# Advance technology innovation and accelerate the integrated innovation of digital technologies

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The integrated innovation of digital technologies is an intrinsic requirement of Digital China. China Unicom courageously shoulders the responsibility and mission of being the frontline troop in the integrated innovation of digital technologies, focusing on elements such as networks, data, and intelligence, implementing technological innovation to achieve "strengthening computing with networks, enhancing intelligence with data, and promoting application through integration".

## Measures adopted in 2024

- The Company undertook major national technological research tasks. We were approved as the original technology source for next-generation Internet and Big Data, coordinating the advancement of related construction and R&D. We became a leading enterprise in the artificial intelligence chain and were approved for 6 tasks in the Ministry of Industry and Information Technology's "Strengthening Long Board" initiative in the artificial intelligence industry chain.

- The Company focused its resources on breakthroughs in core technology research. 53 core technology research projects were initiated in 2024. Several technological achievements such as industry large models, 5G RedCap, and industrial Internet platforms have been realised.

- The Company strengthened the intensity of investment in technological innovation elements and continuously improved the system of scientific and technological talent teams. We made significant breakthroughs in the monetisation of technological innovation achievements and received multiple national-level awards.

- The Company enhanced the integration and innovation of digital technology within the smart operation system and accelerated the empowerment of industry development through digital technology.

## Actions to be taken in 2025

- The Company will strengthen the coordination of R&D budgets, enhance the management of core technology research projects, improve and deepen the mechanism for the monetisation of scientific and technological achievements. We will reinforce the coordination of international and domestic standards and continuously enhance its influence on standards and work effectiveness.

- The Company will focus on continuously increasing the Group's investment in core technology research and development, with a key focus on next-generation Internet, industrial Internet, cloud computing, big data, artificial intelligence, and network security.

- The Company will deepen the development of the scientific and technological innovation talent team and create a talent highland.

- The Company will continuously forge digital operation capabilities such as APP and digital middle platform, enhance the platform capabilities of cloud computing, Big Data, Internet of things, AI, blockchain and security, accelerate the output of digital intelligence capabilities, and expand new development space. We will strengthen data supply and empowerment and promote the circulation of data elements.

# Building technological innovation strength

China Unicom implemented the deployment of Technology Superpower, adhered to promoting industrial innovation through technological innovation, focused deployment on strategic emerging industries and future industries, accelerated the development of new quality productivity, and expedited the advancement of high-level technological self-reliance and self-improvement.

## Promoting high-level technological self-reliance and self-improvement

China Unicom continuously enhanced its technological innovation capabilities, actively undertook major national scientific and technological tasks, and stimulated the vitality and momentum of technological innovation.

### Focusing on national strategic development of emerging industries

China Unicom, starting from the urgent needs and long-term demands of the nation, actively deployed in strategic emerging industries to support the development of new quality productivity.

- The Company was approved for five major projects by the State-owned Assets Supervision and Administration Commission of the State Council, and the "China Unicom Strategic Emerging Industries 'Hundred Major Projects' Special Action Implementation Plan" was formulated and issued, accelerating the advancement of key projects in emerging industries.
- Next-generation mobile communication: The Company undertook the national key research and development plan project "Research and Application Demonstration of Ultra-low Latency, Ultra-large Connection, Safe and Reliable Industrial Passive Optical Network Architecture and System", developed domestically produced 50G industrial PON system core modules and equipment, and completed the industry's first reliable 50G industrial PON pilot in the Taizhou Chemical Park, Jiangsu.
- Computing Power Network: "Innovation and Application of Computing Power All-Optical Network Technology" was selected as one of the top ten technological advancements in the information and communication field by the China Institute of Communications in 2024.
- Network Security: The Company continuously carried out research and development on independent and controllable core technologies in network security, broke through key "bottleneck" technologies in basic software and hardware, and developed independent innovation achievements such as the Mogong security operation platform, collaborated with multiple enterprises through sharing to drive the development of a self-controllable industrial chain ecosystem.
- Big Data: The original technology source of big data has won multiple awards, including one second prize of Scientific Progress Award by the Chinese Institute of Electronics, one first prize of Provincial Scientific Progress Award, developed the first China-led international standard for big data architecture under ITU-T, one of the top ten landmark achievements at the 2024 Big Data Expo, and was also approved as a Technology Innovation Centre by the Ministry of Culture and Tourism.
- Artificial Intelligence: The Company undertook the Science and Technology Innovation 2030 - New Generation Artificial Intelligence "Intelligent Epidemiological Investigation Research on Public Health Events such as COVID-19 Pandemic" project; and released the China Unicom UniAI Large Model and Applications at the 2024 Mobile World Congress.
- Internet of Vehicles: The Company developed an innovative Internet of Vehicles solution based on IPv6+ and completed live existing network trials in Xiong'an.
- Blockchain: The Company undertook the national key research and development project "Research and Development of Big Data Sharing and Integration Technology and System for Ecological Environment Based on Blockchain", completed the construction of a big data sharing and integration system for ecological environment based on blockchain. The project's research results and demonstration applications received the "Data Management" excellent case award from the China National Environmental Monitoring Centre for smart monitoring innovation applications in ecological environment.

