

Strategy to Improve The Value of Commercial Bank Data Assets--The Path From Data Governance to Data Management

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ABSTRACT

In the context of the rapid development of the digital economy, data, as a new production factor, has become a core driver of economic growth. Commercial banks, as key components of the financial system, have accumulated vast amounts of data on customer transactions, risk management, and operational activities, which hold significant commercial value. However, commercial banks still face numerous challenges in managing data assets, such as severe data silos, inconsistent governance standards, and a lack of scientific basis for value assessment. These issues severely limit the full realization of the value of data elements. In particular, small and medium-sized banks, constrained by resources and technology, lag significantly behind leading banks in the management and utilization of data assets.

This article focuses on enhancing the value of data assets in commercial banks, employing case studies, literature reviews, and interviews to explore the full value realization path from data governance to data management. By selecting China Everbright Bank and China Merchants Bank as typical cases, the study systematically analyzes their practical experiences in standardizing data asset governance, scenario-based management, and value realization. Additionally, through in-depth interviews with bank employees, fintech experts, and scholars, the latest industry practices and theoretical insights are gathered. Based on these findings, the article constructs a three-stage evolutionary model of 'governance-management-value' and innovatively proposes a four-stage theoretical framework for the realization of data asset value (resourceization, assetization, capitalization, and servitization). It also designs differentiated implementation paths tailored to the characteristics of different types of banks.

Research has found that enhancing the value of commercial banks' data assets requires a coordinated approach across multiple dimensions: technologically, it is essential to leverage

emerging technologies such as AI modeling, blockchain traceability, and privacy computing; in terms of management, it is necessary to establish cross-departmental collaboration mechanisms and a robust data governance system; and from a policy perspective, there is an urgent need to clarify the compliance boundaries and financial recognition standards for data assets. The findings of this study not only enrich the theoretical framework of data asset management but also provide practical guidelines for the digital transformation of commercial banks, particularly small and medium-sized banks. This has significant practical implications for promoting the market-oriented allocation of data elements and the high-quality development of the banking sector.

Keywords: commercial bank; data assets; value assessment; data governance; data management; digital transformation

1. Introduction

1.1. Research Background

As the digital economy has been elevated to a national strategy, the 19th Central Committee of the Communist Party of China (CPC) in its Decision (2019) first recognized data as the fifth major production factor. It emphasized the need to establish and improve evaluation mechanisms for data in the market and a compensation distribution mechanism that aligns with the revenue generated by data. In the context of widespread digital transformation across various industries, the China Banking and Insurance Regulatory Commission (CBIRC) issued the Guidelines on Digital Transformation of the Banking and Insurance Industries (2022), using policy guidance to encourage banks and financial institutions at all levels to develop scientific strategies for data management and business development, thereby maximizing the value of data in the digital economy. By the end of 2023, to fully leverage the multiplier effect of data elements and enhance economic and social development, the National Data Bureau and other departments released the Three-Year Action Plan for 'Data Elements ×' (2024-2026). This plan clearly requires all industries to accelerate digital transformation and unlock the value of data. In the rapidly evolving digital economy, the effective and compliant extraction of data value and its market circulation have become significant challenges for organizations. With the rapid advancement of emerging technologies such as artificial intelligence and blockchain, the pace of digital transformation across industries has accelerated. Establishing a scientific and comprehensive data asset valuation system is essential for promoting the market-based allocation of data elements. This trend is particularly evident in the financial sector, where the effective management and value conversion of data assets have become core issues for commercial banks in their digital transformation efforts.

As a data-intensive industry, commercial banks have significant potential in customer transactions, risk management, and operational data. However, the current lack of systematic strategies and management mechanisms for enhancing the value of data assets severely hinders the realization of data value. Currently, commercial banks face three main challenges in data asset management. First, the lack of a unified standard for evaluating the value of data elements makes it difficult to accurately measure data assets. Second, the data governance system is inadequate, leading to issues such as low data quality and poor circulation. Third, the absence of a mechanism for converting data value into practical business value makes it challenging to effectively transform data elements into real business value. A common issue among domestic commercial banks is the existence of data silos. According to the China Banking Association's 2023 Digital Transformation Report on Commercial Banks, the single-chain nature of banking operations makes it difficult for departments to collaborate, leading to inconsistent data rules and severe silo phenomena, with insufficient data aggregation. The China Banker Survey Report (2023) indicates that 59.2% of the surveyed banks consider 'data fragmentation between systems' as a major obstacle to digital transformation. In its 2021 semi-annual report, China Everbright Bank disclosed that despite having a total data volume of 5.53PB, the early independent construction of systems resulted in a data interoperability rate of less than 40%, severely limiting the realization of data value. Additionally, there are issues such as non-uniform governance standards and subjective valuation. Although some leading banks, such as China Merchants Bank and China Everbright Bank, have begun exploring data assetization, small and medium-sized banks, due to limited resources, are still in the early stages.

Based on a systematic analysis of existing literature and tracing the origins of various practical issues, it is evident that current research in China is insufficient. Most studies focus on a single aspect, lacking a dynamic evolutionary perspective. While some discuss data governance or optimize evaluation methods, there is a lack of comprehensive research on the value enhancement path from data governance to management, particularly in integrating organizational collaboration with technical implementation. The realization of the value of commercial bank data assets involves a complete chain from 'data governance-data management-value enhancement.' However, existing research often examines only one of these aspects statically. This limitation is particularly pronounced in the digital transformation of small and medium-sized banks. Additionally, there is a lack of differentiated implementation path research in China. Leading banks and small and medium-sized banks differ significantly in data asset management capabilities and technical foundations, yet the solutions provided by existing research are often based on the practical experiences of leading banks, lacking scalability. According to statistics from the China Banking and Insurance Regulatory Commission (CBIRC) in 2022, the average data governance investment for national commercial banks is 8-10 times

that of city commercial banks. This resource disparity makes it difficult for simple method transplants to be effective.

