Research and practice on the valuation method of data assets in power grid enterprises

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Abstract. The digital economy era has spurred the development of data assets, with data showing an explosive growth trend and diversified application value. The data resources of power grid enterprises as the owner of the "data gold mine" have the characteristics of strong professional attributes, large collection scale, fast growth rate, high accuracy, strong sensitivity, large business span, and multiple data types. Evaluating the value of data assets in power grid enterprises plays an important role in the management and application of enterprise data assets. This article aims to evaluate the value of data assets in power grid enterprises. Based on the analysis of the classification, influencing factors, and traditional evaluation methods of data assets in power grid enterprises, a data asset value evaluation model suitable for power grid enterprises is constructed using the cost method. The model is applied in a representative case of a certain power company. After practical testing, the data asset value evaluation model has certain practicality, but it is limited to the immaturity of the existing data trading market and needs further improvement in the future.

Keywords: Power grid enterprises; Data assets; Value; Evaluation; Model; Practice.

1 Introduction

The digital economy era has spurred the development of data assets, with data showing an explosive growth trend and diversified application value. It is not only the internal driving force for enterprise development, but also the most important and active output factor in the development of the digital economy[1]. The core of power grid enterprises lies in their users, and as the enterprise develops, it also generates a massive amount of data, including power grid operation data, user consumption data, and enterprise management data. As the owner of the "data gold mine", power grid enterprises have strong professional attributes, large collection scale, fast growth rate, high accuracy, strong sensitivity, large business span, and multiple data types of data resources, which can be applied in various scenarios to serve different groups of people. Evaluating the value

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of data assets in power grid enterprises plays an important role in the management and application of enterprise data assets, and is the foundation for creating value through enterprise data assets.

In order to further promote the realization and utilization of the value of power grid data assets, this article aims to evaluate the value of data assets for power grid enterprises and a data asset value evaluation model suitable for power grid enterprises was constructed using the cost method based on the analysis of the characteristics, value influencing factors, and traditional evaluation methods of data assets in power grid enterprises. And use a certain power company as a representative case for model application. After practical testing, the data asset value evaluation model has certain practicality, but it is limited to the immaturity of the existing data trading market and needs further improvement in the future.

2 Research on existing methods for evaluating the value of data assets

On August 21, 2023, the Ministry of Finance issued the Provisional Regulations on Accounting Treatment of Enterprise Data Resources[2], which standardized the accounting treatment of enterprise data resources, required accounting recognition, measurement, and reporting of transactions and matters related to data resources, and included data resources in the balance sheet. On September 8, 2023, under the guidance of the Ministry of Finance, the China Asset Appraisal Association issued the "Guiding Opinions on Data Asset Appraisal" [3], providing guidance for the practical evaluation of data assets. The above two documents are specific measures taken by the Ministry of Finance to implement the decisions and deployments of the Central Committee of the Communist Party of China and the State Council on the development of the digital economy. They are an active exploration of a new model of data asset entry into the balance sheet, with high timeliness and practical guidance significance.

2.1 Basic asset valuation methods

Looking at documents such as the "Guiding Opinions on Data Asset Evaluation", "Expert Guidelines for Asset Evaluation No. 9- Data Asset Evaluation" [4], and the "Information Technology-Big Data-Data Asset Value Evaluation" standard [5], there are mainly three basic methods for data asset value evaluation: cost method, income method, and market method [6-8]. Other asset value evaluation methods all evolve and deform from the above three methods.

(1) Cost method

The cost method is evaluated based on the cost of forming data assets. It mainly includes the expenses incurred during the process of data generation and application.

Advantages: Collecting all expenses generated by data, easy to decompose costs, convenient for calculation, suitable for data collection and value summary in the balance sheet.

Limitation: Unable to reflect the benefits that data assets can generate. For some data assets, there is no corresponding direct cost, and the allocation of indirect costs is also difficult to estimate.

