Value Assessment of Data Assetization Based on Value Creation Theory

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Abstract. Data asset value assessment is the foundation of modern data asset management and operation as well as data circulation. Based on the theory of value creation, the thesis constructs a data asset value assessment model based on the theory of value creation, considering the factors of data development and data realization, and takes the data of China's Shandong government platform as an example, and the results of the calculations show that the data asset value assessment model constructed in the thesis can be effectively applied in practice, and play the role of promoting the process of data assetization.

Keywords: value creation; assetization; value assessment; data development

1 Introduction

The "14th Five-Year Plan" for the development of digital economy points out that the digital economy is the main economic form after the agricultural economy and industrial economy, and it is a new economic form in which data resources are the key elements, modern information networks are the main carriers, and the integrated application of information and communication technologies and the digital transformation of all elements are the important driving forces to promote greater unity of fairness and efficiency[1]. Data elements are the core engine of the deepening development of the digital economy, and it is necessary to carry out data rights, pricing and trading activities in an orderly manner, and to explore the construction of an income distribution mechanism that is compatible with the value and contribution of data elements[2]. Data asset value assessment is an important foundation for realizing data circulation and application, and the development of digital economy urgently requires people to conduct in-depth research on the topic of assessing data assets[3].

The data asset value assessment is a cross-disciplinary subject that involves a number of fields, such as computer science, economics, marketing, and the emerging data science. Because the data is multi-faceted and the purpose of value assessment is different, its principle and focus are also different. Currently there are more studies on the assessment of the value of data assets, some scholars use the income approach combined with the real option method, and then use the hierarchical analysis method to

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calculate the weights in order to determine the overall value of the data assets, and then finally carry out empirical analysis and confirm the validity of this scheme[4]. However, there are fewer domestic and foreign studies on the assessment of value creation ability, and a complete research lineage has not been formed yet. Some scholars have used the hierarchical analysis method to establish a value creation ability assessment model with higher accuracy and credibility by optimizing the criteria for determining the influencing factors[5]. Because the hierarchical analysis method has too many indicators, large amount of data statistics, weights are difficult to determine and other problems, some scholars have improved the evaluation model by optimizing the criteria for determining the weights of each indicator[6]. Down to the level of assessment indicators, the ability to create data value, unlike traditional resources such as oil, the value of data lies in the "application", to avoid data becoming an "island"[7]. At the same time, the interactivity underlying the digitalization process is also changing the logic of value creation while promoting the transformation of capabilities[8]. The traditional theory of value creation stems from the concern for enterprise value and its management issues, which believes that value creation is the key to sustainable growth of enterprises, and that enterprises should maximize value instead of maximizing profits as the development goal[9]. Fully exploiting and releasing the value of enterprise data elements has become the key to reshaping the industrial competition pattern and developing the digital economy[10]. Therefore, it is of great importance to assess the data value creation capability of enterprises. However, the existing research related to this mainly focuses on the theoretical level. Based on the above issues, the thesis constructs the data asset value assessment system and model from the value creation theory, and takes government data as an example to analyze the arithmetic examples. The process of data assetization can be facilitated through the study of models for assessing the ability to create data value.

2 Model Construction

The enhancement of data value creation ability has generated great potential social value in "benefiting the people" and "smart government", etc. Meanwhile, the overall growth of the data economy has further empowered the data value creation ability to generate potential "economic value". Therefore, when assessing the data value creation ability at this stage, it is necessary to comprehensively consider the potential social and economic value factors brought about by the data value creation ability, introduce the data potential model, and incorporate these factors as variable coefficients into the model's data value creation ability accounting, so as to obtain the final assessment results, as follows:

Final assessment result = Data development value * Potential economic value presentation factor * Potential social value presentation factor

2.1 Accounting for Data Creation Value

At this stage, the data value creation ability is determined by a combination of data exploitation value, potential social value of data, and potential economic value, as follows:

$$V_d = mgh \tag{1}$$

Where V_d represents the data creation value, m represents the construction cost of the data system (i.e., data development value); g represents the potential economic value presentation factor; and h represents the potential social value presentation factor.