### Looking to future technology to cultivate future industries

China Unicom actively deployed in frontier technology areas such as next-generation Internet and next-generation optical networks, accelerating the cultivation of new driving forces and new advantages.

- Next-Generation Internet: The Company undertook the role of a source for the next-generation internet, released the "Internet 2030 White Paper" domestically for the first time, completed the world's first over 3,000-kilometre wide-area lossless transmission, developed the world's first online inference AI native router, and completed the initiation of one international standard in the next-generation internet field under the IETF.
- Next-generation optical network: The first IETF standard proposal led by China Unicom, "ACTN Optical Network Control System with Integrated YANG Configuration and Management Functions", has been accepted.
- 6G: Significant progress has been made in standardisation, spectrum allocation, reconfigurable intelligent surface, integrated sensing and communication, high reliability and low latency, and intrinsic security.
- Quantum Information: The Company designed and developed two industry-first "communication and encryption integrated" devices, and conducted application verification in live network environments, which played a good demonstrative role in the integration of quantum security and operator networks. We completed the deployment and testing of quantum secure calls in live networks, achieving the first call connection. We achieved a breakthrough in ITU-T international standards, leading the initiation of one standard.
- Satellite Internet: The Company undertook the national key research and development programme "Air-Ground Integrated Intelligent Networking Technology" project, overcoming core technologies such as flexible slicing in air-ground integrated networking in the satellite internet field. We undertook the national key research and development programme "BeiDou Precision Spatiotemporal Information Perception and Intelligent Service General Basic Platform" project, in which the "Beidou + 5G" perception network tester was selected as an important achievement of the national key research and development programme and the "Beidou Star Kinetic Energy" technology demonstration project.

## Building a high-efficiency technological innovation system

### Improving the innovation organisational structure

China Unicom has tailored its technological research capability structure according to circumstances, creating a highland of technological innovation and initially forming a new structure of innovative development that "spreads from points to surfaces, serves the whole nation, and reaches the globe".

• The Company strengthened the leading responsibility in the next-generation Internet industry, enhanced leadership in network and information security technology, implemented the artificial intelligence innovation action plan, and continuously forged advantages in Big Data, Internet of Things, Internet of Vehicles, and digital intelligence application technology.

• The Company improved the deployment in regional innovation institutes by establishing Rural Revitalization Institute of Digital Industry Co., Ltd., the Guangdong-Hong Kong-Macao Greater Bay Area Innovation Institute, and China Unicom (Hong Kong) Innovation Research Institute Limited, among other innovation organisations.

• The Company improved the deployment of technological research subsidiaries, established China Unicom Data Intelligence Co., Ltd. and China Unicom (Huailai) Big Data Innovation Industry Co., Ltd., paving the way for the innovative application of big data and artificial intelligence.

### Improving the technological innovation mechanism

China Unicom placed great emphasis on the role of technological innovation mechanisms and systems, aiming to establish an efficient technological innovation mechanism to ensure high-quality innovation.

• We established the Company's technology committee, which formulated the Company's technological innovation development plan, focused on the major technological development directions, key research and development projects, and technological innovation strategic planning and consultation, fully leveraging the role of experts in technical review.

• The Company continuously improved the technological innovation system, refined management systems for R&D project management, ecosystem management, technological innovation incentives, achievement management, and technological research talent management.