(2) Income method

The income approach estimates the value of data assets by estimating their expected returns. This method is relatively easy to operate in practice and is a valuation method that calculates the present value of future economic benefits based on the expected application scenarios of the target asset.

Advantage: It can accurately reflect the value of data assets, and the corresponding data value is also relatively easy to predict when the expected return of data assets can be estimated.

Limitations: The amount of return and risk are easily influenced by subjective judgment factors, making it difficult to accurately predict.

(3) Market method

Market method is a method of evaluating the value of data assets based on comparative analysis of recent or past transaction prices of the same or similar data assets.

Advantage: Due to the fairness of the reference market price, it is more easily accepted by both buyers and sellers.

Limitations: The requirements for market trading conditions and volume are relatively strict, data assets have a certain degree of confidentiality, and transaction types are relatively single, making it difficult for evaluators to collect market prices for data transactions.

2.2 Emerging asset valuation methods

In addition to using basic asset valuation methods, there have also emerged emerging data asset valuation methods that combine the characteristics of big data. Zhang Zhigang et al. analyzed the composition of data asset value from two aspects: the cost and application of data assets. The data cost consists of construction costs and operation and maintenance costs. Construction costs include labor costs, material costs, and indirect costs, while operation and maintenance costs include business operation costs and technical operation and maintenance costs; The data application consists of four indicators: data classification, frequency of use, target audience, and effectiveness evaluation; Based on the research on the composition of data value, Wang Jianbo proposed that artificial intelligence methods such as neural networks can be used to explore the pricing of data assets. By inputting data value indicators and outputting data intrinsic value or market value indicators, the pricing of data assets can be achieved [9]; Qu Lili et al. focused on the value evaluation of alliance data assets, and used a data asset evaluation method based on real options to calculate the value of alliance target and execution data assets through the importance of each alliance member enterprise. They used an improved B-S model to evaluate alliance data assets [10].

3 Construction of Data Asset Value Evaluation Model for Power Grid Enterprises

3.1 Division of data assets for power grid enterprises

According to functional applications, power data assets can be divided into real-time exchange data, offline data packets, models, algorithms, computing power, data analysis products, etc. In fact, the delivery of data products such as real-time exchange data and offline data packets is mostly standardized data, while models, algorithms, and data analysis products are more customized data products.

3.2 Core factors affecting the value of data assets in power grid enterprises

Based on the management requirements and value generation process of data assets, the core factors that affect the data assets of power grid enterprises can be summarized:

(1) Risk factors

Legal risk: Legitimacy and compliance are the fundamental prerequisites for the use of data assets. Enterprises are facing increasingly stringent data compliance regulations, which may result in huge fines if they violate the law.

Moral hazard: The use of data assets will also face scrutiny from public opinion. Unreasonable operating methods may lead to public condemnation and loss of customer relationships.

Other risks: such as hardware risks, macroeconomic risks, political risks, etc.

The above factors will directly affect the scenarios in which data assets are applied, and the universality and frequency of use of the scenarios will directly affect the process of realizing data assets. Generally, if data belongs to sensitive data or involves personal privacy, the usage scenarios of such data will be strictly controlled. When evaluating the value of enterprise data assets, it is generally necessary to first classify and classify the data assets, clarify the risk level of each type of data, whether it has value for use, and specific usage scenarios.

(2) Data quality

Accuracy and uniqueness: mainly depend on the source of the data. Real, accurate, and nonrepetitive data will inevitably be transformed into robust and reliable commercial results, thereby enhancing the value of data assets.

Integrity: If the data is sufficient, complete, and highly sustainable, it can greatly reduce the cost of supplementing missing data and subsequent annual recycling and reuse for enterprises.

Timeliness and timeliness: Timely acquisition of high timeliness data is crucial for all aspects of enterprise operations.

The above factors will directly affect the efficiency and effectiveness of data asset application. Generally, data assets with good data quality bring higher value, while low-quality data brings costs and risks. Therefore, when evaluating the value of enterprise data assets, the quality factors of data assets are generally considered to clarify the quality of different types of data.

