Evaluation Method of Enterprise Economic Management Model Effectiveness Based on Deep Data Mining

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Abstract. Traditional methods have some problems in evaluating the effectiveness of enterprise economic management model, such as low evaluation accuracy and long time-consuming. An evaluation method of enterprise economic management model effectiveness based on deep data mining is proposed. According to the screening principle of the effectiveness evaluation indicators of enterprise economic management mode, screen the effectiveness evaluation indicators of enterprise economic management mode, refer to the characteristic attributes of candidate indicators, analyze the dimension of candidate indicators, quantify the evaluation indicators, and calculate the index weight by using deep data mining technology to realize the effectiveness evaluation of enterprise economic management mode. The example analysis results show that the evaluation method effectively improves the accuracy of the effectiveness evaluation of enterprise economic management model.

Keywords: Deep data mining · Economic management mode · Effectiveness evaluation · Weight determination · Evaluation system · Index screening

1 Introduction

With the analysis of social and economic development and reform process, the ultimate pursuit of enterprises in the development process is to maximize profits. After the long-term practice of modern enterprise economic management, the standardized development of enterprise economic management model has a long way to go [1]. Enterprise economic management is to realize the value of enterprise resources and the actual management of the enterprise economy. At the same time, in the process of economic development, enterprises conduct scientific and reasonable management, organization, planning and monitoring of economic activities, and realize the sustainable development of the enterprise economy by improving the economic benefits of the enterprise [2]. Therefore, the process of developing economic management is mainly divided into two aspects: First, according to the company's own characteristics and the development

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law of production and operation, through a reasonable method, the company's product pricing and a reasonable salary system for employees are set to ensure.

In domestic research, Liu Zhenhua et al. [3] considered that the environmental pollution caused by heavy polluting enterprises in the process of production and operation has become one of the important factors restricting the healthy development of China's economy and society, and built a performance evaluation system for heavy polluting enterprises to identify the existing problems of enterprises and provide reference for the formulation of improvement measures. Firstly, based on the sustainability theory, the performance evaluation index system of heavy polluting enterprises is established from the perspective of economy, society and environment. Then, the performance index weighting model of heavy polluting enterprises is constructed based on COWA operator. Finally, The performance evaluation model of heavy pollution enterprises is constructed based on the cloud model. In addition, the feasibility of the performance evaluation system is verified by case analysis; Zhang Yulan et al. [4] established an investment efficiency evaluation system for manufacturing enterprises from the perspective of technological innovation, and used DEA model to evaluate the investment efficiency of 158 Manufacturing Listed Companies in Beijing, Tianjin and Hebei from 2016 to 2018.The study found that the average investment efficiency of listed companies in the Beijing-Tianjin-Hebei manufacturing industry is between 0.75 and 0.79, and the investment efficiency is low. From the perspective of manufacturing industry segments, the investment efficiency of companies related to the petrochemical industry is the lowest, and from the perspective of property rights. The investment efficiency of state-owned enterprises is above 0.8, which is always higher than that of private enterprises. From the perspective of regional distribution, the investment efficiency of listed manufacturing companies in Beijing is the highest, followed by Hebei Province, and Tianjin is the lowest. In addition, the Malmquist index model is used for investment efficiency. The dynamic change value was measured and found that the average total factor productivity change was 0.944, indicating that the overall investment efficiency of the Beijing-Tianjin-Hebei manufacturing industry has declined. Based on this, suggestions for improving the investment efficiency of manufacturing enterprises are put forward from the perspectives of both the enterprise and the government.

The process of enterprise economic management mode reform is reflected through the change of economic management level, and to comprehensively strengthen enterprise economic management, we should start with reforming the operation mechanism of economic management mode and improve enterprise economic operation and financial management system [5]. Thus, it is of great practical significance to change the extensive economic management mode of enterprises in the past, improve enterprise operation efficiency, reduce costs, realize fine management, mobilize the enthusiasm of enterprise staff, and return to public welfare.

