

Digitally Ignited the Engine of Technological Innovation to Strengthen Growth Momentum

Optimising Mechanism of Technological Innovation
Promoting Application of Innovative Technology
Empowering Digital Transformation of Industries



DIGITALLY IGNITED THE ENGINE OF TECHNOLOGICAL INNOVATION TO STRENGTHEN GROWTH MOMENTUM

Technology, a powerful tool for a nation, enables a country to become stronger, an enterprise to outperform peers and people to live a better life. As the main force in building a technology superpower, China Unicom takes the responsibility to ensure technology independence and self-improvement. It seized the new opportunities for technological innovation brought by the digital economy, enhanced its own innovation capabilities, and nurtured a flourishing and synergetic innovation ecosystem. It accelerated the transformation of technological innovation achievements into actual productivity, and enriched and expanded new innovative technology products, assisting the government in efficient social governance and serving the digital transformation of numerous industries.

Measures adopted in 2020

- Optimised technological innovation system, increased research and development investment, strengthened incentives for technological innovation, and expanded cooperation among industries, universities and research institutions.
- Focused on research and innovative applications of core technologies such as 5G, cloud computing, Big Data, Internet of things, blockchain and AI.
- Enhanced proprietary product research and development capability to offer total solutions. Developed industry cooperation ecology to empower digitalisation of industries.

Actions to be taken in 2021

- To actively strengthen ecological cooperation in technological innovation externally and comprehensively promote the integration of technological innovation into production internally.
- To focus on research on foundation technologies such as cloud computing, Big Data, Internet of things, AI, blockchain and forward-looking application scenarios. To strengthen early-stage research on next-generation network technologies such as computing power network, 6G and quantum communication, and application products such as industrial Internet.
- Focusing on key fields and industries, to build a “platform +application” product system with cloud-network collaboration, digital integration and open capability to provide richer integrated application products for the whole society

OPTIMISING MECHANISM OF TECHNOLOGICAL INNOVATION

Robust system and mechanism of technological innovation is an important foundation for accelerating the development of technological innovation. China Unicom kept strengthening its innovation awareness, overcame the obstacles of systems and mechanisms, enhanced policy edges and stimulated the energy of innovative development to propel technological innovation and accelerate the digital transformation.

Improved Technology Management

China Unicom continuously optimised its technological innovation system, strengthened research and development management, stepped up research and development investment, and adopted full-lifecycle management of technological achievements.

- Thoroughly implemented the requirements of the State-owned Assets Supervision and Administration Commission (SASAC) on central state-owned enterprises to increase investment in technological innovation and enhanced the intensity of research and development investment. As at the end of 2020, technological innovation investment amounted to RMB12.28 billion, representing 4.5% of the total revenue.
- Optimised and restructured the technology committee of the head office and promoted the establishment of technology committees at subsidiary companies.
- Clarified the management standard, process and collection requirements of various research and development projects to realise 100% platform management.
- Actively developed technology R&D talent team and explored the acquisition of outstanding external technology R&D talents.
- Systematically carried out the registration, review and management of technological achievements nationwide and established a database of evaluation experts.

Increased Innovation Incentives

The Company continuously improved the incentive system for technological innovation and increased the incentives for technological innovation. With the maximisation of interests as the goal, it formulated and published incentive policies for technological innovation, which were publicised as broadly as possible through meetings, production of H5 publicity materials, remote consultation, DingTalk and other multi-channel communication forms, so that the technological personnel of the Group can understand the policies and gain confidence. In 2020, the Group awarded technology innovation incentives of RMB45.09 million, double that of the prior year, greatly stimulating the vitality of the technology R&D personnel.

Expanding R&D Cooperation

The Company actively expanded cooperation among industries, universities and research institutions. It established joint laboratories with colleges and universities, carried out research projects in the fields of Internet of vehicles, optical transmission and new network evolution with renowned universities such as Tsinghua University, Peking University and the Chinese University of Hong Kong as well as research projects in the fields of base station equipment and network system with high-tech companies such as Huawei and ZTE. In 2020, a total of 61 projects were under research and 49 projects were newly declared.

