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Enterprise Data Asset Value Evaluation with Model Building and Case Study

Bo Feng[1,2*]

[1]School of Intellectual Property, Nanjing University of Science and Technology, Nanjing 210094, China.
[2]Nanjing Audit University Jinshen College, Nanjing 210023, China

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ABSTRACT: In the information age of the 21st century, data is everywhere. As an intangible asset, data asset is an important strategic resource of enterprises. With the rapid development of mobile Internet, cloud computing, Internet of things and other technologies, the total amount of data presents a rapid increasing mode, and the data sources are becoming more and more diversified. The concept of big data begins to enter the public's vision. As a corporate asset, the importance of data has become increasingly prominent. Data asset management has become the main source of enterprise competitiveness in the era of big data. With more and more opportunities for data to generate value, data will become an important source of wealth creation in the future. Therefore, the evaluation of data assets will also become the core issue of enterprise valuation. This paper studies the background of contemporary data assets, analyzes the value of data assets for enterprises and society, refers to many documents, analyzes the factors affecting their value, and studies their value and significance from the perspectives of market method, cost method, income method, analytic hierarchy process and so on. Finally, a data asset evaluation model is established to understand the value of data more deeply and intuitively. Then, according to the value generated by the data, it is applied to all aspects of society.

Keywords: Date assets; Date asset valuation; Evaluation model; Evaluation method, Case study

I. INTRODUCTION

Against the background of global data opening, China's public data opening has been accelerating in recent years.Open public data plays a vital role in the ecosystem of data assets and supports the construction of "digital China" due to the current situation and the challenges faced by public authorities.Price Waterhouse Coopers, China's open Data Object, recently released its "Open Data Object Valuation White Paper".Asset valuation is the core of future data value sharing.However, due to the uniqueness of open public data, there are many challenges in the application of traditional data.The white paper points out that data capitalization is an important trend of data elements, aiming at: In the context of global data resources opening, the pace of public data opening in China has been accelerating in recent years.Open public data plays an important role in the ecosystem of data assets and supports China's efforts to accelerate digital development and build a "digital China".China has officially established 18 provincial-level public data platforms to provide free public data of relevant government units to all social sectors.But free doesn't mean worthless.Open public data has great social value in "benefiting the people" and "smart government".At present, the application scenarios of public open data are becoming more and more abundant.Over time, it will accumulate huge potential economic value that can be expected in the future.

The report argues that open data, such as "soil" in the ecosystem of data resources, can help accelerate China's digital development and create a "digital China".On the one hand, ministries and commissions at all levels have a large number of basic and central data resources, dominating the vast majority of social data in sectors such as transportation, finance, telecommunications, industry and commerce, and health.On the other hand, large and small businesses, individuals, brokers and other social entities that collect and store data also own large amounts of data with public attributes and public value.The primary prerequisite for ensuring national security, trade secrets and personal privacy, and maximizing the disclosure of these public data for the development and use of society as a whole, is to promote the market for data elements and the social and economic sharing of public data.

Data assets are intangible assets. In asset appraisal, data is mainly used as the object of asset

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appraisal[1]. As a new kind of intangible asset, the value asset in data has developed into an important strategic value resource of Chinese enterprises.This important contribution fully draws on the three current valuation methods for all kinds of intangible assets and their brand value.Li Yonghong, Zhang Shuwen[2] stated that acording to the information life cycle theory, the value of data value can only be reflected in their exchange.From the amount of data, data quality and data analysis ability analysis data values, using the analytic hierarchy process (AHP) and grey correlation analysis method of double combination, considering the influence on the value of data, contrast comparable data assets, further to modify market method, comprehensive data assets value assessment model is established, in order to determine the value of data assets.Zhu Zili, Ni Shan[3] studied the applications in the industry background and key data assets risk management through the use of a variety of visualization analysis method, inductive, found for data definition, asset management accounting, data digital asset risk management and the intrinsic value of assets evaluation and so on various aspects are still unclear definition, so in this paper, the intellectual property management problems about digital data assets, industry development characteristics, management assessment method for the practical applicability and other aspects of in-depth study.