And the specific calculations of m, h, and g are shown in equations (2), (4), and (5).

2.2 Data Development Value

$$m = m_0 \times \prod_{i=1}^{n} q_i \times s \tag{2}$$

Where m_0 is the construction cost of the data service system; q_i represents the data quality adjustment factor; and s is the data compliance security adjustment factor.

The construction cost of the data service system m_0 is all the inputs required to build the value of the data service, including the initial construction cost, the accumulated operation and maintenance cost, and the management cost, etc., as follows:

1) Initial construction costs: the cost of infrastructure (server rooms, cabinets, storage devices, etc.) occupied by data storage;

2) Operation and maintenance costs: the human (employee costs) and material resources (servers, software, etc.) required to ensure normal and reliable data services;

3) Management costs: manpower (employee costs, service provider costs, project costs) and material resources (servers, software, etc.) designed in the process of data processing and organization.

The data quality adjustment factor q_i is the overall quality level of the data service as follows:

$$q_i = \sum_{i=1}^{n} a_i s_i \tag{3}$$

Where a_i represents the weight given to the the i-th evaluation item; and s_i is the score obtained for the i-th element.

2.3 Potential Social Value Presentation Factors

The potential social value is quantified by introducing a power function with an exponent between 0.5 and 1 as follows:

$$h = d^a \tag{4}$$

Where h represents the potential social value; d represents the most representative quantitative indicators reflecting the social value, such as the number of application downloads, daily activity, data usage satisfaction, data usage frequency and stickiness, and repeat visits; and a represents the efficiency index.

The function expresses that the potential social value h has a positive non-linear relationship with the indicator, which is because in the early stage of data value creation, the community's knowledge of the value of data as well as the development and utilization of the data is gradually formed, and the social value embedded in the data value creation ability is higher; in the growth period, the contribution of social value contained in the new unit indicator will continue to rise, but it is not as rapid as the initial stage of development, and gradually transforms into commercialization to form economic value. The new value of unit data gradually changes from social value to economic value. The rise of social value conforms to the law of marginal decline, and the overall curve is convex. The selection of quantitative indicator d is not unique, but needs to meet the following characteristics:

1) It can reflect the degree of acceptance of data services by the whole society, including individuals, enterprises and governments, as well as the effective reach of data assets;

2) It can reflect users' recognition of data value creation ability and data service application. For example, if users choose to download and retain the data after clicking and browsing or repeatedly log in to use the data for a period of time, they are more likely to further analyze the data assets in the future, and develop the data value creation ability in a more long-term period of time;

3) The rise of this indicator can reflect the " benefiting the people " effect to a certain extent, and the public's recognition of the value creation ability brought by data services, which further makes the data value more widely circulated in society and applied in more scenarios, and gradually changes the economic business model and social life style, resulting in a huge leverage effect.

2.4 Potential Economic Value Presentation Factors

The data products at this stage do not directly generate positive cash flow and incremental cash flow in terms of value creation, but they contain huge business potential, which is calculated as follows:

$$g = (1 + g_e)^x \tag{5}$$

Where g_e represents the growth rate of revenue from data value creation (such as the growth rate of the gross data economy); and x is the value corresponding to the third-party expert's value creation score for the data in the application scenario.

The continuous flow of data in the process of collection, analysis, and application, and its use in different business scenarios, make the economic value of data creation ability expand exponentially. Therefore, the introduction of data application scenarios can better reflect the potential economic value of data creation ability.

3 Example Analysis

June 25, 2022 was selected as the assessment baseline date, and the data sources for the assessment were the Shandong Public Data Open Platform, the financial statements of the Shandong Provincial Department of Finance, the China Government Procurement Network, the China Shandong Government Procurement Network, and the China Local Government Data Openness Report (Provincial Area 2021 Annual).

(1) Data development value m : By reviewing the financial statements of the Shandong Provincial Department of Finance for 2018-2022 and the relevant financial data of the Shandong Provincial Big Data Center, the main budgetary expenditures of the Shandong Public Data Open Platform in recent years are summarized, and the relevant financial data are shown below table 1:

Table 1. The main budget expenditure table of Shandong public data open platform from 2018 to 2022.