1.2. Research objectives and significance

Based on the case studies of China Everbright Bank and China Merchants Bank, as well as interviews with bank employees, fintech company technicians, and academic experts in related fields at universities, this article focuses on strategies to enhance the value of commercial banks' data assets. It aims to address how to solidify the foundation of value through standardized governance, how to achieve value transformation through scenario-based management, and how to design replicable implementation paths. The article constructs a three-stage evolutionary model of 'governance-management-value' to address the traditional research's neglect of dynamic transformation mechanisms. This provides practical solutions for commercial banks, especially small and medium-sized banks, to transform data resources into asset value, thereby supporting their digital transformation. By studying the data assets of commercial banks, summarizing and organizing industry experiences, this research forms an effective plan to promote industry development, offering practical explorations to address common issues in data asset management within the industry. Additionally, by selecting the data assets of commercial banks as the research subject, it provides theoretical academic references for the field of data asset evaluation and offers ideas for the future development of data asset evaluation practices. Ultimately, this aims to enable commercial banks to measure the value of their data assets, prevent underestimation of data asset value, and convert it into new sources of profit for commercial banks. This article analyzes the challenges faced by commercial banks in realizing the value of their data, explores effective strategies and implementation paths for building data asset value. It offers a new solution for banks to maximize the business value of data assets from governance to management, helping them build robust data asset management capabilities in the digital age. Through detailed case studies and analyses, it provides practical and effective references for commercial banks in constructing the business value of their data assets.

This article addresses the shortcomings of existing research and enriches related theoretical ideas. By studying the evolution mechanism and improvement strategies of data assets in commercial banks, it provides a deeper understanding of the current research status in this field and identifies the deficiencies in existing studies. By summarizing and integrating domestic and international theories, it enhances the theoretical understanding of data assets in commercial banks, deepens the theoretical framework regarding their evolution mechanisms, and offers new perspectives and theoretical foundations for the academic community, thereby promoting the development of theories in this area. This article aims to guide practice with theory, enhance the practical application of theories, and gain a deep understanding of the evolution mechanisms of data assets in commercial banks. By combining these theories with practical applications, it can

provide theoretical guidance for actual business operations. Applying theoretical knowledge to the practical operations of commercial banks, through the theoretical guidance of data assets, can improve their practical application. By integrating various theories, such as data management and risk assessment, it can achieve more scientific and effective management of data assets in commercial banks. In practice, this article supports the decision-making of commercial banks by providing insights into the evolution mechanisms and improvement strategies of data assets, which can support the bank's decision-making level and effectively enhance the internal operational management capabilities of commercial banks. A deeper understanding of the evolution patterns and evaluation methods of data assets enables bank management to more accurately assess the value of data assets, communicate data more efficiently, improve operational efficiency, and thus make more targeted and scientific decisions in strategic planning and decision-making.

1.3. Research methods and frameworks

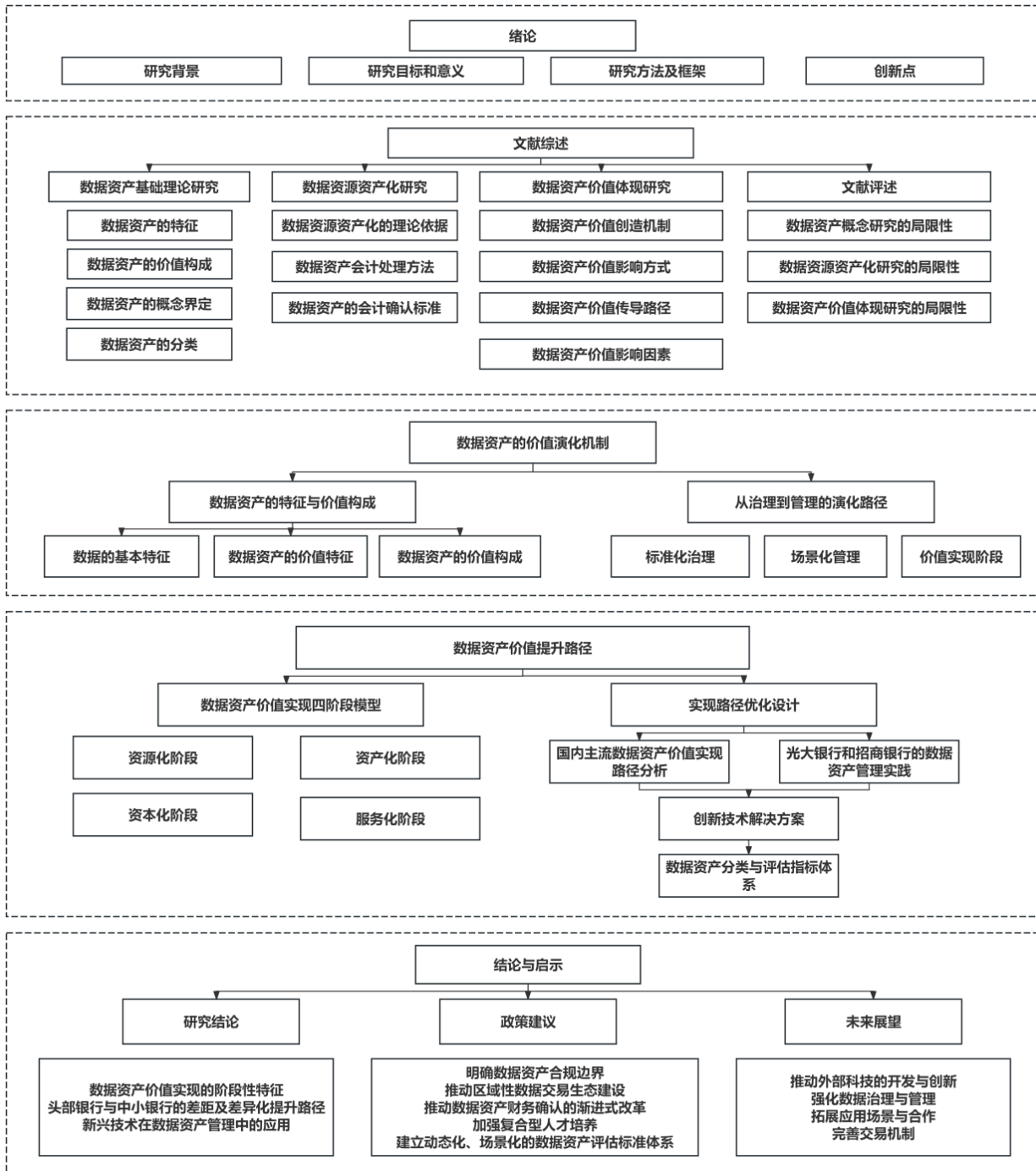
Using the case analysis method, the current situation of data assets of specific domestic commercial banks is analyzed, the problems are summarized and the reasons are analyzed, and the evolution mechanism and improvement path of data assets value are explored.

