

China Internet Development Report 2018

Chinese Academy of Cyberspace Studies

China Internet Development Report 2018

Blue Book of World Internet Conference

Chinese Academy of Cyberspace Studies
Beijing, China

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ISBN 978-981-15-4042-4 ISBN 978-981-15-4043-1 (eBook)
<https://doi.org/10.1007/978-981-15-4043-1>

Jointly published with Publishing House of Electronics Industry
The print edition is not for sale in China (Mainland). Customers from China (Mainland) please order the print book from: Publishing House of Electronics Industry.

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The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

Foreword

Today, information technology is changing day by day, represented by digitalization, networking, and intelligence, contributing to the development of economy and society, national governance systems and governance capacity, and the people's increasing demand for a better life. Thanks to this historic opportunity, China's Internet has entered the fast lane of development. Especially, the country has worked out a road of Internet development and governance with Chinese characteristics and has contributed to the world Internet development.

Against this backdrop, we have compiled *China Internet Development Report 2018* (referred to as "the *Report*" hereinafter), in which the compiler tries to study and analyze in detail China's Internet development by summarizing what the country has done, analyzing the status quo, and looking into the future, so that the *Report* will be the best choice for people to know about the past, present, and future of China's Internet. To this end, the compiler tries to:

1. We take General Secretary Xi Jinping's Strategic Thoughts on Cyber Power as the Theoretical Basis and Guideline for the Compilation

Since the 18th National Congress of the Communist Party of China (CPC), General Secretary Xi Jinping, a visionary man, has put forward a series of new ideas, thoughts, and strategies based on China's Internet development and governance, systematically illustrating the important theoretical and practical issues concerning cybersecurity and informatization and thus forming rich, profound, scientific, and systematic strategic thoughts on cyber power. All these ideas, thoughts, and strategies are an important part of Xi's Thought on Socialism with Chinese Characteristics for a New Era. In particular, in the speech he made at the National Cybersecurity and Information Technology Conference, based on the general situation of the CPC and the country, he scientifically analyzed the trend and mission

of information reform, systematically illustrated his thoughts on cyber power, and answered a series of theoretical and practical questions about cyber affairs. It is the guideline for making China into a cyber power. We take Xi Jinping's strategic thoughts on cyber power as the spirit and main thread running through the *Report* to interpret Xi's ideas, philosophy, and thoughts so that the readers can accurately grasp the significance of his thoughts.

2. We Take the Practice of China's Internet Development as the Research and Reality Basis

Guided by Xi Jinping's Thought on Socialism with Chinese Characteristics for a New Era, especially his strategic thoughts on cyber power, the country has achieved a lot in Internet development and governance. The cyberspace is becoming clearer day by day, the national cybersecurity defense is being consolidated, informatization's role in boosting the economic and social development is becoming prominent, China's power of discourse and influence in cyberspace keeps increasing and the Chinese people are having more sense of gain in sharing the benefits of Internet development. All these vivid achievements provide broad space and rich resources for the compilation of the *Report*. While illustrating the status quo of China's Internet development, and new practice and achievements in particular, the compiler tries to show China's experience in Internet governance.

3. We Take Comprehensiveness, Accuracy, and Objectivity as the Aim and Principle for the Compilation

In the process of compilation, we always follow the principle of making everything internationalized, authoritative, accurate, theoretical, and generalized, to show the Chinese academic circle's understanding of and thought on the Internet development. We try to make the Report comprehensive by doing an all-field and panoramic research on China's network infrastructure, information technology, digital economy, e-governance, network media, cybersecurity and Internet law construction, and international cyberspace governance; we try to make all the data accurate, authoritative, and up-to-date by collecting data from governmental agencies, industries, and research institutes; we try to make our assessment objective by setting up China's Internet Development Index on the basis of the mature index systems from both home and abroad, making assessment on cybersecurity and informatization in 31 provinces (autonomous region and municipalities directly under the Central Government) from 6 dimensions to comprehensively and accurately reflect the Internet development level throughout the country.

It is our sincere hope that the *Report* will provide a new drive for China's Internet development, and will be used as a new window for the world to know about China's Internet development, and a new reference for the world Internet development.

Beijing, China
October 2018

China Academy of Cyberspace

Contents

| | |
|---|----|
| 1 Accelerated Construction of Information Infrastructure | 1 |
| 1.1 Overview | 1 |
| 1.2 Broadband Network | 3 |
| 1.2.1 Fast Popularization of High-Speed Broadband | 3 |
| 1.2.2 Rapid Development of Mobile Broadband | 5 |
| 1.2.3 Start-up of Large-Scale IPv6 Commercial Use | 7 |
| 1.2.4 Continuously Optimized International Network Layout | 8 |
| 1.2.5 Breakthroughs Made in Air Base Station Technology | 10 |
| 1.2.6 Promotion of Universal Telecommunication Service | 10 |
| 1.3 Application Facilities | 13 |
| 1.3.1 Rise of Data Centers and Cloud Computing Platforms | 13 |
| 1.3.2 Development of CDN Industry in Competition | 15 |
| 1.3.3 Large-Scale Layout of Narrow-Band IoT Facilities | 17 |
| 1.3.4 China's Internet Resources Ranking Among the Top in the World | 18 |
| 2 Continuous Network Information Technology Development | 21 |
| 2.1 Overview | 21 |
| 2.2 Rapid Development of Basic Network Information Technology | 22 |
| 2.2.1 Steady Development of Advanced Computing Technology | 22 |
| 2.2.2 Progress in IC Technology | 23 |
| 2.2.3 Acceleration of Commercialized Application of Software Technologies | 26 |
| 2.3 Emerging Cutting-Edge IT Highlights | 27 |
| 2.3.1 Attractive AI Applications | 27 |
| 2.3.2 Innovative Applications of Emerging Blockchain Technology | 29 |
| 2.3.3 Quantum Information Technology Developing in Line with that of the World | 29 |