On 30 November 2020, China Unicom held the 2020 Technological Innovation Conference in Beijing, gathering experts and industrial innovation forces from multiple fields to learn from each other and promote the optimal allocation of technology R&D forces and resource sharing. At the meeting, China Unicom entered into cooperation agreements with Renmin University of China, Beijing University of Posts and Telecommunications, Beijing University of Science and Technology and the National Time Service Center of the Chinese Academy of Sciences, setting up joint laboratories in artificial intelligence and Big Data, intelligent open optical network, 5G metallurgical intelligent manufacturing, high-precision ground-based timing system, etc. It held the founding ceremony of “China Unicom Computing Power Network Industry Technology Alliance” with the representatives of the Chinese Academy of Information Technology, the Network Information Center of the Chinese Academy of Sciences, Tsinghua University and industry partners to jointly promote industry development.



PROMOTING APPLICATION OF INNOVATIVE TECHNOLOGY

China Unicom played its role as an engine of technological innovation among central state-owned enterprises. It bravely acted as the “source” of original technologies and entered untapped technological fields. It accelerated to tap the potential of digital technology and promoted the security and stability of the supply chain.

Developed New Communication Technology

Propelled 5G technology innovation

China Unicom adhered to Standalone (SA) as the ultimate 5G architecture and resolutely built a technologically leading 5G network. It actively propelled the evolution of 5G technology and deployed the first Standalone (SA) networks in the world. It cooperated with chip, terminal and equipment manufacturers to overcome challenges to drive the development of 5G value chain.

- Took the lead in completing three 3GPP standards including 2.1G 50MHz/40MHz large bandwidth. Secured the approval for the refarming of 2.1G frequency band as 5G spectrum, supporting world-leading 5G deployment in 2.1G frequency band.
- Spearheaded technical trials of millimetre wave network in the Winter Olympics use cases.
- Spearheaded and completed tests to decouple 13 5G social cloud micro-sites from existing network 5GC NG interface.
- Created a proprietary 5G intelligent energy-saving platform and 5G base station energy-consumption intelligent control system “integrating wireless technology and AI”.
- Carried out new technology trials, centralised procurement testing and research on key issues of commercial deployment, and completed the first large-scale commercial deployment and operation of 5GC.



China Unicom announced a 5G drone-carried terminal called “Rainbow 1” which was put into use in multiple drone projects, turning Anyang into China Unicom’s 5G ubiquitous low-altitude test base and the Civil Aviation Administration’s drone test base.

Propelled the application of quantum communication technology

- Actively carried out research on the application of new technologies such as quantum secure communication architecture, optical fibre transmission and application effect analysis, and implemented a number of applications such as quantum encrypted video conferencing systems on the Jingxiong International pre-commercial quantum encryption trunk line.
- Combined quantum encryption key services and blockchain technology to carry out in-depth research in the fields of digital identity and trusted terminals, and jointly promoted real-world applications in typical industry use cases.

Conducted 6G wireless technology pre-research

Completed the first domestic air-space-ground integrated business demonstration and verification, published several white papers on topics such as terahertz, blockchain, and air-space-ground integration, and successfully applied for multiple topics of the 6G national major project.

Built a Cloud-driven Business Model

Focusing on the new base, new cloud management and new PaaS capabilities and targeting at product capabilities and business scale enhancements, China Unicom vigorously enhanced the carrying capacity and research and development capabilities of the WO Cloud platform, constructed an integrated cloud product system, and achieved solid growth in innovative business.

Built a WO Cloud support system

The cloud support system adopted the microservice cloud-based architecture of “large middle platform + small front-end” to realise the decoupling between services and products. It had rich and flexible business arrangement capabilities, supporting rapid resource provisioning and full life cycle management. The four platforms of Yunjing, Yunce, Yunjing, and Yunchang support unified management of heterogeneous cloud pools and unified monitoring of resources across the entire network. 38 products have been launched so far.