Using the literature review method, through the study of typical domestic and foreign commercial bank data assets literature, it provides a detailed elaboration and analysis, so as to provide effective reference for the construction of business value of commercial bank data assets.

Through interviews with bank practitioners, technical personnel of fintech companies and academic experts in related fields of universities, questions are raised from different levels to serve as a reference for data governance to data management practice.

The following is the research framework of this paper:

Figure 1 Project research framework



1.4. Innovation Point

The innovation of this paper lies in:

Firstly, The novelty of the research perspective. Previous studies on the value of data assets have typically focused on a single aspect and have not been the central focus of their analyses. Few studies have explored the specific pathways that influence the value of data assets in commercial banks. This paper focuses on the mechanisms and pathways for enhancing the value of data assets, using the data asset application practices of China Merchants Bank and China Everbright Bank as case studies to explore multiple pathways for increasing the value of data assets.

Secondly, The innovation of the research methodology. Current research on data assets primarily focuses on qualitative analysis, with a focus on defining the concept and accounting treatment of data assets. While there have been some initial explorations into the value realization of data assets, these studies are mainly theoretical, with a notable lack of case studies. This paper employs a case study approach, focusing on the banking sector, using China Everbright Bank and China Merchants Bank as case studies. It thoroughly examines the mechanisms and pathways for enhancing the value of data assets, aiming to inspire and guide other enterprises, particularly commercial banks, to enhance their data asset value extraction, thereby contributing positively to value enhancement. Additionally, the paper uses interviews to gather insights from bank employees, fintech company technicians, and academic experts in related fields at universities, focusing on the theme of commercial bank data assets. The interviews address issues from various perspectives, serving as a reference for data governance and management practices. This not only enriches the theoretical content but also provides practical insights, opening new directions for further research.

2. Literature Review

2.1 Basic theoretical research on data assets

In the digital economy era, data resources have evolved into a new type of production factor with unique attributes. International data management expert Laney (2001) first introduced the '4Vs' theory of big data, highlighting four key characteristics: volume, velocity, variety, and value. This theory laid the groundwork for subsequent research on data assets. Chinese scholar Feng Ke (2022) further explored these concepts, identifying additional features such as timeliness, renewability, and strong permeability. These features have significantly enhanced the status of data elements in economic activities. As research has progressed, the academic community generally agrees that data assets are the most representative new form of assets in the digital

economy era (Xu Xianchun, 2022). Driven by the rapid development of new information technologies like big data, artificial intelligence, mobile internet, and cloud computing, the technical barriers to data collection, storage, processing, and analysis have been significantly reduced, enabling data to participate in value creation processes on an unprecedented scale and efficiency. Huang Shizhong et al. (2023) found through empirical research that in the context of digital transformation, data assets have become a core driver of corporate value creation, with their contribution to corporate value surpassing that of traditional production factors.

Commercial banks, as a core component of the modern financial system, have a natural advantage in accumulating data assets. Lu Minfeng (2020) categorized commercial bank data assets into two levels: basic data assets, which primarily consist of static data such as customer identity and account information; and derivative data assets, which include dynamic data like transaction records and behavioral patterns. This classification method provides a valuable reference for the management of commercial bank data assets. Wang Weiling (2021) emphasized that, as a data-intensive industry, commercial banks should establish a data asset management system that aligns with their business characteristics. By deeply integrating data assets with financial operations, they can fully unlock the potential value of data elements. Notably, the data assets of commercial banks also possess unique sensitivities and risks specific to the financial sector, presenting special challenges in their valuation and management (China Banking Association, 2023).

Data assets, as a new category of assets, have long been a focal point in academic research for defining their concept. Brown (2011) defined data assets as economic resources that exist in the form of structured or unstructured data sets, with key features including clear ownership, measurable value, and the potential to generate economic benefits through analysis. This definition highlights the tradability and value creation potential of data assets. Chinese scholar Zhang Junrui (2020) found through comparative studies that data assets share many similarities with traditional intangible assets, leading him to propose that data assets are 'data-based, identifiable non-monetary assets owned or controlled by enterprises.' This definition integrates data assets into the existing accounting standards framework, providing significant practical guidance. Xu Xianchun (2022) focused on the temporal dimension of data assets, suggesting that they should be data resources that are repeatedly or continuously used over more than one year during production processes, emphasizing the continuous value creation capability of data assets. In 2019, the China Academy of Information and Communications Technology (CAICT) published the 'Data Asset Management Practice White Paper 4.0,' which provided a more comprehensive definition of data assets: 'Data assets refer to data resources recorded in physical or electronic form, owned or controlled by enterprises, and capable of bringing future economic benefits to the enterprise.' This definition systematically defines data assets from three

dimensions: legal ownership, value characteristics, and form of existence, and has been widely cited in domestic academic circles.