| | | |
|----------|---|-----------|
| 2.4 | Network Information Technology Bringing About Revolution in Traditional Areas | 33 |
| 2.4.1 | Industrial Internet Facilitating Intelligent Manufacturing . . . | 33 |
| 2.4.2 | Thriving Automatic Driving | 34 |
| 2.4.3 | Optimized Intelligent Logistic Resource Allocation | 35 |
| 3 | Digital Economy Promoting High-Quality Development | 37 |
| 3.1 | Overview | 37 |
| 3.2 | Steady Development of Information Technology | 37 |
| 3.2.1 | Sound Development of Electronic Information Manufacturing | 37 |
| 3.2.2 | Steady Growth of Software and IC Service Industry | 40 |
| 3.2.3 | Diversified Information Content Services | 41 |
| 3.2.4 | Steadily Growing Telecommunication | 43 |
| 3.3 | Continuous Manufacturing Transformation and Upgrading | 44 |
| 3.3.1 | Increasing Investment in High-Tech Manufacturing | 44 |
| 3.3.2 | Deepening Integration Between Informatization and Industrialization | 44 |
| 3.4 | Digital Technology Facilitating Rejuvenation of Rural Areas | 45 |
| 3.4.1 | Improving Information Service for Farmers, Agriculture and Rural Areas | 45 |
| 3.4.2 | Digital Technology Upgrading Agricultural Production Modes | 47 |
| 3.4.3 | Rapid Development of E-Commerce in Rural Areas | 47 |
| 3.5 | Digital Innovations in Service Industry | 48 |
| 3.5.1 | Life Service Digitalization Improving Life Quality | 48 |
| 3.5.2 | Digitalization of Production Service as the New Driving Force of Real Economy | 50 |
| 3.5.3 | Cross-Border E-Commerce Facilitating New Foreign Trade in the Digital Era | 51 |
| 3.6 | Financial Technology Facilitating New Industrial Reforms | 51 |
| 3.6.1 | Mobile Payment Being Done in All Scenario Consumption | 52 |
| 3.6.2 | Standardization of Online Crowdsourcing and P2P Loaning | 52 |
| 3.6.3 | Emerging Internet Financial Products | 52 |
| 4 | Steady Opening-Up of Governmental Data | 55 |
| 4.1 | Overview | 55 |
| 4.2 | History of Public Information Publicity | 56 |
| 4.2.1 | Government's Connection to the Internet | 56 |
| 4.2.2 | Governmental Information Publicity | 56 |
| 4.2.3 | Governmental Information Sharing | 57 |
| 4.2.4 | Public Information Publicity | 58 |

- 4.3 Remarkable Effect of Governmental Information Publicity 59
 - 4.3.1 Better and Better Governmental Information
Publicity Policies 59
 - 4.3.2 Remarkable Provincial Governmental Information
Publicity Achievement 60
 - 4.3.3 Good Prefecture-Level Governmental Information
Publicity 60
- 4.4 Governmental Information Sharing Being Improved 60
 - 4.4.1 Governmental Information Sharing Policies 60
 - 4.4.2 Great Achievements of Governmental Information
Sharing 61
 - 4.4.3 Information Integration to Be Improved 63
- 4.5 Strong Momentum of Public Information Publicity 64
 - 4.5.1 Public Information Publicity Route Being Clarified 64
 - 4.5.2 Rapid Public Information Publicity 65
 - 4.5.3 Initial Effect of Public Information Publicity 72
- 5 Cleaner Cyberspace 75**
 - 5.1 Overview 75
 - 5.2 Continuously Enhanced Network Content Construction 76
 - 5.2.1 Steadily Increasing Influence of Positive Publicity 76
 - 5.2.2 Capacity Building in Communication, Leading Power,
Influence and Credibility Being the Key Goal
of News Media 78
 - 5.2.3 Continuous Construction of Media Platforms 78
 - 5.2.4 Increasingly Thriving Internet Culture 81
 - 5.3 Continuously Improved Comprehensive Governance
of the Network 82
 - 5.3.1 Accelerating Legislation on Cyber Content 82
 - 5.3.2 Special Actions Launched 83
 - 5.3.3 Defining Businesses’ Accountability 83
 - 5.3.4 Network Social Organizations and Industrial
Self-discipline Organizations Playing Their Role 84
 - 5.3.5 Internet Users Being a Major Force for Cyberspace
Governance 85
 - 5.4 Thriving Network Media 86
 - 5.4.1 Steady Media Integration 86
 - 5.4.2 Steady Development of New Applications
and New Industrial Forms 87
- 6 Steady Improvement of Cybersecurity Safeguarding Capacity 89**
 - 6.1 Overview 89
 - 6.2 Increasingly Complicated Cybersecurity 90
 - 6.2.1 Serious Situation for Cybersecurity 90

- 6.2.2 More and More Security Problems Concerning Mobile Internet and IoT 90
- 6.2.3 APT Aimed at Key Organizations of the Country 91
- 6.2.4 Increasingly Difficult Defense Against DDoS 91
- 6.2.5 Endless Emergence of Cyber Frauds 92
- 6.2.6 Frequent Emergence of Malicious Attacks like Ransom Attacks and Mining 93
- 6.3 Upgrading of Cybersecurity Mechanism 93
 - 6.3.1 Steady Progress in Top Design of Cybersecurity Administration 93
 - 6.3.2 Improved Legislation on Cybersecurity 93
- 6.4 Steady Development of Cybersecurity Industry and Technology 95
 - 6.4.1 Development of Cybersecurity Industry 95
 - 6.4.2 Development of Cybersecurity Technologies 97
- 6.5 Cybersecurity Prevention, Protection, and Guarantee 98
 - 6.5.1 Critical Information Infrastructure Security Protection 98
 - 6.5.2 Classified Protection of Cybersecurity 99
 - 6.5.3 Security Protection of Industrial Internet 99
- 6.6 Cybersecurity Talents Production and Promotion 99
 - 6.6.1 Accelerating Cybersecurity Talent Production 100
 - 6.6.2 Cybersecurity Promotion and Awareness Cultivation 100
- 7 Improved Construction of Rule by Law for the Internet 103**
 - 7.1 Overview 103
 - 7.2 Steady Progress in Internet Legislation 103
 - 7.2.1 Network Information Service 104
 - 7.2.2 Cybersecurity Protection 105
 - 7.2.3 Legislation in Economy and Society 106
 - 7.3 Improved Internet Law Enforcement 107
 - 7.3.1 Clearance of Illegal Information on the Internet and Regulation of Online Communication Order 108
 - 7.3.2 Continuous Cybersecurity Examination and Implementation of *Cybersecurity Law* 109
 - 7.3.3 Sharpening of Law Enforcement and Promotion of Orderly Operation of the Internet 110
 - 7.4 Judiciary Innovation for the Internet 111
 - 7.4.1 Innovation of Case Trials and Improvement of the Judicial Trial Mechanism 111
 - 7.4.2 Reinforcement of Information Construction of Courts and Provision of Case Trial Convenience 112
 - 7.4.3 Regulation of Cyberspace Order and Construction of the Pluralistic Dispute Settlement Mechanism 112
 - 7.4.4 Summarization of Lawsuit Judgement Rules for Improvement of Cyberspace Governance Capacity 113

