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Analysis of Data Value Mining Paths of China Unicom under the Background of Integrated Innovation Strategy

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Abstract. Against the backdrop of the in-depth advancement of the "Digital China" strategy and integrated innovation strategy, China Unicom is in urgent need of transforming and upgrading from a "pipe provider" to a "digital service provider". Based on the theoretical framework of resource orchestration, this paper systematically explores the value mining paths of China Unicom in the three stages of data resourceization, assetization, and capitalization. The research shows that relying on 5G, cloud-network integration, and the mixed-ownership reform mechanism, China Unicom has formed large-scale capabilities in data element construction, bundling, and utilization; through intelligent search, elastic deployment and other means to promote data on-balance sheet, the data assets reached 379 million yuan in 2024. Furthermore, China Unicom can activate data capital through securitization, equityization and other means to realize the market-oriented allocation of factors. This paper provides a replicable practical framework for traditional operators' data valorization, and offers policy implications for the government to improve the data element market system and share digital dividends.

Keywords: China Unicom, Data Resources, Data Orchestration, Value Mining

1. Introduction

The rise of the digital economy is reshaping the global economic structure and becoming a key driving force. China has established the digital economy as a national strategy, accelerating the construction of new infrastructure such as 5G and gigabit fiber broadband, which has opened up a broad market for the communications industry. The government has issued supporting incentive policies to support 5G construction, speedup, and fee reduction. At the same time, as an important carrier for the construction of Digital China, smart cities are promoting the modernization of urban governance and showing a new trend of social development.

China's telecommunications industry has developed steadily with simultaneous technological innovation. By the beginning of 2025, the industry revenue has maintained positive growth, the user scale has expanded, and the number of 5G users has reached 1.051 billion. The market competition is concentrated, dominated by China Mobile, China Telecom, and China Unicom. Operators strengthen their competitiveness through differentiated strategies. The industry is facing both challenges and opportunities. In the future, 5G applications, computing intelligence, and quantum communication will promote the intelligent and integrated development of the industry.

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Founded on July 19, 1994, China Unicom is the second basic telecommunications operator approved by the State Council, breaking the telecommunications monopoly. From 2G to 5G, it has continuously improved network speed and service quality. It merged with China Netcom in 2009 and implemented mixed-ownership reform in 2017. In recent years, it has actively promoted 5G co-construction and sharing, and accelerated the layout of computing-network-digital-intelligent businesses.

2. Analysis of data value mining paths

The value of data does not lie in itself; instead, it needs to be processed and integrated to be transformed into resource information and release a multiplier effect. Based on the resource orchestration theoretical framework proposed by D. G. Sirmon et al. [1] and existing literature analyzing the characteristics of data resource orchestration (such as Peng Zhengyin et al. [2], Yang Yaqian et al. [3]), this paper systematically explores the realization paths and key strategies of China Unicom's data value from the perspectives of data resourceization, assetization, and capitalization.

2.1. Analysis of data resourceization paths

2.1.1. Data resourceization orchestration

Data resourceization not only covers links such as quality control, standard formulation, security guarantee, and sharing mechanisms of data elements, but also includes in-depth integration with traditional production factors. It enhances the value of data elements through coordinated configuration and other behaviors. Therefore, in different application scenarios and big data platforms, data resourceization should include the following aspects:

2.1.1.1. Data element construction

Element construction refers to the process of collecting, organizing, and reserving effective resources to build a data element pool that can meet the further development of enterprises [4]. Compared with physical resources, the core work of data element construction is the structured management of data elements, including element collection, element preprocessing, and element storage.

2.1.1.2. Data element bundling

Element bundling refers to the process of integrating data elements to form relevant capabilities. Different from traditional physical resources, data cannot create value on its own [5]; it must realize the value of data elements and develop into data productivity through element bundling, including value multiplication, resource optimization, and input substitution.

2.1.1.3. Data element utilization

Element utilization refers to the use of element combinations and capabilities. According to the orchestration model, data element utilization includes data integration, resource integration, as well as data analysis and decision-making, so as to optimize the configuration and utilization of data elements and realize data empowerment of entities and data productivity.

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2.1.2. Current situation of data resourceization

2.1.2.1. Data element construction: building a national integrated computing power network base

Relying on the "Eastern Data and Western Computing" strategy, China Unicom has built a "5+4+31+X" computing power system, including the Southwest Green Data Center with a PUE of 1.2, the Tianfu Information Center with 11,500 cabinets, and the Zhongwei AIDC Intelligent Computing Center, the largest in western China. In terms of cloud-network integration, China Unicom Cloud 7.0 supports 10,000-level cluster nodes, manages more than 350 cloud pools of over 20 cloud providers, and serves more than 3,000 private network customers. Data collection realizes real-time industrial collection through 5G RedCap, power hard slicing reduces costs, and Beijing IDC provides 40G bandwidth to ensure the security of government and finance.

