Smart Development: Empowering Industries by Digitalized and Intelligent Infrastructure

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► **Sustainability Context**

New infrastructure supported by innovative, upgraded new-generation network information and communications technologies (ICT), such as 5G and AI, has accelerated high-quality economic development. In 2020, China sped up the construction of such new infrastructure, fostered new economies, technologies and industries, and created new drivers for economic growth. How to make better use of new infrastructure, promote integration of technology and innovation, and drive transformation and development across industries, has become the pressing issue to be addressed by ICT enterprises.

► **Our Actions**

Centering on digitalized and intelligent transformation and high-quality development, we accelerated information infrastructure construction, enhanced integrated innovation such as "5G+AICDE/ blockchain", and promoted integration of information technology across industries to speed up their transformation and upgrade. At the same time, we strive to develop the most advanced information technology and the best telecommunication services for clients.

Building the Information "Highway"

Seizing the opportunities of digital economy, China Mobile actively laid its plans for building first-class new infrastructure and information "highway", spared no efforts in building 5G-centric digital, intelligent integrated infrastructure, and elevated the network coverage, capacity and user experience to a higher level, unblocking the "artery" of information flow for economic and social development.

Leading Infrastructure Construction

In 2020, overcoming adversities brought by the COVID-19 pandemic and the immature industry chain, China Mobile accelerated the building of "nationwide, technologically advanced, high-quality and world-leading" 5G premium networks and related infrastructure, and strengthened the construction of computing and platform infrastructure to foster the growth of digital industries.

Strengthening network infrastructure

China Mobile has comprehensively strengthened the construction of network infrastructure to meet ubiquitous access needs, and extended network infrastructure with 5G at the forefront to cover all urban areas above prefecture-level. As of the end of 2020, we had opened 390,000 5G base stations to provide 5G commercial services for all prefecture-level cities, selected counties and key areas in China. We had built a technologically-leading and the world's largest 5G standalone (SA) commercial network.
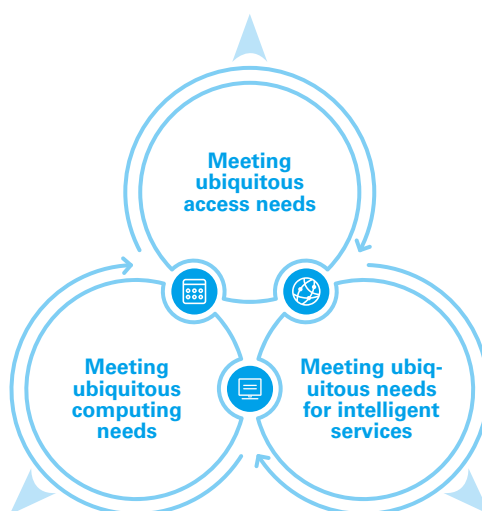
Enhancing computing infrastructure

China Mobile endeavored to develop "3+3+X" data centers layouts that are more effective, better planned and more sustainable: three key regional centers (in the Beijing-Tianjin-Hebei Region, the Yangtze River Delta, and the Guangdong-Hong Kong-Macao Greater Bay Area), three inter-provincial centers (in Hohhot, Harbin and Guiyang), as well as provincial centers and service nodes across the country, efficiently meeting the intelligent computing needs across industries.

Accelerating platform infrastructure construction

China Mobile continued to accelerate platform infrastructure construction to meet ubiquitous needs for intelligent services, and actively deployed industrial Internet and other application platforms to provide clients with one-stop solutions. At the same time, China Mobile built a capacity and platform service system to empower various industries with AI technologies.

5G signal covers Mount Qomolangma - A new legend for China Mobile

Case

Upon the start of the Mount Qomolangma elevation measurement project on April 30, 2020, a China Mobile team worked day and night non-stop and successfully opened a 5G base station at the 6,500-meter-elevation advance camp to cover the mountaineering routes on the north face and the summit with the 5G signal so that the 5G signal can be detected on the world's highest peak.

