

Research on performance evaluation of J enterprise under ESG concept

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Abstract. This study examines Company J through the lens of sustainability theory, stakeholder theory, and triple bottom line theory, analyzing its current development status while evaluating the necessity and feasibility of implementing an ESG performance assessment framework. The ESG evaluation system is constructed across four dimensions: financial, environmental, social, and governance (ESG), with 18 criterion layers derived into 50 representative third-level indicators. The research employs Analytic Hierarchy Process (AHP) for indicator weighting and topsis method to calculate Company J's comprehensive ESG performance scores from 2020 to 2022. Through systematic evaluation, key factors influencing ESG performance scores and existing challenges are identified. Finally, targeted policy recommendations are proposed based on these findings to help companies improve ESG performance and drive sustainable development.

Keywords: ESG, Performance Evaluation, Analytic Hierarchy Process(AHP), Topsis Method.

1. Introduction

To address global climate change and rising sea levels, environmental protection has become a critical concern for nations worldwide. Against this backdrop, the ESG framework emerged as a strategic response. First formally introduced by the United Nations in 2004, ESG stands for Environmental, Social, and Governance. This concept aims to achieve coordinated development between economic growth and ecological preservation through three key metrics: environmental performance, social impact, and governance effectiveness.

Breakthrough technologies are creating new opportunities for eco-environmental sectors. For instance, AI and cloud computing enable precise monitoring of pollutant emissions, boosting regulatory oversight. Meanwhile, technological advancements are driving innovations in ecological restoration, providing efficient solutions for rehabilitating terrestrial and marine ecosystems. Furthermore, the application of new technologies can significantly enhance resource utilization efficiency and promote the recycling of waste resources, thereby driving the development of a circular economy. With rapid economic growth and heightened environmental awareness, public concern about environmental protection has been steadily increasing. As globalization accelerates, the environmental sector faces growing international competition and challenges. An increasing number of companies are now recognizing the critical importance of synergistic development between economic growth and environmental protection. Meanwhile, shareholders, external investors, and other stakeholders are placing greater emphasis on corporate ESG performance. Outstanding ESG performance can attract more investors, help companies expand, and strengthen their risk resilience.

Compared to international markets, the concept of ESG emerged relatively late in China, but significant progress has been made in ESG governance in recent years. Institutions such as the Shenzhen Stock Exchange, Shanghai Stock Exchange, and the National Development and Reform Commission have successively issued a series of policy documents related to ESG. These policies not only regulate corporate practices in ESG information disclosure and performance evaluation but also provide a policy framework for the localization of ESG development, effectively promoting the popularization and practical implementation of ESG concepts domestically.

2. literature review

2.1. ESG related research

Hakan et al. (2022) conducted a focused analysis of ESG ratings' impact on systemic risk indicators, revealing that companies with higher ESG ratings face reduced systemic risk exposure and contributions compared to those with lower ratings [1]. Sudipta et al. (2022) found that banks with high ESG ratings issued fewer mortgages in poor regions than their low-rated counterparts. The study further demonstrated that high ESG-rated banks were more likely than their low-rated counterparts to reject mortgage applications in impoverished communities [2].

2.2. Research on enterprise performance evaluation

In the selection of indicators and construction of performance evaluation systems, evaluation methods such as the Balanced Scorecard (BSC), Key Performance Indicators (KPI), and the Walsh Scoring Method are widely used in building corporate performance evaluation frameworks. Among these, the evaluation framework based on the four major capability dimensions is particularly prevalent. Huang Xiao (2017) conducted a study on railway construction enterprises, categorizing target companies into five dimensions: profitability, market competitiveness, business operations and sustainable development, management level, and social contribution. Through Analytic Hierarchy Process (AHP) and dimensionless data processing, the research analyzed performance evaluation results and provided practical recommendations [3]. Wang Xiuping and Sun Xiaoyan (2017) developed a corporate performance evaluation system for the retail industry, integrating the Balanced Scorecard framework while introducing suppliers as a new dimension. The study applied AHP to assign weights to the performance evaluation system and concluded relevant findings [4].