- 8 Active Participation in International Cyberspace Governance 115**
- 8.1 Overview 115
- 8.2 China’s Proposals on International Cyberspace Governance 116
 - 8.2.1 China’s Position in International Governance in
Cyberspace as an Important Manifestation of the Concept
of Extensive Consultation, Joint Construction, and Shared
Benefits in Global Governance 116
 - 8.2.2 Respect for Cyber Sovereignty as the Solid Foundation
for International Cooperation 117
 - 8.2.3 Building of a Community of Shared Future in
Cyberspace: An Irresistible Trend 117
 - 8.2.4 Open Cooperation to Promote Transformation
of the Global Internet Governance System 118
- 8.3 Diversified and Multilevel International Cooperation in
Cyberspace. 119
 - 8.3.1 Bilateral Exchanges and Dialogues 119
 - 8.3.2 Serving the Belt and Road Initiative 120
 - 8.3.3 Regional Multilateral Cooperation. 122
 - 8.3.4 Cooperation Encouraged Among Think Tanks,
Businesses, and Other Nongovernmental Partnership 123
- Afterword 125**

Overview

Today, information technology (IT) represented by the Internet is developing day by day. Digitalization, network transformation, and intelligent development are playing an increasingly important role in boosting economic and social development and modernization of the national governance system and capability, and in meeting the people's ever-growing needs for a better life. Facing the historic opportunities brought about by IT development, the Communist Party of China (CPC) and the Chinese Government both attach importance to Internet development, application, and governance, coordinating major issues of cybersecurity and informatization in politics, economy, culture, society, and military affairs. They have made important decisions and launched important measures to promote cyberspace administration, which has witnessed historic achievements.

The year 2018 is the opening year of comprehensively carrying out the spirit of the 19th National Congress of CPC, the 40th anniversary of the country's adoption of the reform and opening-up policy, and the decisive and transitional year of building a moderately prosperous society in all respects and of implementing the 13th Five-Year Plan. It is also an important year for China's cyberspace administration to enter a new era, in which it will meet new challenges and see new progress. In March 2018, the Central Leading Group for Cyber Affairs was renamed the Central Committee for Cyber Affairs in accordance with *Decision on Deepening Reform of Party and State Institutions*. It is in charge of cyber affairs, including top design, overall layout, coordination, supervision, and implementation of policies. Thus, the responsibilities of the Office of Cyber Security has been optimized. From April 20th to 21st, the National Cyber Affairs Conference was held in Beijing. General Secretary Xi Jinping delivered an important speech, in which, he, by starting from the overall situation of the CPC and the country, analyzed the trend and mission of the IT revolution, systematically illustrated the important thoughts on cyber power and answered a series of major theoretical and practical questions. His speech provides guidance and fundamental principles for building China's strength in cyberspace. Guided by Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era and especially his thoughts on cyber power, the Internet of China, in accordance with the strategic layout made at the 19th National

Congress of the Communist Party of China, is seeing rapid development. Great achievements have been made in cyber strength, digital development, and smart society, contributing to and providing a guarantee for the development of the CPC and the country.

I. General Secretary Xi Jinping's Thoughts on Cyber Power Provide Guidance and Blueprint for China's Cyber Administration Development

Since the 18th National Congress of the Communist Party of China (CPC), General Secretary Xi Jinping, a visionary man, has put forward a series of new ideas, thoughts, and strategies based on China's practice of Internet governance. All of them are systematic illustrations on important theoretical and practical issues concerning cybersecurity and informatization, covering cyber content building, cyber security, informatization, and international cyber governance, and guiding China's cyber administration in witnessing historic achievements and revolution. An Internet governance path with Chinese characteristics and Xi Jinping's thoughts on cyber power have been formed.

The important speech General Secretary Xi Jinping delivered at the National Cyber Affairs Conference gives systematic illustrations of his thoughts on cyber power. He made explicit the important position of cyber administration in the general layout of the CPC and national development and the strategic goal and tasks of and principles for building China's strength in cyberspace, and put forward proposals on international Internet governance, along with basic methods for cyber administration. The thoughts conform to the trend of the world Internet development, revealing historic opportunities and challenges brought about by the information revolution to China's economic and social development. A series of fundamental and strategic questions are answered concerning the direction and overall situation of the country's cyber development. Therefore, they are the guidelines for building China's strength in cyberspace.

According to Xi Jinping, we should construct a concentric circle of online and offline communities and reach a better consensus to consolidate the ideological foundation for forging ahead in unity. Cyberspace is the common home of humankind and the new space for people's learning, working, and life and a new platform for obtaining public services. Making it better, cleaner, and safer accords with the interests of the people. To enhance Internet governance and content building requires the improvement of comprehensive cyber governance capability, and the CPC committees' leadership, governmental administration, businesses' accountability, social supervision, and Internet users' self-disciplining, as well as the combination of economic, legal, and technical means. We must enhance positive publicity, adhering to the right directions of politics, public opinions, and values, and uniting all the Internet users with Xi Jinping Thought on Socialism with

Chinese Characteristics for a New Era and the spirit of the 19th National Congress of the Communist Party of China. We should carry out education on ideals and convictions, deepen the publicity of Socialism with Chinese Characteristics for a New Era and the China Dream and cultivate and practise the core socialist values. We should administrate, open, and visit the websites in accordance with laws, enhance the accountability of Internet businesses and self-disciplining of the Internet industry, give full play to Internet users' initiative, and mobilize all sectors to participate in Internet governance.

