Research on the Evaluation of Enterprise Accounting Information Disclosure under the Double Carbon Background

-- Take Environmental Accounting Information as an Example

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Abstract

This article selects five enterprises that have published environmental accounting information and five enterprises that have not published environmental accounting information, and takes environmental liabilities, environmental income, environmental expenditure, and environmental performance as the main indicators of environmental accounting information. Using the CRITIC weighting method, it conducts a conflict comparison and comparative strength analysis on the five information indicators, and then establishes a fuzzy Bordea evaluation model, obtain a comprehensive ranking of the environmental accounting information scores of these10enterprises, and compare them with the return on equity of each company. The results of empirical research indicate that companies that disclose environmental accounting information have better operating conditions.

Keywords

Environmental Accounting Information; CRITIC Weighting Method; Fuzzy Bordea Evaluation.

1. Introduction

With the rapid development of modern technology, environmental issues such as air pollution and forest fires have penetrated into all aspects of human production and life. The global environment is deteriorating day by day, and contemporary environmental issues have become a topic of common concern for the entire society. China has always been committed to promoting countries around the world to reach agreements to address climate change and actively develop green and low-carbon energy. In response to climate change, in September2020, China explicitly proposed the goals of "carbon peak" in 2030and"carbon neutral" in 2060, highlighting China's great responsibility and responsibility to actively address climate change, which is of great significance for China's economic and energy transformation. The report of the 20th National Congress of the Communist Party of China pointed out that "accelerating the green transformation of development methods" and "actively and steadily promoting carbon peak and carbon neutrality". It can be seen that based on the "dual carbon" goal, promoting high-quality development while promoting comprehensive green transformation of economic and social development is the way to go.

With the rapid economic development, the impact of enterprise production on the ecological environment has become a common concern of the public, enterprises, governments, and even the international community. While utilizing social resources for production and operation to gain benefits, enterprises have had a certain negative impact on the public and the environment. Enterprises should and must disclose high-quality environmental accounting information to third-party institutions. China has successively promulgated laws and regulations such as

"*Reform Plan for the Legal Disclosure System of Environmental Information*" and "*Measures for the Administration of Legal Disclosure of Enterprise Environmental Information*", and the content of legal disclosure of enterprise environmental information is being further refined and standardized. In the context of the "dual carbon" goal, corporate environmental accounting information disclosure is an important proposition in the development of the era, which not only reflects the urgent needs of economic and social development, but also the internal needs of enterprises to strengthen management.

As a for-profit economic organization, the purpose of its survival and development is to achieve greater profits with less investment through its specific business activities. Most enterprises believe that there is no inevitable relationship between environmental accounting information disclosure and corporate income, and they are unwilling to invest too much in environmental accounting information disclosure. These enterprises disclose environmental accounting information mainly to meet the requirements of laws and regulations, complete management assessment, and even have a small number of enterprises conceal negative environmental information of enterprises, and few enterprises are willing to actively disclose high-quality environmental accounting information. How to achieve this critical shift from mandatory disclosure to active disclosure is worth our consideration.

2. Literature Review

Currently, many domestic scholars have conducted research on the current research situation of environmental accounting information disclosure (such as Hua Qiuhong, 2022) [1]), environmental accounting information exploration in various industries (such as Liu Fumin et al., 2019) [2]), and the impact of factors such as corporate profitability on environmental accounting information disclosure (Chen Dongling, 2019) [3]).

However, many scholars have different opinions on the impact of environmental accounting information disclosure on the business performance of enterprises, and there is no clear conclusion yet. Yu Xuebin et al. (2013) conducted empirical analysis by constructing a regression model of environmental accounting disclosure level and financial performance, indicating that there is a positive correlation between environmental information disclosure index of listed companies and comprehensive financial performance of enterprises [4]; The empirical research results of Luo Yanqin et al. (2016) indicate that there is a positive correlation between environmental accounting information disclosure and market performance, and strengthening environmental accounting information disclosure by enterprises can help improve their market performance [5]; Yang Lulu et al. (2013) found through empirical research and analysis that environmental accounting information disclosure has a weak impact on enterprise value [6]; Wang Zhongbing et al. (2013) conducted empirical analysis on 89 socially responsible listed companies in the Shanghai Stock Exchange, and the results showed that there was no significant correlation between carbon information disclosure and corporate value of listed companies [7]; Shen Jianfei et al. (2022) constructed panel data and adopted a multiple regression model to show that the level of environmental accounting information disclosure in enterprises is negatively correlated with their short-term value and positively correlated with their long-term value, and the value effect is more significant for non-state enterprises than for state-owned enterprises [8].

