the political game

In recent years, the political game between China and the US has intensified, which may lead to some innovative enterprises and individuals facing political pressure and uncertainty. For example, US restrictions on technology exports to China and sanctions on Chinese companies may affect their R&D and innovation capabilities. US restrictions on technology export to China and sanctions on Chinese enterprises may affect the R&D and innovation capabilities of Chinese enterprises, such as the restrictions and repression of Huawei.

3.3. Strategies to address the challenges of China's innovative development

To sustain its growth trajectory, China needs to address productivity challenges and promote innovation in its economy. A report jointly released by the Development Research Center of the State Council, China's Ministry of Finance, and the World Bank Group proposes that China focus on promoting new drivers of growth, such as removing resource allocation distortions and accelerating the diffusion of advanced technologies. By doing so, China can expand its productivity frontier, discover new technologies, products, and processes, and overcome the challenges it faces in its innovative development, ultimately emerging as a more productive and innovative economy.

China has become a hotbed for start-ups, with a large number of them reaching a $1 billion valuation in record time. The country has also made remarkable strides in several fields, such as drone and robotic technology for COVID-19 response, developing plasma drives for green aircraft, and setting a timeline for the completion of a permanent space station in 2022. In addition, China has landed the Chang'e-4 probe on the dark side of the moon, launched the ChengDu artificial moon, initiated the Hongyun Project to provide rural broadband through satellite launches, produced 9,500 new electric buses every five weeks, and developed a super solar expressway that charges electric vehicles while they are on the move.

4. Conclusion

This paper provides an overview of China's innovative development in the field of big data. It begins by introducing the concept of big data and China's national strategy for its development. The current status of big data development in China is then discussed, with examples of specific cases provided. Then shows the opportunities and challenges that come with big data development, and

how China can address these challenges. The opportunities discussed include policy support, market demand, human resources, technological progress, and advanced experiences from developed countries. On the other hand, the challenges discussed include data nationalism, ethics, political regulation, monopolization by big companies, incomplete legal frameworks, and intervention by capital. After that, examines China's innovation development, its advantages, and disadvantages. The advantages discussed include a large market, government policies, financial support, talent resources, and technological progress. The disadvantages discussed include intellectual property, innovation culture, funding structure, regulatory environment, and political competition with the United States. Finally, the paper provides strategies to address the challenges of China's innovative development. In summary, this paper provides insight into the current state of big data and innovation development in China, highlighting opportunities and challenges and proposing strategies to address them.

References

[1] Appelbaum R P, Gebbie M A, Han X,et al. Will China's quest for indigenous innovation succeed? Some lessons from nanotechnology [J]. Technology in Society, 2016, 46(aug.):149-163.

[2] Chang Y, Lei S, Teng J, et al. The energy use and environmental emissions of high-speed rail transportation in China: A bottom-up modeling [J]. Energy, 2019, 182(SEP.1):1193-1201.

[3] Cheng Baihua, Long Kun, Qin Zhongnan. Strategies of the US government to ban TikTok [J]. Intelligence Journal, 2022, 41 (08): 24-30 + 52.

[4] Chen Ying. TikTok The phenomenon of information cocoon room in use: siege crisis and individual autonomy [J]. News communication, 2022 (12): 19-21.

[5] Gao X, Yu J, Li M. Developing effective strategies to address complex challenges: evidence from local high-tech firms in China[J]. International Journal of Technology Management, 2010, 51(2/3/4):319-341.

[6] Deng Ziyun, Chen Lei, He Tingqin, Meng Tao. Developed countries implement the modernization of government governance with big data [J]. Economic system reform, 2017 (05): 168-174.

[7] Gunkel D. J. Second thoughts: toward a critique of digital divide [J]. New Media Society, 2023, 5(4):499–522.

[8] Jiang Yong, Zevenbergen Chris, Ma Yongchi. Urban pluvial flooding and stormwater management: A contemporary review of China's challenges and "sponge cities" strategy [J]. Environmental Science & Policy, 2018, 80:132-143.

[9] Li J. Analysis of the 'information cocoon' problem in the era of big data [J]. Cultural Industries, 2020, (16):24-25.

[10] Li Ling. China's manufacturing locus in 2025: With a comparison of "Made-in-China 2025" and "Industry 4.0" [J]. Technological forecasting & social change, 2018, (135):66-74.

[11] Liu Xiaoying. Research on personal Information Protection in the Era of Big Data [J]. Journal of Tianjin Sino-German University of Applied Technology, 2020 (5): 119-122.

[12] Ren Fujun, Yin Lin, Raza Gauhar. Science Popularisation among the Youth [M]. Science Communication Practice in China, 2021.

[13] Nana Wang. Research on personal privacy protection in the era of large data from the perspective of communication science [J]. News Outpost, 2022 (20):75-76.

[14] Xiong B. Personal Privacy Protection in the Context of Big Data Era Analysis of the dilemma faced and the solution strategy," [M]. Ideas Library, 2020.

[15] Ye Beizhan. The realistic promotion of government data governance and its collaborative logic —— Take N city as an example [J]. China Administration, 2021 (6): 44-49.