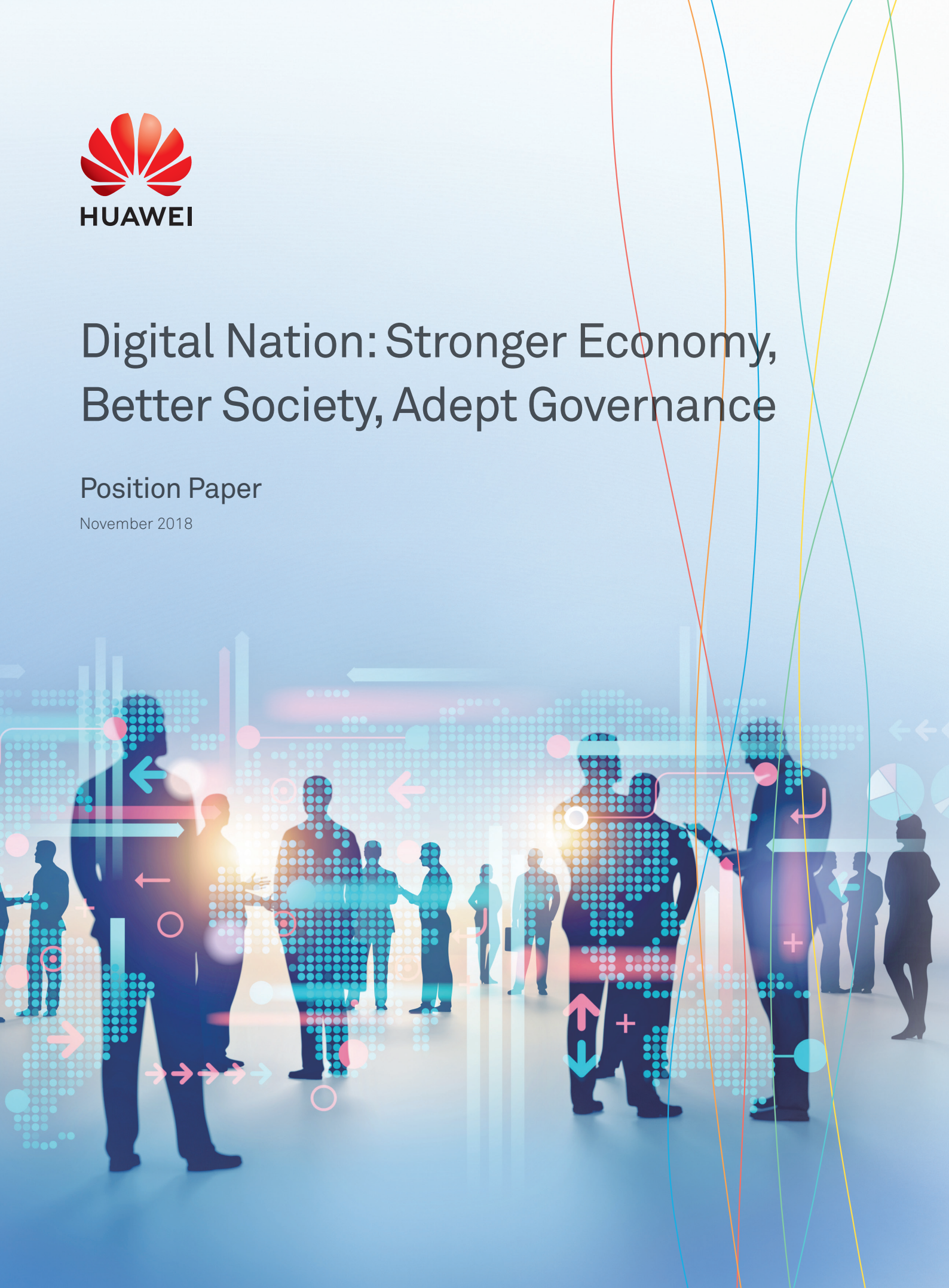




Digital Nation: Stronger Economy, Better Society, Adept Governance

Position Paper

November 2018





Satisfying Maslow's Hierarchy of Needs for National Digital Transformation

Guo Ping, Rotating Chairman of Huawei

Going digital has become the strategic high ground for governments around the world. Today, 156 of the world's 193 countries have developed a national digital strategy. Globally, I think that each country has four levels of digital transformation needs. We can call this Maslow's Hierarchy of Needs for national digital transformation, and we should work to satisfy these needs from the most basic level to the highest level.

The first level of needs is to deploy ICT infrastructure. This is the foundation of a digital economy. Take China as an example. The digital economy is developing rapidly, and the industrial scale of digital transformation reached CNY21 trillion in 2017, accounting for 25% of China's total GDP. This development was attributed to the rapid construction of ICT infrastructure. Today, China has over 3.4 million 4G base stations, accounting for over 55% of the total mobile communications base stations worldwide. As video, virtual reality, and Industrial Internet of Things gain momentum, the speed of 5G network construction is increasing. To support the construction of this new type of infrastructure, China has developed preferential policies for 5G spectrum utilization, which will save operators up to CNY10 billion in expenditure. In addition, best practices have been emerging in many countries in terms of spectrum, right of way, infrastructure coordination, and taxation. These practices can serve as valuable inputs for countries that plan to develop their own policies.

The second level of needs is to deploy security equipment both physically and in cyberspace to ensure the robust development of the digital economy. In terms of physical security, we have built safe cities in Kenya, which has cut the crime rate by 46% and served as a security showcase project. In terms of cyber security, Huawei believes that governments and relevant enterprises should work together to develop and adopt globally recognized security standards, best practices, security assurance solutions, and assessment systems. These should be led by the industry, and voluntarily negotiated and agreed upon. Doing so will create a fair and

standardized environment to satisfy security needs and pave the way for a thriving digital economy.

The third level of needs is to help industries go digital and enable them to keep pace with the times. Based on their own comparative advantages, governments in different countries can develop favorable policies for their chosen industries. The purpose of this is to drive sectors like finance, transportation, energy, manufacturing, agriculture, and tourism to go digital, boost efficiency, promote business model innovation, and create digital competitiveness. These policies will also help industries seize technological trends, and create a digital transformation market that will be worth US\$23 trillion before 2025.

The fourth level of needs is to build digital brains, achieving intelligent management from city- to country-level. As cloud services, big data, and artificial intelligence continue to develop, countries will be able to increase governance efficiency, improve governance quality, integrate data from different times and locations across industries and domains, and build digital brains that can help with policymaking and national governance. All of these factors will ensure the transparency of the economy, security status, and environmental protection, enabling more effective and dynamic adjustments to macro strategies.