2.3. Research on enterprise performance evaluation

Chinese scholars have conducted in-depth research on the impact of ESG on corporate performance, exploring its mechanisms from three dimensions: environment, society, and governance. Most researchers believe that corporate environmental responsibility positively influences business performance. Guo et al. (2022), using heavy-polluting industries as a case study, found that environmental cost inputs exhibit significant lag effects on corporate performance, particularly evident among non-state-owned enterprises, small-scale businesses, and enterprises in central and western regions [5]. Liu (2024) empirically demonstrated through Chinese listed distribution companies that proactive environmental responsibility fulfillment and green innovation strategies significantly enhance operational performance. However, some scholars hold opposing views [6]. For instance, Wu (2013) discovered that more active environmental responsibility fulfillment and more comprehensive environmental disclosures correlate with lower economic benefits [7].

In literature regarding CSR performance impacts, most studies reveal positive correlations. Matteo et al. (2024) aimed to explore the potential impact of corporate social responsibility (CSR) practices on the financial performance of ESG enterprises by leveraging the moderating effect of board characteristics. The results indicated that board characteristics partially moderated the relationship between CSR practices and financial performance in European ESG enterprises. Additionally, CSR practices positively influenced corporate financial performance [8]. Song et al. (2024) investigated the impact of executives' green experience on the environmental, social, and governance (ESG) performance of enterprises. The study found that enterprises hiring executives with green experience performed better in ESG, and this positive effect was more pronounced in non-high-tech industries and the eastern region [9]. Huang et al. (2024) through empirical research discovered that executives with a legal background were more likely to enhance the ESG performance of enterprises. A good corporate governance structure could also improve the ESG performance of enterprises, and the quality of information disclosure played a mediating role in the relationship between executives with a legal background and the ESG performance of enterprises [10].

3. Construction of ESG performance evaluation system for J Enterprise

3.1. Selection of financial indicators

The selected financial indicators are as shown in the following table.

Table 1. Financial indicators

Primary indicators	Secondary Indicators	Tertiary Indicators	Attribute 1	Attribute 2
Financial	Profitability	Return on Net Assets (ROE)	Quantitative	Positive
		Net Profit Margin on Sales	Quantitative	Positive
		Profit Margin of Cost and Expenses	Quantitative	Positive
	Debt Risk	Debt - to - Asset Ratio	Quantitative	Negative
		Interest Coverage Ratio	Quantitative	Positive
		Quick Ratio	Quantitative	Positive
	Asset Quality	Accounts Receivable Turnover	Quantitative	Positive
		Total Asset Turnover	Quantitative	Positive
		Inventory Turnover	Quantitative	Positive
		Net Profit Growth Rate	Quantitative	Positive
	Business Growth	Revenue Growth Rate	Quantitative	Positive
Capital Accumulation Rate		Quantitative	Positive	

3.2. Selection of environmental indicators

The selected environmental indicators are as shown in the following table.

Table 2. Environmental indicators

Primary indicators	Secondary Indicators	Tertiary Indicators	Attribute 1	Attribute 2
environmental	Environmental Management	Number of Environmental Penalties	Quantitative	Negative
		Investment in Environmental Protection	Quantitative	Positive
		Total Power Generation from Waste	Quantitative	Positive
	Solid Waste Management	Volume of Domestic Waste Disposal	Quantitative	Positive
		Volume of Medical Waste Disposal	Quantitative	Positive
		Volume of Hazardous Waste Disposal	Quantitative	Positive
		Volume of Sludge Disposal	Quantitative	Positive
	Water Governance	Water Supply Volume	Quantitative	Positive
		Water Conservation Volume	Quantitative	Positive
		Volume of Sewage Disposal	Quantitative	Positive
		Water Consumption per Unit of Revenue	Quantitative	Negative
		Total Electricity Consumption	Quantitative	Negative
	Energy Management	Total Natural Gas Consumption	Quantitative	Negative
		Total Gasoline Consumption	Quantitative	Negative
Comprehensive Energy Consumption per Unit of		Quantitative	Negative	

Gas Management	Revenue	Quantitative	Negative
	Total Emissions of Nitrogen Oxides (NO _x)		
Gas Management	Total Emissions of Sulfur Dioxide (SO ₂)	Quantitative	Negative

3.3. Selection of social indicators

The selected social indicators are as shown in the following table.

Table 3. Social indicators

Primary indicators	Secondary Indicators	Tertiary Indicators	Attribute 1	Attribute 2
Social	Employee Management	Total Number of Employees	Quantitative	Positive
		Average Training Hours per Employee	Quantitative	Positive
		Average Remuneration per Employee	Quantitative	Positive
		Number of Working Days Lost due to Work-related Injuries	Quantitative	Negative
	Safety Management	Amount of Investment in Work Safety	Quantitative	Positive
		Frequency of Safety Emergency Drill Activities	Quantitative	Positive
	Innovation Management	Research and Development Expenditure	Quantitative	Positive
		Number of R & D Staff	Quantitative	Positive
		Number of Invention Patents	Quantitative	Positive
	Social Contribution	Amount of Investment in Public Welfare and Philanthropy	Quantitative	Positive
		Number of Volunteers	Quantitative	Positive

3.4. Selection of governance indicators

The selected governance indicators are as shown in the following table.