2.1.2.2. Data element bundling: cross-domain collaboration and in-depth industry integration

China Unicom has launched the "Yuji" Digital Twin CIM Platform, integrating 3D GIS and other technologies to build an urban data base, creating projects such as the Jiangxi Jishui Dual Carbon Brain and Wuhan 3D Trajectory Tracking, serving more than 20 national ministries and commissions and over 100 cities. In the industrial field, 5G + data collection has increased the utilization rate of Yinhua mechanical equipment by 16%. In terms of data circulation, it has pioneered the "four rights and four certificates" mechanism, participated in the Guangzhou Data Exchange, piloted public data operation in Guangdong and Zhejiang, and opened a model library to promote the integration of industry, university, and research.

2.1.2.3. Data element utilization: AI empowerment and scenario-based implementation

China Unicom has independently developed a large model with over 10 billion parameters, and developed industry models in finance, urban, clothing and other fields. "Yitong" supports multi-modal detection of clothing, and the smart medical cloud improves hospital informatization. The storage-computing separation technology has realized 30TB data remote training of 200 kilometers between Hangzhou and Jinhua (efficiency 97%), and the computing power intelligent network AINet empowers AI training and edge computing. In terms of green development, the Southwest Data Center saves 3,405 tons of water annually, and the Chongqing base promotes low-carbon transformation; in the security field, technologies such as storage-computing separation and blockchain ensure the full-life-cycle security of data.

2.1.3. Exploration of data resourceization paths

Data resourceization is the foundation for the formation of data value. High-quality data is formed by processing and organizing raw data from different sources and forms. Based on the above analysis, China Unicom can further resourceize data elements through the following schemes:

2.1.3.1. Improving data applicability

China Unicom can realize the full-life-cycle management of data collection, development, governance, service, and application through the "China Unicom Data" integrated data asset management platform to ensure high quality and stability of data. At the same time, based on its data

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governance capabilities, it can develop standardized data products to improve the versatility and reusability of data and reduce data use costs. It is also necessary to promote data sharing and circulation, and facilitate the safe sharing and circulation of data through the "Trusted Data Resource Space" and "Lianshu Network Platform" to ensure the efficient use of data in different scenarios.

2.1.3.2. Multi-source data fusion collection

Deepen the "three-track parallel" collection model. On the basis of existing market-oriented procurement, contractual access, and privacy computing collection, explore a confirmation and registration mechanism based on blockchain, and establish a trusted collection system with traceable data sources and auditable use. Focus on expanding the collection of equipment operation data and environmental perception data in fields such as industrial internet and smart cities, forming a data set covering the entire chain of production, circulation, and consumption.

2.2. Analysis of data assetization paths

2.2.1. Data assetization orchestration

Data assetization is the process of further integrating data resources to make them create benefits for enterprises in the form of assets. According to the orchestration theory, data assetization orchestration includes two stages: data resource retrieval and data resource deployment. Their mutual coordination is crucial to realizing the potential of data resources to gain competitive advantages [6].

2.2.1.1. Data resource retrieval

Data resource retrieval is a technical means to retrieve data required by users from data resources in the resource pool and integrate these data into data assets. It mainly includes identifying data resources, evaluating data assets, and innovating business models.

2.2.1.2. Data resource deployment

Data resource deployment refers to realizing the integration of data and elements based on the data base, integrating resources to build a data ecosystem, promoting the data transformation of elements, enhancing the exclusivity and precipitation of resources, and improving the value of data assets. This stage includes providing value vision, fostering innovation, and coordinating joint dedicated assets.

2.2.2. Current situation of data assetization

2.2.2.1. Data resource retrieval: construction of intelligent search system

Relying on the metadata management platform, China Unicom has built an intelligent search capability covering all data, supporting natural language semantic retrieval and multi-modal data association. Through the Data Map 3.0 tool, it realizes second-level positioning of cross-domain data assets. At the same time, it adopts a federal search architecture and national secret encryption technology to ensure the secure query of relevant client data with a response time of less than 0.5 seconds.