Based on the above research background, this paper uses deep data mining technology to design an evaluation method of enterprise economic management mode, so as to improve the economic benefits of enterprises.

2 Design of Effectiveness Evaluation Method of Enterprise Economic Management Model

2.1 Screening Evaluation Indicators of Enterprise Economic Management Mode

Since this article is only for the evaluation of the economic management model of the enterprise, not the overall work development of the enterprise, it is necessary to screen and analyze the evaluation indicators of the economic management mode of the enterprise. The following principles must be followed when selecting the indicators: 1. Integrity; 2. Relevance; 3. Statistics; 4. Independence. "Integrity" emphasizes that the indicator must be aimed at the entire enterprise rather than some employees, "relevance" emphasizes that the indicator is closely related to the economic management of the enterprise, and "statistics" emphasizes that the indicator can be quantified and easily obtained and cannot be a rigid absolute value., "Independence" emphasizes that the indicator is not interfered by subjective factors of statisticians and objective factors that are not the enterprise itself. The indicators that meet the above conditions will be included as candidate indicators into the final screening range [6].

The focus of enterprise financial management is emphasized from the six dimensions of budget management, balance and risk management, asset operation, cost management, revenue and expenditure structure and development capacity, plus a total of 25 indicators of the depreciation life of fixed assets. The specific screening results are as follows (Table 1):

Table 1. Evaluation and screening indicators of enterprise economic management mode

Indicator name	Concrete content
Budget management	Budget revenue implementation rate. Budget expenditure implementation rate. Implementation rate of special financial appropriation
Balance and risk management	Balance rate of business income and expenditure. Asset liability ratio. Current ratio
Asset operation	Total asset turnover. Days sales outstanding. Inventory turnover
Cost control	Single product revenue of production department. Single product expenditure. Production cost rate
Revenue and expenditure structure	Personnel expenditure ratio. Public expenditure ratio. Cost management rate
Development capacity indicators	Personnel expenditure ratio. Public expenditure ratio. Cost management rate
Development capacity	Growth rate of total assets, net assets and fixed assets

2.2 Analysis of Candidate Index Dimensions for Enterprise Economic Management Model Evaluation

According to the tasks and objectives of the enterprise economic management model evaluation system, that is, taking economic management as the entry point, further strengthen the construction of enterprises in improving the level and capacity of economic management, and ensure that enterprises give full play to the important work of economic management characteristics and advantages. At the same time, refer to the candidates The characteristic attributes of the indicators and their role in the evaluation of enterprise economic management models have finally determined eight dimensions [7], namely: budget management, financial capital management, cost management, production expense management, production efficiency, and production quality, Comprehensive satisfaction, special services.

Budget management: these indicators are mainly based on the requirements of modern enterprise management. The enterprise needs to gradually establish a comprehensive budget management system. According to the long-term plan and operation objectives formulated by the enterprise, the scientific and standardized budget method should be used to reasonably arrange the funds required for various business work of the enterprise, and all fund arrangements should be supervised, accounted, evaluated, rewarded and punished in the whole process.

Financial fund management: these indicators are mainly aimed at the management of enterprise financial fund use, financial fund risk and financial burden. They are the main aspects of economic management. They are the comprehensive control and evaluation of enterprise economic operation and business development, which can effectively reduce financial fund risk and reduce enterprise economic loss, it is of great significance to improve business operation efficiency.

Cost management: Cost management is of great significance for companies to effectively use the company's production materials, reduce or even eliminate waste, accurately measure business consumption, and rationally purchase equipment. Enterprise managers can strengthen cost management, timely grasp the specific situation of cost changes, analyze the reasons, strengthen rectification, and summarize the key nodes of cost control, so as to continuously improve operational efficiency.