Wang Jing, Wang Juan[4]Financial platform based on China's Internet network enterprise actual operational data characteristics, using layer analysis method to establish the financial platform for Internet network conditions influencing factors of evaluation of assets in the enterprise operating data evaluation index system, combining the theory of B - S data evaluation model on the comprehensive analysis of the assets of the enterprise data weight status value evaluation, at the same time to speed up the construction of a set of perfect enterprise data resource sharing management platform.Zuo Wenjin and Liu Lijun[5], based the literatures both at home and abroad, combined with big data technology industry market development trend in our country, analyzed the big data assets appraisal value of practical use, the introduction of Shapley value method and the distribution of bankruptcy law, design the decomposition of large data assets valuation methods to establish a set of big data valuation methods choice system to adapt to the industry the status quo, finally using typical case to verify its theoretical and practical feasibility.Dong Xiang thousand etc.[6] analyzed the method of data value evaluation and the commodity attribute of assets by using data analysis, then discusses the market model of data asset transaction, and finally puts forward the method of profit modeling for participants to provide theoretical reference for participants to enter the market.In the use of cost evaluation method for asset evaluation research, Lin Feiteng et al[7] studied the feasibility of using different asset valuation methods, including market method, cost and profitability, is discussed.Finally, it is concluded that the cost determination method is the best method to determine the value of big data and determine the relevant evaluation stage. Linfei Teng[8] pointed out that with the popularization and development of Internet technology, big data, as a derivative product of the Internet, has created solid value for enterprises, and carries out prospective research on big data assets and their value according to the research results of existing scientists.Zuo Wenjin and Liu Lijun[9 considered that big data asset valuation method is the basis of big data asset price management, and analyzes the big data asset price with mostly linear programming method, and verifies the feasibility and effectiveness of the new method through an example.Shi Yixin etc.[10], based on the previous research results of intangible asset value evaluation system, and according to the characteristics of data asset,constructed a comprehensive evaluation model of big data asset value by using multi-level comprehensive analysis method.Li Yonghong and Li Jinao[11] pointed out that there are few researches on data assets and their value evaluation at present. Therefore, this paper takes Internet enterprises as the analysis object, uses the traditional asset value evaluation method to evaluate data assets, and adjusts the original method in order to realize the combination of theoretical research and practical application.Liu Qi, Tong Yang et al[12]defined,Data assets and evaluated the value of similar big data assets on the basis of quantitative adjustment of technical level, density, data capacity and other factors.Luo Xiaoyi etc.[13] combined with the research background of big data and the achievements of data asset management at home and abroad, put forward the definition and characteristics of data asset of electric power company, quantifies data asset based on panoramic perspective, and finally puts forward data management suggestions.Wang Jianbo[14] analyzed the influencing factors of data assets, this paper introduces the current income method, market value method and cost recovery method to test the asset pricing method.At the same time, based on the traditional evaluation methods, the paper expounds the application of game method and artificial intelligence method to evaluate the status of data assets. Cheung Chi-Kong etc.[15] using analytic hierarchy process software, introduced the analytic hierarchy process model into the research and

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application of data asset valuation model, so as to calculate the weight data value of each valuation index and determine the valuation model based on cost and application.Different from traditional valuation methods, the valuation point in this paper is changed from data quality to data asset value.

On the basis of summarizing previous studies, this paper analyzes the influencing factors of enterprise data assets, constructs an index system and model of enterprise data assets value evaluation, and analyzes it with a case.

II. ANALYSIS OF INFLUENCING FACTORS OF ENTERPRISE DATA ASSET VALUE

The risk factors affecting the application value of existing data enterprise assets are mainly considered from two main dimensions: risk return and application risk of existing data application assets. The risk return of data application assets mainly depends on the technical quality and practical application value of existing data application assets.The security and quality stability of data center assets is an important basis for realizing application value.