Xi points out that without cybersecurity there would be no national security, stable economy, and society, or people's guaranteed interests. There are an increasing number of threats to and risks in cyber security, which are penetrating into politics, economy, culture, society, ecosystem, and national defense. Anything slight in cybersecurity may affect the whole situation, since it is a significant issue concerning national security and development as well as the people's interest. To safeguard cybersecurity requires the right outlook on it and the realization of the fact that it is something as a whole rather than separate, something dynamic rather than static, something open rather than closed, something relative rather than absolute, and something shared rather than isolated. We must improve our capacity in cybersecurity protection as soon as possible, and strengthen information infrastructure security protection, and construction of the mechanism, means, and platforms for cybersecurity information coordination. We must build the capacity in guiding cybersecurity emergency response, develop cybersecurity industries, and prevent any hazards in advance. Insisting that the cybersecurity should serve and rely on the people, we will implement the accountability mechanism, combat cyber-attack, online fraud, and infringement on citizens' privacy, and carry out popularization of cybersecurity knowledge and skills.

According to Xi Jinping, core technologies are the pillar of a nation. Therefore, we must make up our mind, keep our perseverance, and find the focus to speed up breakthroughs in core technologies of information. Network information technology is an area of technical innovation with the highest input in R&D, the most active innovation, the most extensive application, and the most remarkable radiating significance. It is the height of competition in global technical innovation. So we must realize that China has to catch up with leading countries in core technology breakthroughs. As the "life-gate" for a country's development, core Internet technologies being controlled by others will be a hazard for us. To speed up breakthroughs in them is the fundamental solution to cybersecurity and the requirement of cyber administration development. We should construct the industrial system involving technology, industry, and policy-making while improving the institution and market favorable to innovation and entrepreneurship and reinforcing intellectual property protection and vitalizing innovation. We should provide green channels for the combination of basic research and technical innovation, trying to promote team breakthroughs of applied technologies through basic research.

According to General Secretary Xi Jinping, the cyber and information technology sector represents the new productivity and new development direction, so it is expected to take one step ahead in practising the new development philosophy.

With the accelerated penetration of technical innovation into all areas of economy and society, informatization is producing fundamental and comprehensive influence on the operation of economy and society as well as on production and lifestyles, becoming a driving force for economic transformation and upgrading and high-quality development. To practise the new philosophy of development requires the cultivation of new driving forces through informatization and promotion of new development through new driving forces. We should strengthen network infrastructure construction and in-depth information resource integration, and open up the “main artery” of information for economic and social development. We should develop digital economy, accelerate digital industrialization, drive innovation through IT, and produce new business forms and new modes. We should promote industrial digitalization, transform traditional industries from all dimensions, all angles, and all chains, and speed up digitalization, networking, and intelligent development of manufacturing, agriculture, and service industries, so that we can improve the total factor productivity and data can play an amplifying, superimposing, and multiplying role in the economic development.

Xi points out that to promote the global Internet governance is the general trend conforming to the people’s will. In the information era, the Internet is making the international community into a community of shared future and giving rise to new challenges to national sovereignty, security, and development interests. How to govern the Internet and make good use of it is a common problem faced with the international community. Xi has proposed “four principles” for promoting the global Internet governance system reform and “five proposals” for constructing a community of shared future in cyberspace, both having won more and more international recognitions. Internet cyber governance should involve all sides and all parties, including governments, international organizations, Internet businesses, technical communities, civil organizations, and individual citizens. We should take the security of all countries into consideration, expand cooperation, and innovate the ways of cooperation to jointly promote development, protect security, and participate in governance and share achievements. In particular, we should take the construction of the Belt and Road as a good opportunity to strengthen developing countries’ cooperation in network infrastructure construction, digital economy, and cyber security, so that we can build the Digital Silk Road of the 21st century.

General Secretary Xi Jinping points out that the Internet development must be oriented to benefit the people, started from and aimed for the people’s well-being, so that they will have more sense of gain, happiness, and safety in enjoying the benefits of Internet development. Since its access to the Internet, China has been taking the benefit of its population of 1.3 billion as the most important and trying to enable all the people to enjoy the Internet development achievements. Thanks to the people’s participation and support, the Internet of the country has witnessed permanent healthy development and prosperity; owing to their increasing expectation and demand, the Internet of China has got its direction and goal of development. To make the Internet better serve the people, we should speed up the popularization of informatized services and reduce the use cost, so that all can afford to use the Internet and then have the chance to use it and use it well. We should adopt the

mass line in developing the Internet, trying to have government and CPC affairs open through informatization, speed up e-government building, and construct full-process, one-stop online service platforms. We will promote “Internet + education”, “Internet + medical care”, and “Internet + culture” to make services accessible, beneficial, and convenient to all people, who thus can enjoy services with little effort through the Internet.

General Secretary Xi Jinping’s thoughts on cyber power are the scientific results of the CPC’s theoretical and practical innovation, and creative answers to a series of major questions concerning informatization through the full use of Marxist position and viewpoints. They form an important part of Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era. They are fundamental guidelines for cyberspace administration, of profound significance to building China’s strength in cyberspace and constructing digital China and smart society. We must keep carrying them out and enriching them.

II. Achievements and Advances of China’s Internet Development in 2018

In 2018, guided by Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era, and especially his thoughts on cyber power, the country, by seizing the historic opportunity of information development, has enhanced content building, safeguarded cyber security, and sped up IT R&D while promoting the economic and social development through informatization and participating in international Internet governance. New achievements and advances have been made.

1. China’s information infrastructure keeps being upgraded and has become the strategic foundation for economic and social transformation.

Thanks to the Broadband China Strategy, the Action of Facilitating Faster and More Affordable Internet Connection and the Pilot Project of General Telecommunication Service, China’s information network infrastructure has witnessed leapfrog development. Specifically, fiber broadband, 4G networks, cloud computing, and Content Delivery Networks (CDNs) keep being upgraded, 5G technology is witnessing accelerated R&D and industrial layout, IPv6 is to be deployed and commercially used in a large scale and network service quality has been improved, which lays a solid foundation for economic and social transformation. By June 2018, there were 378 million fixed broadband users, including 328 fiber broadband users, accounting for 87.5% of the total number of broadband users and ranking first in the world. Demonstration of Gbps broadband has been done in full swing, and China is welcoming its fiber era nationwide. The web download speed has been increased dramatically. By the end of the second quarter of 2018, the download speed of fixed broadband and 4G networks of the country had surpassed 20 Mbps, both with a year-on-year increase of over 50%. The country has caught up in the construction of

4G networks and even surpassed some countries in that aspect. There are over 3.4 million 4G base-stations, and 1.11 billion 4G users throughout the country, with the 4G penetration rate being among the world's top five. China is one of the leading countries in the R&D of 5G technology. It is constructing the world's biggest 5G testing ground. The broadband networking capacity and coverage have been improved in rural areas, with the coverage rate in administrative villages amounting to 97.4%, that of fiber broadband to 96%, and that of 4G networks to 95%. The quantity of critical Internet resources has seen steady growth, with the number of IPv4 addresses amounting to 338.82 million, and that of IPv6 to 23,555 (in terms of blocks)/32 (in terms of addresses), both ranking second in the world. The international exit broadband traffic is 8,826.302 Gbps, with a year-on-year growth of 10.68%.

