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Selection of Methods for Valuing Data Assets

-- Taking the Telecommunications Industry as an Example

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Abstract

The development of human society is the history of man's transformation of the material world, and the development of industry has provided mankind with a powerful weapon for understanding and transforming the material world. Industry 1.0 is the era of steam engine, Industry 2.0 is the era of electrification, Industry 3.0 is the era of informationization, and now Industry 4.0 is the era of intelligence with data as the core production factor. At present, data has become the fifth largest factor of production, and China is now facing a critical period of industrial upgrading, which urgently needs to release the value of data elements and empower the key areas of economic and social development. This paper mainly explores the definition, classification and characteristics of data assets, and proposes a portfolio assessment method to comprehensively evaluate the value of data assets.

Keywords

Data Assets; Valuation; Telecommunications Industry.

1. Introduction

At present, the importance of data in economic activities is becoming more and more prominent, and China has entered the era of big data, in which data is the main factor of production. In recent years, China has issued a series of documents on data assets at both the central and local levels, aiming to provide guidance for state-owned and private enterprises to be able to discover, correctly assess, and securely trade data assets in a timely manner during the process of digital transformation. In 2020, China's State Council issued the Opinions of the CPC Central Committee and the State Council on the Establishment of a More Improved Systematic Mechanism for the Market-based Allocation of Resources. The document argues that data is the fifth major factor of production alongside land, labor, capital, and technology. Operator enterprises in the telecom industry, with extensive user groups, abundant data reserves and strong data processing capabilities, occupy an important position as both suppliers and service providers in the value chain of data factors, and therefore urgently need a set of practicable methods that not only enable objective and accurate assessment of state-owned data assets, but also fulfill the important task of preserving and adding value to state-owned assets, and also promote a series of data-intensive industries in the country. High-quality development of a series of data-intensive industries in China.

Taking the telecommunication industry as an example, this paper extensively reads related literature and summarizes the definition, classification and attribute characteristics of data assets using the literature analysis method. The value composition of data assets is disassembled through the inductive summarization method and combined with relevant theoretical knowledge, and the driving factors affecting the value of data assets are extracted.

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The innovation of this paper is that by comparing and analyzing the proposals of various scholars, based on the value chain of data elements and the data life cycle theory, the original single-use cost method, income method and market method are unified, and a set of combined value assessment method is designed, which is used to explore a more objective and accurate assessment of the value of data assets.

2. Overview of Data Assets

2.1. Definition, Classification and Characterization of Data Assets

2.1.1. Definition of Data Assets

Data assets are not simply "data + assets", nor are they the same as intangible assets. Data assets are an organic combination of data elements and intangible assets. Generally speaking, data assets refer to electronically recorded data resources formed in past transactions and events, legally controlled and owned by the enterprise, which can bring expected economic benefits to the enterprise in the future.

2.1.2. Classification of Data Assets

The connotation of data assets is very rich, and very similar to data elements, data assets include structured data, semi-structured data and unstructured data. According to the application industry of data assets, data assets can be divided into financial industry data assets, telecommunication industry data assets, government agency data assets, transportation industry data assets and other industry data assets; according to the stage of development of data assets, data assets can be divided into raw data, rough processing data, (pre-commercialization) finishing data, the first exploration of application scenario data, data at the early stage of economic benefits realization, and commercialized data; according to the source object of data assets, data assets can be mainly divided into data assets originating from people, data assets originating from things, and data assets originating from events; according to the data ownership of data assets, data assets can be mainly divided into private data assets and public data assets.

2.1.3. Characterization of Data Assets

The "Asset Appraisal Expert Guideline No. 9 - Data Asset Appraisal" ("Guideline No. 9") issued by China Asset Appraisal Association points out that data assets can be categorized into five main attributes: non-physicality, dependence, diversity, processability, and volatility of value. On the basis of these characteristics, data assets also have three derivative attributes, namely, multiple derivatization, shareability and zero-cost replication.