Production cost management: Although enterprises are under tremendous pressure for survival and development, they try to improve economic efficiency, but this is contrary to the public welfare attributes of enterprises. Therefore, enterprises must put the management of production costs to a certain level, continuously adjust the income structure of the enterprise, and ensure the sustainable development of the enterprise.

Production efficiency: the overload work of enterprise staff in China has become a norm, and the construction mode of "no holiday enterprise" has been popularized throughout the country. However, there is still a huge gap with the huge service demand of the people, which requires enterprises to strengthen management, continuously improve production efficiency, narrow the gap as much as possible and meet the service demand.

Production quality: production quality is not only the basis for the survival of enterprises, but also the core competitiveness of enterprises in the fierce market competition. The consequences of low production quality are very serious, which will directly endanger the economy and life of the people. Therefore, every enterprise regards production

quality as the "lifeline" of the enterprise, and strictly manages it to ensure the safety of staff.

Comprehensive satisfaction: comprehensive satisfaction mainly refers to the enterprise's satisfaction with the expectations of employees in many aspects. Satisfaction is mainly aimed at production service level and attitude, service quality and safety, production cost burden and so on. Employee satisfaction mainly focuses on the working environment and atmosphere, employee treatment and welfare, comprehensive strength of the enterprise and logistics support. The comprehensive satisfaction index can enable enterprise managers to grasp the enterprise management status in time, constantly rectify various problems, ensure the stability of employees, and ensure the orderly development of various work.

2.3 Determine the Weight of the Evaluation Index of the Enterprise Economic Management Model

The evaluation of enterprise economic management model is a complex process. The indicators involved are qualitative indicators, which are difficult to quantify. Due to different views on evaluation problems, different categories of people will have different ideas when determining the index weight [8]. The given index weight is usually in the real number interval. Therefore, it is suggested to use deep data mining technology to calculate interval number to evaluate the effectiveness of enterprise economic management model.

In the decision-making process, the enterprise economic management information based on deep data mining technology has the advantages of convenient operation, simple, intuitive and easy to understand. Therefore, deep data mining technology is widely used in the field of economic management model evaluation of various enterprises. Assuming that $\tilde{a} = [a_1, a_2] = \{a_1 \le x \le a_2, a_1, a_2 \in R\}$ represents a closed interval obtained by data mining technology, if $\tilde{a}$ satisfies $\tilde{a} = \{x|0 \le a_1 \le x \le a_2\}$, then $\tilde{a}$ is a positive interval number. Let $\tilde{a} = [a_1, a_2]$, $\tilde{b} = [b_1, b_2]$, $k \ge 0$, then we can get the two interval number arithmetic rules, namely:

$$\begin{aligned}
&\text{Number multiplication} : k\tilde{a} = [ka_1, ka_2] \\
&\text{addition} : \tilde{a} + \tilde{b} = [a_1 + b_1, a_2 + b_2] \\
&\text{subtraction} : \tilde{a} - \tilde{b} = [a_1 - b_2, a_2 - b_1] \\
&\text{Number multiplication} : k\tilde{a} = [ka_1, ka_2] \\
&\text{multiplication} : \tilde{a} \cdot \tilde{b} = [\min\{a_1b_1, a_1b_2, a_2b_1, a_2b_2\}, \\
&\qquad \max\{a_1b_1, a_1b_2, a_2b_1, a_2b_2\}]
\end{aligned} \tag{1}$$

In order to make up for the insufficiency of the in-depth data mining technology in the evaluation index weight determination process, the method of replacing the point value is used to calculate the validity evaluation index weight of the enterprise economic management model, and then the original data and results are calculated. Assuming that $\widetilde{\boldsymbol{A}} = \left(\tilde{a}_{ij}\right)_{n\times n}$ represents a judgment matrix for evaluating the effectiveness of an economic management model, and the expression of $\tilde{a}_{ij}$ is $\tilde{a}_{ij}=\left[a_{ij}^{\mathrm{L}}, a_{ij}^{\mathrm{U}}\right]$, mark $A^{\mathrm{L}} = \left(a_{ij}^{\mathrm{L}}\right)_{n\times n}$, $A^{\mathrm{U}} = \left(a_{ij}^{\mathrm{U}}\right)_{n\times n}$, $\tilde{A}=\left[A^{\mathrm{L}}, A^{\mathrm{U}}\right]$, and the evaluation index vector $\tilde{x}$ can be