2.1 Data asset quality value dimension

The quality value of data assets includes authenticity, integrity, accuracy, data cost, security and so on.

Integrity refers to the integrity of data on all related metrics of a record object.Missing critical data can affect the value contribution of the data to the application or increase the cost of completing the data.The higher the integrity, the greater the value of the data value.

Accuracy recording generally refers to the overall accuracy of data in the process of data recording.In the work, the current analysis data must be divided into clear outliers, blank data values, invalid data values, double values and so on.This new work process is expected to take almost half the manpower time of the entire data analysis process.The emergence of full-time "data sweeper" also fully demonstrates the high complexity of enterprise data resource cleansing.The higher the application accuracy of data, the lower the application cost of data resource cleaning, and the greater the application value of data.

Data processing costs.If a data analysis market is not active, there is no clear way to calculate the value of the data and calculate the analysis.The seller's quotation for the sale of customer data will first need to consider the transaction cost of buyer data.Data collection methods are usually collected internally or outsourced.For data generated and collected internally, explicit costs include, in particular, the cost of work and storage equipment.Intangible costs that cannot be reliably measured in the survey and attitude procedures are mainly research and development costs and wage amortization of the companies attached to the data.The higher the purchase cost, the greater the transaction value of the data.

Security refers to the ability not to steal or corrupt data.The higher the information security value of data itself, the more stable the contribution to the interests of an enterprise;At the same time, the higher the cost of the data asset holder's personal data protection asset, the greater the protection value of the data asset.

2.2 Application value dimension of data assets

The key factors that affect the overall dimension of information application and the overall application value of big data information assets are information scarcity, timeliness, multi-dimension, scene and economy.

Scarcity represents the extent to which data owners monopolize data.The essence of competition in the commercial market is the fierce competition for scarce resources.As production differentials flattens, the underlying business message behind scarce resources highlights their value.The timeliness of the data determines whether the decision is valid over time.Multidimensionality can represent the diversity of network data coverage.The more dimensions of data, the greater the scope of data, the greater the value.Scenarios are economical, and the economic value contribution of data lies in the close combination with the enterprise application economy scenarios. In different enterprise application economy scenarios, the value contribution of data to the scenario economy is different.For example, the economic value of transportation information used by logistics companies is greater than that of transportation information used in individual travel scenarios.

There is also a dimension of risk, which is hard to measure.Risk measurement, the risks of data assets mainly come from the legal and ethical constraints in their operating environment, and the quantitative impact of data assets on quality changes. These factors should be fully considered when evaluating the value of data assets.If the law does not specify which data can never be traded and which data can only be traded after design.These issues not only limit data traffic but also the value of data values, with the practical effect, of course, of correspondingly increasing tighter regulation of data transactions, compliance costs and security

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costs for both parties.Although data compliance and security industry as side effects will have development space, but it will have a significant impact on the development of the whole data wealth market, will affect the overall development of digital economy, development and the concept of tolerance should be used, given the data exchange the introduction of laws and regulations or the drafting of the classical decision may affect the value of related data items, from quantitative change to qualitative change.Moral pressure constraint risk is generally refers to the moral risk that the society is under great public pressure.If the user company illegally abuses the personal data of other users and does not respect the personal privacy of other users, it will seriously affect the corporate brand image of the user company and its confidence in customer service, and have a significant negative impact on the use value of personal data and the development of its business value to the company.

III. CONSTRUCTION OF ENTERPRISE DATA ASSET VALUE EVALUATION MODEL

3.1 Construction of enterprise data asset value evaluation index system

The index system of data asset evaluation includes data quality evaluation and data application evaluation.The evaluation indicators of data quality include completeness, correctness, consistency and repeatability.Integrity mainly describes whether a data record contains missing data records or information fields.Correctness is used to describe whether the target data corresponds to the physical characteristics of the corresponding target unit.Any field of data should be in a particular data format and scope.Consistency describes whether the same attribute value of the same cell is consistent across records.Repeatability is the problem of whether there are two records in the index data.