I hope that governments can innovate their policies to satisfy the needs at all four levels, and play the role of a practitioner, motivator, and regulator during the digital transformation of their countries. This position paper contains policy tools and 12 actions that governments can take during this process. I hope it will be helpful to policymakers and regulators.

As a committed partner of each country during their digitization process, Huawei is ready and willing to invest and innovate continuously, and work with all countries to build a fully connected, intelligent world.



Foreword to Digital Nation

By Jeffrey D. Sachs
University Professor, Columbia University

By any standard, Huawei is a remarkable company and by any standard, Huawei's vision of our shared digital future is powerful, exciting, and uniquely well informed. Governments are searching for ways to make rapid progress on the 17 Sustainable Development Goals adopted by all UN member states in September 2015. Huawei provides invaluable guidance and suggestions on that global effort.

Digital Nation is much more than a pep talk or a paean of praise for the new information and communications technologies (ICTs). Digital Nation is a roadmap for governments aiming to put their countries into the fast lane of sustainable development in the 21st Century. Most importantly, Huawei draws on its deep knowledge of the new and emerging technologies, and its remarkable global experience, to highlight practical steps for governments to follow to create a dynamic, healthful, productive digital nation. Huawei also points out several possible roadblocks and impediments, and how to avoid or overcome them.

Huawei usefully defines three pillars of a digital nation: digital economy, digital society, and digital governance. Digital economy means the use of ICTs to drive efficiency, optimization, and innovation across the main economic sectors (including agriculture, manufacturing, finance, transportation, energy, and others). Digital society means the upgrading of healthcare, education, work life, and cities through intelligent systems and devices. Digital governance means the promotion of citizens participation and institutional delivery of public services through digital technologies.

This framework is visionary, cutting edge and holistic. It takes us beyond individual devices or stand-alone applications to entire ecosystems of production and service delivery involving new technologies and devices, the cloud,

physical telecommunications infrastructure, systems standards and operating procedures, and new governance models. Along the way, Huawei provides vivid case studies where this holistic approach is being put into practice.

Huawei rightly stresses that the Digital Nation will play a fundamental role in achieving the UN Sustainable Development Goals. Digital systems will enable cities to operate far more efficiently, healthcare and education to reach all citizens, and industry to operate with vastly less pollution and greenhouse gas emissions. Without the digital revolution it is difficult to imagine the SDGs being within reach.

Perhaps the most important lesson imparted by Huawei is the need to think, plan, and act holistically, and inclusively. The digital revolution can help the world to achieve key global goals – shared prosperity, good governance, high-quality public services, and environmental protection – if the digital technologies are deployed in an open environment that encourages mutual communications among citizens, consumers, businesses, and government, and the inclusion of all citizens. The government has a major responsibility to ensure that the digital systems benefit from unified standards, integrated management, and adequate financial resources.

Huawei offers a highly valuable summary of twelve key action items that governments will find invaluable in promoting a Digital Nation. The list includes establishing a unified structure of standards and coordination across government departments, promoting open-access data, ensuring data security, and adopting key indicators for monitoring systems and making course correction.

Kudos to Huawei for producing such a timely and clear roadmap to help governments, businesses and civil society to create digital nations on the path to sustainable development.



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01

Executive Summary

Nations around the world are increasingly aware of the importance of digitalization. Many countries are embracing a vision to build a Digital Nation with enhanced economic vitality, robust social safety nets, and efficient and fair governance. The success of Digital Nation initiatives depends heavily on having an open environment, especially the application of borderless technology, which means applying universal borderless technology, and promoting the appropriate integration of international and local partners. When done correctly, Digital Nation becomes a part of the fabric of an economy, society and governance, and relies on technological capabilities and supporting policies.

Our research shows that the economy and society transform alongside ongoing digitalization. According to the report published by Huawei and Oxford Economics, digitalization will produce a sustaining effect on the economy (i.e., "digital spillover"). Specifically, for every one US dollar invested in digital, GDP will grow by 20 dollars. Digitalization will also facilitate the fulfillment of the UN's SDGs.

Digitalization promotes an increase to economic efficiency in all industries, through the creation of new business models. In the finance, traditional enterprises apply new digital technologies to enhance their competitive advantages. The convergence of finance and technology is also resulting in the emergence of a new wave of FinTech enterprises. In the transportation, digitalization has led to the new business model of ride sharing. At the same time, an Intelligent Transportation System (ITS) can effectively increase carrying capacity and speed, and lower the failure rate of infrastructure. In the energy, smart grid technology is helping to optimize power generation, transmission, transformation, storage, distribution, and consumption. In manufacturing, traditional manufacturers are upgrading by digitalizing technological processes, with many new product technologies emerging as a result.

In the social sphere, digitalization optimizes resource allocation and improves lives. Globally, intelligent health risk prevention, public medical resources sharing, facilitation of professional training, and collaborative operation of medical facilities will solve key pain points in the healthcare field. Other applications such as remote education, customized content, and virtual classrooms have gradually matured, and are alleviating difficulties previously faced in education.

In respect to governance, digitalization could improve government efficiency and urban administration. Digitalization will assist in the realization of interactive policy channels, self-service transactions, integrated data management, and reliable information encryption in order to improve government services. Digitalization will also boost the formation of a new-era urban management system with self-adaptive environmental protection, independent emergency response, self-verifiable food traceability, and autonomous municipal regulations.

Every nation will encounter some form of difficulties and challenges during the process of digitalization,

including ambiguity about who should organize and implement the initiatives, insufficient supporting resources, inadequate societal participation, a lack of flexible response to change, and lack of unified standards. Therefore, we suggest that governments take proactive measures such as organization, investment, implementation, and regulations, to effectively act as practitioners, motivators, and regulators in digitalization. Specific measures include building a top-down and integrated digital department, establishing a vertical organization specialized in key areas, expanding sources of funding, investing in ICT infrastructure, attracting and training digital talent, forming internal technical foundations, providing open access to public governmental database, implementing digital applications for e-Government, cultivating a digital ecosystem, developing global standards, establishing evaluation indicators, and ensuring data security and privacy, as well as encouraging the exchange of data.



02

Chapter 1: The Concept and Important Components of a Digital Nation

2.1 Countries are moving beyond basic informatization and toward more comprehensive intelligent capabilities in line with the concept of a Digital Nation

Digitalization is a global trend. With the development of infrastructure and technology (broadband, Internet, cloud, big data, and the Internet of Things), digitalization has also undergone a gradual transition from basic informatization to more comprehensive intelligent capabilities.