Improved WO Cloud product system

The new WO Cloud focused on building a new base, new PaaS, and new cloud management product system to enhance the core capabilities of WO Cloud products and achieve scale development.

In 2020, China Unicom held a WO Cloud new product launch ceremony titled “New WO Cloud, New Base, New Intelligence”, reaching out to more than 5 million people nationwide. It created a PR matrix with 9 self-owned social media accounts centred on Weibo and Weixin, and published a total of 2,173 posts, with a total of more than 480,000 views and more than 1.2 million fans. It published 267 articles with more than 300,000 views. It conducted online campaigns. For example, it held an online “Clouds Gathering and Unbounded Symbiosis” cloud market merchant acquisition conference, and created a “Cloud Market Festival”, which attracted more than 300 application providers and was watched 11,776 times. The influence of WO Cloud brand continued to expand.



Strengthened Big Data Capabilities

China Unicom accelerated its digital transformation, consolidated its industry-leading data base, significantly improved its Big Data capabilities and formed an “accurate”, “fast”, “comprehensive”, “unified” and “connected” intelligent Big Data system to enable high-quality business development, striving to be a key player in digital China development. In 2020, the Company’s market share in Big Data business remained the highest in the industry.

- Enhanced data asset integration capability. China Unicom has established a hyperscale Big Data cluster governance and data governance system and developed PB-level technical data processing, real-time analysis and model service capabilities to achieve end-to-end full life cycle data security management capabilities. It processed over 200TB of incremental data and undertook over 100,000 processing tasks every day.

- Leveraging the advantages of centralised Big Data, China Unicom launched a user roaming location query API within 3 days to support “pandemic prevention and control travel history assistant” and “communication Big Data travel history card”. It processed a total of more than 755 million queries, serving 8.35 billion user trails across the network.

- Enriched product capabilities. Building on big data, artificial intelligence and blockchain technology and with the goal of serving the digital transformation of government and enterprise customers, China Unicom formed a product matrix covering data application services, data technology services, artificial intelligence and blockchain and focusing on key industries including government affairs, finance, cultural and tourism, transportation and others. There were 8 ten-million-class products.

- Consolidated proprietary research and development capabilities. China Unicom increased the proportion of proprietary research and development from nearly 0 to 70%, and achieved full autonomy in computing power allocation, data assets, data models, application development, automatic operation and maintenance and data security.

No. 1
in the telecommunications industry
in the 2020 China Big Data Enterprise Ranking

China Unicom Yunnan branch fully leveraged the advantages of its Big Data capabilities, used demographics Big Data obtained from mobile phone signalling to support the natural resources and land planning of Yunnan Province, facilitating the comprehensive digitisation of land and space and the full coverage of human-land factors. It provided powerful support for the Yunnan provincial government’s policy-making in the “14th Five-Year Plan” of Digital Yunnan planning and development.



Population Big Data System for Land and Space Planning of
Yunnan Provincial Department of Natural Resources

China Unicom signed cooperation agreements with four Big Data ecosystem partners including Duxiaoman Technology (Beijing) Co., Ltd. and Hangzhou DT Dream Technology Co., Ltd. to jointly explore product development and application services in financial risk control modeling, etc.

Enhanced the Value of IoT

In the era of intelligent connection of everything, China Unicom is committed to becoming a leader in “AloT” empowering thousands of industries. It enhanced its core capabilities in platforms, networks, ecology, applications, etc., and offered integrated solutions and services including connectivity, applications, and terminals. It joined forces with upstream and downstream partners in the industry chain to jointly develop a new 5G industry ecology and comprehensively empower the digital transformation and upgrade of the industry.

Ranked **7th**
among the world's top 500
IoT enterprises in 2020

Strengthened network construction

- Built a 5G IoT core private network classified by people and things, with the ability to support 5G IoT business.
- Diverted and balanced traffic according to IoT zones to improve network resource utilisation and enhance user perception.
- Fully supported new functions such as VoLTE, directional voice, and directional text messages.