The following is the scoring method of each indicator:

Integrity = (total amount of data/data records that meet the criteria in a data store) *100%

Correctness = (amount of data that is correct for all data in the data set/total number of data records) *100%

Consistency = (total amount of inconsistent data in the dataset/total number of data records) *100%

Repeatability = (amount of all repeated data in the dataset/total number of data records) *100%

The evaluation indexes of data application value include scarcity, timeliness, multi-dimension and scene economy.Due to the lack of specific data and measurement standards for each dimension of data application value, expert scoring method is more used to evaluate according to expert experience and obtain the relative value, which is up to 10.However, the application value of data will change with the change of the situation, and it needs to be evaluated in specific circumstances at a time. There is no cross-department and multi-department universal value evaluation standard.

3.2 Selection of enterprise data asset value evaluation method

Firstly, the weight of influencing factors of data asset value can be calculated through analytic hierarchy process.Then the grey correlation analysis method is used to quantify the influencing factors of data assets value and calculate the correlation coefficient between data assets.Then the correlation degree is calculated by combining the weight of influencing factors of data asset value, and then the data asset with high correlation degree is selected as the comparable data asset.Finally, based on the market method, the weight of comparable data assets is determined by using the correlation degree, and the value evaluation model of data assets is constructed.

3.3 Construction of fuzzy comprehensive evaluation model

Set the evaluation object as P: its factor set U, and evaluation grade set V such as $U = \{u_1, u_2, u_3 \ldots u_m\}, V = \{v_1, v_2, v_3 \ldots v_m\}$. Fuzzy evaluation is conducted for each factor in U according to the grade index in the evaluation set, and the evaluation matrix is obtained such as

$$R = \begin{pmatrix} r_{11} & r_{12} & r_{1m} \\ r_{21} & r_{22} \cdots & r_{2m} \\ r_{n1} & r_{n2} & r_{nm} \end{pmatrix}$$

Where, represents the degree of affiliation of $r_{ij}, u_i, v_j(U, V, R)$. A fuzzy comprehensive evaluation model is constructed.After determining the important indicators of each factor (also known as weights), it is denoted as A, which meets the requirement of and is synthesized to A·R, so the evaluation level of object P can be determined.$P = \{a_1, a_2 \ldots a_n\} * (b1,\ b2,\ \ldots,\ \overline{b_m})T$

The establishment of fuzzy comprehensive evaluation model should go through the following steps:

(1) The set of alternative objects is given and denoted as each enterprise

(2) Determine a set of financial indicators: that is, the ratio of the main several different financial indicator groups that can accurately predict an enterprise's financial crisis can be directly combined

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to form a set of financial indicators.

(3) Establish the full weight set at the project level. Since the importance of each index in the index set is different, corresponding weights should be assigned to the first-level index and the second-level index respectively. The first level weight set $A(a_1, a_2, a_3, \ldots, a_n)$ the second level weight set $A(a_{i1}, a_{i2}, \ldots, a_{ij})(i = 1, 2, 3, \ldots, n)$. Factor analysis will be used here to determine the weights.

(4) Determine the comment set: V, we can set the evaluation set as V= (safe, general, dangerous).$(u_1, u_2, \ldots, u_m)$

(5) Find out an evaluation grade matrix: R=, first determine the membership function of U to V, and then calculate the membership degree of stock evaluation indicators to each grade.$(r_{ij}v)_{n*m}$ r_{ij}

(6) The fuzzy comprehensive evaluation set is obtained, that is, the common matrix multiplication, and the final evaluation result is obtained according to the evaluation set.

IV. APPLICATION CASE ANALYSIS OF DATA ASSET VALUE EVALUATION

Taking DT Map Technology Company as an example, the application of data asset evaluation is analyzed.DT company related services, to provide customers with a large map surveying and mapping, space-time map related services, including online data such as core business, spatial analysis, map data visualization and so on, these data will be updated annually, real and effective data, before the deal, the auditees can inspection on data quality, provides the data quality assessment files at the same time.