Year	Department	Project	Budget/ten thousand yuan
2018	General Office of Shandong Provincial Government	Shandong Provincial Government Information System Integration and Sharing Project Public Data Open Platform	1068
2018	Shandong Provincial Big Data Bureau and its subordinate departments	Administrative operation	16.98
2019	Shandong Provincial Big Data Bureau and its subordinate departments	Business operation	369
2020	Shandong Provincial Big Data Bureau and its subordinate departments	Business operation	497
2021	Shandong Province Big Data Center	Shandong Province Public Data Open Platform Phase II	351
2021	Shandong Provincial Big Data Bureau and its subordinate departments	Business operation	1001.19

2022	Shandong Provincial Big Data Bureau and its subordinate departments	Business operation	1365.04

Based on the above data, it is possible to estimate the cost of building a public data open platform in Shandong from 2018 to 2022:

$$m_0 = 1068 + 16.98 + 369 + 497 + 351 + 1001.19 + 1365.04 = 4668.21 \quad (6)$$

The platform construction cost m data comes from the budget and final account statements of Shandong Province Big Data Bureau, Shandong Province Big Data Center bidding contract and so on. Since the open data platform involves more departments and organizations, certain business and related data may be intersected, so the statements and contract data directly related to the platform are mainly selected for the valuation and analysis of its cost.

(2) Data quality adjustment coefficient q_i: derived from the 2021 China Local Government Data Openness Report (Provincial), the data quality of Shandong's public data open platform is comprehensively scored in four dimensions: data quantity, quality, standardization and scope, and the calculation result is 6.3.

The data compliance adjustment coefficient s is scored by experts on the platform's user agreement, data format and other factors, and the weighted average is 0.64. The data development value m of Shandong's public data open platform can be calculated as follows:

$$m = 4668.21 \times 6.3 \times 0.64 = 18822.22 \quad (7)$$

(3) Potential social value presentation factor h: The actual cumulative download volume of government open data can comprehensively reflect the level of social cognition of the open data platform and the activity of its utilization, and is the most representative indicator of the social value of open data. From November 2021 to the assessment date, the actual resource download volume of Shandong's public data open platform is 609,830 times. Since the data factor market is still imperfect and data utilization is still in the development stage, the efficiency index a is taken as 0.6, and the potential social value presentation factor results are calculate:

$$h = d^a = (60.983)^{0.6} = 11.77 \quad (8)$$

(4) Potential economic value presentation factor g: g_e is the average nominal growth rate of digital economy in Shandong Province in the past five years. During the 13th Five-Year Plan period, the average annual growth rate of Shandong's "digital economy" exceeded 30%. Relevant experts score the diversity of data application scenarios and data completeness of the Shandong's public data open platform, derive the corresponding data application scenario coefficient x as 5, and calculate the potential economic value presentation factor:

$$g = (1+g_e)^x = (1+30\%)^5 = 3.71 \tag{9}$$

In summary, the results of the value creation ability of Shandong government 's public open data are as follows:

$$V_d = mgh = 18822.22 \times 3.71 \times 11.77 = 821904.23 \tag{10}$$

By collecting relevant data and substituting them into the model for calculation, it can be verified that the data asset value assessment model constructed in this paper can be effectively applied in practice, and at the same time, through the calculation, it is possible to have a more objective understanding of the status quo of the value creation ability of the public open data of the Shandong government, which promotes the process of data assetization.

4 Conclusions and Recommendations

Starting from the production and consumption of data assets, this thesis proposes a data asset value assessment method and conducts practical measurements on government data platforms and actual business data. The method is innovative at the model level, describes the whole process of data asset value assessment, and carries out an in-depth discussion on the key parameters, proposes alternative parameters at different stages, and enhances the practicality of the model. For data assets that are difficult to quantify, the assessment results cannot be verified in the market in the context of the lack of a data trading market and a trading mechanism, and the assessment effect can be verified in the future based on the promotion of the data trading market, which will lead to the improvement of the model and the method.

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