Based on national digitalization strategy statements and the relevant definitions put forward by major economic organizations and experts, Huawei and Roland Berger propose a theoretical framework for a Digital Nation (Figure 2.1). Empowered by digitalization, a Digital Nation can promote economic vitality, bolster societal wellbeing, and improve governance efficiency and fairness.

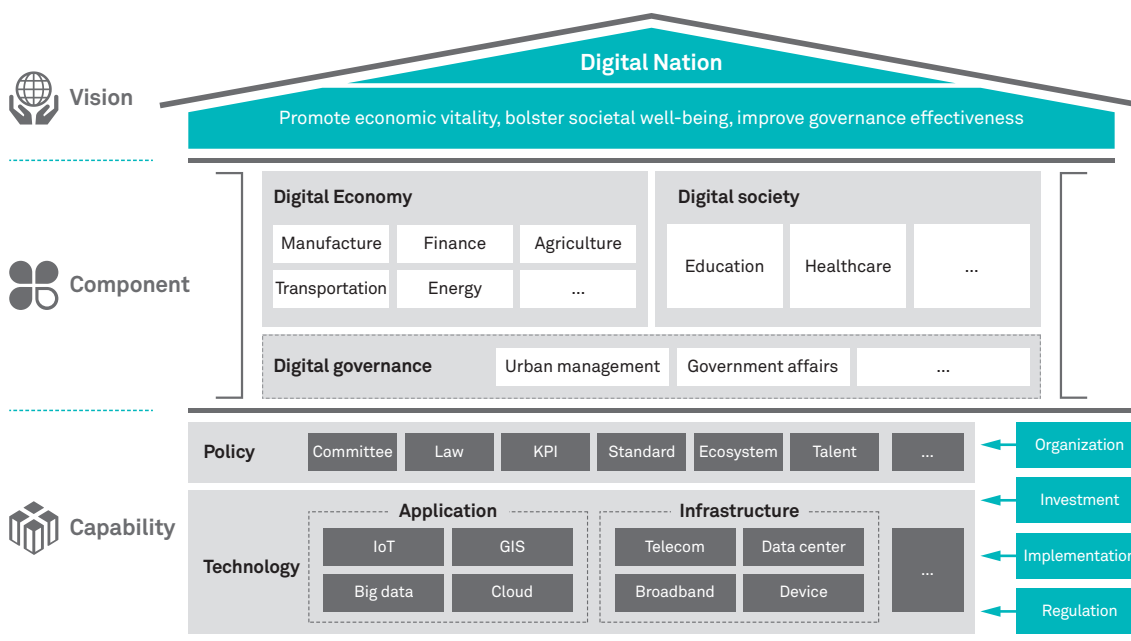


Figure 2.1: The theoretical framework of a Digital Nation

2.2 The creation of a Digital Nation depends heavily on an open environment

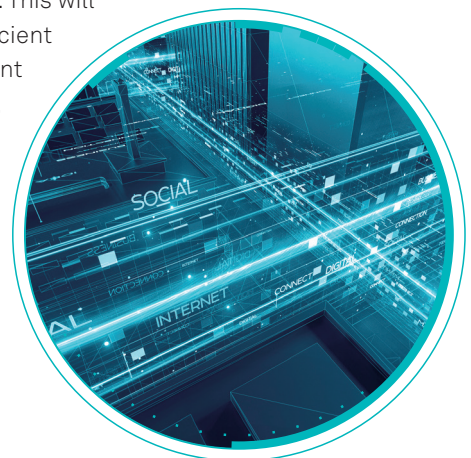
An open environment is of great importance for successful digitalization. In addition to the openness of technology resources, international talent exchanges, cross-company communication, and international openness regarding infrastructure and capital investment, will all promote the development and innovation of digitalization. Borderless technology is a good example of an open environment. For the digital development of a country, the focus lies in applying universal borderless technology, promoting appropriate integration of international and local partners, and enabling the creation of a variety of applications. Examples of such applications include online travel in Thailand, mobile payments in China, and smart medical diagnoses in the United States. With strong openness when it comes to technology, countries (especially emerging markets) will be able to capitalize on access to global knowledge and enhance their innovation capacity and productivity, forming competitive advantages through a highly localized process.

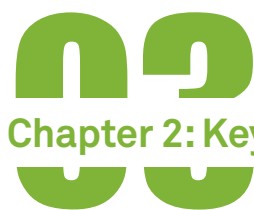
2.3 The vision of Digital Nation is illustrated through the digital economy, society and governance with support of policies and technologies

The Digital Economy includes the digitalization of competitive industries and the development of core digital industries. This is beneficial to the promotion of digital transformation and the empowerment of traditional industries such as finance, transportation, energy, manufacturing, agriculture, and tourism. Such digitalization further encourages improvements in efficiency, optimization of the industrial chain, and the transformation of business models while also providing new impetus for economic growth of emerging businesses such as ICT infrastructure, telecommunications services, software/platforms, and other relevant services.

The Digital Society uses digital technology to comprehensively transform all aspects of society and guarantee social welfare. For instance, the government could use digital intelligent devices for monitoring, auxiliary diagnoses and medical treatment. Such devices can also be used in interconnected medical systems in cities to promote equal distribution of medical resources and improve health services provided for citizens.

Digital Governance requires governments to use digital technologies adeptly. This will promote citizen participation and institutional optimization, achieving efficient and high-quality administration with new decision-making and management methods, as well as improving the operation of environmental protection, public safety, municipal regulations, and food safety. Digital economy and digital society are both supported by adept governance.





Chapter 2: Key Benefits of Being a Digital Nation

3.1 Unprecedented productivity, industrial innovation, and improvements to employment structures are the typical benefits of digitalization

Digitalization can revolutionize productivity and production, improve production efficiency, and ensure an increasingly flattened structure for economic activities, which will result in digital spillover¹ within the economy. Over the past 30 years, every one US dollar in digital investment has resulted in GDP growth of 20 dollars. However, the average ROI of non-digital investment is just 1:3, about 6.7 times less than the ROI of digital investment. The research of LSE also shows that the economic spillover made possible by ICT technology is significantly higher than other innovative technologies² (Figure 3.1). Digital spillover gives digitalization the power to drive the economic development of other industries. According to the Huawei Global Connectivity Index (GCI) 2018, the growth rate of the digital economy was 2.5 times that of global GDP over the past 15 years. The total size of the global digital economy was \$11.5 trillion in 2016, and is predicted to reach \$23 trillion by 2025³.