(3) Data development stage

The development of data generally goes through the following stages:

In the initial stage, data assets are only in the form of raw unprocessed data, and there are no specific matching commercial scenarios, and their value may be limited to their development costs.

After certain processing, data assets have a certain profit model after initially finding suitable commercialization scenarios, and their value has significantly increased, but there is still uncertainty.

In the end, after multiple attempts, the commercialization scenario of data assets was determined, most uncertainties were eliminated, and the value of data assets significantly increased to achieve maximization.

When data is transformed from resources to assets, and then from assets to capitalization operations, its development stage and value vary. In the data resource stage, the transition of data from unordered to ordered results in costs; In the data asset stage, various products are derived from data and begin to have application value; In the data capital stage, financial transactions can be conducted like other capital, such as land, with diversified values.

(4) Application scenarios

The existence of clearly defined commercial application scenarios determines whether data assets have value. In different business scenarios, data assets will also play different roles and achieve different values. Undoubtedly, the more multidimensional the scenarios that data assets are applicable to, the higher the compatibility between scenarios, and the higher the value of data assets.

Generally, data assets with clear and repeatable application scenarios have high value, while data assets with unclear application scenarios have low value. It should be clarified that the application scenarios of data are usually divided into internal enterprise scenarios and external scenarios for data asset circulation applications. The external scene is usually unclear.

(5) Market scarcity and substitutability

If a certain type of data asset is relatively scarce and there is a high demand in the market, but there are few suppliers, then the scarcity of that type of data asset is relatively high, and the price will rise in the short term due to the impact of supply and demand.

If a certain type of data asset has strong substitutability, it indicates strong supply substitutability and low value.

3.3 Construction of Data Asset Value Evaluation Model for Power Grid Enterprises

(1)The basic model of cost method

The basic model of cost method is:

$$V = C \times \delta \tag{1}$$

In the formula:

V - Value of evaluated data assets;

C - The reset cost of data assets mainly includes upfront expenses, direct costs, indirect costs, opportunity costs, and related taxes and fees. The upfront expenses include the upfront planning costs. Direct costs include the continuous investment costs from data collection to processing to form assets. Indirect costs include software and hardware procurement, infrastructure costs, and public management costs that are directly related to data assets or can be reasonably allocated.

δ - Value adjustment coefficient. The value adjustment coefficient is a coefficient that adjusts for the difference between the expected condition of all data assets invested and the actual condition of data assets on the evaluation benchmark date, for example, the coefficient that adjusts for the difference between the expected quality and actual quality of data assets.

(2)A Value Evaluation Model for Data Assets of Power Grid Enterprises

Based on the cost price method, evaluate the value of power grid data assets taking into account the factors that affect the realization of the value of electricity data assets and market supply and demand factors comprehensively.

The data asset value evaluation model for power grid enterprises is based on the price calculated using the modified cost method, and its formula is:

$$V = \sum_{i=1}^{3} M_i S_i \sum_{j=1}^{8} C_j \left(1 - R_j\right) Q_j \tag{2}$$

In the formula:

V - Value of evaluated data assets;

I - Types of data assets: generally divided into three types: data (real-time exchange data, offline data packets), standardized data products (models, algorithms, data analysis products), and computing power.

J - Data asset acquisition, processing, storage, security, maintenance/update, development, management, sales, and other aspects.

C - The cost incurred by a certain type of data asset in various stages such as data asset acquisition, processing, storage, security, maintenance/update, development, management, and sales.

R - is the risk coefficient of a certain type of data asset at a certain stage;

Q - Quality coefficient of a certain type of data asset at a certain stage;

S - is the scenario coefficient of a certain type of data asset;

M - The market coefficient, scarcity, and substitutability of a certain type of data asset.