2. China has seen progress in Internet information technology and made single-point breakthroughs in some areas.

Network information technology is witnessing its rapid development. By seizing the opportunity brought about by the new-round technical revolution and relying on self-dependent innovation of core technologies, China is speeding up the layout of cutting-edge and nonsymmetrical technologies, and through technical, industrial, and policy support, promoting progress in the R&D and application of high-performance computing, mobile communication, quantum communication, core chips, and operating system. In 2017, the country applied for 3.986 million patents in IT, including 48,900 PCT patents, ranking second in the world for the first time.¹ According to Global Innovation Index 2018 released by WIPO and other agencies, China's innovation capacity keeps improving and its innovation index ranks 17th, listed into the top 20 for the first time. By June 2018, it had created a national high-performance computing service environment made up of 17 high-performance computing centers, with its resource capability among the top of the world. In July 2018, Tianhe No. 3 E-class prototype was successfully developed, with its computing capability 200 times higher and its storage capacity 100 times higher than that of Tianhe No. 1. Internet businesses are key forces in IT R&D, accelerating the application of AI, cloud computing, and big data and the emergence of a large number of innovative intelligent service scenarios. For example, Baidu's PaddlePaddle (a deep learning platform), Apollo's automatic driving platform, Alibaba's ET City Brain, and Tencent's auxiliary medical diagnosis and treatment platform are all influential AI software platforms. They have been put into application in many scenarios, such as smart city, medical care and health, education and amusement, and housekeeping and elderly care. On the other hand, China still lags behind countries leading in IT, with weaknesses and shortcomings in some areas, so we have to accelerate deployment and promote development in such areas.

¹Source: *Information Technology Patents* (2018), China Industrial Control Systems Cyber Emergency Response Team (CICS-CERT).

3. China's digital economy is gathering momentum, contributing to the formation of the new development mode in which data and real economy are deeply integrated.

China adheres to cultivating the new drive through informatization and promoting new development through the new drive. New economy represented by digital economy is thriving, boosting economic and social development. In 2017, the digital economy scale of the country reached RMB 27.2 trillion *yuan*, accounting for 32.9% of the national GDP, with a year-on-year growth of 2.6%, and digital economy contributed 55% to the GDP. In the same year, e-commerce transaction volume amounted to RMB 29.16 trillion *yuan*, with a year-on-year growth of 11.7%; social e-commerce witnessed rapid development, with the number of social retail users amounting to 223 million, contributing to the expansion of e-commerce. There were 171 million employees in digital economy, accounting for 22.1% of the total number of employees that year. Therefore, digital economy is an important channel for employment. Digital industrialization has witnessed rapid development, technical application is commercialized at a high speed and new industries and new business forms keep emerging. In 2017, the scale of IoT market was over RMB one trillion *yuan*, with a compound annual growth rate of over 25%; the revenue of key IoT businesses that have gone public was RMB 483.38 billion *yuan*, with a year-on-year growth of 20.7%²; the AI market volume was RMB 23.7 billion *yuan*, with a year-on-year growth of 67%.³ Industrial digitalization keeps being deepened and the penetration rate of digital economy in industry, agriculture, and service is, respectively, 17.2, 6.5, and 32.6%. Intelligent manufacturing projects are being implemented. By the end of the first quarter of 2018, the popularization rate of digital R&D design tools in industrial businesses above the designated size was 67.4%, and the numerical control rate of critical process was 47.8%. Coordinative networked manufacturing, personalized customization, and service-oriented manufacturing are new highlights in traditional industries. China keeps optimizing the market environment and policies for Internet businesses, and a number of such businesses with innovation vitality and development potential have been cultivated, with their international competitiveness increased. By December 2017, there were 102 Chinese Internet businesses that had gone public at home or abroad, with a growth of 12% in comparison to that in 2016. There are 77 unicorn Internet businesses,⁴ and such businesses with the scale of over RMB one hundred million *yuan* keep emerging. They are brilliant stars promoting the development of digital economy.

²Source: *Annual Report on China's IoT Development 2017–2018*, China Economic Information Service.

³Source: *AI Development Report 2018*, Tsinghua University.

⁴Source: *The 41st China Statistical Report on Internet Development*, CNNIC.

4. China's cyber protection capacity keeps improving dramatically, and a solid cybersecurity shield has been set up.

China is accelerating the construction of its cybersecurity system, having improved its cybersecurity guarantee capacity and level and formed an overall cybersecurity defense line to tackle relevant threats in the new situation. Over the past year, the country has reinforced the protection of critical information infrastructure, carried out cybersecurity examinations of all critical information infrastructure, and checked the risks of cybersecurity concerning such infrastructure of key areas and industries to enhance the capability of cybersecurity protection. Technologies of cybersecurity keep being improved. A large quantity of such technologies based on big data, AI, and blockchain are becoming mature, witnessing extensive use in cybersecurity protection. Regulations supporting *Cybersecurity Law* are being formulated and cybersecurity censorship has been established. China is speeding up the standardization of cyber security, having issued *Information Technology—Personal Information Security Specification* and other important national standards. In September 2018, the Fifth National Cybersecurity Publicity Week was successfully held. Through a host of activities like cybersecurity Exposition and Internet Literacy, it has contributed to the improvement of the cybersecurity protection awareness and skills of the public. The scale of cybersecurity industry has increased. In 2017, it was RMB 43.92 billion *yuan*, with a year-on-year growth of 27.6%; the number of cybersecurity businesses was over 2,681.⁵ The international competitiveness of China's cybersecurity products and services has been enhanced.