2.2. Research on assetization of data resources

Whether and how data resources can be recognized as assets is a significant topic in theoretical research. Fisher (2009) and Zhang Junrui (2020) conducted an in-depth analysis from the perspective of accounting recognition standards, arguing that data resources fully meet the criteria for being classified as assets: first, they are under the actual control of the enterprise; second, they originate from past transactions or events; most importantly, they can bring expected economic benefits to the enterprise. This view has gained widespread acceptance in academic circles. Li Jingping (2020) further explored this issue from a macroeconomic perspective, noting that data resources not only have clear economic ownership but also have broad application value in both enterprises and government departments, providing ample grounds for their classification as assets.

Scholars have differing views on the accounting treatment of data assets. Warren (2015) innovatively introduced the concept of 'soft assets,' suggesting that data assets should be classified as a new asset category for accounting purposes. However, Daley (2022) argues that while data assets share similarities with intangible assets, they are often inseparable from the company as a whole and do not meet the criteria for recognition as intangible assets due to their difficulty in being 'separably identifiable.' This debate highlights the unique and complex nature of data assets. Notably, regarding data ownership, Daley (2022) advocates the principle of 'substance over form,' suggesting that even if the legal ownership of certain data is unclear, it should still be recognized as an asset if it can create value for the company. This perspective provides important guidance for commercial banks in managing customer data assets.

2.3. Research on the value of data assets

As research on data asset theory deepens, the mechanisms by which data assets create value have become a focal point for scholars. Early studies by Goodridge and Haskel (2015) found that data assets primarily enhance corporate value indirectly, such as through optimizing operational processes and improving management decisions. This insight highlights the distinct value creation methods of data assets compared to traditional assets. Li Haijian (2021) further categorized the value creation pathways of data assets into three types: first, driving the digital transformation of corporate thinking and organizational structures; second, promoting the intelligent upgrade of traditional businesses; and third, fostering new business models based on data. This classification method provides systematic guidance for the development of data asset value in commercial banks. In the commercial banking sector, the value creation of data assets

exhibits distinct industry characteristics. Qin Rongsheng (2020) noted that commercial banks' data assets primarily create value through three channels: precise risk control, personalized customer service, and intelligent operations management. The practice of China Everbright Bank (2021) demonstrates that effective utilization of data assets can significantly enhance risk management efficiency and reduce non-performing loan rates. A case study from China Merchants Bank shows that data asset-driven precision marketing can significantly boost business conversion rates (China Merchants Bank Annual Report, 2023). These empirical studies offer valuable insights for the value management of data assets in commercial banks.

2.4. Literature review

A systematic review of existing literature reveals that current research on data assets is still in the theoretical exploration and development phase, with the academic community yet to reach a consensus on many key issues. The existing research primarily focuses on three core areas: defining the concept of data assets, the theoretical basis for the assetization of data resources, and the mechanisms for realizing the value of data assets. While these studies have made some progress, there are still significant theoretical gaps and practical challenges.

In the study of data asset concepts, scholars primarily draw on traditional asset theory frameworks to define data assets from three dimensions: first, the legal ownership dimension, which emphasizes a company's control over data resources (Zhang Junrui, 2020); second, the economic value dimension, which highlights the ability of data to generate future benefits (Xu Xianchun, 2022); and third, the form of existence dimension, which focuses on the electronic storage of data (China Academy of Information and Communications Technology, 2019). While this approach provides a foundational understanding, it fails to fully capture the unique attributes of data assets that distinguish them from traditional assets, such as non-rivalry, time sensitivity, and value creation (Huang Shizhong et al., 2023).

Regarding the theoretical exploration of data resource assetization, current research primarily focuses on the recognition criteria outlined in accounting standards. Most scholars argue that data resources meet the definition of assets by focusing on two key aspects: 'economic benefit inflow' and 'reliable measurement of value' (Fisher, 2009; Li Jingping, 2020). Notably, Dai Lida (2022) introduced the principle of 'substance over form,' suggesting that even if the legal ownership of certain data is in dispute, it should be recognized as an asset if it can create value for the enterprise. This perspective offers a new approach for commercial banks in managing customer data assets. However, most of these studies remain at the theoretical level, lacking in-depth analysis of the unique characteristics of the financial industry.

In the study of data asset value, scholars generally agree that data assets primarily enhance corporate value through indirect means (Goodridge & Haskel, 2015). Specifically, in the banking sector, this value creation is reflected in: reducing credit losses through precise risk assessment (China Everbright Bank, 2021), improving operational efficiency through process optimization (China Merchants Bank Annual Report, 2023), and innovating financial products through customer insights (Wang Weiling, 2021). Regarding the value transmission pathways, four key channels have been identified: refined risk management, intelligent operations management, innovative business models, and personalized customer service (Qin Rongsheng, 2020). Finally, in terms of factors influencing value, scholars focus on three dimensions: data scale, data quality, and the company's data analysis capabilities (Li Haijian, 2021).

Despite the achievements of existing research, there are still significant limitations. (1) Most studies focus on theoretical derivations, lacking quantitative empirical support. (2) Data asset value is often treated as a secondary issue rather than a primary research focus, leading to insufficient depth in research. (3) There is a severe lack of industry-specific studies, particularly those focusing on data-intensive institutions like commercial banks. According to a 2023 survey by the China Banking Association, over 80% of banks reported that current theories are inadequate for guiding their data asset practices.

This research status contrasts sharply with the evolving needs of the digital economy. With the implementation of the 'Three-Year Action Plan for Data Elements,' data assets have become a core component in the digital transformation of commercial banks. However, building data assets requires substantial ongoing investment in human, material, and financial resources, and the value returns are often delayed (Lu Minfeng, 2020). This characteristic of input-output has led many commercial banks, particularly smaller and medium-sized ones, to adopt a wait-and-see attitude toward data asset development. Therefore, conducting empirical studies on the value of data assets in the banking sector is of significant theoretical and practical importance.

3. The Value Evolution Mechanism of Data Assets

3.1 Characteristics and value composition of data assets

Data, as a new production factor, is the most critical foundational element for developing new productive forces. Understanding and clarifying the fundamental characteristics of data is essential to grasp the value of data assets. Based on existing literature, this article suggests that the basic features of data should be explored from three perspectives: raw data, big data, and high-quality data.