Due to the harsh natural environment on the mountain, the maintenance equipment could only be carried up to the base station on the back of workers or yaks. The workers installed and troubleshot the equipment barehand-edly at a temperature of around minus 20°C, and used parallel connection of two oil machines to power the base station. In addition, they upgraded, maintained, and improved the 177km transmission trunk line around the service zone and the machine rooms along the line. Our 12 network maintenance workers worked in shifts around the clock at an elevation above 5,300 meters above sea level until the measurement team reached the top.

From 2G to 5G, China Mobile's signals are always there to serve Chinese and foreign mountaineers, scientific expedition teams and tourists on Mount Qomolangma. This historic moment in the global telecommunication history would not be possible without the bravery and hard work of our builders.

■ In May 2003, China Mobile successfully launched the multimedia messaging service (MMS) on Mount Qomolangma

■ In November 2007, China Mobile opened a base station on Mount Qomolangma at an elevation above 6,500 meters

■ China Mobile opened the world's highest 5G base station on Mount Qomolangma

Data centers boost the development of local digital economy

Case

In 2020, China Mobile made considerable progress in data center construction. For instance, the Phase II project of the data center built in Gui'an New Area can accommodate 70,000 servers, becoming the backbone node in the southwest region; after completion, the Nanjing Data Center in Jiangsu will accommodate 19,000 racks and 300,000 servers, and is expected to be one of the best Internet data centers in Eastern China. With strong capabilities in terms of platform processing, storage, cloud computing and mobile communications service, these data centers can effectively gather and integrate the upstream and downstream businesses, laying a new foundation for the development of local digital economy.

OnePOWER advances 5G+ industrial internet transformation

Case

On October 29, 2020, China Mobile announced the 5G+ industrial Internet brand "CMCC OnePOWER". It's clearly positioned to provide better industrial solutions, more diversified industrial applications and products, more powerful industrial modeling tools, and more flexible platform deployment methods. It demonstrates the latest developments in 5G-powered industrial Internet, covering four major areas of terminals, private networks, platforms and applications, and best practices in six sub-industries: factories, metallurgy, mining, power, ports and chemicals.

Advancing Openness for Innovation

China Mobile furthered the strategic cooperation with government agencies, leading enterprises and research institutes, etc. to advance cross-sector collaboration and complementation through 5G-powered digital innovation. While constantly improving independent innovation capacity, we developed specialty capabilities and empowered partners to jointly build a new ecosystem for digitalized and intelligent services.

In 2020

- Co-established a research institute with Tsinghua University, with **five** research centers dedicated to "6G", "next-generation Internet" and others.

- Provided comprehensive authentications and connection services to various classes of Internet enterprises. China Mobile Passport has connected over **15,000** Internet applications, processing on average **1.444 billion** authentications per day.

- Led **35** new key projects to develop international 5G standards commissioned by 3GPP, ITU and other international standards organizations, bringing the total to **99**.

- Submitted more than **1,200** standards documents, bringing the total to over **6,000** documents, **leading** among global operators.

- Co-launched **20** 5G chip solutions with industry partners.

8 Open Capability Platforms

Giving full play to its own advantages and unique resources, China Mobile adopted one-point access and centralized operations, and introduced eight specialty capability platforms to serve micro, small and medium-sized enterprises and individual innovators. As of the end of 2020, these platforms had received over 800 billion service requests and incubated over 300,000 applications.

