ICT Innovation Policy in China: A Review

BY ROBERT D. ATKINSON | JULY 2014

China is not only a producer of manufactured goods; it is also increasingly a nexus for innovation as a growing share of homegrown Chinese technology companies compete at home and abroad. The Chinese government views information and communications technology (ICT) both as the cutting-edge industry for China's transition from a manufacturing to a knowledge-based economy, and as a general purpose technology that can affect almost every aspect of China's economy and society. That is why a decade ago China designated "informatization" as a national strategy covering all areas of China's modernization.

The word "informatization," which has a very similar form to the word "industrialization," refers not only to the ICT industry but also to the adoption of ICT in society and the economy. In order to maximize the potential of ICT, China has developed long-term, mid-term, and industry-specific ICT policies.

For long-term ICT development, the State Informatization Development Strategy (2006-2020), published by the General Office of the Communist Party of China (CPC) Central Committee and General Office of the State Council, sets forth China's goals in informatization development for the next 15 years.[1] In the strategy, nine key aspects are emphasized: promoting informatization of the national economy; popularizing e-government; establishing an advanced Internet culture; advancing informatization in sectors such as education, health care, and public safety; expanding information infrastructures (e.g., wireline broadband and 3G/4G wireless networks); exploiting information resources more efficiently; improving the global competitiveness of the

Chinese ICT industry; building national information security systems; and improving people's ability to use information technology.

Meanwhile, for the mid-term ICT development, the report of the 18th Central Committee of the CPC Congress in 2012, the most important document for China's development for the following five years, significantly expanded the focus on ICT by designating it as one of China's key societal and economic goals through 2020. In fact, in each of the five-year plans for China's societal and economic development from the past decades, ICT has an outstanding position. The latest, the Twelfth Five-Year Plan, designates the ICT industry as one of China's seven strategic and emerging industries.[2] Specific areas of focus include burgeoning applications area sectors such as cloud computing and the Internet of Things (IOT), as well as established technology areas such as integrated circuits (ICs), basic software, and broadband technology.

Apart from long-term and mid-term overarching policy, the Chinese government has developed many industry-specific development policies. In the past 10 years, one of the more important industry-specific policies is undoubtedly the "Circular on policies for the development of software and IC industries," issued by the State Council in 2000, which includes investment, financing, taxation, industrial technology, export, income distribution, training, government procurement, intellectual property and other policies to support a number of aspects of software and IC development.[3] Many in the Chinese government view this policy as a key factor contributing to the following "Golden Ten Years" of China's software and IC development. In 2011, the government renewed the policy and issued a "Circular on the issuance of further encouraging the development of software and IC industry."[4] The software industry policy environment was further extended and updated. In 2006, China initiated 16 government-funded mega-projects in science and technology, two of which were directly related to IT: one for core electronic components, including high-end generic chips and basic software and extra-large scale integrated circuit manufacturing and technique, and the other for next-generation broadband wireless mobile telecommunications. For wired infrastructure, China issued its own National Broadband Plan with the aim to provide 40 megabits per second (Mbps) broadband to urban areas and 4Mbps to rural areas before 2015.[5]

Several sectors have ICT specific plans, including education, agriculture, software and information services, manufacturing, forest management, and land resources.[6] The three most important government agencies in China with respect to ICT policy are the National Development and Reform Commission (NDRC), the Ministry of Industry and Information Technology (MIIT), and the Ministry of Science and Technology (MOST). NDRC takes charge of plans and public investment; MIIT is responsible for the policy and operational action in the ICT industry, while MOST supports R&D. Above all, there is a newly appointed Central Cybersecurity and Informatization Leading Group, headed by President Xi and composed of 21 ministers from related ministries and commissions. This leading group, similar in function to the White House's Office of Science and Technology Policy, focuses on long-term cybersecurity and informatization strategy and planning, as well as inter-agency coordination.