Built platform capabilities

- The Company's self-developed connection management platform supported innovative services such as 5G, eSIM, public Internet of Things, and MVNO and carried more than 80 million connections.
- The Company's self-developing device management platform supported 32 standard object models and 88 API interfaces such as smart street light, hydrological monitoring, industrial inverters and edge gateways in the field of smart city and industrial Internet, underpinning the rapid development of SaaS applications in the upper stack.

Improved product system

Released more than 20 standardised non-access IoT products around smart city, industrial Internet, 5G industry terminals, smart energy and other fields. Among them, we developed 7 proprietary products including Yanfei Cat.1 module and Yanfei smoke sensor. The Industrial Internet AloT platform was rated as the only dual cross-level industrial Internet platform in Jiangsu Province in 2020.

China Unicom Shandong branch made use of NB-IoT and cloud platform technologies to develop and deploy a smart energy Big Data service system and intelligent high-precision pipe network monitoring product. It enabled comprehensive online monitoring of heating pipe networks and provided data support for smart heating to achieve low-carbon energy conservation objectives. Among the 7 power supply stations and 1,500 units in the initial pilot programme, more than RMB1.9 million was saved in the heating season of 2019–2020 compared with the previous heating season, and the overall user complaint rate was reduced by 25%.



Built industry ecosystem

The Company developed its IoT industry alliance with an open sharing philosophy. It added 91 new partners in the year from key industries such as consumer electronics, smart healthcare, and smart city, thereby broadly aggregating industry ecological resources to accelerate the development of an intelligent IoT ecosystem.

In June 2020, China Unicom held the “Enabling New Infrastructure for the New Future of IoT — 5G + AloT Summit for Boosting Industry Digital Transformation, Innovation and Development”. In cooperation with more than a dozen industry partners such as Unisoc (Shanghai) and MeiG Smart, it published the first Cat.1 white paper in the IoT industry to promote the development of the IoT industry.



Innovated on Blockchain Application

China Unicom regards blockchain as an important field for the breakthrough of proprietary innovation of core technology. It accelerated the integration between blockchain technology and innovative development of industry, and provided credible infrastructure for the development of the digital economy in the 5G era.

Built platform capabilities

The Company announced the “China Unicom Chain”, a unified carrying platform for blockchain products and capabilities. It developed a blockchain capability base with “1” BaaS platform and “8” generic service modules and created “N” innovative applications powered by blockchains to provide integrated infrastructure services of cloud, network and chain for the digital transformation of government and enterprise customers.

Continued to empower the nation

- Developed the country’s first blockchain-based enterprise work resumption reporting platform, which was tested in 15 provinces and cities across the country and served more than 300 companies.
- Blockchain-based test instruments and data management system were deployed and used in scale at China Unicom’s Hebei branch, with more than 100 instruments and 200 users registered in the chain.
- The Company was the first in the industry to develop a spectrum blockchain test system and launch a pilot run on the live network. It won the “ICT China 2020 Best Excellent Solution Award”.

China Unicom Guangzhou branch and Guangzhou Judicial Bureau jointly created smart judicial applications such as a blockchain judicial evidence platform and social security management to make judicial procedures such as collection and retrieval of evidence immutable and irrefutable, which reduced the difficulty of electronic evidence fixation and authentication and improved judicial efficiency and judicial service quality effectively. Currently, the Guangzhou “Public Law Chain” has been operating stably for nearly one year, with a block height of 69,074 and a total of 120,198 records.



Press conference for the launch of “Guangzhou Public Law Chain”

Accelerated AI Innovation and Empowerment

China Unicom is committed to building intelligent infrastructure and product services and driving the comprehensive upgrade and restructuring of networks and products through artificial intelligence technology.