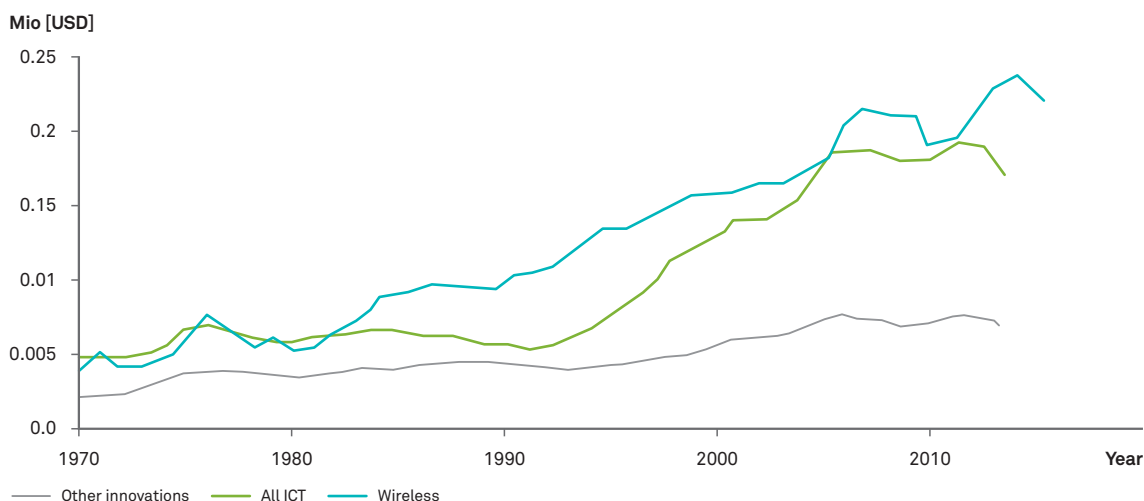


Figure 3.1: Average global digital spillover effect (1970-2014)

¹ Huawei. ICT New Vision. July 2018.

² LSE Consulting for Huawei. The Evolving Role of ICT in the Economy.

³ Benchmark of Huawei ICT Sustainable Development Goal 2018

The attraction of digitalization is not only reflected in the incubation of cutting-edge technologies and the creation of new business models, but also in how it encourages innovation more generally. The digital economy provides a strong foundation for innovation that encourages the development of small and medium-sized enterprises (SMEs).

Digitalization is also accompanied by the development of the industrial chain, the extension of value chain, and the demand for mid-senior level, knowledge-based talent. The urbanization spurred by digitalization can also help improve the structure of the job market. According to the World Bank, the disappearance of one traditional industry position will lead to 2.4 new jobs in the digital economy⁴. LSE's research also shows that as technology advances, there will be new job requirements and the demand for high-tech talent will increase⁵.

Digitalization will promote an increase of economic efficiency in all industries, and will encourage the emergence of new innovative business models. For example:

Finance

With the development of digitalization, finance has gone through a process of transforming its own architecture and upgrading services. The number of users covered and the quality of services have both greatly improved. The United Nations vision for inclusive finance is gradually being realized. In order to become more competitive, traditional financial enterprises actively apply new digital technologies to transform IT architecture. This digital transformation requires IT systems to provide effective support for data storage, data analysis and mining, and data services. Therefore, with the development and integration of FinTech, companies with new business models are emerging, such as those involving mobile payments, Internet banking, and P2P, as well as new product service models like big-data credit reporting, smart investment, Internet insurance, and AI-assisted high-frequency trading. In the face of this new wave of financial technology, governments will act as regulators for the financial industry, setting standards and supporting financial digitalization. For example, the Regulatory SandBox program was launched by the UK in 2016. This program supports disruptive innovation while simultaneously working to mitigate risks.

Transportation

With the increase in mobile Internet penetration rate and the reduction of data transmission costs, a new business model of transportation sharing has emerged, which has fundamentally changed daily travel. The enhancement of information traceability and improvement in data analysis have also greatly optimized the digital operations and management of rail transit. The Intelligent Transportation System (ITS), powered by digital technologies such as mobile monitoring, data analysis, and the Internet, improves efficiency and optimizes the management of road. The ride-sharing market in China is developing rapidly, increasing the efficiency of vehicles, reducing traffic congestion, creating jobs, and facilitating economic growth.

Energy

Traditional energy networks include multiple sub-segments such as power generation, transmission, transformation, storage, distribution and consumption. Each of these segments can be digitally optimized. For example, power generation can be separated by digital systems and achieve marketization, allowing electricity to be generated based on demand. The digitalization of power transmission is even more urgent. Digital technologies such as UAV line locating and sensors can be used to digitally detect the transmission

⁴ Huawei. ICT New Vision. July 2018.

⁵ LSE Consulting for Huawei. The Evolving Role of ICT in the Economy.

backbone network and deal with the difficulties in monitoring the status of transmission lines covering a large area. The digital detection of the distribution transformer can monitor the operational status, locate problems and promptly prevent losses. This can greatly improve the service life of devices and reduce replacement costs. Substations can also be upgraded to smart substations. In 2017, the Russian federal government incorporated a digital energy strategy into the Russian Federation Digital Plan. It is estimated that US\$280.3 billion will be invested to transform old grid equipment, reduce grid distribution losses, and improve energy efficiency.

Manufacturing

The widespread use of digital technology has fundamentally changed the manufacturing industry. The traditional manufacturing process has been upgraded through digitalization, and the manufacturing industry has entered an era defined by intelligence, greatly improving production efficiency. In addition, the development of digitalization has led to new production technologies and promoted innovation in the manufacturing industry. Smart factories can achieve highly reliable operations and low manual intervention, as well as simultaneously monitoring asset status, tracking schedules, and optimizing energy consumption, output distribution, running time, quality control, and other elements. This makes it possible for smart factories to achieve a significant reduction in operating costs and promote highly customized products, as well as flexible and efficient processes for manufacturing and product development. Germany's Industry 4.0 initiative is marked by highly digitized production, digitalization, and self-organizing machines. By 2025, Germany's industrial digitalization will boost the economy by an additional 425 billion euros.

3.2 Digitalization can protect societal well-being, promote sustainable development, and create friendly living spaces

Digital technology helps to ensure that basic needs in society are met, including education, healthcare, and sanitation. This technology ensures that resources that are in high demand, such as education and healthcare, can be obtained and utilized by a wider number of people. In addition, intelligent algorithms brought about by digital technology can realize more precise and intelligent distribution of such resources.

Digital technologies promote the realization of the UN's goal of sustainable development. By comparing the SDG score with the ICT score, Huawei's research shows that there is a positive correlation between the two indexes (91%). ICT can significantly improve the performance of a country's SDGs (Figure 3.2)⁶. Research shows that the greatest improvements to SDGs are seen in SDG 4 (Quality Education) (73%) and SDG 3 (Good Health and Well-being) (71%).