1）C_j(The cost of a certain type of data asset)

The cost of acquiring data assets C_1 includes: the procurement price and taxes involved in obtaining the original data assets from external sources, the cost of collecting personnel, the cost of purchasing personnel, the cost of purchasing terminal equipment, as well as the procurement system cost, adverse data elimination cost, and other acquisition costs involved in internal collection.

The cost C_2 of data asset processing includes: processing personnel cost, processing system cost, and other processing costs.

The cost of storing data assets C_3 includes: storage equipment costs and other storage costs.

The costs of data asset security C_4 and maintenance/update C_5 include: data asset maintenance personnel costs, data asset maintenance system costs, update and upgrade personnel costs, update and upgrade system costs, security maintenance costs, etc.

The cost of data asset development C_6 includes: developer costs, development system costs, other costs, etc.

The cost C_7 of data asset management includes: management personnel costs, management system costs, other costs, etc.

The cost C_8 of data asset sales includes: sales personnel costs, sales system costs, and other costs.

2）R_j(The risk coefficient of a certain type of data asset at a certain stage)

$$R_j = \frac{\text{Level of data asset classification}}{\text{Total level of data asset classification}} \tag{3}$$

The risk coefficient of a certain type of data asset in a certain stage R_j is indirectly reflected by the sensitivity of the data. Generally the more sensitive data (with higher levels of data classification) is, the more likely it is to bring compliance legal risks, and its risk coefficient is higher.

3）Qj (The quality coefficient of a certain type of data asset at a certain stage)

Q_j is the sum of the evaluation scores for each dimension of data quality inspection, generally ≤ 1.

Table 1. Data Quality Coefficient Calculation Table

Data asset pricing object	**inspection dimension**	**inspection standard**	**inspection result**	**data quality coefficient (≤1)**
A certain type of data asset	Accuracy	Accurate data range Encoding/Code accuracy No redundancy in data	α_1=Score(≤1)× Weight (0.2)	**$\alpha=\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5$**
	Integrity	Complete data elements Complete data recording	α_2=Score(≤1)× Weight (0.2)	
	Validity	Data naming conventions Data length specification	α_3=Score(≤1)× Weight (0.2)	

		Data format specification		
	Uniqueness	Unique identification of data	α_4=Score (≤1)×Weight (0.2)	
	Accessibility	Accessible at any time Stable storage medium	α_5=Score(≤1)×Weight (0.2)	

4）S_i(Scenario coefficient of a certain type of data asset).

$$S_i = \frac{\text{The number of realized scenarios for this type of data asset}}{\text{The number of scenarios for predicting this type of data asset}} \tag{4}$$

5）M_i(Market coefficient of a certain type of data asset):

$$M_i = \frac{\text{The usage of this type of data asset in the current year}}{\text{The total amount of this type of data assets in the current year}} \tag{5}$$

The market coefficient of a certain type of data asset M_i is the ratio of the data usage of that type of data asset to the total amount of that type of data asset in the current year. This trend can reflect the proportion of data involved in the operation and trading of data assets.

4 Practice of Data Asset Value Evaluation Model for Power Grid Enterprises

Based on the actual business data of a certain power company, the above model is applied to the enterprise, and the actual evaluation process is as follows:

(1) Data asset inventory: Based on the company's data classification and grading standards, inventory various levels of data assets, identify the details of various types of data assets under each business line of the company, and form a list of data assets as the evaluation object.

According to the actual situation, a total of 11 data assets have been determined to participate in the evaluation, including electricity load table, power generation load (minute) table, power generation facility situation table, daily power generation and reception table, maximum load table of the previous day in the region, analysis table of total social electricity consumption, electricity consumption of 100 power enterprise users, public building electricity consumption, residential building electricity consumption, monthly power generation and reception (report) table, and power generation table.

(2) Data asset information registration and review: Collect and organize information about the company's data sources, structure, scale, period, update cycle, metadata standards, etc., draft a data asset registration form, and carry out data information registration and filing, formal review, substantive verification and other processes, and pass the registration review.