Promoted intelligent network transformation

- Developed network AI test beds and MR intelligent construction and maintenance assistant systems, etc., and defined measurable classification of autonomous driving network.
- Constructed a prototype of the digital twin model of the broadband access network to achieve an integrated and Internet-oriented operating model of access network planning, construction, maintenance and operation.
- Designed and developed a proprietary IP network routing simulation system and designed an architecture prototype of the network digital twin system.
- Built a digital twin system in the National New District (Xiong'an).
- Held 2020AIIA Cup Artificial Intelligence and 5G Network Application Competition and ITU AI/ML in 5G Challenge and Network AI Forum.

Offered AI capabilities and applications

- Opened up the Company’s capabilities in intelligent network, perception analysis, AI algorithm model, application services, etc. to reshape the smart city operating model.
- Created applications such as new effective urban governance, new convenient public services, new industry upgrade, and new livable and green ecology to reshape the experience of citizens.

Actively Developed Standards and Regulations

China Unicom actively participates in international and domestic industry standard organisations and standard formulation, covering 5G, cloud computing, Big Data, IoT, artificial intelligence, edge computing, blockchain, information security, etc. The Company successfully promoted the standardisation of its cutting-edge research and development results, enhancing its influence in the industry and bargaining power in the international cyberspace.

- China Unicom had severed for more than 100 positions in ITU-T, 3GPP, GSMA, Linux Foundation, OpenStack and other major international standards organisations and open sources communities, including more than 20 key management positions. It participated in the China Communications Standards Association, a domestic communications industry standardisation organisation, and became a major member unit.
- Currently, China Unicom leads and participates in nearly 1,000 ongoing research projects in CCSA. It led the establishment of 37 new international standards and the release of 23 international standards. The YIG project incubated by WO Cloud’s production system was accepted as a core project by the Linux SODA Foundation, achieving breakthrough in projects led by the Company in the international open source communities.
- China Unicom-led project “5G Co-build and Co-share Key Technology Research and Industrial Application” won the first prize of China Institute of Communications.

Responsibility performance indicators	2020
International standard documents (article)	467
Industry standards (item)	295
Number of patents applied (item)	1,734
Number of patents granted (item)	518

EMPOWERING DIGITAL TRANSFORMATION OF INDUSTRIES

China Unicom actively integrated modern digital technology into various industries and empowered the digital upgrade of industries with technological innovation. It continued to promote advanced industry foundation and modernisation of the value chain, and pivoted on innovation to promote high-quality development.

Deployment in Smart City

With an objective to improve the quality and efficiency of cities, China Unicom empowered three major areas, namely urban governance, social governance and economic governance, by building a smart data brain engine. Aiming to address people's livelihood issues and echo the national strategy to expand domestic demand, the Company empowered the modernisation of urban governance to enhance the level of intelligent and refined governance.



Screenshot of China Unicom's Smart Data Brain Engine

China Unicom Fujian branch self-developed the "Diversified Solution Platform for Conflicts and Disputes-Huihejie", which rationally allocated various social dispute resolution resources and effectively improved the social governance system of the grassroots and modernised governance capabilities with the new model of "Internet + diversified governance". In 2020, the Diversified Solution Platform for Conflicts and Disputes was put into use successively in Changle District Political and Legal Committee, Dongjiekou Police Station, Putian Municipal Bureau of Justice and other places. The number of users exceeded 10,000, and more than 1,000 conflicts and disputes were resolved, effectively ensuring social harmony and stability.



The first "Diversified Solution Platform for Conflicts and Disputes-Huihejie" in Fujian Province was officially unveiled

Developed Digital Government

China Unicom leveraged new technologies such as 5G and AI to build a digital government affairs platform so as to improve the government's operating efficiency and decision-making capabilities, enhance the perception of citizens and enterprises and help the development of digital government.

China Unicom Chizhou branch fully implemented the strategy of "Embracing the Government". It signed strategic cooperation agreements with all county and district governments within the city, put itself in the government's shoes and catered to its needs. Focusing on "platform + application + operation" projects, the branch solved the government's pain points through information technology and helped to modernise the governance capabilities of governments at all levels. It became the vanguard of the development of Chizhou's digital government.