⁶ Benchmark of Huawei ICT Sustainable Development Goal 2018

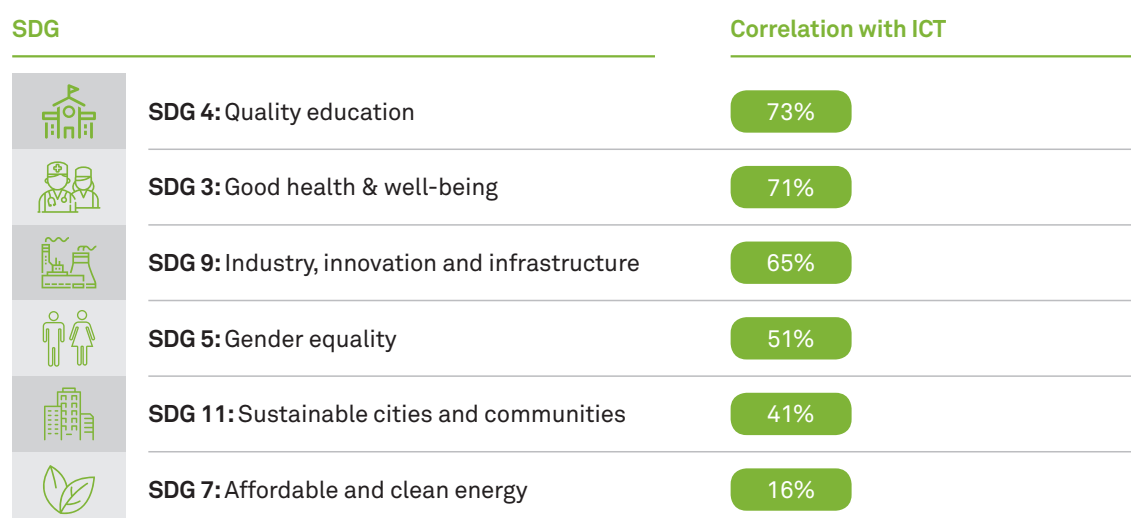


Figure 3.2: Correlations between SDGs and ICT scores (highest to lowest)

In terms of living standards, the advantages of digitalization are mainly reflected in the monitoring of regional environmental quality (air, water, travel, etc.) and action guidance provided through monitoring of data.

Healthcare

Digital technology, because of its potential to provide low-cost applications and having no limits regarding time and space, is extremely valuable for disease prevention, medical treatment, medical staff training, and medical facility support. According to existing international digital practices, intelligent health risk prevention, public medical resource sharing, facilitation of professional training, and collaborative operation of medical facilities are maturing and exerting a positive influence in the healthcare field. In terms of disease prevention, a health risk monitoring and prevention system can be established based on smart wearable devices and artificial intelligence algorithms. In terms of medical visits, a medical resource sharing system can be established that relies on remote communications, as well as an auxiliary diagnose and treatment system based on visual recognition. In terms of training of professional medical personnel, a more convenient talent training system can be established that relies on information communications and visual simulation technology. In terms of support for medical facilities, a medical facility operations system that works in harmony with overall urban management can be established. The typical cases of this include the German Ambient Assisted Living (AAL) system and the artificial intelligent medical imaging diagnosis algorithm used in the United States.

Education

In terms of education, digital technology can alleviate the uneven distribution of educational resources, lack of personalization, and inadequate infrastructure support because digital technology is not limited by time and space, and solutions can be highly customized. From the perspective of international digital practices, applications such as distance education, customized content, and virtual classrooms have gradually matured and been proven effective. In terms of the allocation of educational resources, excellent courses and online teaching can be used for digital teaching and monitoring with no limitations on time and space. In terms of customized content, an AI algorithm can be used to match course schedules and course content for different needs and different people, and create adaptive learning for specific scenarios. For the support of educational facilities, AR/VR and other technologies can be used to establish a virtualized digital classroom, enabling students to engage in a wide range of teaching activities in a virtual context, including scientific experiments and classroom activities. Typical cases include the "Ready to Work" platform in Buffalo, New York.

3.3 In the field of governance, digitalization improves government efficiency and municipal administration

Digital technology can provide effective solutions for the transparency of government affairs, one-stop public services, and information security. In real life, citizens of countries such as the United Kingdom and Singapore are already enjoying the conveniences of such systems, including real-time notifications regarding government affairs, mobile apps to access government services, and open data platforms.

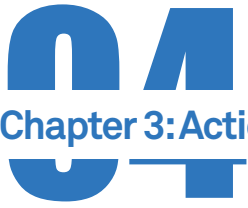
Through real-time monitoring of regional environmental quality, quality of life, and other factors for sustainable development, digital technology can provide further guidance for urban management strategies and create a living space that is people-centered, environmentally friendly, and sustainable. Specifically, in terms of ensuring environmental quality, the Internet of Things can be used to realize sensor-based air and water quality monitoring, and provide prompt warnings if intervention is required to address unlawful activity. In terms of ensuring quality of life, technologies, such as blockchain and municipal cloud, play an important role in areas such as monitoring food safety and municipal construction planning.

Digital technologies have also shown their value in the improvement of government affairs, service facilitation, information security, and department coordination. Things like digital policy interaction channels can also be established for policy advocacy and feedback. A self-service application for one-stop government services can be established to ensure convenience for the public. A highly reliable data encryption mechanism can be established for information security maintenance, and integrated data flow management platforms can be built to facilitate inter-departmental cooperation.

In the field of urban management, digital technology can likewise help to form a new urban management system with self-adaptive environmental protection, independent emergency response, self-verifiable food traceability, and self-governing municipal regulations.

3.4 Implications in typical practices: Government support, such as financial support, innovation supervision, data openness, and policy encouragement, greatly facilitates digital development

As development progresses in a digital economy, digital society, and digital governance, the government can play a role in creating a fertile ground for digital development of all industries, building a platform ecosystem that is conducive to digital development. Governments can also promote innovation by adopting flexible regulatory measures and working to mitigate risks. For example, the government can give direct financial support, adopt flexible and innovative regulatory measures, provide open access to relevant data, emphasize the growth of the ecosystem, and introduce supportive policies. In promoting digital governance, governments could adopt means such as legislation, capital investment, establishing governing bodies, and building of relevant platforms to promote stronger digital governance and ensure the implementation of relevant policy planning.



Chapter 3: Actions for the Government to Achieve the Vision of Digital Nation

Based on the experience of countries in driving digitalization, problems and challenges can include not knowing who should organize and implement such initiatives, insufficient supporting resources, inadequate societal participation, inflexible mechanisms for change, and a lack of unified standards.