01 Telecommunications	02 Internet
03 IoT	04 Digital home
05 Digital content	06 R&D
07 IT	08 Industrial application

1 Collaborative Innovation Platform

We have built a service platform for innovators and startups, through which we introduced the "Star Plan" to recruit partners from SMEs and universities for innovation projects, to deepen cooperation between businesses of various sizes, universities and research institutions and explore a market-oriented, business-led path toward technological innovation. As of the end of 2020, the platform had released 60 such projects in various fields such as smart home, smart city, smart hardware and cultural & creative industries.
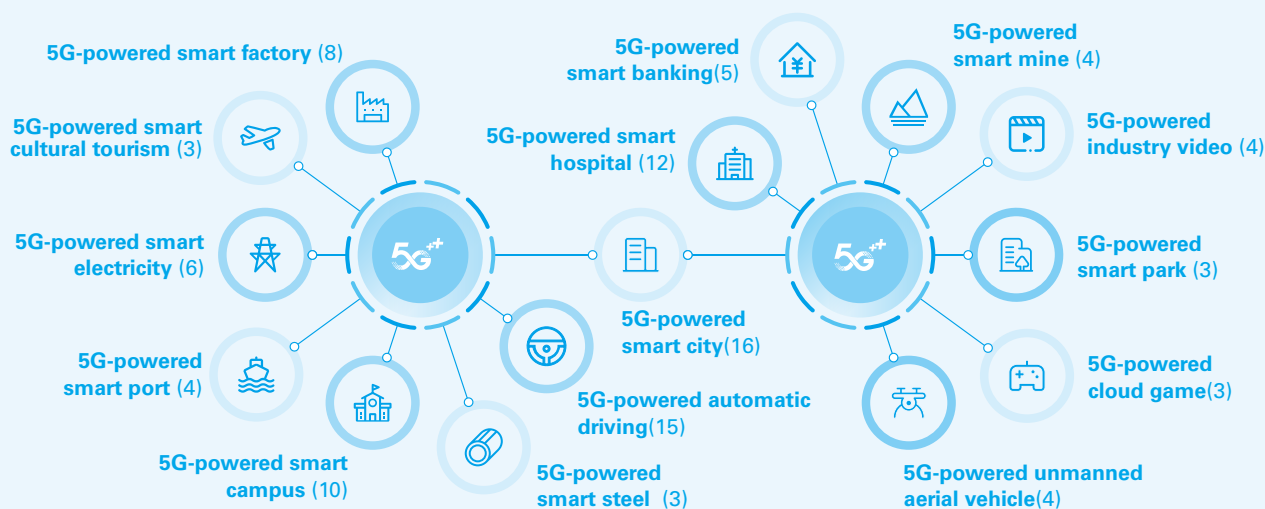
Operating the Information "High-Speed Train"

The information infrastructure with 5G at the forefront has provided strong support for digital and sustainable development across industries. China Mobile actively operated information "high-speed train" and explored new scenarios, applications and business models of information services to facilitate transformation and upgrade across industries. Meanwhile, we provided a wider range of digital, intelligent services for making a better digital life for all.

Promoting ICT Applications in All Industries

China Mobile sought further integrated innovation by applying ICT to various industries and promoted the application of the new-generation ICT such as 5G technology to empower areas of economic, social development and livelihoods. As of the end of 2020, China Mobile had created 100 Group-level pilot projects for 15 industries, and boosted efficiency and profitability across industries.

5G-powered smart factory (8)

5G-powered smart cultural tourism (3)

5G-powered smart electricity (6)

5G-powered smart port (4)

5G-powered smart campus (10)

5G-powered smart banking (5)

5G-powered smart hospital (12)

5G-powered smart city (16)

5G-powered automatic driving (15)

5G-powered smart steel (3)

5G-powered smart mine (4)

5G-powered industry video (4)

5G-powered smart park (3)

5G-powered cloud game (3)

5G-powered unmanned aerial vehicle (4)

5G-powered unmanned aerial vehicles (UAVs) offer diversified smart solutions	Case

Emergency response: China Mobile's 5G-powered UAVs participated in emergency rescue for forest fire in Xichang City of Liangshan Prefecture of Sichuan, wildfire in Anzhou District of Mianyang City, catastrophic flood in Leshan, and earthquake in Changning of Sichuan.