Launching Ceremony of Chizhou Smart CPPCC Platform

Focusing on the core function of "comprehensive application of government information services and information and data", China Unicom Liaoning branch led the development and maintenance of the "Liaoning Province E-government Cloud" project. Currently, the project is operating 768 non-confidential government information systems for 78 commissions, offices, departments and bureaux, and utilises 46,000 VCPU cores, 153T memory and 6PB storage to provide intellectual support and operational assurance for "Building a Digital Liaoning and Developing a Digital Government".

Pushed forward Smart Ecology

With the goal of "green and low-carbon development fostering environmental quality improvement", China Unicom leverages its own informatised, digital, and intelligent means to provide three major categories of product solutions, namely smart ecology, smart housing and construction, and smart water conservancy. It helps "China's ecological environment fundamentally improve" in 2035 and achieve the prospect of "green water and green mountains".

China Unicom Henan branch built a smart water comprehensive management service platform, a smart sand mining comprehensive supervision service platform and a smoke monitoring platform to help prevent and control pollution holistically.



Smart water comprehensive management service platform of Jia County



Smart sand mining comprehensive supervision service platform

Built Smart Factories

Based on 5G+ Industrial Edge Cloud + AI, China Unicom launched the “5G+ Industrial Internet Action Plan” and the “5G+ Industrial Internet Application Scenario Joint Innovation Plan” to create “fully 5G-connected factories” for large enterprises. For small and medium-sized manufacturing enterprises, with the mission of enabling the digital transformation of industrial clusters and enterprises, the Company built the “Yundee Industrial Internet Platform” to promote the upgrade of China’s “intelligent manufacturing”.

China Unicom Xuzhou branch and Xugong Group built the domestic construction machinery industry’s first smart park private 5G SA network combining end-to-end network slicing and edge computing. It had full-chain connectivity from signal transmission, control, design to production and circulation, and integrated the application needs of enterprises along the full value chain from 5G+ smart research and development, 5G+ smart manufacturing to 5G+ marketing services, 5G+ smart parks and 5G+ product construction. All factors including people, vehicles, machinery and equipment, production materials and upstream and downstream resources in the industrial chain were connected, facilitating Xugong Group’s smart transformation.

Innovated on Smart Medical Care

China Unicom actively explored the application of 5G in various scenarios such as smart hospitals, telemedicine, smart elderly care and consumer healthcare, etc. to improve medical service quality comprehensively and offer support to first aid, clinical diagnosis and treatment, medical education, graded diagnosis and treatment and hospital management, etc. facilitating the development of healthy China.



“Internet + Health Poverty Alleviation” remote consultation
by China Unicom Henan branch



Remote visit at ICU ward by China Unicom Fuzhou branch

China Unicom Jiangxi branch built a 5G operating room + VR remote teaching system for the Affiliated Hospital of Jiangxi University of Traditional Chinese Medicine to enable various services such as surgical demonstration, surgical guidance, surgical observation and medical education, etc., and improve the hospital’s surgical demonstration and its management of medical education and training through real-time, two-way, medical-quality video.

Supported Smart Culture and Tourism

Echoing tourism informatisation policies and industry needs, China Unicom created a series of smart culture and tourism products covering cultural and tourism management departments, tourist attractions, museums, etc. It served 17 provincial cultural and tourism departments, 116 municipal and county cultural and tourism bureaux and more than 100 scenic spots and museums, and developed smart tourism platforms for 34 total tourism demonstration areas. It has become a smart technology service provider with great reputation and brand influence in the culture and tourism field.

Aiming to develop “intelligent tours of Hailing Island” and achieve “tourists experience freedom and government management services everywhere”, China Unicom Guangdong Yangjiang branch strived to build Hailing Island’s culture and tourism informatisation base, Big Data centre, comprehensive management platform, comprehensive marketing platform, comprehensive service platform, demonstration and guiding standards and comprehensive support system to promote the transformation and upgrade of Yangjiang’s tourism industry.