4.1 By embracing digital development, governments can improve governance, create an environment conducive to development, and regulate flexibly and effectively

We suggest that governments prioritize promotion of how to realize digitalization before launching a package of digital initiatives (Figure 4.1). The government's mindset for enhancing its capabilities through digital technology will determine its responsibility as a practitioner of digitalization. How governments pursue the building of a favorable environment for digital development will determine its status as a motivator for the digital ecosystem. And the responsibilities governments assume in guiding and supervising digital development will determine their roles as a regulator for digital development.



Improve management capabilities through digitalization

- **UK:** "government as a platform" concept
- **Singapore:** e-government platform and application



Practitioner



Create an enabling environment for digitalization

- **German:** financial support for R&D project team
- **Brazil:** fund for the installation of smart meter



Motivator



Supervise and guide the development of digitalization

- **China:** policies on car sharing in Shanghai
- **US:** KPI monitoring digital process in Buffalo



Regulator

Figure 4.1: Three major roles of the government in promoting digital capabilities

4.2 Governments can adopt practical measures, such as establishing organizations, providing open access to data, and building up ecosystems

The government must adopt encouraging policy tools and action measures based on the four initiatives in the policy package: organization, investment, active implementation, and regulation. (Figure 4.2)

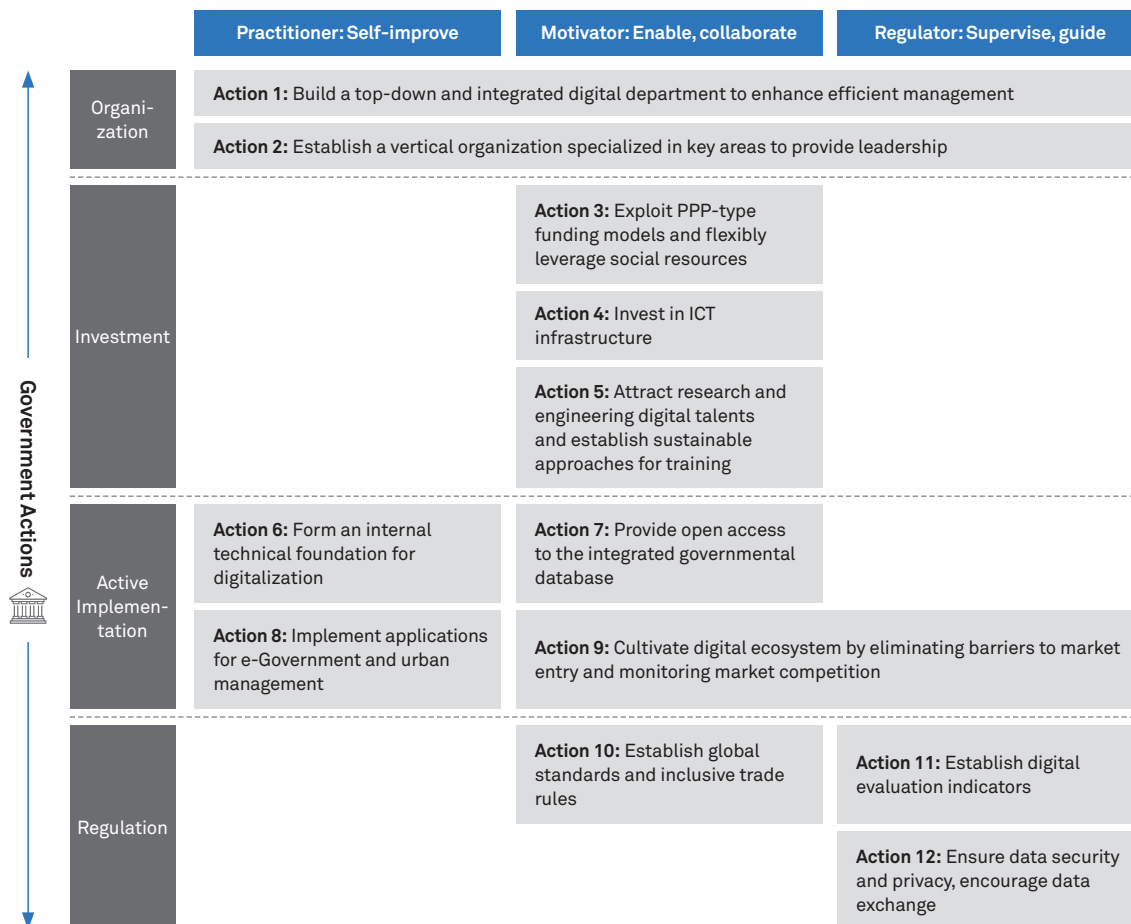


Figure 4.2: Government actions package

4.2.1 Governments can utilize an integrated or vertical organizational structure based on the specific stage of digital development and governance model

- **Action 1: Build a top-down, integrated digital department to enhance comprehensive coordination and efficient management**

Specific action: Governments can set up an independent digital department to centrally plan, decide, and implement the construction of a Digital Nation. This includes developing plans for shared goals, deciding on future projects, promoting responsibility division and collaboration among authorities through regular meetings and joint project teams, collaboratively constructing infrastructure and

platforms, and seeking advice on digital development from an advisory team by engaging with external data scientists and experts. The government not only acts as a pioneer in digitalization, but also as a leader in digital development. For example, Singapore has established a special department with a top-down structure, called Smart Nation and Digital Government Group (SNDGG), to act as a promoter of the Smart Nation. As a management organization, the SNDGG, takes responsibility for planning and coordinating external departments (finance, transportation, energy, etc.). At the same time, GovTech is responsible for construction of infrastructure (broadband, platform construction, etc.) and the development of applications (such as mobile apps) to provide digital services and offer guidance on issues regarding digital standards, digitalization of small and medium-sized enterprises, introduction of foreign digital enterprises, and talent training.

- **Action 2: Establish a vertical organization specialized in key areas such as core industries and urgent problems to provide leadership**

Specific action: Governments can concentrate on the digitalization of select areas. The departments responsible for the specific areas will lead the decision-making, organization, and implementation of digitalization. Issues could be coordinated by non-permanent teams such as cross-department/industry working groups, special project working groups, and a non-permanent "office" (joint programs, commissions, or cabinets). Digitalization is more likely to occur in key areas (such as e-Government in the UK), leading industries (such as Industry 4.0 in Germany), pivotal sectors (such as FinTech in Singapore), and surrounding core pain points (such as intelligent transportation in Thailand). Digitalization is managed by the relevant authorities. Along with the advancement of digitalization in the economy, society, and governance, the demand for central leadership, management, and coordination will increase. For example, Thailand established the Ministry of Economic and Social Digitalization to replace the former Ministry of Information and Communication Technology to further promote the "Thailand 4.0 Strategy".