5. China's cyberspace is becoming cleaner day by day and its cyber culture enjoys prosperity.

The cyberspace is the common home of China's Internet users. Positive energy publicity is the general requirement, and controllability is the absolute principle. The country is enhancing content building, launching projects such as Good Internet Users in China and Network Media Reporting the Grass Roots, as well as a large number of phenomenal news broadcasts and thematic publicity products, and spreading and introducing core socialist values. The capability of excellent cyber content supply keeps being enhanced, and communities of digital content consumers have been cultivated. By June 2018, the number of network video users was 609 million; that of network music listeners, 555 million and that of network literature readers, 406 million. Besides, the environment for digital content copyrights has been improved.⁶ Legislation on cyber governance is being sped up. In 2018, China launched *the E-commerce Law of the People's Republic of China* as the legal basis for Internet governance. People take an active part in comprehensive Internet governance, and <http://www.piyao.org.cn/>, a united rumor refuting platform, has been put into use, adopting the work pattern of linked discovery, tackling,

⁵Source: *White Paper of China's cybersecurity Industry Development 2018*, China Academy of Information and Communications Technology.

⁶Source: *The 42nd China Statistical Report on Internet Development*, CNNIC.

and rumor refuting. In the first half of 2018, 39.028 million complaints concerning cyber space were tackled, with a year-on-year growth of 117.1% in complaint handling. Harmful information can be detected and tackled timely, so the cyberspace is becoming cleaner day by day.

6. China's international communication and cooperation in cyberspace are being deepened, and it is continuously contributing Chinese experience and wisdom to the world Internet development.

China takes an active part in Internet governance, strengthens international communication and cooperation, and works for joint promotion, protection, participation, and result sharing. The country has successfully hosted five sessions of the World Internet Conference, which is an international platform for cooperation, leading to a series of influential cooperative achievements made by Chinese and other governments, social organizations, and businesses, including the signing of a number of cooperative agreements such as the *Belt and Road Initiative for International Digital Cooperation*. China is deepening its cooperation with the United States, Russia, and Europe, and expanding its cooperation with emerging markets and developing countries in cyberspace, to combat cybercrime, boost digital economy, and accelerate infrastructure construction. In September 2018, the Third China-ASEAN Information Harbor Forum was held. Informatization is the focus of the cooperation between China and ASEAN countries. Besides, cooperation has been promoted among countries along the Belt & Road, and China offers advanced experience and practical solutions in Internet development to more countries.

7. China's Internet development better meets the expectations and needs of the people, whose sense of gain has dramatically increased.

As has been mentioned, China's development is always oriented to benefit the people, started from, and aimed for their well-being, so that they will have more sense of gain, happiness, and safety in enjoying the benefits of Internet development. By June 2018, the number of China's Internet users had reached 802 million and that of websites, 544 million, and the Internet popularization rate, 57.7%. Information service is becoming faster and more convenient, in better quality and lower price. The average expenditure on fixed band and mobile traffic has decreased by 90% in comparison with that in 2014, and that on dedicated Internet access has decreased by 30%. Long-distance charge and roaming charge for mobile calls have been abolished. Traffic of mobile Internet access has seen explosive growth. It witnessed an accumulated growth of 26.6 billion GB in the first 6 months of 2018, with a year-on-year growth of 199.6%.⁷ "Mobile life" is people's first choice. Poverty alleviation through Internet serves as a new way of targeted poverty alleviation and elimination. E-commerce is penetrating into impoverished counties through its comprehensive demonstration in rural areas. 499 national-level

⁷Source: *The 42nd China Statistical Report on Internet Development*, CNNIC.

impoverished counties have been channeled into the support, accounting for 60% of all impoverished counties. Thus, the income of 2.74 million people from registered impoverished households has increased. Informatization has been adopted to improve the government's service efficiency. The number of online governmental service users had reached 470 million by June 2018. The rate of using online governmental service was 42.1% through Alipay and the WeChat City Service Platform, which are the most frequently used online government service platforms. People can enjoy services with little effort through the Internet, which is a vivid embodiment of China's governmental service in the new era.

III. Remarkable Achievements of Innovative Internet Development in all Provinces, Autonomous Regions, and Municipalities Directly Under the Central Government

In *China Internet Development Report 2017* released last year, China's Internet Development Index was set up and published for the first time, covering infrastructure construction, innovation capacity, development of digital economy, Internet application, cyber security, and cyberspace administration, which were used to assess and rank the effect and level of Internet development in all provinces, autonomous regions, and municipalities directly under the Central Government ("municipalities" for short hereinafter). It is a reference for all regions to seize the development opportunities and catch up in some fields. This year, we have improved the Internet Development Index and followed up the latest effects and progress in Internet development of the province, municipalities, and autonomous regions, to assess and reflect their Internet development more comprehensively, objectively, and scientifically.

1. China's Internet Development Index has been optimized and improved.

To make a better assessment on the Internet development throughout the country, we have optimized and improved China's Internet Development Index (see Table 1). We have adjusted and improved the index system, optimized the algorithm model, and enhanced data collection, so that the assessment is more authoritative, scientific, and accurate.

Table 1 China's Internet Development Index

| Indicator | Key assessment factors | Weight | Specification |
|--------------------------------|---|--------|--|
| Infrastructure construction | Number of broadband access ports and percentage of optical fiber users, number of 4G mobile base stations and percentage of 4G users, and number of IDC centers | 10% | Local infrastructure construction level and Internet coverage of broadband, mobile and wireless networks, and cloud computing |
| Innovation capacity | Number of patents registered, index of human resources in information society, and investment in R&D | 20% | Level, capacity, and environment of local industrial innovation and local talents cultivation |
| Development of digital economy | ICT industry, income of telecommunication, e-commerce, and development of Internet businesses | 20% | Development of local ICT industry, e-commerce, and development of Internet businesses |
| Internet application | Rate of Internet coverage, scale of e-commerce, online full-process government service rate, and online full-process public service rate | 25% | Local individuals' use and corporations' use of the Internet, e-government, and public service application |
| Cyber security | Malicious computer program, number of controls against web vulnerabilities, number of cybersecurity businesses, and talents of cyber security | 13% | Local security of Internet and websites, as well as cybersecurity industry and talent production |
| Cyber administration | Number of governmental <i>Weibo</i> accounts, number of government <i>toutiao</i> accounts, and number of local regulations, policies, and action plans | 12% | Construction of local cyber administration organizations, platforms, institutions, and personnel as well as their capabilities |

Assessment items are refined and increased in number. China's Internet Development Index 2017 contained 6 primary indicators, and 16 secondary and 33 tertiary ones. This year, considering that all the regions have put more stress on cyber content building, informatization, and cybersecurity protection, we keep the primary indicators unchanged, but adjust the secondary and tertiary ones and add and refine the assessment items in accordance with the follow-up and collection of data. China's Internet Development Index 2018 is made up of 6 primary indicators and 24 secondary and 51 tertiary ones, covering infrastructure construction, innovation capacity, development of digital economy, Internet application, cyber security, and cyberspace administration. Indicators, aggregate and per capital, qualitative and quantitative, positive and negative, are combined to reflect the Internet development of different regions more comprehensively, objectively, and scientifically.