The essential attributes of raw data include non-exhaustibility, replicability, heterogeneity, and timeliness. The core distinction of data elements from traditional production factors is their non-

depleting nature during use. Data not only does not diminish with use but can also generate derivative data through the expansion of application scenarios, creating a positive feedback loop. The widespread adoption of generative AI technology has further enhanced this characteristic, leading to an exponential growth in data resources. Data's near-zero marginal cost for replication makes it exhibit quasi-public good characteristics. However, the complexity of data ownership (including personal, corporate, and public data) makes achieving complete non-exclusivity challenging, posing special challenges to the valuation of data assets. The non-uniform distribution of data value is evident in three dimensions:

Content, subject and scene dimensions. Timeliness is reflected in the typical exponential distribution of data value decay curve. Studies show that about 60% of unstructured data depreciates rapidly after generation, which requires the establishment of a dynamic value evaluation mechanism.

The technical characteristics of big data are scale, high speed, diversity, value density and authenticity.

The evaluation of high-quality data encompasses five key dimensions. Accuracy is the foundation of data quality, requiring that the discrepancy between data values and real-world conditions be kept within an acceptable range. Consistency serves as the formal basis for data integrity. The freshness of data directly impacts the reliability of analysis results, necessitating the establishment of a data lifecycle management system. Credibility is essential for the market-based trading of data elements. Driven by regulatory compliance and ethical standards, the clear labeling and visualization of data semantics have become increasingly important, impacting the market acceptance of data products. These characteristics collectively highlight the unique nature of data elements, presenting three major challenges to commercial banks in managing their data assets: establishing a dynamic adjustment mechanism for value assessment, ensuring that the technical architecture supports real-time processing of heterogeneous data, and balancing data utilization with compliance requirements in the governance system.

The value of data assets is evident. Economically, data assets exhibit unique synergistic and integration effects, offering new possibilities for cross-industry innovation and development. From a macroeconomic perspective, the integration model of 'data elements + traditional industries' effectively breaks down barriers between traditional sectors, promoting the restructuring and collaborative innovation of industrial ecosystems, thus injecting new momentum into economic growth. Data assets not only drive the development of innovative business models, particularly in strategic emerging industries, but also promote the evolution of the industrial division system towards greater integration and inclusiveness. From a micro-enterprise perspective, data assets can generate significant economic benefits and value-added

opportunities. By deeply exploring the diverse integration characteristics of data assets and integrating them with core business operations, companies can innovate their business models, enhance operational efficiency, and drive organizational change and innovative thinking, supporting sustainable development. Typical application scenarios include standardizing internal data assets to create tradable data products or services, monetizing value through licensing, and ensuring data security through contractual constraints.

3.2 Evolution path from governance to management

Based on the data assetization practices of China Everbright Bank and China Merchants Bank, as well as the preliminary analysis and research of this project, the project team has developed a three-stage model from governance to management. The first stage is the standardized governance phase, where unified standards are established and technical support is provided to address data quality and security issues. The second stage is the scenario-based management phase, where a data platform is established to facilitate effective cross-departmental collaboration. The third stage is the value realization phase.

(1) Standardized governance

Accelerate the construction of unified standards for data asset pricing mechanisms and establish a foundation for connecting with external data markets. China Everbright Bank and China Merchants Bank are steadily expanding their overseas institutions, advancing institutional development in an orderly manner. These measures enhance the standardization and compliance of data production processes, facilitating deeper integration of data with business operations. The establishment of unified standards addresses the previous issues of subjective judgment, better unlocking value and transitioning from data governance to data management.

To establish a reliable valuation parameter system and a 'data asset table' that complements this system, a data asset value assessment framework is constructed. China Everbright Bank has designed a value correction coefficient (U) by considering factors related to the quality, application, risk, and market of data assets. This measure considers the multidimensionality, scale, and availability of data assets, reflecting the integrated value-added and network effects of data, thereby uncovering the potential value of data applications. It helps address the issue of potential risks associated with data assets, such as privacy breaches, underdevelopment, and accidental damage, which can prevent them from reaching their intended usable state, thus facilitating effective data management. This measure standardizes the entire process of data asset procurement, processing, and application, expands the scope of data asset applications, transforms data from an 'intangible resource' into a quantifiable asset, helps management

intuitively understand the economic value of data, and facilitates the transition from data standardization to data management, effectively unlocking the value of data assets.

(2) Scenario-based management

Focusing on data asset evaluation, we aim to establish a 'data asset management center, data value operation hub, and data market trading intermediary.' This initiative explores new models of digital value creation and cultivates core capabilities that can withstand economic cycles. By analyzing the evolution of the data lifecycle, we can identify value growth points at different stages, enhance the company's ability to utilize data assets, manage data in real-time, and control data versions. This improves dynamic data governance strategies, thereby enhancing the decision-making capabilities of management and the marketing skills of business personnel. It addresses issues such as inaccurate data storage, poor data management, and low data utilization, improving overall data management levels. By integrating data asset applications with banking operations, risk control, and other lines of business, we can provide customers with intelligent and personalized products and services, and offer managers more forward-looking strategic information. This measure enhances the value of data assets, facilitates innovative business models, and boosts decision-making capabilities. It also tackles issues like insufficient data value mining and poor value conversion, enhances the standardization of data management, and promotes continuous optimization of data management.

The management objectives have evolved from a single focus on internal applications to a dual emphasis on both internal and external applications, with a greater emphasis on the economic benefits of data, the value of applications, and the ability to drive business growth. This shift enhances risk control and compliance optimization. Moreover, the dual focus on internal and external applications fosters business innovation by integrating data from both sources to offer personalized products and services to customers, thereby enhancing customer experience and increasing customer loyalty. This transformation elevates banks from mere 'data holders' to 'data service providers,' maximizing the economic value of data and facilitating effective data management.