• The Company further improved the technological innovation platform, which integrated multiple functions such as research and development management, achievements, patents, talents, and strategic emerging industries into one. It unified management and connected with business, initially achieving digitalization of technological innovation management.

### Increasing investment in innovation elements

China Unicom increased its investment in technological innovation, expanded the team of high-level technological research talents, and formed a hierarchical structure of high-level talents.

• Research and development expenditure amounted to RMB15.926 billion, with an R&D intensity of 4.07%.

• The number of full-time engineering master's and doctoral students in the class of 2025 reached 48, an increase of 60% compared to last year.

• A total of 23 people were selected for the superior technology association's youth talent support programme, an increase of 27% compared to last year.

• The number of technological research professionals reached 77, an increase of 22% year-on-year. 9 leading talents and 36 field experts were appointed. 2 individuals were selected as top talents by the State-owned Assets Supervision and Administration Commission of the State Council, and China Unicom Digital Technology Co., Ltd. was selected for the talent highland special action.

### Optimising the monetisation of innovation achievements

China Unicom has established a comprehensive closed-loop management mechanism for the monetisation of achievements and revenue sharing, accelerating the commercialisation of achievements, and rapidly increasing the revenue from self-developed products.

• The Company promoted the industrialization of patents, accelerated the transformation of innovative achievements into actual productivity, and formulated the "China Unicom Patent Transformation and Utilisation Special Action Plan (2023–2025)".

• The Company achieved a breakthrough in standard establishment in the next-generation internet field at IETF, with applications of 193 external patent (an increase of more than ten times compared to 2023), and joined the Avanci 5G patent pool.

• One achievement was selected for the first batch of projects in the Central Science and Technology Commission's Achievement Application Expansion Project List. Three achievements were shortlisted for the finals of the State-owned Assets Supervision and Administration Commission's Yixing Competition. The Company was selected as a pilot for the reform of empowering technological achievements by the State-owned Assets Supervision and Administration Commission of the State Council. Multiple achievements received prestigious domestic and international awards such as the First Prize of National Science and Technology Progress Award, Second Prize of National Technological Invention Award, Top Ten Scientific and Technological Advances in the Information and Communication Field in 2023, and the First Prize of the "Management Science Award" by the Ninth China Management Science Society.

"Key Technologies and Engineering Applications of the Fifth Generation Mobile Communication System (5G)"

# Winning the First Prize of National Scientific and Technological Progress Award

| Responsibility performance indicator | 2022 | 2023 | 2024 |
|---|---|---|---|
| Number of patents applied | 2,672 | 4,398 | 2,071 |
| Number of patents granted | 1,666 | 2,287 | 1,436 |
| Number of new entries in leading international standards | 29 | 26 | 40 |
| Number of new entries in leading industry standards | 71 | 35 | 55 |

## Upgrading digital intelligence operation capabilities

China Unicom deeply implemented digital intelligence-based corporate development and continuously upgraded its digital intelligence capabilities. The smart operation system extended from points to surfaces, forming a chain, continuously strengthening the advantages of "one China Unicom with integrated capabilities and operating services", setting a benchmark for digital transformation among central enterprises.
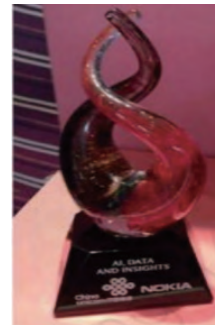
### Constantly deepening smart operation

China Unicom continues to upgrade its smart brain capabilities, using digital and intelligent methods to continuously enhance smart operation efficiency.

• Strengthening capabilities and brining up perceptions through five major APPs. China Unicom's app has been revamped, with monthly active users exceeding 100 million; the public and government-enterprise apps have enhanced their ability to resume operations in complex scenarios; the Unicom Network app has completed the integration of over 184 applications; and the office APP supports a mobile office ratio exceeding 90%.

• Controlling risks and improving efficacy through five major operation platforms. The public operation platform completed the integration of customer operation strategies, reaching over 270 million subscribers. The government-enterprise operation platform completed 60 centralised operations including contracts, acceptance, and accounting.