expressed as $\tilde{x} = (x_1, x_2, \cdots, x_n)^{\mathrm{T}}$. Assuming that $\tilde{A}=\left[A^{\mathrm{L}}, A^{\mathrm{U}}\right]$ is given, then the steps of using in-depth data mining technology to calculate the effectiveness evaluation index weight of the enterprise economic management model are as follows:

Step 1: use the deep data mining technology to calculate the economic management mode eigenvectors x^L and x^U corresponding to the maximum eigenvalues of A^{L} and A^{U} [9];

Step 2: calculate α and β according to the maximum eigenvalues of A^{L} and A^{U}, and the formula is:

$$\alpha = \left[\sum_{j=1}^{n} \frac{1}{\sum_{i=1}^{n} a_{ij}^{\mathrm{U}}}\right]^{\frac{1}{2}} \tag{2}$$

$$\beta = \left[\sum_{j=1}^{n} \frac{1}{\sum_{i=1}^{n} a_{ij}^{\mathrm{L}}}\right]^{\frac{1}{2}} \tag{3}$$

In formula (2) and formula (3), α and β both represent the optimal vector values of different indicators, and n represent the number of index optimization.

Step3: Calculate the weight vector $\tilde{\omega} = \left[\alpha x^{\mathrm{L}}, \beta x^{\mathrm{U}}\right]$ of the effectiveness evaluation index of the enterprise economic management model.

In the process of collecting opinions from enterprise employees and economic managers, according to the calculation and evaluation method of index weight based on deep data mining technology, statistical management is adopted to form a unified standard for the effectiveness evaluation of enterprise economic management model, and the interval number weight vector of primary evaluation index in the effectiveness evaluation system of enterprise economic management model can be calculated [10], For the same reason, the weight of each secondary evaluation index can be obtained, as shown in Table 2.

Table 2. Validity evaluation index weight of enterprise economic management model

Indicator name	Weights	Indicator name	Weights
Budget revenue implementation rate	[0.20, 0.24]	Consumption of sanitary consumables	[0.36, 0.40]
Budget expenditure execution rate	[0.25, 0.29]	Consumables ratio	[0.10, 0.14]
Implementation rate of special fiscal appropriations	[0.14, 0.18]	Production settlement rate	[0.51, 0.55]
Assets and liabilities	[0.27, 0.31]	Single line cost	[0.52, 0.56]
Current ratio	[0.18, 0.23]	Daily production quantity	[0.22, 0.26]

(*continued*)

Table 2. (*continued*)

Indicator name	Weights	Indicator name	Weights
Accounts receivable turnover days	[0.28, 0.32]	Sales volume per day	[0.44, 0.48]
Depreciation period of fixed assets	[0.20, 0.25]	Utilization rate of production equipment	[0.29, 0.34]
Inventory turnover	[0.14, 0.18]	Rate of qualified products	[0.38, 0.43]

Due to the complexity of the effectiveness evaluation of enterprise economic management model, it is difficult to quantify the qualitative evaluation indicators. The weight of the effectiveness evaluation indicators of enterprise economic management model is calculated by using deep data mining technology, and the weight of the effectiveness evaluation indicators of enterprise economic management model is determined.

2.4 Establish the Effectiveness Evaluation System of Enterprise Economic Management Model

According to the weight of the effectiveness evaluation index of enterprise economic management mode, the effectiveness evaluation system of enterprise economic management mode is established, as shown in Table 3.