In the management decision-making process, it plays a crucial role in driving business departments to carry out relevant tasks and supporting corporate operational decisions. It can collect, organize, and analyze fragmented information from business departments, providing comprehensive and accurate data support for decision-making, accelerating the decision-making process, ensuring effective execution, and thereby enhancing data management levels. Additionally, data assets that control operational risks and costs can be categorized as general support data, facilitating the transition from data security mechanisms to data management. This measure addresses issues such as information asymmetry, the disconnection between strategy

and business, and inadequate risk prevention in management decision-making, thereby improving the level of data management.

4. The Path Of Value Enhancement Of Data Assets

4.1 Four-stage model of data asset value realization

Data assets, as a key production factor in the digital economy era, exhibit systematic and complex characteristics in their value realization. The value realization of data assets extends beyond mere data collection and storage to encompass data governance, management, operations, and the creation of innovative value chains. Currently, the academic community generally agrees that the value realization of data assets can be divided into four stages: resourceization, assetization, capitalization, and servitization. This theoretical framework elucidates the progressive relationship in the realization of data value. However, in practical implementation, the specific needs and business environments of different industries or enterprises necessitate a more detailed and differentiated approach to this path.

First, during the resourceization phase, raw data is transformed into usable resources through standardization, cleaning, and preprocessing. Traditional data collection methods often result in heterogeneity, redundancy, and inconsistency, making it essential to establish a rigorous data standardization system. Data standards encompass not only the definition of fields and the consistency of data criteria but also the unification of data formats and storage methods. As some domestic financial institutions have demonstrated, by implementing hierarchical and categorized management of data, raw data can be classified into basic data, business data, management data, and external data, thereby constructing a systematic data resource map, which lays a solid foundation for subsequent assetization.

In the assetization phase, the most critical aspects are data ownership confirmation and quality management. During this stage, data assets undergo ownership confirmation, numerical evaluation, and quality testing to ensure clear ownership and measurable value. Ownership confirmation not only prevents misuse and leakage but also provides legal and accounting grounds for data asset registration. Meanwhile, data quality management requires companies to establish comprehensive monitoring and feedback mechanisms to ensure high-quality data throughout the collection, storage, and processing stages. China Merchants Bank has implemented a real-time monitoring platform to promptly identify data anomalies and missing information; China Everbright Bank has developed a 'five-dimensional twelve indicators' core quality assessment system, with a responsibility system to ensure closed-loop problem resolution. These measures not only enhance data accuracy and completeness but also provide a solid foundation for future value-added activities.

During the capitalization phase, data assets are monetized through market transactions and financial innovations. Traditional financial asset pricing models are not directly applicable to data assets due to their zero-marginal replication and high liquidity. To address this, scholars recommend a diversified valuation model that integrates cost, market, and income methods, incorporating scenario-specific coefficients and risk adjustment factors to more accurately reflect the true economic value of data assets. Practical experiences from some banks in the financial sector show that by establishing a ledger for data assets and including them in the balance sheet, banks can effectively incorporate data assets into their balance sheets, thereby supporting various forms of data financing and financial innovation. For example, some banks have achieved cross-departmental data sharing through internal data markets, transforming data assets from being confined to a single department into a key driver of overall corporate operational efficiency. Additionally, the capitalization of data assets is also evident in new models such as data trading platforms and data trusts, which offer companies a wider range of financial tools and funding options.

The service-oriented phase marks the deepening and expansion of data asset value realization. This involves building cross-border ecosystems and diverse application scenarios to unlock the derivative value of data assets. In this stage, companies not only use data for internal management and financial innovation but also collaborate with external partners to build ecosystems, achieving data sharing, cross-border integration, and coordinated development. The 'government-led-authorized operation' model in the government data sector and the 'scenario-driven-value feedback' model at the enterprise level are concrete examples of this concept. Under the government-led model, by opening up and sharing government data, public services are optimized, and social governance is modernized. At the enterprise level, through deeper integration of business scenarios, data not only supports operational decisions but also generates new business models and profit models.

4.2. Optimal design of implementation path

Based on the four-stage model, this paper will further explore the mainstream pathways for realizing data asset value in China and the issues that exist. Currently, China's data asset management exhibits a 'dual-track' approach: on one hand, in the government sector, departments leverage data resources to realize their value through information disclosure, inter-departmental collaboration, and third-party authorized operations; on the other hand, within enterprises, the focus is more on business scenario-driven approaches, promoting data application in sectors such as finance, manufacturing, and retail through data standardization and asset ledger establishment. Financial institutions, particularly banks, have developed relatively mature implementation paths for data asset governance and operations. For instance, both China Everbright Bank and China Merchants Bank have implemented strict classification management and quality control

measures in their data governance processes. In asset operations, they use tools like data maps and data chain technology to effectively enhance the utilization efficiency and transparency of data assets.

In practice, China Everbright Bank has established a three-dimensional governance system centered on data standards, quality, and security, making data asset management more systematic and standardized. China Merchants Bank, on the other hand, has achieved the legal representation of data assets in financial statements by confirming and listing data assets, thereby promoting the development of an internal data market. The exploration of different approaches has demonstrated that realizing the value of data assets not only relies on advanced information technology but also requires comprehensive support in systems, management, and processes. During the early stages of the project, the team found that using traditional evaluation methods alone had limitations, such as the cost method overlooking future data benefits, the market method lacking transaction data support, and the income method struggling to predict future benefits. Therefore, these three methods can be integrated: first, use the cost method to determine the basic value of data assets, considering the costs of data collection, storage, and organization; then, use the income method to forecast potential additional benefits from data assets in future business, such as increased profits from precise marketing, such as higher loan interest rates or lower default rates; and finally, refer to similar data asset trading cases in the market to refine and supplement the evaluation results. For example, when evaluating customer credit data for a medium-sized bank, start by calculating the costs of data collection and organization, then analyze the future benefits of this data in credit business due to improved customer screening accuracy, and finally, refer to similar data transaction prices in the market to comprehensively determine its value.