• Strengthening innovation and improving efficiency through five middle platforms. The Company achieved integrated billing for public and government-enterprise sectors, completed the upgrade of the channel centre architecture, and reduced commission calculation time by 35%. We established a geographically distributed dually active core system, ensuring the stability of ultra-large business systems with disaster recovery technology reaching a new level. The internal application adoption rate of Unicom Cloud reached 89.3%, achieving breakthroughs in full-stack information innovation adaptation.



Passed the digital transformation maturity assessment national standard (DTMM) level four certification with the highest score in the industry



Awarded 2 TeleManagement Forum (TMF) Catalyst Awards

The effectiveness of digital transformation in the comprehensive evaluation of IOMM

# Ranked first for three consecutive years

China Unicom adheres to empowering frontline production with intelligent, agile, and efficient smart operations, continuously embedding digital intelligence technology into key aspects of production operations. Unicom Online and the Software Research Institute were successfully selected as pilot enterprises for the digital transformation of state-owned enterprises.

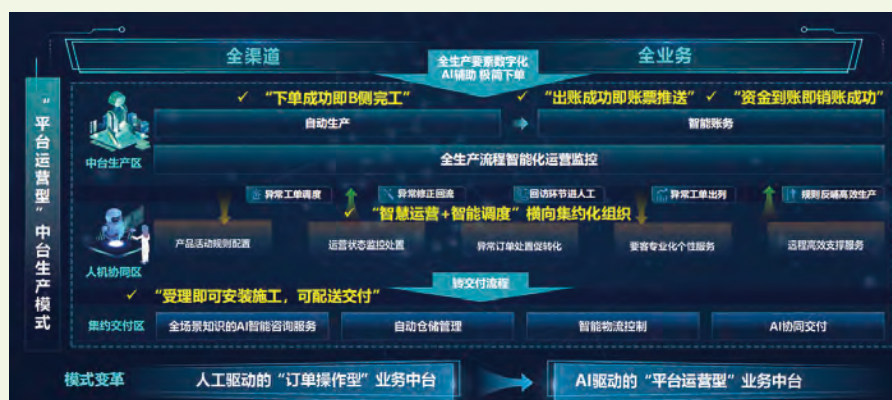| Intelligence in production operations | Digital technology provides insight into the key stages of broadband installation, relocation, repair and delivery, reducing broadband delivery time by 15 hours. The government-enterprise "Three Comprehensive Views" empowers key customer data to be fully viewed at a glance, enriching industry labelling capabilities. |
|---|---|
| Agility in customer service | The Company established a customer service large model, implemented in 13 production scenarios, with smarter intelligent customer service, achieving an intelligent service satisfaction rate of over 84%, leading among operators in hotline intelligent service levels. |
| Efficiency in enterprise management | The Company successfully completed multiple digital intelligence pilot projects of the State-owned Assets Supervision and Administration Commission of the State Council with high quality, maintaining a leading position in the digital intelligence capability of state-owned assets supervision; developed a digital intelligence financial platform integrating six major operational scenarios including data, knowledge, and risk. Digital employee capabilities have been implemented in a total of 6,138 scenarios, saving 439,800 person-days, and the effect of empowering the front line to reduce burdens is evident. |

## Deepening data governance and process governance

China Unicom insists on strengthening data supply empowerment and improving process governance.

- The Company strengthened data supply and empowerment. We promoted internal circulation of corporate data, with an average monthly data sharing of 192 trillion entries to subsidiaries. We built a high-quality AI dataset of 30.8TB and alleviated burdens at the frontline level by systematising support for over 3,000 manual reports.

- The Company promoted the digital intelligence transformation of process governance. Digital intelligence capabilities empowered headquarters and provincial process operations. The centralised government-enterprise middle platform's intelligent scheduling saved 1,200 person-months. The delivery time for public broadband business IOM was reduced by 28.5%, enhancing broadband operational efficiency and quality. The Company's process mining application capability and effectiveness have been certified at the advanced level (Level 3), leading the industry in governance standards.

Shanghai Unicom's "Digital Super Factory" operation system based on AI+ middle platform operation: By applying AI technology, focusing on aspects such as touchpoint ordering, middle platform acceptance, and billing services, it creates capabilities such as streamlined acceptance, intelligent order review, intelligent scheduling, automated production, and intelligent billing. It achieves automatic production of over 80% of business orders, with cumulative annualised savings in production and operation costs exceeding RMB4 million.



"Digital Super Factory" Operating System