4.2.2 Governments can provide funding, infrastructure, and talent to support digitalization

- **Action 3: Allocate fiscal capital by multiple means and flexibly leverage social resources**

Specific action: For the allocation of funding, the government could shift from the broad approach of "offering funding" to a targeted and effect-oriented method of "enhancing capabilities" to empower the economy and society. From the perspective of revenue and expenditure, the government could directly provide funds for digital development (such as setting up special funds, financial subsidies for digital upgrades, and purchasing services from digital enterprises). In addition, the government could reduce taxes on digital projects (tax exemptions, tax rebates, free-trade zones). The government could also consider adopting new business models and making full use of the technology and management capabilities of the private sector. This will improve efficiency and reduce costs and risks. In practice, the government could offer exclusive rights, preferential policies, or economic returns to attract private capital and companies to engage in the investment and construction (such as government bidding or public-private partnership funds). For example, the Rwanda Development Committee (RDB) and Korea Telecom (KT) have established a PPP in the form of a joint venture company, managed by KT, while the Rwandan government provides financial and administrative support to deploy high-speed 4G technology.



Case study: Malaysia's government investment

Malaysia promotes the development and application (especially for SMEs) of digitalization through government funding, tax incentives, and digital free trade zones. In terms of infrastructure, the government allocated MYR1 billion as part of the 2018 budget to the Malaysian Multimedia Commission (MCMC) to develop communications infrastructure. The government allocated MYR835 million for the construction of the Digital Free Trade Zone (DFTZ) in KLIA Aeropolis⁷. In 2014, the Malaysian government planned to invest MYR1.8 billion to improve domestic broadband, MYR1.5 billion to build 1,000 new communications towers, and MYR850 million to build new submarine cables⁸. In order to promote the application of ICT equipment and enhance digital capabilities, the Malaysian government announced a wide range of incentives to drive the development of the ICT industry on the demand side. The specific policies include capital subsidies for ICT equipment and software, support for corporate digitalization upgrades, and infrastructure construction funds. According to its budget for FY 2018, the purchasing of ICT equipment and computer software for the 2017–2020 tax year will result in a "first-time purchase" reduction of 20% and an annual tax reduction of 20%. The cost to develop customized software will also benefit from the reductions mentioned above, beginning from tax year 2018. In Industry 4.0, the government used investment funds and extended tax incentives to stimulate corporate digitalization and provided MYR245 million in subsidies, under the Domestic Investment Strategy Fund, to enhance smart manufacturing facilities. The government also provided an accelerated capital allowance of 200% for the application of automation equipment in labor-intensive industries.



- **Action 4: Investing in ICT infrastructure to lay the foundations for digital transformation**

Specific action: Physical inputs can be used to construct ICT infrastructure, which will function as the cornerstone for the application of digital technology. The government needs to build infrastructure for digitalization such as broadband, fiber optics, Wi-Fi hotspots, data centers, and public cloud. As an important enabling technology for digitalization, cloud computing requires government attention and input in order to drive digital transformation and modernization. Governments can promote the development of digital infrastructure by building data-centers or establishing the public cloud. In addition, the government can achieve this goal by providing supportive and facilitated policies for infrastructure sharing, spectrum resource allocation and management, and right-of-way (ROW) acquisition to promote infrastructure deployment.

⁷ Malaysia 2018 Budget.

⁸ Summary of Malaysia's 2014 Budget



Case study: Supportive Policy for ICT Infrastructure in China

The Chinese government leads the way in supporting infrastructure sharing, free spectrum, and ROW acquisition. These supportive policies have led to the number of base stations in China increasing more rapidly than anywhere else in the world. There are now 4.62 million 3G/4G base stations in China, and the country's three major telecom operators account for the largest share of the total global volume of 4G – more than 40%. In terms of infrastructure sharing, the construction sharing in China is supported by legislation. According to the Emergency Notice on Promoting the Co-construction and Sharing of Telecommunications Infrastructures, published by the Ministry of Industry and Information Technology, existing towers and poles must be shared and new towers and poles must be built collaboratively. Other base station facilities and transmission lines that fall under the scope of joint construction should be built together as well. Second, China Tower, which is an SEO, provides overall services for infrastructure (e.g. base stations) for China Mobile, China Unicom, and China Telecom. This approach helps to avoid wasting of resources and improves industrial investment efficiency. In terms of spectrum allocation, an allocation system is used instead of auction. Government administrative approvals and the charging of radio frequency occupation fees are also applied in the allocation system, in which responsible administrative units allocate resources to telecom operators. In terms of ROW, Heilongjiang Province, Hebei Province, Hainan Province, the city of Nanjing, and the city of Hangzhou are promoting the simplification of base station approval procedures and the protection of ROW. To support the development of new technologies and new services, the charging standard for the current occupancy of 5G public mobile communications frequencies conforms to the preferential policy of providing it free for the first three years and at a discount (25%, 50%, 70%) over the subsequent three years. This is expected to save operators billions of dollars in expenses.



- **Action 5: Attract leading research and engineering digital talent and establish sustainable approaches for training**

Specific action: Build up a talent pool, design talent plans, set up a special organization geared toward fostering talent, and attract research and engineering talent and other leading talent through a package of plans including special funding, residence permits, talent incentive programs, subsidies, and training. In addition, governments can cultivate local talent through diversified means such as national training programs, cooperating with corporations and NGOs, establishing training bases, and providing training equipment and systems.

4.2.3 Governments can build a digital management system, provide open access to data resources, create e-government and city management applications, and cultivate a digital ecosystem in order to shape the environment

- **Action 6: Reshape government operation processes, integrate internal data, and form an internal technical foundation for digital applications**

Specific action: Governments can clarify and follow through on internal government management and service processes in order to achieve coordinated, multi-sector operations. The data from siloed departments can be shared through the use of cloud technology to establish a data pool, form an internal technical foundation, and build up a service platform for digital applications.

- **Action 7: Provide open access to integrated public governmental database and create a digital environment for the public and enterprises**

Specific action: Governments can coordinate public data resources and open up data interfaces to external sources, in order to realize the creation of an open data system and a digital environment in which enterprises and the public can participate. For example, New York established the New York Digital Office and the Mayor's Office of Data Analysis, released the New York City Open Data Act, and established the "OpenData" core system platform under this Act, which improves efficiency, encourages high-end tech talent and enterprises to innovate, and encourages the creation of massive hidden business value.

