Research on the Evaluation of Sustainable Development Performance of Mining enterprises Based on ESG

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Abstract. In recent years, stakeholders have increasingly emphasized enterprise's environmental, social, and corporate governance (ESG) performance. As one of the industries in urgent need of green transformation, the coal mining industry faces difficulties on the topic of sustainable development that should not be underestimated. In this regard, this paper integrates the concept of ESG into the sustainable development performance evaluation of enterprises and utilizes the entropy weight-TOPSIS model to evaluate the performance of S-mining enterprises, to help them identify the deficiencies and better achieve the goal of sustainable development.

Keywords: Performance evaluation, sustainable development, ESG, entropy weights-TOPSIS.

1. Introduction

In recent years, green and sustainable development has gradually become the focus of the development of various industries. As a major energy-consuming and carbon-emitting industry, the coal mining industry is in urgent need of green and sustainable transformation. To realize the long-term goal of green and sustainable development, the non-ferrous metals industry faces a series of corporate social responsibility issues in addition to environmental issues such as energy saving and emission reduction. In addition, the revised annual report disclosure standards issued by the China Securities Regulatory Commission (CSRC) in 2021 will put further governance pressure on listed mining companies.

ESG is a comprehensive matrix indicator system for assessing the environmental sustainability, social value, and governance of enterprises. Using the ESG framework to evaluate the sustainability performance of non-ferrous metal enterprises can help promote the achievement of high-quality sustainable development goals.

Based on this, this paper selects indicators from four aspects: economic, environmental, social, and corporate governance, and utilizes the entropy weight-TOPSIS method to evaluate the sustainable development performance of S mining enterprises.

2. Indicator selection

This paper focuses on performance evaluation from four dimensions: economic, environmental, social, and corporate governance.

On the economic level, referring to the research results of most scholars, the economic performance indicators are selected from the four dimensions of solvency, operating ability, profitability, and development ability. On the environmental level, the characteristics of coal production, raw material consumption, waste emission, and recycling are taken as the entry points to select the environmental dimension indicators. On the social level, evaluation indicators were selected from the stakeholder perspective in the two dimensions of society and employees. For the corporate governance dimension, the indicators were selected from the three dimensions of shareholders, directors, and governance results.

Table 1. Indicators for sustainable development

Dimension	Indicator	Attribute
Eco	Interest Coverage Ratio	P
	ROA	P
	Net operating margin	P
	Total asset turnover	P
	Equity growth rate	P
Env	Investment in environmental protection	P
	Comprehensive energy consumption / 10,000 Yuan output	N
	Carbon emission	N
	Comprehensive energy consumption of 10,000 Yuan output value	N
	Wastewater utilization rate	P
Soc	Occupational diseases	N
	Social contribution value per share	P
	Investment in production safety	P
	Million-ton mortality rate of raw coal production	N
	R&D / operating revenue	P
CG	Shareholding checks and balances	P
	Percentage of independent directors	P
	Percentage of female directors	P
	Attendance rate of board meetings	P
	Number of disclosure reports	P

3. S enterprise sustainable development performance evaluation model construction

3.1. Indicator weighting method selection

This paper adopts the entropy weight method to assign weights to the evaluation indicators, compared with the subjective assignment method, the entropy weight method is more objective, the specific steps are as follows: the first step: standardize the original data. The second step is to calculate the weight of indicators. The third step is to calculate the information entropy. The fourth step, calculate the indicator difference coefficient. The fifth step, calculate the weight of indicators. The formulae used are as follows:

$$y_{ij} = \frac{X_{ij}-X_{jmin}}{X_{imax}-X_{imin}}, \text{ Positive indicators} \quad (1)$$

$$y_{ij} = \frac{X_{max}-X_{ij}}{X_{imax}-X_{imin}}, \text{ Negative indicators} \quad (2)$$

$$P_{ij} = \frac{y_{ij}}{\sum_{i=1}^{m} y_{ij}} \quad (3)$$

$$K=\frac{1}{lnm} \quad (4)$$

$$e_j=-k\sum_{i=1}^{m} P_{ij}\ln(P_{ij}) \quad (5)$$

$$g_j=1-e_j \quad (6)$$

$$W_j=\frac{g_j}{\sum_{j=1}^{n} g_j} \ (0<W_j<1) \quad (7)$$

3.2. Comprehensive evaluation method selection

This paper adopts the TOPSIS model to evaluate the sustainable development performance of S mining enterprises, which evaluates the sample by comparing the distance of the sample from the optimal solution point to evaluate the advantages and disadvantages of the sample. First, the indicators need to be normalized. Second, the normalization matrix is constructed. Third, calculate the gap between the indicator and the optimal and worst vectors. Finally, calculate the indicator closeness, the more convergent to 1, indicating that the evaluation object is superior. The formulae used are as follows:

$$Z_{ij}=\frac{X_{ij}}{\sqrt{\sum_{i=1}^{m}(X_{ij})^2}} \tag{8}$$

$$D_i^+=\sqrt{\sum_{j=1}^{n} W_j * \left(Z_j^+ - Z_{ij}\right)^2} \tag{9}$$

$$D_i^-=\sqrt{\sum_{j=1}^{n} W_j * \left(Z_j^- - Z_{ij}\right)^2} \tag{10}$$

$$C_i=\frac{D_i^-}{D_i^+ + D_i^-} \tag{11}$$

4. Evaluation results of S mining enterprise sustainable development performance

After calculating the standardized S company performance data using the entropy weight method, the weights of S company's performance indicators in the four dimensions of economy, environment, society, and corporate governance are 0.2951, 0.2063, 0.1777 and 0.3209, respectively, of which the indicator that has the greatest impact on the performance is the board of directors' participation rate, which further reacts to the importance of corporate governance on the sustainable development of enterprises.

The results of the comprehensive evaluation of S mining enterprises using TOPSIS are shown in the table below. It can be seen that 2021 is the year with the highest S comprehensive performance, while 2019 is the lowest, and the comprehensive performance of S enterprises shows a fluctuating upward trend.

Table 2. Three Scheme comparing

Year	D+	D-	C	Rank
2018	0.162	0.070	0.303	4
2019	0.167	0.060	0.265	5
2020	0.133	0.123	0.480	2
2021	0.124	0.120	0.491	1
2022	0.136	0.113	0.452	3

The figure below shows the comprehensive performance change trend of the four-dimensional indicators, and it can be seen that the corporate governance performance has changed the most in the past five years, reaching the highest value in 2020; The economic performance was the best in 2021. The changes in the indicators of the environmental and social dimensions are relatively flat, showing an upward trend of fluctuation.

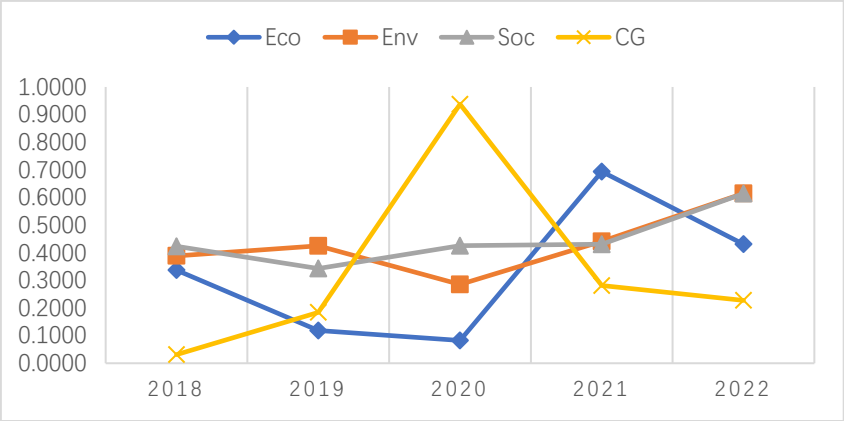

Figure 1. Trends in the economic, environmental, social and governance performance of S

From the results of the performance evaluation, S still needs to make efforts in the following areas to improve its sustainable development performance: first, strengthen its operational capacity and optimize the cost management of the enterprise; second, optimize the corporate governance mechanism and strengthen the incentives for the directors and supervisors. The third is to pay attention to fulfilling its own environmental responsibility and improving the efficiency of energy reuse.

5. Summary

This paper applies ESG concepts to the performance evaluation of S mining enterprises, selects enterprise sustainability performance indicators from four dimensions: economic, environmental, social, and corporate governance, utilizes entropy weighting-TOPSIS to assign weights to the indicators, and evaluates the comprehensive performance of S enterprises. Finally, we provide suggestions for the sustainable counter-warfare of S from the aspects of operation management, corporate governance, and environmental responsibility.

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