Table 3. Effectiveness evaluation system of enterprise economic management model

Target layer	Criterion layer	Index layer
Effectiveness Evaluation System of Enterprise Economic Management Model	Budget management	Budget revenue implementation rate
		Budget expenditure execution rate
		Implementation rate of special fiscal appropriations
	Financial Fund Management	Assets and liabilities
		Current ratio
		Accounts receivable turnover days
	Cost management	Depreciation period of fixed assets

(*continued*)

Table 3. (*continued*)

Target layer	Criterion layer	Index layer
		Inventory turnover
		Consumption of sanitary consumables
	Production cost management	Consumables ratio
		Production settlement rate
		Single line cost
	Productivity	Daily production quantity
		Sales volume per day
		Utilization rate of production equipment
	Production quality	Rate of qualified products
		Staff quality

Through the establishment of the effectiveness evaluation system of enterprise economic management mode, the effectiveness evaluation of enterprise economic management mode is realized.

3 Case Analysis

3.1 Sample Source

The case analysis takes the economic management data of an enterprise in 2018 and 2019 as the research object, and the specific samples are shown in Table 4.

Table 4. Experimental samples

First level indicator	Secondary indicators	2018	2019
Budget management	Budget revenue implementation rate	94%	97%
	Budget expenditure implementation rate	96%	97%

(*continued*)

Table 4. (*continued*)

First level indicator	Secondary indicators	2018	2019
	Implementation rate of special financial appropriation	99%	99%
Financial fund management	Asset liability ratio	62%	66%
	Current ratio	56%	61%
	Days sales outstanding	53 days	55 days
Cost control	Depreciation life of fixed assets	-	-
	Inventory turnover	262 times	357 times
	Consumption of sanitary consumables	19 yuan	18 yuan
Production cost management	Consumable ratio	12.4%	12.2%
	Production settlement rate	76.32%	76.41%
	Cost of single pipeline	9016.5 yuan	9220.5 yuan
Production efficiency	Daily production quantity	803900	867400
	Daily sales quantity	25518	26039
	Utilization rate of production equipment	91.7%	91.7%
Production quality	Product qualification rate	99.9%	99.9%
	Staff quality	high	high

3.2 Evaluation Method

The evaluation indicators of this study are quantitative indicators, which are convenient for calculating the relative ratio score. However, due to the existence of proportion, value and negative value, in order to organically combine the evaluation results and facilitate comparative analysis, the index results need to be normalized. The processing principles and sequence are as follows:

Step 1: direct use of quantitative indicators;

Step 2: divide each indicator by the sum of each indicator in two years;

Step 3: according to the accounting system, the depreciation life of fixed assets of enterprises has different types and different types have unified provisions. Therefore, this item is not counted and replaced by "0";

Step 4: the higher the value of some indicators, the higher the priority (high priority), and the lower the value, the higher the priority (low priority). For high-quality indicators, use the results directly, and for low-quality indicators, use "1" minus the results of "(2) above;

Step 5: multiply the processing score of each evaluation index for two years by the weight of each index to obtain the final comparison score.

Although the index weights in this study total 100 points, the calculation of relative scores is used in specific applications rather than the calculation of absolute values, so the index system is suitable for comparative analysis.

3.3 Evaluation Results

The evaluation results of the effectiveness of the enterprise's economic management model in 2018 and 2019 are shown in Table 5.

Table 5. Effectiveness evaluation results of economic management model

Primary index	Secondary index	2018	2019
Budget management	Budget revenue implementation rate	2.8637	2.9541
	Budget expenditure implementation rate	1.1430	1.1548
	Implementation rate of special financial appropriation	3.2756	3.2756
Financial fund management	Asset liability ratio	2.7133	2.5511
	Current ratio	1.5424	1.6776
	Days sales outstanding	1.1707	0.1289
Cost control	Depreciation life of fixed assets	0.0000	0.0000
	Inventory turnover	0.9302	1.2680
	Consumption of sanitary consumables	1.5436	1.6248
Production cost management	Consumable ratio	1.1368	1.1554
	Production settlement rate	1.7188	1.7204
	Cost of single pipeline	1.4249	1.3935
Production efficiency	Daily production quantity	1.4069	1.4589
	Daily sales quantity	1.2260	1.3229
	Utilization rate of production equipment	3.3733	3.3733
Production quality	Product qualification rate	0.9800	1.9800
	Staff quality	1.9438	1.9438