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2.2.2.2. Data resource deployment: innovation of elastic deployment architecture

Relying on Kubernetes, China Unicom realizes minute-level expansion of data services. During the Double 11 period, the number of e-commerce instances increased from 500 to 8,000, resource utilization rate increased by 40%, and the service mesh ensures the high concurrency and stability of finance and medical care. Through the computing-network platform, it realizes real-time synchronization of government data between Guangdong and Guizhou (RPO < 5 minutes), and edge deployment in Haier Shenyang Factory triples the quality inspection efficiency. It builds a security sandbox + zero-trust architecture, and in the process of blockchain evidence storage deployment, cooperates with the Beijing Higher People's Court to build the "Tianping Chain" to complete the whole-process online evidence storage of electronic evidence.

2.2.3. Exploration of data assetization paths

Data assetization refers to the process of transforming controllable, quantifiable, and monetizable data resources into data assets. Based on the above analysis, China Unicom can further assetize data through the following schemes:

2.2.3.1. Continuously deepening data application scenarios

China Unicom should continue to deepen data application scenarios. First, deepen industry applications. In fields such as industrial manufacturing, cultural tourism, financial services, and urban governance, combine the advantages of China Unicom's communication big data to form data-intensive solutions and standardized products. Second, continue to promote the integration of AI and data, and cover more industry scenarios through the Yuanjing large model system to enhance the application value of data in specific scenarios.

2.2.3.2. Tapping the value potential of data

China Unicom should further tap the value potential of data. First, through data valuation models and methodologies, materialize data value, promote data asset on-balance sheet, and further explore data capitalization paths. Second, build a data element value conversion chain, and apply data value evaluation results to data asset operation, resource allocation optimization, etc., driving data elements to be fully embedded in intelligent operation scenarios. Finally, promote the market-oriented allocation of data resources.

2.2.3.3. Promoting data resource on-balance sheet

China Unicom should continue to promote data resource on-balance sheet. Under the background of the Interim Provisions, China Unicom's integrated innovation strategy further promotes a large number of generated data resources to be included in the enterprise's financial statements, transforming data resources into measurable assets, making financial value explicit, which can support enterprise financing and valuation, and help enterprises achieve sustainable development.

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2.3. Analysis of data capitalization paths

2.3.1. Data capitalization orchestration

Data resource assetization endows data capital with characteristics of virtuality, non-consumability, and increasing marginal benefits. Its cross-subject circulation and large-scale value-added capabilities promote the process of data valorization. As an innovative direction of asset allocation, data capital operation needs to be incorporated into the orchestration model. This link includes two processes: data value-added and data operation. Through the construction of a trusted circulation mechanism and intelligent scheduling algorithms, the dynamic configuration and value multiplication of data assets are realized.

2.3.1.1. Data asset value-added

Data asset value-added refers to improving the economic value and application value of data assets through a series of coordination and decisions, enabling them to bring more economic benefits and social benefits to enterprises or organizations. The main contents of this stage include resource combination and value maintenance.

2.3.1.2. Data asset operation

Data asset operation refers to continuously tracking and analyzing data services and data circulation. With data value management as a reference, from the perspective of data users, comprehensively evaluate the effect of data application, establish a scientific positive feedback and closed-loop management mechanism, promote the iteration and improvement of data assets, and continuously adapt to and meet the application and innovation needs of data assets. It mainly includes capital circulation, benefit distribution, and specification and form derivation [7].

2.3.2. Current situation of data capitalization

2.3.2.1. Data asset value-added: scale expansion and structure optimization

China Unicom has maintained rapid growth in the process of data assetization. In 2024, the amount of data resources on-balance sheet reached 379 million yuan, a year-on-year increase of 85%, among which the growth rate of data resources included in development expenses reached 193%. The company's data assets show high value-added characteristics. Through AI large models and storage-computing separation technology, it realizes intelligent processing and cross-domain collaboration of data assets. In addition, the company focuses on the dynamic management of data assets, establishing a value evaluation system and a full-life-cycle monitoring mechanism to ensure the preservation and appreciation of assets.

2.3.2.2. Data asset operation: governance upgrade and market-oriented breakthrough

Based on the DCMM Level 5 governance system, China Unicom has established a global data quality management platform and opened more than 34,000 data assets. Through the "digital sandbox", it realizes transparent management of all data, incubates ten gold medal models, covering smart cities, industrial internet, medical and health fields. In terms of market-oriented operation, its market share in operator big data has led for six consecutive years. At the same time, it actively

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explores data asset financing models and carries out data asset pledge credit with financial institutions.