- **Action 8: Implement digital applications for e-Government and urban management, improve administrative effectiveness, and digitalize government administration**

Specific action: Governments can take the initiative to use emerging digital technologies to establish e-government and urban management applications, improve and optimize administration, enhance efficiency, and digitalize government affairs. Estonia actively promoted e-government programs with electronic ID cards and government database openness. In 1997, e-Estonia was proposed. Till now, more than 90% of Estonians have e-identity, which is used to get access to services such as health insurance, online banking, voting and tax declaration. Meanwhile, the distributed data storage and exchange platform X-Road, which uses blockchain technology, carries all the data related to people's life and the open data of the government. It is the key technical support behind the digital nation. E-government simplifies government procedures and benefits government administration. At least 2% of state GDP is saved due to collective use of digital signatures.

- **Action 9: Cultivate a digital ecosystem by eliminating barriers to market entry and monitoring market competition**

Specific action: To cultivate a digital ecosystem, governments have a number of options: 1) Enact laws and regulations to monitor competition within industries, protect consumers, and prevent the formation of monopolies. 2) Appropriately lower market entry requirements, reduce restrictions, encourage testing and evaluations before making decisions, and customize the entry requirements for new digital products and services in various industries and fields. 3) Build test sites, industrial parks, research institutes, incubators, or innovation centers. In terms of infrastructure, applications, data, research and cooperation, the Chinese city of Yingtian has adopted an open approach and leveraged inclusive market access to attract private enterprises. The sound digital ecosystem has attracted a large number of highly competitive IoT enterprises, as well as industrial projects and investments.



Case study: Singapore's FinTech Fast Track Initiative^{9 10}

Singapore is promoting policy changes and creating the basic conditions for the development of financial digitalization. The Intellectual Property Office of Singapore (IPOS) announced the launch of a patented, one-year fast track project for financial technology software. This fast track project requires that the declared software has not previously been patented in Singapore, and that the technology covered by the project is primarily related to electronic payments, investment platforms, insurance technology, banking and blockchain, or anti-fraud technology. Beginning from April 26, 2018, the period for patent examination for financial technology projects was shortened from 2 years to 6 months. In addition, the Monetary Authority of Singapore (MAS) proposed the updating of the regulatory framework to reduce barriers to blockchain exchanges. The existing single-layer “market-recognized operator”¹¹ regulatory framework is no longer able to meet the needs of emerging business models. Therefore, MAS plans to divide the existing regulatory structure into three levels, in order to align better with blockchain's peer-to-peer trade model and reduce the capital and technical requirements of start-up operators.



4.2.4 Governments can establish international industry standards and digitalization process evaluation indicators, encourage the exchange of data, and ensure data security in order to supervise and guide the market

- **Action 10: Establish global standards and inclusive trade rules, and balance the demands of industries and governments**

Specific action: 1) Based on circumstances of industries, governments could establish alliances with leading players in industries and jointly develop standards and norms; 2) Governments could participate in the formulation of digital trade rules to promote the sustainable development of digital trade, adhere to principles of openness, non-discrimination and fair national treatment, promote the elimination of non-tariff barriers and investment restrictions, and actively promote trade and investment facilitation. For example, the American Automated Driving Industry Standard reduces uncertainties with the development of autonomous driving technology caused by different state laws by separating federal laws from state laws. This standard also promotes the commercial use of autonomous vehicles, and accelerates the deployment and testing process of autonomous driving technologies. In addition, global

⁹ Monetary Authority of Singapore. Consulting Report P010-2018.

¹⁰ Intellectual Property Office of Singapore. Enabling Fast-track Financial Technology.

¹¹ Singapore's "market-recognized operator" regulatory framework: the first level is newly added, allowing the participation of retail investors. Enterprises that conform to the original single-layer regulatory framework are classified as second level. The third level covers small Enterprises, especially start-up companies, that are going through sandbox tests and are about to enter the market.

standards have been established for 5G to fully promote technological advancement and application. The implementation of the WTO Trade Facilitation Agreement, the development of the WCO e-commerce policy framework, discussions of investment facilitation rules, and the formulation of digital trade rules in the FTA will have important impacts on the policy governance of global digital trade.

- **Action 11: Establish digital evaluation indicators, monitor the digitalization process, and promptly correct deviations from standards**

Specific action: Governments can set up key performance indicators (KPI) through collaborating with industry experts to monitor and evaluate the performance of relevant players in the industry, and quickly adjust policies and incentives. The EU Digital Scoreboard is one example of such a best practice.

- **Action 12: Ensure data security and privacy, encourage data exchanges and promote innovation**

Specific action: Governments have a number of options when aiming to ensure data security and encourage the exchange of data: 1) Legislate to ensure data security and privacy, or establish data rating mechanisms based on data sensitivity, and clarify the exchangeability of different levels of data when data is transacted; 2) Promote data exchange and set up data alliances to encourage data flow; 3) Provide support through funds, services, or infrastructure.





Case study: Shanghai Data Exchange Center¹²

The Shanghai Data Exchange Center is an important state-owned functional organization established by the Shanghai municipal government as part of the five-in-one planning layout of Big Data Development. It combines a transaction organization, an innovation base, an industry fund, a development alliance, and a research center. It was largely developed in 2017, providing data exchange services to more than 200 organizations, including 23 sets of data in 4 categories for the marketing industry, and 83 sets of data in 4 categories for the financial services industry. By the end of December 2017, the total number of data center transactions exceeded 1 billion.

The Shanghai Data Exchange Center actively responds to the strong and growing requirements of enterprises. Two major types of data applications were developed: marketing applications and credit reporting applications. For marketing applications, the data collected includes predictions about basic information (e.g. demographic characteristics and degrees of knowledge), browsing behavior, e-commerce purchase intentions, and application preferences. The data of marketing applications includes unique data items related to the automotive industry and the financial industry, as well as maternity products. During the application of credit reporting, the data is used for identity verification. At present, the system mainly supports verification based on either three elements (ID card, name, and mobile phone number) or four elements (ID card, name, mobile phone number, and bank card). **In addition, the Shanghai Data Exchange Center is working to better leverage the value of existing data.**

The data transaction service platform is oriented towards the scenario-based needs of industries, and enables member registration, de-identification of metadata regulations, independent listing controls, ID identification matching, and unified settlement and clearing.

This ensures the continuous online gathering and sharing of derivative products related to commercial data. The platform makes combinations of self-produced data and inputted data possible, further magnifying the value of existing data. The data transaction system does not respond to any data requests beyond the reasonable dimensions of the application scenarios. In addition, the system does not store the data of any users, does not transmit any non-anonymized data, and does not allow users to retain unauthorized data. This ensures the efficiency, security, and privacy of all data that is exchanged.





¹² Official website of Shanghai Data Exchange Corp.

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