It can be seen that the evaluation score of the effectiveness of the enterprise's economic management model in 2018 was 47.0339 and that in 2019 was 50.0017. Overall, the economic management in 2019 has improved and improved compared with that in 2018.

In order to further verify the effectiveness of the proposed method, experiments have compared the accuracy of this method, literature [5] method and literature [6] method in evaluating the effectiveness of enterprise economic management model. The results are shown in Fig. 1:

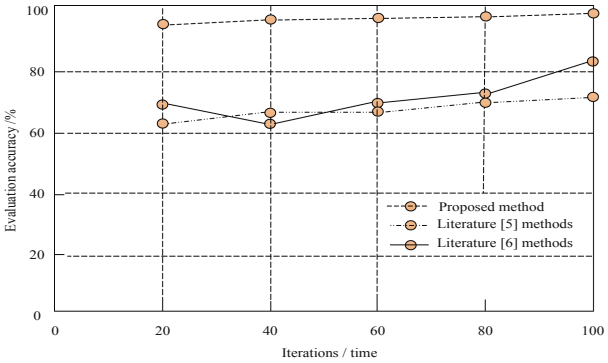

Fig. 1. Accuracy analysis of effect evaluation of different methods

By analyzing the experimental curve in Fig. 1, it can be seen that there are some differences in the accuracy of evaluating the effectiveness of enterprise economic management mode by using the methods of this paper, literature [5] and literature [6]. Among them, the accuracy of using this method to evaluate the sample data is always higher than 90%, and the accuracy of literature [5] method and literature [6] method to evaluate the effectiveness of enterprise economic management model is always lower than this method, which verifies that this method is feasible.

3.4 Result Analysis

Budget management mainly assesses the budget implementation rate. On the one hand, the budget implementation rate reflects the scientificity and operability of budget preparation, and it also reflects the changes in the budget implementation process. The company prepares a budget every year. Because the local permanent population is relatively stable, the income and expenditures of the company have not changed much over the years, and it adopts a relatively safe way of budgeting revenue. In terms of budget expenditures, considering that the company borrowed money for plant construction in 2015, there were bank loans of more than 100 million yuan, and some of the loans were due. Therefore, active expenditure budgeting was adopted when preparing the budget. Financial special appropriation has always been a concern of enterprises. In 2018 and 2019, the government special appropriation was about 7 million yuan, which is a drop in the bucket for enterprises with production income of 438 million. In terms of special financial appropriations, the company generally prepares budgets for special financial appropriations based on the annual budgets of the higher-level departments, so the implementation rate is 100%, but it is necessary to pay attention to the practical problem of the government's special appropriations being too low.

The balance rate of business revenue and expenditure was −1.63% in 2019 and −1.57% in 2018, indicating that when the sales revenue of the enterprise in 2019 increased compared with that in 2018, the range of production expenditure was greater than that in 2018. The two-year data are negative, indicating that the enterprise has no balance of business revenue and expenditure in the past two years, and also indicating that the

operation cost of the enterprise is high. This can also be reflected from the data of asset liability ratio. The asset liability ratio was 63% in 2018 and 67% in 2019, which has reached the warning value. We need to pay close attention to the economic operation. Current ratio indicates the ability of current assets to be realized and used to repay current liabilities before the maturity of short-term liabilities. The main factors affecting the current ratio include production cost receivables and product turnover speed. Based on the unit nature of the enterprise, appropriate liabilities can be considered, but it is better to keep the current ratio at about 200%. Although the current ratio of the enterprise has improved in the past two years, it is still low on the whole, even lower than 1, indicating that the enterprise is short of cash flow and has prominent debt problems. The turnover days of accounts receivable in the two years are 54 days and 56 days respectively. There is no significant difference between the data, but it also reflects that the realization time of accounts receivable in 2019 is longer than that in 2018.