2.2. Value Drivers and Valuation Logic for Data Assets

2.2.1. Value Drivers for Data Assets

In the process of transforming data elements into data assets, data elements have experienced various links such as data collection, data cleaning, data labeling, data analysis, data storage, data application, etc., in which data elements have completed the re-release of potential value, and have leapfrogged from data resources to data assets. Data risk, data quality, data development stage and data application scenarios all have a profound impact on the value of data assets. In the risk dimension, the value density of data assets is mainly affected by legal risk and moral risk; in the quality dimension, the value density of data assets is mainly faced with the problems of data authenticity, accuracy, completeness, and security; in the development stage, the value density and economic behavior of data assets in different scenarios are not the same; in the application dimension, the scarcity, multidimensionality, timeliness, and scenario economy all cause the value density to fluctuate to different degrees.

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2.2.2. Valuation Logic for Data Assets

Data assets are an important link and intermediate link in the process of releasing the value of data elements, and data assets are both the result of data element resourcing and the starting point of data element capitalization. As a new quality production factor, the connotation of data factor is that it is required to promote the change of production efficiency and optimization of resource allocation. In order to accomplish this goal, data elements are required to continuously release their own potential value, and the value released at each stage needs to be quantified. Therefore, it has become a reality to adopt a value assessment method that fits the characteristics of data assets and is in line with the data life cycle.

3. Overview of the Telecommunications Industry

3.1. Basic Introduction to the Telecommunications Industry

Telecommunications carriers are the main carriers of the telecommunications industry and the main providers of communications network services, relying on a huge substantive telephone network and telecommunications equipment to carry out various types of communications network services, and belonging to a capital-intensive, resource-rich and highly capitalized service industry. China's telecommunications carriers are asset-heavy state-owned enterprises, and there are currently four major telecommunications carriers in China, namely China Telecom, China Mobile, China Unicom and China Radio and Television.

In 2023, China's communications industry comprehensively implemented the spirit of the 20th CPC National Congress, conscientiously carried out the decisions and deployments of the CPC Central Committee and State Council, adhered to the general tone of seeking progress while maintaining stability, made every effort to push forward the construction of a strong network country and a digital China, and promoted the in-depth fusion of the digital economy and the real economy, with the main operating indexes of the whole industry growing steadily, the network infrastructures, such as 5G and Gigabit Optical Networks, being more and more complete, the popularization of applications accelerating in a comprehensive manner. The high-quality development of the industry is steadily advancing. According to the Ministry of Industry and Information Technology's 2023 Communications Industry Statistics Bulletin, from the industry's overall situation, the total amount of telecommunications business and business revenue maintained steady growth, with a growth rate of 6.2% and 16.8% respectively; from the development of subscribers, there was a net increase of 37.07 million subscribers across the country, with a cumulative total of 1.9 billion subscribers. Among them, the total number of cell phones was 1.727 billion, with a net increase of 43.15 million for the year, and the telephone penetration rate reached 122.5 per 100 people, an increase of 3.3 per 100 people over the same period of the previous year. 5G users totaled 805 million, accounting for 46.6% of all cell phone users, an increase of 13.3% over the same period of the previous year; in terms of the volume of telecom services, the flow rate of mobile Internet access amounted to 301.5 billion GB, a year-on-year increase of 15.2 percentage points, and the average monthly mobile Internet household traffic for the whole year was 16.58 GB/household-month, a year-on-year increase of 10.9 percentage points; from the viewpoint of network infrastructure, the investment in fixed assets has remained stable, with a cumulative total of 420.5 billion yuan invested in the whole year of 2023, a year-on-year increase of 0.3%, of which the total investment in the construction of 5G amounted to 190.5 billion yuan, a year-on-year increase of 5.7%, accounting for 45.3% of the total investment.

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3.2. Analysis of Data Assets of Telecommunication Operators

3.2.1. Telecom Operator Data Sources

The telecom industry is very data-intensive, and operators, as data producers and service providers under the digital economy, possess a huge total amount of data, rich data types, and extremely high data value. The data source channels of telecom operators are mainly IT production systems, business platforms, communication networks, Internet data, external customers and other channels. The vast majority of the data of telecom operators is based on the internal proprietary communication data of mobile Internet customers nationwide, which is time-sensitive, highly accurate and rich in content, and which is often used by operators to draw exclusive profiles of their subscribers and carry out precision marketing in their daily operations. Therefore, the value density of data assets and data products developed based on such data is extremely high and sensitive.