Weight of the indicators has been adjusted and optimized. For the year 2018, we have adjusted the weight of the primary indicators in China's Internet Development Index. First, the weight of infrastructure construction is reduced to 10%. Network infrastructure is the foundation of Internet development of all provinces, municipalities, and autonomous regions. Thanks to years of construction and development, the fixed and mobile infrastructure of all regions is nearly perfect through constant improvement. Therefore, the weight of this indicator is reduced. Secondly, the weight of innovation capacity has been increased to 20%. Innovation capacity is the inexhaustible driving force for Internet development and the guarantee for permanent competitiveness. To better reflect the input of different regions into technical innovation and talent production, and to encourage and guide all the regions to attach importance to the Internet innovation capacity building, we have increased its weight. Thirdly, we have increased the weight of digital economy, cyber security, and cyber administration. More secondary indicators have been put in the three dimensions in accordance with the Internet development of different regions, including cybersecurity business development, cybersecurity industry, rule of law on the Internet, and cyber administration organization architecture.

Data collection has been expanded and enhanced. This year, we have been following up the Internet development of all regions, sorting the latest progress and representative cases concerned, updating data of all indicators in time, and referring to the statistics of the Internet released by governmental agencies, research institutions, and businesses to ensure that all data are authentic, complete, accurate, and traceable.

2. The Index comprehensively and objectively reflects the general situation of the Internet development of different regions.

According to the latest indicator system and calculation method, we have got the scores of the Internet Development Index of 31 provinces, autonomous regions, and municipalities of China (see Table 2). From the table below, we find that the Internet is mostly developed in economically developed regions like Beijing, Guangdong, Shanghai, and Zhejiang while it is gathering momentum in the middle and western regions.

Guided by General Secretary Xi Jinping's thoughts on cyber power, all provinces, municipalities, and autonomous regions are, in accordance with the unified arrangement by the CPC Central Committee, have achieved great success by enhancing cyber content building, cybersecurity guarantee, and informatization through a series of new creations and practices based on their local reality.

In terms of infrastructure, thanks to the local governments' increase of the fund and policy support, information infrastructure has been reinforced, and the number of Internet users has increased, and the gap between urban and rural areas in information infrastructure is narrowing. In general, the information infrastructure of

Table 2 Top 10 provinces, autonomous regions, and municipalities in the assessment of the internet development

| Ranking | Region | Infrastructure construction | Innovation capacity | Development of digital economy | Internet application | Cyber security | Cyberspace administration | Total score |
|---------|-----------|-----------------------------|---------------------|--------------------------------|----------------------|----------------|---------------------------|-------------|
| 1 | Guangdong | 7.63 | 13.30 | 13.31 | 22.06 | 1.06 | 4.67 | 62.03 |
| 2 | Beijing | 7.59 | 13.92 | 12.43 | 17.32 | 2.17 | 3.00 | 56.43 |
| 3 | Shanghai | 6.79 | 8.95 | 10.42 | 22.11 | 1.90 | 2.55 | 52.72 |
| 4 | Zhejiang | 6.38 | 10.06 | 8.80 | 21.60 | 0.79 | 5.01 | 52.64 |
| 5 | Jiangsu | 6.55 | 12.52 | 9.82 | 15.97 | 1.67 | 4.06 | 50.59 |
| 6 | Shandong | 6.16 | 8.64 | 5.47 | 16.05 | 0.39 | 7.19 | 43.90 |
| 7 | Shaanxi | 5.41 | 6.17 | 7.73 | 14.74 | 1.40 | 3.94 | 39.39 |
| 8 | Sichuan | 5.82 | 5.70 | 5.24 | 13.54 | 1.55 | 5.41 | 37.26 |
| 9 | Fujian | 5.41 | 5.37 | 5.52 | 15.39 | 1.27 | 3.75 | 36.71 |
| 10 | Hubei | 5.40 | 6.37 | 4.90 | 14.46 | 1.16 | 3.42 | 35.71 |

economically developed regions like Beijing, Guangdong, and Zhejiang is more developed and regions like Shanxi, Ningxia, and Sichuan are catching up fast in fiber broadband. Chongqing and Hubei are promoting 5G R&D and technical innovation, trying to deploy 5G testing networks. Beijing, Guangdong, and Shanghai are taking the lead in cloud computing infrastructure, laying a foundation for the Internet development of these regions.

In terms of innovation capacity, all regions have begun to take innovation of network information technology as the grip for local innovative development and have been increasing fund and policy support for technical innovation, which has witnessed remarkable results. For example, Beijing and Shanghai, with more talents, take the lead in developing big data and AI, while Shaanxi and Hubei support the R&D of cutting-edge technologies in digital economy by boosting major special projects of science and technology.

In terms of development of digital economy, all regions take e-commerce and the industrial Internet as their development focus, so e-commerce is increasing. Guangdong takes the lead in digital economy by boosting industrial e-commerce and industrial Internet while Zhejiang is facilitating digitalized transformation of traditional industries and rank among the national top in integrated industrial innovation.

In terms of Internet application, new Internet technologies have seen increase in individual, business, governmental, and public service applications, all tending to be diversified, efficient, and convenient. Guangdong, Zhejiang, and Chongqing, by starting with the construction of “digital government”, are boosting the governmental information integration while Sichuan, Hubei, and Tianjin are taking the lead in public service application.

In terms of cyber security, cybersecurity awareness and guarantee strength have obviously increased in different regions. Zhejiang and Sichuan have seen the rapid development of the cybersecurity industry through an increase of governmental support, with the scale of their cybersecurity industry and number of relevant businesses taking the lead in China. Anhui and Beijing are among the top regions in cultivation of talents in that field, with great potential in development.