In 2019, the company's inventory turnover rate increased significantly compared with 2018, indicating that there have been major improvements in cost management such as consumables and production. Basically "increasing revenue and reducing expenditure". The company introduced a consumable management system, and many production procedures adopted an outsourcing model, which greatly reduced The cost of consumables. The production revenue cost rate in 2019 has increased compared to 2018, indicating that the sales revenue is greater than the production expenditure, and the cost of the company's staff is higher. It is necessary for managers to further strengthen cost management in the production process or develop new high value-added products project.

4 Conclusion

This paper proposes a research on the effectiveness evaluation method of enterprise economic management model based on in-depth data mining. The results of the case analysis show that the evaluation method can find the dilemma faced by the enterprise economic management model. However, there are still many shortcomings in the research of this article. In future research, while enterprises continue to strengthen their own economic management, government departments must carefully calculate production income and operating costs, and the establishment of price charging standards must be scientific and reasonable, and reflect the staff. Labor value; the production settlement must be timely and in full, and the enterprise must not be held responsible for insufficient production expenditure funds; financial compensation must be made for the difference between the income and expenditure of the enterprise, and the funds must be in place in time to prevent the enterprise from breaking the capital chain. At the same time, enterprises must strengthen their own standardized management to ensure strict implementation of price and charging standards, careful calculation and use of special fiscal funds. At the same time, they must conscientiously do a good job in cost control, reduce losses, and eliminate waste, so that the enterprise can embark on sustainable development.

References

1. Liu, Y., Zhang, Y., Yang, L.: Design and application of enterprise environmental performance evaluation index system. Commun. Finance Account. **20**(5), 28–30 (2021)

2. Cai, S., Fang, H.: The establishment of demonstration enterprises evaluation system in service-oriented manufacturing. Modernization Manag. **39**(05), 70–76 (2019)
3. Liu, Z., Zhang, C.: Research on performance evaluation of heavily polluted enterprises from the perspective of sustainability: based on COWA operator and cloud model. Sci. Technol. Manag. Res. **39**(01), 235–241 (2019)
4. Yulan, Z., Siting, J., Shuang, N., et al.: Research on investment efficiency evaluation of listed manufacturing companies in Beijing, Tianjin and Hebei – from the perspective of technological innovation. Friends of Accounting **12**(18), 14–19 (2020)
5. Zhou, Y., Zuo, Y.: A study of the constructionof performance evaluation system of enterprise's patent operation. Shandong Soc. Sci. **281**(01), 147–153 (2019)
6. Huijin, C., Hao, D., Youcai, M.: Supply chain risk evaluation and application of export-oriented enterprises based on improved SCOR. Enterp. Econ. **39**(1), 80–89 (2020)
7. Sun, Y., Mou, L.: Performance management of private environmental protection enterprises under the background of ecological civilization. Appl. Anal. Fuzzy Synth. Eval. Method **14**(2), 3–7 (2020)
8. Liu, S., Fu, W., He, L., Zhou, J., Ma, M.: Distribution of primary additional errors in fractal encoding method. Multimedia Tools Appl. **76**(4), 5787–5802 (2014). https://doi.org/10.1007/s11042-014-2408-1
9. Liu, S., Chen, X., Li, Y., Cheng, X.: Micro-distortion detection of lidar scanning signals based on geometric analysis. Symmetry **11**(15), 1471 (2019)
10. Liu, S., Bai, W., Srivastava, G., Machado, J.A.T.: Property of self-similarity between baseband and modulated signals. Mob. Netw. Appl. **25**(4), 1537–1547 (2019). https://doi.org/10.1007/s11036-019-01358-9