With regard to legislation, there are several important regulations or laws with significant influence on China's ICT development. The most important law may be the Telecommunication Regulation passed in 2000, which affected the telecom market of China for more than 10 years.[7] In 2004, Electronic Signature Law was passed to provide legal status to electronic signatures in e-commerce.[8] Radio Regulations, enforced in 1993, has been renewed in 2014 to provide radio spectrum for mobile broadband.[9]

A core component of China's ICT strategy has been the development of indigenous ICT technologies and industries so that China is less dependent on imports in these technologies, even though China continues to run trade surpluses overall. One strategy for doing so is to become more involved in the development of international standards, governance, and trade rules across many areas of ICT—such as the 3G/4G standards and Internet governance—in order to preference Chinese companies and technologies. Toward that end, the government has made it a priority that its companies be involved in these international bodies. However, such a strategy of indigenous standards development runs the risk that China will develop what is known as the Galapagos Island syndrome, similar to Japan, where the technologies and related industries cannot effectively scale globally.[10]

China is focusing on a number of ICT technology areas. Rather than address them all, the rest of this report covers three: cloud computing, the Internet of Things (IOT), and data innovation.

CLOUD COMPUTING

The Chinese government views cloud computing as an important wave of ICT development that China may be able to use to gain a significant competitive advantage. This is why the initial introduction of cloud computing into China was quickly followed by a tide of Internet data center (IDC) construction. Many large companies invested heavily in IDCs and many local governments announced cloud computing parks to support these centers. Some in China saw this as a real estate investment rather than an IT investment; many companies would build apartments or houses to sell in the name of IDC construction. Indeed, in at least one case, a Chinese software company made more profits from its real estate development than from the actual IT sales.[11] However, this was a form of subsidy from local governments to cloud computing and data center companies. Despite the government's push for cloud computing, many commercial customers are still suspicious of putting data and services in the cloud; the benefits from cloud computing have not yet materialized to the level expected by the government.

Suspicions regarding data security and overall benefits have led enterprise customers to allocate limited budgets to cloud services. Aliyun, the leading cloud computing service provider under the Alibaba group, earned only the equivalent of $90 million from January to September of 2013. Meanwhile, slow, unstable broadband network speeds and unsatisfactory customer service are also barriers. Broadband penetration in China is only around 14 percent and the speed for 40 percent of broadband users is slower than 4Mbps.[12]

Despite limited broadband, cloud computing services for individuals are growing in popularity, with firms such as Xiaomi, Baidu, 360, and others providing services similar to

Google Drive, for instance. Some of these companies provide very large amounts of free storage, up to two terabytes per user, which allows individual users to store videos, documents, books, and photos on the cloud and access the content anywhere. The most attractive feature of these products is the function of content share, which allows users to share content with others. However, this has exacerbated problems of digital piracy because many users share pirated content for other users to download.

Nevertheless, the growth potential of China's cloud computing market is significant. This is why Alibaba, Baidu, Tencent, and other domestic companies began to deploy cloud computing services several years ago, and many solution or software companies also embraced cloud solutions. Because of this, international cloud leaders are also focusing on the Chinese cloud market.

However, the Chinese government is committed to expanding cloud computing, but in a way that enables Chinese-owned companies to dominate. China's ongoing classification of cloud computing as a value added telecom service means that foreign companies are forced to find Chinese partners in order to enter the market. The central government defines cloud computing as a value-added service, and there is no specific "cloud computing" category in the license list of value-added services. As a result, Microsoft found a new-model partnership to deploy its Office365 in China. The cloud computing service of Microsoft in China is hosted by a Chinese domestic company, by license requirement. Amazon, IBM, and SAP all started deploying their cloud computing service in China in the same way. This "forced localization" strategy for cloud services is similar to other technology areas where the Chinese government has used "innovation mercantilist" policies to gain access for foreign technology and know-how.

The government's strong support for indigenous cloud computing is reflected by the decision in October 2011 of NDRC, MIIT, and the Ministry of Finance to allocate $236 million to support Chinese cloud providers. In addition, many local governments, such as Chongqing, Ningxia, and Beijing, have targeted cloud computing and IDCs, providing subsidies to attract providers to their jurisdiction. Meanwhile, the central government encouraged the industry sector to set up a trade association as the platform for Chinese cloud computing industry communication.