In terms of cyberspace administration, all local governments are, in accordance with the unified requirement of the Central Government, promoting the establishment of provincial and prefectural cyber space administration organizations while formulating laws, policies, and regulations as guidance, and fulfilling local accountability. Zhejiang has launched the initiative of “credit cyber administration” to establish the cyber credit administration mechanism, enrich the cyber governance methods, and improve their effect. Fujian, Tibet, and Qinghai have launched a series of laws and regulations in accordance with the local need to develop the Internet.

IV. Trend of China's Internet Development and Suggestions on Relevant Policies

China is in an era of securing a decisive victory in building a moderately prosperous society in all respects, and the Chinese nation is at a critical juncture in its drive toward rejuvenation. By seizing the historic opportunity brought about by informatization, the country will, by upholding Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era, especially his thoughts on cyber power, keep its foothold in the new historic moment and fulfill its mission in cyber administration. It will speed up the construction for building the country's strength in cyberspace and promote new breakthroughs and leaps in Internet construction, application, and governance.

1. Information infrastructure is playing an increasingly supporting and enabling role in economic and social development, so we should enhance the proactive layout and overall upgrading oriented to future.

Information infrastructure is the strategic public infrastructure in China's economic and social development in the new era. With the iterative IT upgrade and application, Internet of Everything (IoT) and man-machine-thing integration have become reality, with new higher demand for the supporting capability of information infrastructure, which should be immediately improved in domain and capacity and upgraded. The new-generation high-speed, mobile, secure, and ubiquitous information infrastructure should be constructed for networking, digitalization, and intelligent development of economy and society, to provide strong support for the supply-side structural reform and good social order construction. We should upgrade the existing infrastructure's capacity and deployment of emerging technology infrastructure, proceed network structural optimization and critical link dilatancy, and deploy the next-generation Internet in advance while facilitating the overall upgrade to IPv6 to increase traffic unblocking and business-bearing capabilities. Cloud computing centers, CDNs, and IoT and other facilities should be deployed in advance to facilitate comprehensive intelligent information infrastructure which integrates perception, transmission, storage, computing, and processing so that the virtual cyber world and the real world can be integrated in depth. To meet the demand for intelligent manufacturing networking, the construction of new manufacturing foundations like industrial cloud and smart service platforms and industrial Internet should be sped up to form high-ratio, reliant, low-delay, flexible, and fast networks. To meet the demand of social operation and administration, we should transform and upgrade traditional infrastructure to smart power grids, transportation tools, and water affairs facilities, to improve the resource utilization capacity and efficiency.

2. Digital economy's development is coming into the technology-dominating period, so core technology breakthroughs should be made to foster new international competitive advantages.

The global IT technical innovation is witnessing a new-round acceleration and shortened iteration cycle. Technical systems are being restructured fast and emerging technologies such as IoT, cloud computing, big data, and AI are becoming the core driving forces for industrial revolution. A major technical revolution is often a significant opportunity for technical surpassing and “corner overtaking”. China will see the critical juncture of high-quality development of its economy, and the innovation and competition advantages generated by “technical development + scale effect” will be the solid foundation for the permanent healthy development of the country's economy. The government should, to facilitate the policy and institutional environment for core technology innovation, formulate and implement ground-breaking policies and measures on special tax exemption, loan support, and talent recruitment and cultivation, to encourage State-owned enterprises, private businesses, and colleges to increase their input in the R&D of core technologies. We should accelerate the application of technically innovative achievements to real economy and the popularization of smart factories, digitalized workshops, and production lines, facilitate the overall reform of production factors, industrial chains, technological processes, and business models, and encourage emergence of new business and new models like networking coordination, personalized customization, smart production, and service-oriented manufacturing, to improve the industrial strength and the contribution ratio of technical innovation to economic development. We should enhance the proactive and strategic deployment of standards for basic, cutting-edge, nonsymmetrical, and critical technologies, and accelerate R&D of basic technologies and breakthrough of cutting-edge technologies like AI, quantum computing, quantum communication, and neural network chips to consolidate the technical foundation for the permanent healthy development of China's economy. Businesses should play the major role in accelerating technical R&D and industrial layout to transfer through emerging technologies the advantages in industrial scale and a number of users into advantages for taking the lead and hence new international competitive advantages. A large number of multinationals with strong competitiveness are expected to emerge in China.

3. High-quality content will be the focus of competition among media platforms, so we should speed up restructuring of the order of the cyber content industry and create a healthy cyber ecosystem.

The cyber content industry is witnessing fierce competition. Affected by users' information consumption upgrade and scarcity of quality content resources, quality content has become the new focus of competition among major media platforms, who, therefore, should attach importance to content generation capacity building, introduce positive energy, and innovate the means of cooperating with content generators so that they can jointly plan and generate content products popular among users. They should enhance the profitability of content, foster one-stop

service platforms, with quality content as the core, and native advertising and HOBBY as the complementary, and expand the added value of the content. They should optimize content generation and delivery through technical innovation, constantly upgrade technical models and launch new services like personalized products, tailored reading, and targeted-push, and set up the production, checking, and delivery mechanism which is more consistent with content administration. Competent authorities should enhance the intellectual property protection, improve the legal system in the field of network media communication, and reinforce supervision and technical administration over public opinions to upgrade the cyber content industry in healthy competition and make content ecosystem better.

4. Data security is closely related to the security of the nation, industries, and individuals, so we should attach equal importance to security and development and make the best use values of data.

In the information era, data, as a new production factor, is playing an increasingly important role. It is significant basic strategic resource of a nation. China's data will see exponential growth, enjoy extensive application, and influence the development of economy, culture, society, and military affairs. There are closer relations between data security and national security and between social stability and individual interests. How to make the best use of the values of data and guarantee data security is a problem that the Chinese government, businesses, and society have to face and solve. We should attach equal importance to security and development. First, we should take data security as the core of cyber security. Therefore, we should establish the data-centered security protection system, improve rule systems concerning data, clarify the accountability in all steps of data generation and the data ownership and code of conduct concerned, improve data security protection measures, and enhance anti-attack, anti-breach and anti-theft technologies and data security supervision and early warning. Secondly, we should attach more importance to the openness and circulation of data resources and take data flow as the leader of technical, material, capital, and talent flows. Information barriers should be broken and a bigger public data-sharing platform covering the whole country should be formed. This platform should be used in coordination and can be accessed in a unified way to promote the integration and integrated application of data in fields like energy, transportation, and environmental protection. Moreover, we should give full play to the role of data in policy-making and efficiency improvement.