3.2.2. Telecom Operator Data Application Scenarios

Telecommunications carriers have more diversified economic application scenarios for carrier data due to the quality characteristics of their data itself, which is large in total volume, rich in types and high in value density, and also with the rapid development of 5G and artificial intelligence technologies in recent years. The data application scenarios of telecom operators mainly focus on commercialization scenarios such as market precision marketing, enterprise operation management, network upgrade and optimization, and customer relationship management.

4. Portfolio Assessment Method based on Data Value Chain and Data Life Cycle Theory

4.1. Relevant Theoretical Foundations

4.1.1. Data Value Chain

Value chain theory was originally proposed by American scholar Michael E. Porter in 1985 in his book Competitive Advantage, he believed that enterprises should highlight their unique competitive advantages in the development process and attach higher value to their products and services, and enterprises should add value to their products and services through a series of strategies, and this value-added process is known as the value chain.In 2013, H. Gilbert Miller and Peter Mork proposed the data value chain theory on the basis of the value chain theory, and they believed that in order to maximize the value of data and provide effective information for business decision-making, enterprises need to establish a portfolio management model that manages and coordinates data involved in the entire product or service process, continuously analyzes and optimizes the data, and at the same time streamlines the data management activities, and building relationships with stakeholders. This process relies on a data value chain model centered on "data discovery - data integration - data development".

4.1.2. Product Life Cycle

Product life cycle mainly refers to the market life of the product, which was firstly put forward by Raymond Vernon, an American economist, who believed that the product and biological life will go through the four stages of formation, growth, maturity, and decline, and the product will also go through the process of research and development, growth, maturity, and decline in the market. In the theory of product life cycle delineation, the life cycle of a product is divided into four stages: start-up, growth, maturity and decline.

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4.2. Analysis of the Adaptability of Traditional Valuation Methods under Data Assetization

The traditional value assessment method mainly assesses intangible assets, because data assets have both data attributes and intangible asset attributes and derive other new types of features, so the use of traditional value assessment methods to assess the value of data assets may have compatibility problems, so this paper assesses the value of data assets using traditional methods to do an adaptability analysis, as shown in the following table.

Table 1. Adaptability analysis of data asset value assessment methods

Methodologies	Scope of Application	Superiority	Limitations	Overall Score
Cost Method	① The data asset is in active or available status; ② Data assets can be reset or reconstructed; ③ The replacement or reconstruction cost, initial operating cost and related wear and tear of data assets can be measured reliably.	① The depreciation and attrition of data assets are fully taken into account; ② The cost and value densities of data assets show a non-linear relationship during the development process, which can lead to a serious deviation from cost and value at a certain stage.	① The cost approach lacks consideration of the expected return on data assets; ②The cost approach only considers the development cost of the data asset and ignores the initial operating costs	Start-up period: ★★★ Growth period: ★★ Maturity: Not recommended Decline: Not recommended
Revenue Method	① The expected return on the data asset is measurable; ② The expected risk of data assets can be measured; ③ The expected period of return on data assets is determinable	① The expected returns and corresponding risks of data assets are fully considered; ② More accurately reflect the value of data assets at the maturity stage ③ The theoretical application of the income approach is now more mature.	① The income approach to determining the period of return, discount rate and risk of data assets is susceptible to the subjectivity of the appraiser; ② The application of the income approach requires a high level of professionalism from appraisers.	Start-up: Not recommended Growth: ★★ Maturity: ★★★ Decline: ★★
Market Method	① The data exchange market meets the conditions of an open and efficient market; ② Data trading markets require the existence of a large number of comparable references	① Simple to operate compared to the cost method and income method; ② Can objectively and fairly reflect the true value of data assets	① At present, the data asset trading market is still in its infancy, the market system is not sound enough, and the openness, transparency and effectiveness need to be strengthened; ② Most of the data trading is done off-exchange and there is a lack of comparable references on-exchange; ③ Lack of awareness of the risks of data transactions on both sides of the transaction	Start-up: Not recommended Growing: Not recommended Maturity: ★★★ Decline: ★★★