INTERNET OF THINGS

The peak of inflated expectations for the Internet of Things in China began in 2009. But the widespread adoption of IOT applications did not appear until after that year, and China realized that it might take dozens of years to see the full benefits from the Internet of Things.

There are many categories in IOT, such as intelligent household appliances, smart power grids, health applications, intelligent buildings, and smart transportation. China has focused on a number of different IOT applications. One is automobile manufacturing. In early 2014, the domestic automobile manufacturer BYD introduced a new car, the Qin, equipped with hybrid power and many remote controllers. The Qin driver may use a smart phone to learn the car's status, get its location, and control the air conditioner. It can even

drive the car by remote control from several feet away. In addition, many large Internet companies are focusing on IOT. Baidu, Alibaba, and Tencent, the top three Internet companies in China, have all developed their products for Internet of Vehicles applications.

Smart cities are another example of China's application of IOT. Many local governments see smart city applications as a solution to administration challenges. The NDRC and MIIT have issued a guideline for the development of smart cities. To date, the Chinese central government has selected 202 cities to pilot smart city projects. Beijing, Shanghai, Guangzhou, Hangzhou and some other large cities have established large database and sensor networks to collect, store, and analyze information related to transportation, electricity, public safety, and environmental factors. One famous successful case is Tai Lake in Wuxi City, which uses IOT to monitor and predict the cyanobacteria outbreak and protect the water supply to the city.

In August 2010, Premier Wen Jiabao announced that the IOT is critical to China's ICT plans, and a national IOT Center was established in Shanghai in the same year. The government investment in IOT will increase to 10 billion renminbi (RMB) ($1.6 billion) annually in 2014 and will be used to promote several policy priorities related to advancing the Chinese IOT industry and IOT applications. For example, China's National Broadband Plan will support city-wide ICT infrastructure for IOT usage.[13] Meanwhile, the standards are considered a key factor for IOT usage because interoperability and compatibility is essential for different *things* to be connected. As it has done in other IT areas, the central government leads standards development and supports the establishment of IOT standard association with the hope that Chinese-developed standards will prevail internationally, even if that presents a risk that IOT deployment domestically will be hindered.

Indeed, China believes its role in international IOT standards is critical for the position of China's IOT industry in the global market. MIIT estimated that the scale of China's IOT industry exceeded 600 billion RMB in 2013.[14] When the first general IOT standard initiated by China was passed by the International Telecommunication Union (ITU) in 2012, Chinese officials saw it as a milestone. Furthermore, China is targeting not just IOT applications, but the core tech and industry value chain. For this reason, an inter-agency council was established in 2013 to coordinate the government's policy and action on IOT. The members include NDRC, MIIT, MOST, the Ministry of Education, and the National Standardization Administration. With the support of this council, China issued a Directive on IOT industry development and IOT Action Plan in 2013. The plan specified targets for the industry by 2015 in terms of top-level design, standards formation, technology R&D, application and promotion, industrial support, business models, safety, government support, laws and regulations, and workforce training.

DATA INNOVATION

"Big data" and data innovation more broadly have gained considerable attention in China, with many conferences held and industry association efforts made in the last three years. It is estimated that China's total amount of data in storage in 2012 is 364 exabytes. Every

Every year, 250 petabytes of new data is put into storage in China, equivalent to 40 percent of Japanese levels and 6 percent of North American levels.

year, 250 petabytes of new data is put into storage in China, equivalent to 40 percent of Japanese levels and 6 percent of North American levels.