In addition to innovation, the project team believes that integrating big data analysis and machine learning algorithms is also an effective method to enhance the value of data assets. By leveraging big data analysis technology, these algorithms can mine and analyze vast amounts of data to identify key value drivers of data assets. On this basis, machine learning algorithms, such as neural networks and decision trees, are used to build evaluation models, enhancing the accuracy and efficiency of assessments. These algorithms can automatically learn complex patterns and relationships within the data, improving the accuracy and adaptability of the evaluation models, thus enabling more precise predictions of the value of data assets.

At the same time, several common issues remain in the value realization path of existing data assets. Firstly, the current approach heavily relies on specific business scenarios, lacking universality and replicability, and lacks a unified theoretical framework. Secondly, in cross-entity data collaboration, the lack of unified data standards and contracts often leads to unclear data ownership and uneven benefit distribution, causing institutional friction. Thirdly, in a dynamic

environment, the mechanisms for data asset value depreciation and compensation measures have not been adequately developed into a comprehensive theoretical model and empirical system, which affects the long-term stable appreciation of data assets. To address these issues, the project team proposed classifying data assets based on their characteristics and purposes, categorizing them into customer data, transaction data, risk data, operational data, etc. For each type of data asset, a specific evaluation index system is established to more accurately measure their value. For example, customer data can be evaluated based on indicators such as customer characteristics, consumption behavior, and credit history; transaction data can be assessed based on indicators such as transaction amount, frequency, and type. Additionally, the Analytic Hierarchy Process (AHP) and Fuzzy Comprehensive Evaluation (FCE) methods are used. The AHP method is susceptible to subjective expert judgment when determining the contribution weights of data assets, while the FCE method can handle the fuzziness and uncertainty in the evaluation process. Initially, the AHP method can be used to construct a hierarchical structure model for evaluating the value of data assets, determining the approximate weight ranges of each indicator. Then, the FCE method can be applied to classify the fuzzy membership degrees of each indicator, adjusting and optimizing the weights based on these degrees to ensure that the weights more accurately reflect the actual contributions of each part of the data assets.

In summary, the realization of data asset value is a systematic project that encompasses the standardization of data resources, the confirmation and quality management of data assets, the capitalization of data operations, and the innovation of data service-oriented approaches. By constructing a four-stage model centered on 'resourceization, assetization, capitalization, and servitization,' this approach not only elucidates the intrinsic progression of data value realization but also provides theoretical guidance for implementation across various industries. Although the mainstream path to realizing data asset value in China has been explored in government and enterprise sectors, most efforts remain at the level of institutional design and single technology application. However, the proposed path in this project has achieved comprehensive innovations in governance mechanisms, value assessment, and cross-entity collaboration, thereby enhancing the overall efficiency of data assets and offering new ideas and practical examples for the financialization of data assets.

Through the deepening of theoretical insights and practical exploration, it is evident that realizing the value of data assets not only requires the support of hardware and software technologies but also necessitates coordinated optimization across governance, management, operations, and innovation. Only by developing a comprehensive and systematic solution can we truly unlock the intrinsic value of data as a new production factor, thereby facilitating the digital transformation and upgrading of enterprises and society as a whole. Meanwhile, governments at all levels and regulatory bodies should formulate targeted policies and regulations based on the

current realities of the data market, ensuring the secure and efficient circulation of data assets, and promoting the deep integration of data elements with capital markets, financial markets, and technological innovation.

Finally, establishing a mature system for realizing the value of data assets is not only a critical topic in theoretical innovation but also an essential approach to driving the digital transformation of industries and fostering new economic growth points. Future research should draw on advanced practices both domestically and internationally, taking into account China's specific conditions and industry characteristics, to continuously refine the management and operational models of data assets, and explore implementation paths suitable for large-scale application. This will not only enhance internal efficiency within enterprises but also provide a solid theoretical foundation and practical guidance for the healthy development of China's data element market.

5. Conclusion and enlightenment

5.1. Research conclusions

By conducting an in-depth analysis of the data asset management practices of commercial banks, this study reveals that the realization of data asset value exhibits distinct phased characteristics, which can be systematically categorized into four progressive stages: resourceization, assetization, capitalization, and servitization. In the resourceization stage, the focus is on the standardized collection and cleaning of data; in the assetization stage, the emphasis shifts to resolving issues of data ownership and quality management; in the capitalization stage, the goal is to facilitate market transactions and financial innovation through data; and in the servitization stage, the aim is to maximize value through the construction of an ecosystem. Each stage requires appropriate technical support and management mechanisms, and commercial banks should develop a step-by-step implementation strategy based on their own development levels.

Research indicates a significant capability gap in data asset management between leading banks and smaller, medium-sized banks. Leading banks, such as China Merchants Bank, have established robust data platforms and governance systems, enabling them to manage complex data assets. In contrast, most smaller and medium-sized banks are still in the early stages of data governance. Therefore, this article proposes a differentiated improvement strategy: for leading banks, it is recommended to innovate in data asset application scenarios and explore the market circulation of data elements; for smaller and medium-sized banks, the priority should be on building a basic data platform, rapidly enhancing data management capabilities by introducing external technology solutions, and adopting a 'small steps, fast run' incremental development approach. Traditional data management methods are no longer sufficient to meet current business needs. Through case studies and expert interviews, several breakthrough technological solutions

have been identified: AI modeling can significantly enhance the accuracy of data asset valuation; blockchain technology can effectively address issues of data traceability and ownership confirmation; privacy computing technology provides a secure and feasible method for cross-institutional data sharing. Commercial banks should increase investment in these emerging technologies while focusing on the deep integration of technology with business operations, avoiding the pitfall of 'technology for technology's sake.'

The data management challenges faced by many commercial banks are fundamentally rooted in the rigid organizational structures. To effectively manage data assets, it is essential to break down departmental barriers and establish cross-functional collaboration mechanisms. Additionally, the shortage of versatile talents, who are proficient in both banking operations and data technology, poses a significant constraint. It is recommended that commercial banks adopt a strategy that combines internal training with external recruitment, collaborating with universities to cultivate specialized talent and establishing flexible talent sharing mechanisms, thereby ensuring a steady supply of human resources for data asset management.