In foreign research, Belkaoui (1976) earlier studied the impact of environmental accounting information disclosure on enterprise value. This study analyzed the impact from the perspective of capital market reflection, and found that the more detailed the environmental information disclosure of enterprises, the more stable the investor evaluation, and the possibility of errors in enterprise value judgment decreased [9]. An empirical study conducted by Mao Chang Wang (2016) concluded that there is a certain relationship between the

willingness and quantity of enterprises to disclose environmental information and their value. This article links the specific evaluation of environmental accounting information and the return on equity (ROA) of enterprises to specifically analyze whether environmental accounting information has an impact on the operating status of enterprises [10].

3. Model Establishment and Research

In order to evaluate the impact of environmental accounting information on the operating performance of listed companies, this article selects five enterprises that have published environmental accounting information and five enterprises that have not published environmental accounting information, using N1, N2, N10 represents (where N1 to N5 are companies that publish environmental accounting information). Based on the existing academic literature, this article selects environmental liabilities, environmental income, environmental expenditure, and environmental performance as the main indicators of environmental accounting information.

3.1. CRITIC Weighting Method

Due to the lack of involvement in the importance and correlation between environmental accounting information, we cannot establish a model through fitting or regression.". For the setting of key weights, we use the CRITIC weighting method instead. CRITIC weighting method is an objective weighting method that mainly uses conflicting indicators and comparative strength. Conflict is represented by a correlation coefficient. If the correlation coefficient between indicators is larger, it indicates that the conflict is smaller, and its weight is also lower. The contrast strength is expressed using standard deviation. If the data standard deviation is larger, the fluctuation is greater, and the weight is higher.

Firstly, a conflict analysis, namely correlation coefficient analysis, is conducted for five information indicators. The formula for calculating the correlation coefficient is as follows, where the numerator is the covariance of the two factors and the denominator is the product of the standard deviation of the two factors.

$$\rho = \frac{cov(X,Y)}{\sigma_x, \sigma_y} \tag{1}$$

Table 1. Correlation coefficient of four indicators

	Environmental liabilities	Environmental benefits	Environmental expenditure	Environmental performance
Environmental liabilities	1.0000	-0.7234	0.8891	-0.7009
Environmental benefits	-0.7234	1.0000	0.8832	0.9234
Environmental expenditure	0.8891	0.8832	1.0000	0.8812
Environmental performance	-0.7009	0.9234	0.8812	1.0000

Through the analysis of correlation coefficients, we can obtain the following conclusions:

(1) There is a high correlation between environmental benefits and environmental performance, with a correlation coefficient of 0.9234.

(2) Environmental liabilities have a negative correlation with environmental benefits and environmental performance, with correlation coefficients of -0.7234 and -0.7009, respectively.

Quantitative indicators of the conflict between the jth indicator and other indicators are as follows:

$$\sum_{i=1}^{n}(1-r_{ij}) \tag{2}$$

Where, r_{ij} is the correlation coefficient between the evaluation indicators i and j.

Next, we analyze the comparative strength of our indicators. Due to the dimensional impact, we need to standardize the data. The processing formula is as follows:

$$y_i = \frac{x_i - \min_{1 \leqslant j \leqslant n}\{x_j\}}{\max_{1 \leqslant j \leqslant n}\{x_j\} - \min_{1 \leqslant j \leqslant n}\{x_j\}} \tag{3}$$

Finally, we calculated the conflict and contrast strength, and obtained the weight results as shown in the figure below.