Most advanced big data applications are happening in large Internet companies. For example, Alibaba, the largest business-to-business e-commerce platform in China, uses its massive transaction data to predict macro-economic growth and establish a large user credit system. Alibaba can predict consumer price inflation (CPI) according to the transaction data on its platform, and it can provide small loans to users according to their credit record. Alibaba even collects data through the provision of subsidies for its users to encourage usage. Baidu has already begun to explore the value of its social media data and has successfully reported the population movement in real time during China's most important holiday, the Spring Festival. The Industrial and Commercial Bank of China, the largest bank in the world, has 4,500 terabytes of data which it uses to provide custom service and risk management.

Apart from those large companies who can generate the data they need through their regular daily work, many independent big data solution providers are appearing in China's market. Jusfoun Big Data is one. Established in 2010, Jusfoun has the only enterprise database in China that covers 8,000 industries and millions of companies. Taobao, the largest B2C platform in China, provides several application programming interfaces (APIs) for third-party developers to access Taobao's database. As for big data technology and equipment, international and indigenous companies share the market; companies such as Microsoft and IBM compete with companies such as Inspur and Ruijie Network.

China has several regulations on open data and privacy protection, such as the Act of Access to Government Information, Decision of the Standing Committee of the National People's Congress on Strengthening Information Protection on Networks, and Provisions on Protecting the Personal Information of Telecommunications and Internet Users (issued by the Ministry of Industry and Information Technology).[15] Indeed, in a speech in May 2014, MIIT Minister Wei Miao expressed his support for the big data industry and promised to work for the continued support of big data technology research and development in China.

Despite some progress in use of private sector data, open government data has lagged considerably behind. One reason might be the lack of clear rules on which data should obligatorily be exposed to the public. Another reason might be that much information is still stored in paper format. Although it is difficult for the private sector to access government data for innovative applications, some government agencies have initiated big data projects to make use of the data they own. For example, the National Bureau of Statistics of China calls the big data application its Second Rail.[16] The State Administration of Taxation applies the tax data it owns to analyze inter-province economic relationships. And the municipal governments of Beijing, Shanghai, and Guangzhou have put significant efforts into the integration of data in different agencies and enhancing data's capabilities for city administrations.

Several provinces have also prioritized big data in order to drive local economic development. For example, Guizhou, a remote province in Northwest China, has targeted

big data industry growth. The top three largest telecom carriers of China all built their IDCs in Guizhou. Guizhou was considered a remote, desolate province far from the coastal developed area of China. Now Guizhou sees IT as an opportunity to bypass the limits of space, avoid transportation and distance shortcomings, and take advantage of Guizhou's labor force, temperature, land, and hydroelectric power.

THE NEW ROUND OF REFORM AND INNOVATION POLICY IN ICT

In November 2013, China held an important conference, the Third Plenary Session of the 18th CPC Central Committee, which kicked off the new round for economic and social reform. Although many foreign news reports zeroed in on some political issues, such as the loosened one-child policy, the core of the reforms sought to strike a balance between government and market forces and allow the market to play a more decisive role in resource allocation.

China has a long way to go before its ICT market is fully open to foreign investment and providing equal treatment to foreign and domestic providers.

Many actions have been taken corresponding to the new-round's reform decision in the ICT field. Virtual Network Operators (VNO) are now required and allowed to rent telecom network facilities from the incumbents in order to provide their own service. Given that China has almost no inter-modal broadband competition (e.g., cable and telephone) this move is intended to enhance the competition in broadband. Another loosened policy in telecom supervision is the cancellation of permits on telecom service price plans. Prior to this, telecom carriers were required to submit an application and obtain permits from the supervision agency if the carrier hoped to promote new service price plans to the market. At times, the supervision agency didn't allow the carrier to promote a plan with too low of a price because the agency worried that this would disrupt markets. Now this requirement has been eliminated. As long as the company's board of directors makes the decision to promote new service plans, the plan can appear in the market the next morning.