5.2. Policy recommendations

According to the current market trends, there are still issues with data asset evaluation standards, such as lack of uniformity, inadequate data governance and management, and technical shortcomings. Therefore, it is necessary to enhance the accuracy, completeness, and timeliness of data by improving relevant policies, thereby fully tapping into and leveraging the value of data assets.

(1) Define the compliance boundary of data assets

First, the state should further refine laws and regulations related to data, clearly defining the rights and obligations of data assets in various scenarios, enabling enterprises and institutions to accurately understand compliance standards. Industry associations should also develop industry-specific standards and guidelines for data asset compliance based on industry characteristics, providing specific operational guidelines for businesses. Additionally, regulatory bodies should introduce more detailed data usage norms, specifying the application scenarios and scope of government public data to prevent resource wastage due to vague regulations. Clarifying the boundaries of digital asset compliance is crucial for promoting the healthy development of data assets, reducing risks associated with data transactions and circulation, and fostering sustainable data development.

(2) Promote the construction of regional data trading ecology

The country should promote cooperation among data trading venues and enterprises in different regions to achieve the sharing and complementarity of data resources, thereby facilitating the broader circulation and allocation of data elements. Relevant enterprises should also actively participate in the formulation of international data trading rules, enhance their alignment with the international data trading market, and boost the region's influence and competitiveness in the international data sector. Additionally, it is essential to promote the rational layout of regional data centers, improve data storage, processing, and transmission capabilities, adopt advanced storage technologies and equipment, ensure the security and stable storage of data, and facilitate the rapid circulation of data within the region. Promoting the development of a regional data trading ecosystem is crucial for breaking down data barriers, maximizing the value of data, enhancing the efficiency of data trading, promoting the circulation of data elements, optimizing resource allocation, boosting regional innovation capabilities, and strengthening regional competitiveness.

(3) Promote the gradual reform of financial confirmation of data assets

The finance department and relevant industry associations should organize training sessions for financial personnel and managers of enterprises to familiarize them with the policies and operational methods, thereby enhancing the accuracy and standardization of data asset financial processing. Additionally, the process of including data assets in financial statements should be implemented in stages: the first stage involves disclosing a list of data assets, while the second stage focuses on piloting the measurement of core data assets. Drawing on the EU's Data Governance Act, a 'data asset maturity certification system can be established, incorporating compliance costs into the valuation system. This approach will help improve data governance and management, adapt to new economic trends, and enhance China's influence and voice in the international accounting community.

(4) Strengthen the training of compound talents

The banking association can collaborate with universities to offer interdisciplinary courses in 'Fintech + Data Governance,' aimed at cultivating professionals who are passionate about business and skilled in technology. It should also establish and refine talent sharing mechanisms among small and medium-sized banks, alleviating the talent shortage through short-term secondments or project collaborations. Additionally, the government should support local areas in adding digital domain professional titles based on industry needs, improving policies for income distribution that emphasize the value of digital knowledge and the commercialization of digital technology. Strengthening the cultivation of interdisciplinary talents can enhance management efficiency, optimize operational models, and effectively promote the exploration and innovation of data assets.

(5) Establish a dynamic and scenario-based data asset evaluation standard system

Regulatory authorities should design differentiated evaluation methods for different types of data to make data asset valuation more reasonable. Additionally, they should provide dynamic reference ranges for key parameters such as the discount rate and benefit period, and establish a quarterly adjustment mechanism. Furthermore, a comprehensive standard system should be established, covering multiple dimensions including data quality, usage efficiency, security, and compliance. This will help data owners and users clearly understand the value of data assets, thereby promoting the circulation and sharing of data among various entities, and fully realizing the economic and social value of data.

5.3 Future Outlook

According to the preliminary research and interviews, we find that the value of data assets has not been fully mined and innovated, and there is still a long way to go to improve the value of data assets. Therefore, we propose the following relevant prospects:

(1) Banks and relevant associations should promote the development and innovation of external technologies

In our interview report with bank employees, we found that they face the 'data silo' issue. Due to the long-term independent storage of customer data between the retail and corporate departments of branches, integrating this data has been time-consuming and labor-intensive. The introduction of Ant's Data Trust platform, leveraging blockchain technology, has effectively addressed these issues. By promoting the development and innovation of external technologies, the efficiency of converting unstructured data into standardized, analyzable data can be significantly improved, enhancing data usability and addressing the technical limitations of banks. Additionally, this approach helps banks optimize their valuation methods, expand application scenarios, and ensure compliance and security, thereby maximizing the value of data assets.

(2) Commercial banks should strengthen data governance and management

Currently, China's commercial banks still face issues such as low efficiency and incomplete governance in data management. Commercial banks should continuously improve their data governance systems, clarify data ownership and usage rights, standardize the entire lifecycle of data management processes, and enhance data quality. Additionally, they should strengthen data security measures, improve data management and operational capabilities, and fully unlock the potential value of data assets.

(3) Expand application scenarios and cooperation

Currently, the application of commercial bank data assets is limited, and the partners are often single. Banks should actively expand the use of data assets in areas such as financial services, smart cities, and supply chain finance. They should strengthen cooperation with fintech companies, internet firms, and other external entities to achieve data sharing and complementary strengths, uncover new value growth points, fully enhance the value of data assets, and promote the prosperity and development of the data asset market.

(4) Improve the trading mechanism

Currently, the transaction mechanisms of commercial banks in our country still have many shortcomings, such as non-uniform trading rules and standards, lagging development of trading platforms, and an incomplete risk management system. Therefore, commercial banks should enhance their transaction mechanisms to remove obstacles in data transactions, improve the efficiency of data asset allocation, fully leverage the economic value of data, and promote the efficient circulation of data elements. Additionally, they should establish a comprehensive risk assessment system to effectively identify, evaluate, and control various risks during the transaction process, thereby improving the quality of data assets and maximizing their value.

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