Table 2. Weights of four types of information

Index	Indicator variability	Indicator conflict	Information content	Weight
Environmental liabilities	one point one three one	zero point six zero two	zero point six eight one	14.99%
Environmental benefits	zero point nine nine nine	zero point five nine nine	zero point five nine eight	13.17%
Environmental expenditure	one point one one one	one point six zero seven	one point seven eight five	39.33%
Environmental performance	zero point nine three eight	one point five seven three	one point four seven six	32.51%

3.2. Establishment of Fuzzy Borda Evaluation Model

Compared with the single evaluation method, we can see from the above weight setting that the importance of the index lies more in efficiency. The fuzzy Borda analysis method takes efficiency as the main evaluation object, does not need the support of complex and diverse parameters, and can compare multiple decision-making units of the same type and complexity. It is very applicable when dealing with evaluation issues.

Calculate the "degree of subordination" $u_i^{(j)}$ of each decision-making unit's score for the evaluation unit. The fuzzy Bordea method is calculated using the range transformation method, and its formula is:

$$u_i^{(j)} = \frac{y_i^{(j)} - \min\{y_1^{(j)}, y_2^{(j)}, ..., y_n^{(j)}\}}{\max\{y_1^{(j)}, y_2^{(j)}, ...y_n^{(j)}\} - \min\{y_1^{(j)}\}} \times 0.9 + 0.1 \tag{4}$$

Calculate the fuzzy frequency (f_{ih}) and the fuzzy frequency (w_{ih}) of the i-th evaluation unit at position $h(1 \leqslant h \leqslant n)$. The calculation formulas for both are:

$$f_i = \xi \hat{ui} E = (f_{i1}f_{i2}...f_m)_{1 \times n}^{T} \tag{5}$$

$$w_{ih} = \frac{f_{ih}}{\sum_{k=1}^{n} f_{ik}} \tag{6}$$

Where, $\hat{ui} = \text{diag}(u_i^{(1)}u_i^{(2)}...u_i^{(m)}), E = (11...1)_{1 \times n}^{T}; \xi = [\xi_h^{(j)}]_{n \times m}$. If the ranking given by the method j to the evaluation unit i is the h-th place, then note $\xi_h^{(j)} = 1$ and the remaining $\xi_l^{(j)}(l \neq h) = 0$. Calculate the conversion score of "ranking" using the formula:

$$Q_h = \frac{1}{2}(n-h)(n-h+1) \tag{7}$$

The transformation sub vector $Q = (Q_1 Q_2 ... Q_n)^T$ can be formed, and in fact the vector is a determined sequence. Calculate the fuzzy Bordea score of the i-th evaluation object, and finally rank it according to its size. The formula is:

$$FB_i = \sum_{h=1}^{n} W_{ih} Q_h \qquad (8)$$

Finally, we obtained the comprehensive ranking of environmental accounting information scores of these 10 listed companies, and compared them with the ROAs of each company, as shown below.

Table 3. Comparative Analysis

Environmental accounting information score	ninety	eighty-five	eighty	seventy	sixty-five	fifty-six	forty	thirty-four	thirty-six	twenty
ROARanking	one	two	three	four	five	six	seven	eight	nine	ten
Enterprise	N1	N2	N4	N3	N5	N7	N8	N6	N9	N10

4. Conclusion and Suggestions

From the comparative analysis, it can be seen that the higher the score of enterprise environmental accounting information, that is, the higher the transparency of environmental accounting information and the higher the efficiency of environmental expenditure, the better the business performance of the enterprise. This is because the competition between modern enterprises is becoming increasingly fierce, and only a good corporate image can attract more customers. If we do not pay attention to business ethics, such as destroying the environment, wasting resources, and other behaviors, it will reduce consumers' trust and loyalty to the brand, leading to adverse consequences such as customer churn and declining market share.

From the research results of this article, we can obtain the following enlightenment: (1) As an important information of enterprise accounting information disclosure- environmental accounting information, its transparency and efficiency can help improve the operating conditions of enterprises. Currently, listed companies generally have a low level of environmental accounting information disclosure, low environmental expenditure, and poor efficiency. For listed companies, focusing on the long-term value of the enterprise can be considered from an environmental perspective. When the contribution of the enterprise to the environment increases, it often not only drives the improvement of economic efficiency, but also enables investors to build confidence. (2) Changing the business situation of an enterprise requires consideration of both hard power and soft power. Although soft power cannot be specifically manifested in finance, it is increasingly attracting investors' attention with the development of the times. In future operations, enterprises need to improve their external financial strength, and environmental accounting information will be a major focus.

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