Transport and logistics: China Mobile's 5G-powered UAVs were equipped with cargo space to deliver medical emergency supplies more quickly to remote areas such as Zhaojue County, Liangshan, Sichuan.

Inspection and map survey: China Mobile's 5G-powered UAVs were used for map surveys in Yunyang County, Chongqing. The massive real-time map survey data and the automatically merged images made low-latency, high-precision 3D modeling possible.

Urban management: At the Ningde Nuclear Power Plant in Fujian, AI recognition and 5G-powered UAVs were used to identify potential problems and take photos for troubleshooting, considerably improving the efficiency of inspections over power lines and cold source waters.

Farmland operation: At the Chongqing Yongchuan Smart Pear Garden, 5G-powered UAVs were used for automated and targeted pesticide spraying, protecting the farmland from pest.

Live broadcasting: In Beidahu, Jilin Province, 5G-powered UAVs were used to broadcast the curling competition, part of the points game for the Beijing 2022 Olympic Winter Games. The 5G real-time feedback platform offered high-definition and multi-angle live broadcasting of the game.

5G empowers port operation

As an important hub of modern transportation, ports play a pivotal role in economic development. Our Zhejiang subsidiary enhanced research on 5G SA network, edge computing, network slicing, remote control of port machinery, automatic driving, etc., to help the Zhoushan Port in Ningbo realize 5G+ tire-type gantry crane remote control. It has completed the application test of 5G-powered unmanned trucks. The 5G-powered unmanned trucks built by our Fujian subsidiary for the Far Sea Port carried goods along the pre-designed route and delivered them to the designated place within the specified time, solving common problems such as abnormal communication interference and long delay under traditional operations. The low-latency and high-reliability transmission of AGV (Automatic Guided Vehicle) control signals greatly improved the overall operating efficiency of automated terminals. In addition, 5G technology was also applied at Shanghai's Yangshan Port, Shandong's Qingdao Port and Shenzhen's Mawan Port, etc., laying a more solid foundation for port digitalization.

■ Scan the QR code to learn more about Smart Port

■ China's first 5G+ remote control gantry crane was put into use in Ningbo Zhoushan Port

The deepest 5G base station supports smart mining

On June 18, 2020, China's first 5G-powered smart coal mine was officially completed in Shanxi. China Mobile co-built the then China's deepest 5G base station (534 meters underground) for Xinyuan Coal Mine of Shanxi Yangquan Coal Industry Group. A "super gigabit uplink" private 5G network was built for the coal mine, equipped with diverse applications including unmanned inspections of electromechanical chambers, remote control of tunneling operations and unmanned mining, etc. These solutions enabled monitoring and targeted remote operation of underground equipment, laying a solid foundation for less-manned or unmanned mining and safe mining.

5G-powered smart tourism for the building of Characteristic Towns

In August 2020, China Mobile supported the building of Wengding Hulu Characteristic Town in Yunnan with smart tourism solutions. We made full use of 5G network and employed innovative applications, such as "5G+AR", "5G+WiFi" and "5G+VR", striving to build a characteristic ethnic town based on ethnic characteristics of local Wa people. We helped local property owners improve management with security services, broadcasting and UAVs. The town, equipped with smart toilets, smart hotels, smart parking, smart travel and VR live streaming services, etc., effectively improved the tourist experience and tourist services. To date, it has received nearly 2 million visits cumulatively.

Serving the Digitalized and Intelligent Life

With innovative technologies such as 5G, China Mobile developed specialty services including 5G Messaging, ul-tra-high-definition video, Color Ring Back Tone (CRBT), VR/AR, etc., to meet users' growing needs for diversified, high-quality and personalized digital content and deliver a more intriguing digital life on the "cloud".