The government also established the Shanghai Free Trade Zone and adopted the new special administrative measure (negative list) on foreign investment access to China. This means that foreign investment is allowed to run any business in the zone as long as it is not on the negative list. Take telecommunication administration for example: the MIIT and the Shanghai Municipal People's Government jointly issued the Opinions on Further Opening Value-added Telecom Business in the China (Shanghai) Pilot Free Trade Zone on January 6, 2014, deciding to further open seven value-added telecom businesses on a pilot basis in the China (Shanghai) Pilot Free Trade Zone. Although Shanghai's negative list was criticized for being too long and for having too many limitations, it is an improvement over prior restrictive measures. In fact, many other provinces hope to have the same policy as Shanghai and take the negative list measures in their own province in order to become attractive to foreign direct investments, including those in the ICT industry. Despite the initial excitement, though, companies are still hesitant to move ahead with significant expansion of operations in the FTZ due to many considerable obstacles remaining.

China is also encouraging the private sector to invest in utility, infrastructure, and state-affiliated projects. The NDRC just issued the first list of infrastructure projects in which

the private sector is encouraged to invest. Transportation, ICT infrastructure, clean energy, and gas transportation are all included in that list. Within the ICT field, the projects include 3G and 4G networks, next-generation broadband, access networks for the private sector, Internet data centers, and virtual network carriers.

Despite these reforms, there are other areas of ICT policy where China is expanding state influence at the expense of market reforms. A key one is the recently announced Integrated Circuit plan proposal announced by MIIT. The proposed plan would provide massive subsidies to Chinese-owned integrated circuit companies, impose forced R&D and IP localization measures on foreign firms, develop Chinese-only technical standards, and establish discriminatory government procurement measures.

CONCLUSION

As Deng Xiaoping once stated, "as long as a cat catches mice, it can be any color." In other words, reform should focus on results, and the recent reform efforts in China are a reflection of this view. However, China has a long way to go before its ICT market is fully open to foreign investment and providing equal treatment to foreign and domestic providers. And despite a focus on both ICT use and development, the Chinese government appears to be giving the lion's share of policy focus to Chinese ICT industry development rather than ICT use, despite the fact that the lion's share of economic benefits come from ICT use.[17]