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4.3. Portfolio Approach

The current research in academia mainly focuses on the income method, especially the multi-period excess earnings method. Ge Yanfei uses the DCF model and B-S option model as the main valuation model, combines the hierarchical analysis method and the entropy method to determine the proportion of data assets in intangible assets, and values the data assets of China Mobile. Wang Jing completed the valuation of China Unicom's data assets through the multi-period excess earnings model, using the gray prediction model to predict the excess earnings, and also combined with the comprehensive empowerment method. Although the multi-period excess earnings method is able to reflect the economic value of data assets by fully considering the earnings contribution channels of data assets, the value density and expected earnings period of data assets vary to different degrees in different scenarios, which can lead to difficulties in determining the earnings period of data earnings, and the final value of data assets will be distorted as a result. Therefore, when designing the data asset value assessment method, it needs to be based on the data element value chain and product life cycle theory, and this paper puts forward the following two suggestions for the design of the data asset value assessment method.

4.3.1. The Design of Data Asset Value Assessment Methods Should Be based on the Data Element Value Chain

The value-added process of data elements in the value chain has to go through three stages: data resourceization, data assetization and data productization. Data assetization is the end point of data resourceization and the starting point of data productization, and it plays the role of carrying on and starting off in the whole process, in which the data elements are gradually attached to the value of use, exchange value and economic value.

Table 2. Value-added activities of data elements along the value chain

Value-added Phase	Conceptual	In the End
Resourcing of Data Elements	This stage focuses on the collection, cleaning and simple processing of raw data, and is the initial release of the potential value of data elements	Data elements are attached with use values and are primed for scenario applications
Assetization of Data Resources	This stage is the intensive cultivation of data resources, constantly tapping the potential value contained in data resources, data resources gradually transformed into the form of data assets, and the re-release of the value of data elements.	Data elements are attached with additional exchange value, more applicable to the needs of specific scenarios, and are able to participate in market exchanges, bringing initial economic value inflows to the organization.
Data Asset Productization	Enterprises complete the third release of the value of data elements through data assets acquired in production and operation or market transactions, and develop mature data products adapted to specific economic scenarios based on these data assets	Data elements have economic value attached to them and are able to participate deeply in the functioning of the market economy and continue to bring an inflow of economic value to the enterprise

4.3.2. The Design of Data Asset Value Assessment Methods Should Be in Line with the Product Life Cycle

The end result of the value added by data elements in the value chain is data products developed on the basis of data assets. Therefore, in the process of value assessment, the life cycle of data products should be fully considered, and it is not appropriate to use a single value assessment method, but should combine the cost method, income method and market method,

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which are commonly used at present, with the life cycle theory to form a set of combined assessment method. At the same time, it is also necessary to take into account that the data assets of telecom operators are often closely related to livelihood and national security issues, and that certain desensitized data still cannot easily flow out to the market.

Table 3. Assessment of the value of data assets based on the portfolio valuation method (desensitized to allow outflow to the market)

Life Cycle Stage	Portfolio
Start-up	Cost Method
Growth	Revenue Method + Cost Method
Maturity	Revenue Method + Market Method
Decline	Market Method + Revenue Method

Note: When two methods are used in combination, the method written in the front is the primary method and the method written in the back is the secondary method.

Table 4. Assessment of the value of data assets based on the portfolio valuation method (desensitization does not allow outflow to the market)

Life Cycle Stage	Portfolio
Start-up	Cost Method
Growth	Cost Method + Revenue Method
Maturity	Revenue Method
Decline	Revenue Method + Cost Method

Note: When two methods are used in combination, the method written in the front is the primary method and the method written in the back is the secondary method.

5. Summary

Data assets in the telecom industry are characterized by wide sources, diverse types, rich application scenarios, great value density and high sensitivity. Meanwhile, since the telecom industry is a heavy asset industry, the basic carriers in the industry are mega state-owned enterprises, so the data assets in the telecom industry belong to the category of state-owned assets. At present, data elements are in the process of releasing their value for the second time, and how to quantify the value released in the assetization of data elements has become a key point. This paper finds that using a single valuation method to evaluate data assets and their data products with life cycle will lead to value distortion, therefore, based on the theory of data factor value chain and product life cycle, we comprehensively compare the advantages and disadvantages of the three valuation methods and the characteristics of each stage of the data product life cycle, and design a set of combined valuation method that conforms to the life cycle of data products.

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