2.3.3. Exploration of data capitalization paths

2.3.3.1. "Dual-wheel" drive

China Unicom can drive data capitalization through the "dual-wheel" of data securitization and equityization: on the one hand, package data with services, technologies and other resources into asset portfolios with predictable returns and controllable risks, introduce financial tools such as rating and credit enhancement and SPV structure, and issue data-backed securities to improve liquidity and price discovery capabilities; on the other hand, value high-quality data assets after governance as equity, introduce strategic investors to jointly establish data operation entities, and investors continue to develop data products for external transactions, forming a closed loop of "exchanging equity for circulation and promoting utilization through circulation". At the same time, clearly define data value maintenance, benefit distribution and exit mechanisms in the articles of association to realize the capital appreciation and market-oriented circulation of data elements.

2.3.3.2. Cultivating an innovative ecosystem for data capital

China Unicom needs to promote collaboratively from three aspects: infrastructure, technological research, and scenario application. Relying on the "New Eight Vertical and Eight Horizontal" 400G all-optical intelligent computing network and Lianshu Network, build a base for computing power scheduling and high-speed data circulation; strengthen the construction of the Trusted Data Resource Space platform. At the same time, deepen the research on blockchain and privacy computing technologies, establish a data asset value evaluation and dynamic monitoring system, and form an innovative ecosystem driven by "technology + system" to help the transformation of data elements into capital form.

3. Conclusions and implications

Digital transformation and integrated innovation are the key driving forces for current economic and social development. On the basis of summarizing the positive and negative experiences at home and abroad, combined with China's actual situation, this paper puts forward policy suggestions for promoting digital transformation and integrated innovation from the demand side, circulation side, and guarantee side.

3.1. Enterprise demand side

3.1.1. Enhancing awareness of digital transformation

Enterprises should deeply understand the importance of digital transformation and integrated innovation, and regard them as the key to enhancing competitiveness and achieving sustainable development. Through internal training, industry exchanges, etc., improve the digital literacy of managers and employees, and enhance their recognition and sense of urgency for digital transformation.

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3.1.2. Increasing investment in digitalization

Enterprises need to increase investment in digital technology research and development, platform construction, etc., and promote the digital transformation of business processes. Encourage the establishment of special digital transformation funds to support internal digital projects. Manufacturing enterprises can invest in the construction of smart factories to realize production automation and intelligence; service enterprises can develop online service platforms to expand business channels.

3.1.3. Exploring digital application scenarios

Enterprises should combine their own businesses, actively explore digital application scenarios, and promote the in-depth integration of digital technology and business. Encourage the development of digital pilot projects, summarize experience and gradually promote them. For example, retail enterprises can optimize inventory management through big data analysis; logistics enterprises can use IoT technology to realize real-time tracking and scheduling of goods.

3.2. Social circulation side

3.2.1. Promoting data sharing and circulation

Accelerate the construction of data sharing platforms to promote data circulation and sharing. Encourage enterprises, universities, scientific research institutions and other organizations to carry out data cooperation, and realize business collaboration and innovative development through data sharing. A data trading platform should be established to standardize trading processes and ensure the legality and security of transactions.

3.2.2. Promoting industrial ecosystem construction

Promote the formation of an industrial ecosystem for digital transformation and integrated innovation. Encourage industry associations, social organizations and other institutions to play a bridging role, organize enterprises to carry out technical exchanges, experience sharing and other activities, and promote the coordinated development of upstream and downstream enterprises in the industrial chain.

3.2.3. Strengthening digital infrastructure construction

Strengthen the construction and optimization of digital infrastructure to provide support for digital transformation. Accelerate the layout and construction of infrastructure such as 5G networks, data centers, and industrial internet, and improve network bandwidth and service quality. For example, promote the full coverage of 5G networks in key areas to provide enterprises with a high-speed and stable network environment.

3.3. Government guarantee side

3.3.1. Improving top-level policy design

The government should formulate and improve the policy and regulatory system supporting digital transformation and integrated innovation, and clarify development goals and key areas. Support

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enterprises to carry out digital transformation projects through financial subsidies, tax incentives, special funds and other methods.

3.3.2. Strengthening talent training and introduction

The government should strengthen the training of professionals related to digital transformation, and encourage universities and vocational colleges to set up relevant courses. Increase the intensity of introducing high-end talents and attract outstanding talents from home and abroad. Support enterprises to carry out internal training to improve employees' digital literacy and skills.

3.3.3. Assisting financial support

The government should increase financial investment in digital transformation and integrated innovation, establish special funds to support the research and development of key technologies and the construction of pilot projects. Guide the participation of social capital to provide diversified financing channels for enterprises. Encourage financial institutions to innovate financial products and service models to support the development of digital enterprises.

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