DT Company applied research in the field of graphics is in the middle and high end of the industry.Collect different sales data by package type or system.Models can meet different levels and needs of users.At the same time, we can use our data for transformation and layout of the company.The degree of data extraction greatly affects the value of data assets.

DT Company data not only increases the transaction value of the data object, but also improves the overall value of the company. Trading enterprises need to conduct sample survey on the data and evaluate the value of the data by using the evaluation model.

Assume that the base date of this case evaluation is set as January 1, 2018.The evaluation object and scope is 300,000 pieces of location data provided by DT Company.The purpose of the evaluation is to evaluate the value of the 300,000 data assets, so as to determine the actual income that the data assets can bring to DT Company when the buyer and seller companies conduct the transaction.

According to the negotiation between the two parties of the transaction and the score estimation of the amount of data by several evaluation experts, the arithmetic average score is 6.5 points, and the final score is 4.5 points for the degree of data mining such as the feasible analysis algorithm and visualization.In addition to data acquisition cost, average maintenance cost and other data costs, the standardized processing was carried out by referring to the average cost level of the industry, and the final score was 4.9 points.

According to the characteristics of the data of the cases in the uniqueness of data quality assessment of selected data, the data accuracy and data entity integrity three indexes, the formation of a total of five features, setting calculation rules, write SQL statements can be concluded that the three index is 0.65, the average of the dimensionless processing, finally the data quality of 6.5.Plug into the data model and the final data asset price is 4893910 yuan.

V. CONCLUSIONS AND RECOMMENDATIONS

In the era of big data, data has become an important factor of production. Data is a necessary condition for promoting data circulation and mining data value.First, factors that influence data value include data volume, data quality and analytical capabilities, including company size, data coverage, data integrity, data externalities, data terminals, data relevance, information systems, human skills and consumer needs.Secondly, based on the analytic hierarchy process, the weight of factors affecting data assets is calculated. According to the factors affecting data assets, the corresponding comparable data assets are determined through grey correlation analysis, and the weight of comparable data assets related to the correlation degree is determined. The valuation model of data value is determined according to the market method of data value valuation.

At present, there are some deficiencies in the definition of data-related assets, accounting, industrial data-related asset management and other aspects. Cost estimation and other aspects put forward the following suggestions for the development of big data management system:

(1) Accelerate the development of big data asset appraisal system.Big data property right is the basis of big data asset valuation, and the relevant theoretical research is not mature yet.At the same time, there is a lack of targeted legal system for the legal status of big data asset appraisal, the

establishment of appraisal institutions and the design of management system.Therefore, relevant administrative departments should study and issue national laws and regulations as soon as possible to provide institutional basis for improving the value management of big data.

(2) Scientific preparation of big data asset appraisal technical procedures.The authoritative basis of big data asset appraisal comes from its professionalism. Scientific compilation of big data asset appraisal technical procedures is the technical basis for standardizing the practice of big data asset appraisal.The technical procedures for big data asset appraisal should include appraisal principles, procedures, methods, etc.Based on relevant theoretical research and asset appraisal practice, scientific compilation and promotion of big data asset appraisal technical procedures can effectively improve the professional level of big data asset appraisal.

(3) Establish a professional big data asset appraisal agency as soon as possible.Professional big data asset appraisal institutions are specialized in big data asset appraisal business, which is conducive to training professional big data asset appraisal personnel and improving the work efficiency and business level of big data asset appraisal practice.Drawing on the asset appraisal management system and relying on the big data asset trading center and research institutions, establish big data asset appraisal institutions in the asset appraisal industry.

As a new form of assets, the research prospect of big data asset valuation method can be carried out from two aspects: on the one hand, it is necessary to study reasonable and operational standards for the selection of comparable examples and the determination of relevant parameters in the big data asset market valuation method to ensure the scientific nature of the valuation results;On the other hand, other classical multi-attribute decision models can be combined with traditional asset evaluation methods to carry out method innovation and put forward corresponding big data asset evaluation methods.

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