New Technology

- Initiated the first multimedia alliance in China - 5MII, and co-established the Cloud Game Industry Alliance and the 5G+Video CRBT Industry Alliance;
- Co-released the *5G+8K Ultra HD Localization White Paper* and participated in the preparation of the world's first national standard for video CRBT, continuing to drive industry innovation.

New Content

- Applied 5G technology to deliver 4K live broadcasting of games of Chinese Football Association Super League (CSL), China Basketball Association (CBA) and China Volleyball League (CVL) every day;
- Partnered with the China Museums Association, National Centre for the Performing Arts of China (NCPA) and Shanghai Animation Film Studio to create ultra-HD immersive content based on classics works.

New Experience

- Launched five new 5G applications: "5G+4K+VR", the world's first 5G ultra-HD video CRBT, AR Photo-shooting, MiguPlay on 5G Cloud Game Platform, and 5G-enabled mobile newspaper;
- Launched the Digital Smart Cloud services online including Cloud Performing Arts, Cloud Museum, Cloud Dance, Cloud Fitness and Cloud Class, etc.

5G+VR offers an immersive digital experience   Case

China Mobile employed the Gigabit Ethernet to develop omni-terminal mobile cloud-based VR applications with immersive experience. We combined 5G and VR technologies to enrich online cultural life and better disseminate knowledge. We are the first in the industry to apply VR technology to live broadcast the cherry blossom festival, on Mount Qomolangma, and at concerts. For sports events, we employed 5G technology to allow you an immersive game-watching experience with friends far away. We also held online classes. Our Migu Reading became China's first 5G-powered new-generation reading App containing e-books, audio books and videos, as well as bestselling screen adaptations, enabling more new experiences for the public.

■ China Mobile MIGU Company Limited launched the VR bookstore on World Reading Day, unveiling the era of reading in virtual reality

Putting Customer First

China Mobile always puts "customer satisfaction" in the first place. We attentively listen to the demands of customers, leverage digital and intelligent technologies, and strive to deliver first-class service management, complaint response, network quality, emergency communications and information security.

Improving Service Quality

In 2020, China Mobile continued the "Leading Service" Action, "Sunshine Action", and "Peak Cut Action". We took the lead to organize customer communication activities such as the "Quality Service Season" to effectively improve customer experience and satisfaction. The service quality of 10086 hotline, service halls and home bandwidth installation & maintenance, etc. continued to maintain a leading position.

Optimizing Closed-loop Management

Improving standards for better quality: China Mobile continued to improve the service quality standards of key CHBN services, and increased such standards to 20 in 2020. We also formulated administrative measures for ecosystem-wide cooperation service quality, expanding quality management from our own business to the ecosystem-wide cooperation system.

Evaluating customer perception: Through the customer experience perception evaluation platform, China Mobile conducted over one hundred quality perception evaluations for 32 key products, reaching an average of over 140 million users per month.

Improving customer complaint response: China Mobile set up the semi-monthly disclosure system for 5G and mobile number portability services, and the three-level closed-loop management mechanism featuring "daily alert, weekly update, and monthly disclosure". Moreover, China Mobile investigated the causes of complaints about focal and hot issues. The rate of timely complaint handling rose by 10%, the time for complaint handling fell by 43.3%, and the rate of complaints about "perceived user experience" fell by 53.5% from the previous year.

Developing More Digitalized and Intelligent Services

Improving CHBN-oriented service and operation capabilities: China Mobile took the lead in setting up the 10086 hotline, the country's first smart integrated telecom service portal covering all CHBN markets. China Mobile also launched smart voice navigation services that can understand and rapidly respond to customers' needs. Smart voice responses accounted for 72% of the services. The entire complaint response process is made transparent, and the repeated complaint rate has dropped by 39.7%.

Enhancing smart service capability: China Mobile continued to build a "new level of customer service system" characterized by data convergence, integration of capabilities and digitalization of services, to deliver more targeted and proactive services.