(3) Data asset quality evaluation: Based on the "TABLE I. Data Quality Coefficient Calculation Table", collect and provide materials from the dimensions of accuracy, consistency, completeness, standardization, timeline, and accessibility of data to form

a data asset quality evaluation report After evaluation, the quality coefficient of the 11 data assets mentioned above is 0.99.

(4) Valuation of data assets. Collect the costs of various data assets at various stages of their lifecycle, evaluate their risk, quality, scenarios, and markets, and form various evaluation coefficients, as shown in the table II.

Table 2. Data Asset Value Evaluation Parameter Table

Serial Number	Data asset	C_i (yuan)	R_i	Q_i	S_i	M_i
1	Electricity load table	57227761	0.2	0.99	0.8	0.5
2	Power generation load (minute) table	51607822	0.2	0.99	0.8	0.5
3	Power generation facility situation table	1404282	0.4	0.99	0.6	0.4
4	Daily power generation and reception table	54991152	0.4	0.99	0.6	0.4
5	Maximum load table of the previous day in the region	22886696	0.4	0.99	0.7	0.5
6	Analysis table of total social electricity consumption	1547593	0.6	0.99	0.6	0.4
7	Electricity consumption of 100 power enterprise users	508798	0.4	0.99	0.8	0.6
8	Public building electricity consumption	79500	0.2	0.99	0.8	0.4
9	Residential building electricity consumption	79500	0.2	0.99	0.8	0.4
10	Monthly power generation and reception (report) table	1017596	0.4	0.99	0.8	0.5
11	Power generation table	1271995	0.6	0.99	0.8	0.6
	Total	48,093,000				

It should be noted that because the risk coefficient of a certain type of data asset in a single stage and in other stages of its lifecycle are determined by its hierarchical level, it can be considered that the risk coefficient of a certain stage is the risk coefficient of that type of data asset. In addition, due to the governance process in which data forms assets, its data quality no longer changes. The quality coefficient of the data asset quality evaluation can be used as the quality coefficient for each link.

5 Summary

The data asset value evaluation model was applied to 11 data assets of a certain power grid enterprise, and the values of the 11 data assets are shown in Table III. Preliminary evaluation shows that the value of 11 data assets is 48.093 million yuan. Through the application of this model, the value of enterprise data assets has been effectively explored, providing strong support for data asset appreciation, data asset entry into the balance sheet, and financial innovation.

Table 3. Data Asset Value Evaluation Form

Serial Number	Data asset	Valuation value of data assets (yuan)
1	Electricity load table	18129754.80
2	Power generation load (minute) table	16349358.06
3	Power generation facility situation table	200194.44
4	Daily power generation and reception table	7839538.70
5	Maximum load table of the previous day in the region	4758144.03
6	Analysis table of total social electricity consumption	147083.28
7	Electricity consumption of 100 power enterprise users	145068.44
8	Public building electricity consumption	20148.39
9	Residential building electricity consumption	20148.39
10	Monthly power generation and reception (report) table	241780.73
11	Power generation table	241780.73
	Total	48,093,000

However, the evaluation model still has shortcomings.

(1) Although the value evaluation results of data assets have been obtained, the rationality of the evaluation results cannot be tested due to the lack of real transaction cases at present.

(2) There is still room for optimization in terms of application scenario factors, market scarcity, and substitutability considerations. At present, the data trading market in China is not yet mature, and the market trading intensity is not active. At the same time, due to the diverse types of data assets and a wide range of application scenarios, comparability is poor.

Overall, the strategic position of data assets in enterprise development is becoming increasingly important. For power grid enterprises, utilizing data assets to generate more value is an important means for them to gain a competitive advantage. At present, the value evaluation methods applied to enterprise data assets are still relatively theoretical. It is hoped that more enterprises can continuously practice in this field in the future, forming a more reasonable, practical and applicable data asset value evaluation system that is widely accepted in the market, and promoting the rapid circulation and trading of power data assets.

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