ENDNOTES

1. "2006—2020 National Informatization Development Strategy," *China.com*, accessed June 3, 2014, http://www.china.com.cn/chinese/PI-c/1203246.htm.
2. "'Twelve Five' National Information Technology Planning," Baidu, accessed June 3, 2014, http://wenku.baidu.com/view/d1ce7d7fa26925c52cc5bf71.html.
3. "State Council on Issuing Several Policies to encourage the software industry and integrated circuit industry development," last modified June 24, 2000, The Consulate General of the People's Republic of China in Los Angeles, http://losangeles.china-consulate.org/chn/tech/policy/t27574.htm.
4. "Several policies to further encourage the development of software and IC Industries," last modified January 28, 2011, *Kezil*, http://www.kezil.com/a/kjzx/qyjsjbygkjcyh/2013/0809/314.html.
5. "China Announces Broadband Plans," *News China Magazine*, March 2012, http://www.newschinamag.com/magazine/china-announces-broadband-plans.
6. "Ministry of Education on the issuance of 'decades of development planning education information notice (2011-2020),'" last modified March 13, 2012, Ministry of Education of the People's Republic of China, http://www.moe.edu.cn/publicfiles/business/htmlfiles/moe/s3342/201203/xxgk_133322.html; "National Rural Development Agricultural Information," last modified December 6, 2011, Sina Technology; http://finance.sina.com.cn/nongye/nyhgjj/20111206/155110943928.shtml; "Software and IT services development Twelfth Five-Year," last modified April 6, 2012, Sina Technology, http://tech.sina.com.cn/it/2012-04-06/11116918777.shtml; "National Forestry Information Development "Twelfth Five Year Plan,'" last modified March 2, 2011; State Forestry Bureau, http://www.lypx.cn/WebSite/forestry/Upload/File/201310/20131018103411944750.pdf; "Land and Resources on the issuance of "Land and Resources Informatization" second five 'planning,'" last modified February 17, 2012, Ministry of Land and Resources of the People's Republic of China, http://www.mlr.gov.cn/zwgk/zytz/201202/t20120217_1064754.htm.
7. "People's Republic of China Telecommunications Regulations PRC, Telecommunications Regulations," last modified September 2000, Eduzhai, http://www.eduzhai.net/yingyu/615/763/yingyu_246840.html.
8. "People's Republic of China Electronic Signature Law PRC, Electronic Signature Law," last modified August 28, 2004, Eduzhai, http://www.eduzhai.net/yingyu/615/763/yingyu_247201.html.
9. "Radio Regulations of the People's Republic of China," last modified September 11, 1993, Eduzhai, http://www.eduzhai.net/yingyu/615/763/yingyu_246271.
10. Hiroko Tabuchi, "Why Japan's Cellphones Haven't Gone Global," *The New York Times*, July 20, 2009, http://www.nytimes.com/2009/07/20/technology/20cell.html.
11. Usha C.V. Haley and George T. Haley, *Subsidies to Chinese Industry: State Capitalism, Business Strategy and Trade Policy* (Cambridge: Oxford University Press, 2013).
12. "China's broadband penetration rate is less than 14%," last modified August 19, 2013, *Chinaabout*, http://www.chinaabout.net/chinas-broadband-penetration-rate-is-less-than-14/; "Broadband speed will show more demand for consumer applications," last modified March 13, 2014, http://www.19lou.com/forum-464764-thread-7451377140582336-1-1.html.
13. "Broadband China strategy," last modified June 18, 2014, *Baidu*, http://baike.baidu.com/view/8581901.htm.
14. "Networking industry scale of things to break 600 billion yuan," last modified April 3, 2014, Ministry of Finance of the People's Republic of China, http://www.mof.gov.cn/zhengwuxinxi/caijingshidian/jjrb/201404/t20140403_1063329.html.
15. "People's Republic of China State Council Order," last modified April 24, 2010, The Central People's Government of the People's Republic of China, http://www.gov.cn/flfg/2007-04/24/content_593403.htm; "National People's Congress Standing Committee Decision concerning Strengthening Network Information Protection," last modified December 28, 2012, China Copyright and Media, http://chinacopyrightandmedia.wordpress.com/2012/12/28/national-peoples-congress-standing-committee-decision-concerning-strengthening-network-information-protection/;

Cuatrecasas Gonçalves Pereira and Omar Puertas, "Provisions on protecting the personal information of telecommunications and internet users," last modified August 31, 2013, Association of Corporate Counsel, http://www.lexology.com/library/detail.aspx?g=7174e101-e09f-46b6-9cb6-13d82c562b0c.

16. Compared to the traditional way to collect and analyze data.

17. Ben Miller and Robert D. Atkinson, "Raising European Productivity Growth Through ICT" (ITIF, June 2014), http://www2.itif.org/2014-raising-eu-productivity-growth-ict.pdf.

ABOUT THE AUTHOR

Dr. Robert Atkinson is the President of the Information Technology and Innovation Foundation. He is also the author of the book, *The Past and Future of America's Economy: Long Waves of Innovation that Power Cycles of Growth* (Edward Elgar, 2005). Dr. Atkinson received his Ph.D. in City and Regional Planning from the University of North Carolina at Chapel Hill in 1989.

ABOUT ITIF

The Information Technology and Innovation Foundation (ITIF) is a Washington, D.C.-based think tank at the cutting edge of designing innovation strategies and technology policies to create economic opportunities and improve quality of life in the United States and around the world. Founded in 2006, ITIF is a 501(c) 3 nonprofit, non-partisan organization that documents the beneficial role technology plays in our lives and provides pragmatic ideas for improving technology-driven productivity, boosting competitiveness, and meeting today's global challenges through innovation.

FOR MORE INFORMATION, CONTACT ITIF BY PHONE AT 202.449.1351, BY EMAIL AT MAIL@ITIF.ORG, ONLINE AT WWW.ITIF.ORG, JOIN ITIF ON LINKEDIN OR FOLLOW ITIF ON TWITTER @ITIFDC AND ON FACEBOOK.COM/INNOVATIONPOLICY