Enhancing Customer Communication

Internal: Cultivating "customer-centric" service awareness. China Mobile carried out two activities to discuss the meaning of customer-centric services and how to improve services, raising the service awareness of our staff, with 1,600 cases collected in over 300 discussions held. Moreover, China Mobile further promoted the use of the two platforms: the "Voice of Customers" and "Voice of the Frontline", and continued to recognize "Best Practice of Service Management" and "Service Star" as role models. With these efforts, the awareness that "everyone is the customer manager" has gradually taken root.

External: Hosting the Quality Service Season. Under the theme of "Heartfelt Service, Excellent Experience", focusing on "excellent network, products and services", China Mobile organized three customer interaction activities, including "General Manager Customer Reception Day", "Welcome to China Mobile", and "I Am a Service Experience Officer", with over 20 million participating customers.

■ Live streaming of General Manager Customer Reception Day organized by our Sichuan subsidiary

■ "Welcome to China Mobile" campaign of our Jilin subsidiary

In 2020

32.2%
The 10086 hotline received less complaints on a year-on-year basis

53.5%
The rate of complaints about "perceived user experience" dropped

36.1%
The rate of complaints about "household broadband internet service quality" per 10,000 users dropped

Improving Network Quality

In 2020, China Mobile led the industry with its 5G network performance by launching "4/5G network quality collaborative improvement" and "5G SA network quality improvement" campaigns. Taking a problem-orientated approach, China Mobile launched a "special action for quality improvement" to improve household broadband quality and installation & maintenance capabilities. Apart from the checklist handling of the household broadband complaints, we continued to track the progress of rectification by all provincial branches to ensure complaints are resolved, substantially improving household broadband quality.

In 2020

337
Cities in China put 5G SA into commercial use

99%
The 5G SA wireless connection rate exceeded

750+ Mbps
5G SA average download speed

Emergency Communications Services

China Mobile built an "iron army" for emergency communications support by improving management system, preparation normalization, capability standardization, and centralized dispatch. Faced with floods and other natural disasters, we braved the frontline for emergency communications support and secured telecom services for local residents. Moreover, we delivered telecom services to the Third China International Import Expo (CIIE) and 11 other major events, as well as routine telecom services to our users, with "zero major network failure, zero major cyber security incident, and zero major customer complaint".

■ Our workers at Meishan subsidiary hiked 10 kilometers carrying 100 kg of equipment to repair the communications network

■ Our workers at She County subsidiary in Anhui braved the flood to ensure that students could timely take College Entrance Exams

In 2020

4,887

Incidences of emergency communications services provided

264,102 **person-times**

Personnel dispatched for emergency communications services

Safeguarding Cybersecurity and Information Security

China Mobile attaches great importance to cybersecurity. Apart from building the information governance system, we took multiple measures to resolutely prevent spam messages and fraudulent communications, so as to ensure the safety of customer information and privacy.

Cybersecurity Protection

We attach great importance to the implementation of the cybersecurity accountability mechanism. A highly efficient data security management system with clear division of labor and responsibilities and integration of technology and management is in place to protect cybersecurity and information security around the clock. China Mobile coordinated the construction of the 5G-enabled "security as service" system, actively explored the role of AI and big data in cybersecurity and information security, and responded to such risks arising in new business development.

Information Governance

We continued to deepen centralized information governance in terms of improving governance approaches, processes, monitoring and handling, etc. In 2020, China Mobile launched the "Protecting Minors' Online Safety" service and helped build safe online environments such as mobile network and household broadband internet for minors through information reporting, time management, personalized settings and online safety protection, etc.

Preventing Telecom Frauds

We improved the three-level collaborative technical defense system, enhanced interception of fraudulent information, and rapidly handled suspected fraudulent phone numbers. Moreover, we built a database of customers with bad credit record and leveraged own resources to block domain names or websites used for loan frauds, and assist law enforcement agencies to help cement the defense against fraud.