Table 4. Governance indicators

Primary indicators	Secondary Indicators	Tertiary Indicators	Attribute 1	Attribute 2
Governance	Organizational Structure	Proportion of Independent Directors	Quantitative	Positive
		Proportion of Female Executives	Quantitative	Positive
	Governance Performance	Number of General Meetings of Shareholders	Quantitative	Positive
		Number of Board of Directors Meetings	Quantitative	Positive
		Number of Supervisory Board Meetings	Quantitative	Positive
	External Supervision	Number of Disclosure Announcements	Quantitative	Positive

	Result of Audit Report	Qualitative	Positive
Compliance Management	Integrity and Compliance Management	Qualitative	Positive
	Total Number of Anti - Corruption Training Sessions	Quantitative	Positive
Investor Relations	Earnings per Share	Quantitative	Positive

4. Analysis of the ESG Performance Evaluation System Results of J Enterprise

4.1. Determination of indicator weights

(1) Establish a hierarchical structure model.

(2) Construct the judgment matrix. According to the hierarchical analysis structure model, by distributing questionnaires, experts and scholars are invited to compare each pair of indicators at each level based on the 1-9 scale method, thereby determining the importance of the indicators.

Table 5. 1-9 Scale Table for Judgment Matrix

Scale a_{ij}	Meanings
1	Indicator i is equally important as indicator j.
3	Indicator i is slightly more important than indicator j.
5	Indicator i is significantly more important than indicator j.
7	Indicator i is strongly more important than indicator j.
9	Indicator i is extremely more important than indicator j.
2、4、6、8	The importance level is between the adjacent levels mentioned above.

(3) Construct the judgment matrix $A = (\alpha_{ij})_{n \times n}$

$$A_{n \times n} = \begin{bmatrix} \alpha_{11} & \alpha_{12} & \dots & \alpha_{1n} \\ \alpha_{21} & \alpha_{22} & \dots & \alpha_{2n} \\ \dots & \dots & \dots & \dots \\ \alpha_{n1} & \alpha_{n2} & \dots & \alpha_{nn} \end{bmatrix} \quad (1)$$

(4) Calculate the relative weights of the judgment matrix. This paper uses the geometric mean method to calculate the weights. The specific calculation method is as follows: multiply the data of each row to obtain a column vector, then take the n th root of each element in the column vector to get the root vector, and finally normalize this new vector to obtain the weight vector W_i .

$$W_i = \frac{\sqrt[n]{\prod_{j=1}^n \alpha_{ij}}}{\sum_{k=1}^n \sqrt[n]{\prod_{j=1}^n \alpha_{kj}}} \quad (2)$$

(5) Conduct a consistency check.

$$\lambda_{\max} = \sum_{i=1}^n \frac{[AW]_i}{nW_i} \quad (3)$$

$$CI = \frac{\lambda_{\max} - n}{n - 1} \quad (4)$$

RI is only related to the order n of the matrix, and its specific values are shown in Table 6:

Table 6. RI

n	1	2	3	4	5	6	7	8	9
RI	0	0	0.52	0.89	1.12	1.26	1.36	1.41	1.46

$$CR = \frac{CI}{RI} \tag{5}$$

If $CR < 0.1$, it indicates that the judgment matrix has passed the consistency test; if $CR \geq 0.1$, it has not passed the consistency test and the judgment matrix needs to be adjusted or corrected.

(6) Calculate the comprehensive weights. By multiplying the weights of the target layer with those of the criterion layer, the weights of each indicator in the indicator layer with respect to the overall target layer can be obtained.

Table 7. Indicator weights

Primary weight	Secondary weight	Tertiary weight	Comprehensive weight	Sorting
		0.3594	0.0193	21
	0.2592	0.3023	0.0162	28
		0.3383	0.0181	25
		0.4196	0.0232	15
	0.2668	0.2010	0.0111	45
		0.3795	0.0209	18
0.2068		0.3813	0.0204	19
	0.2592	0.2893	0.0155	31
		0.3294	0.0177	26
		0.4139	0.0184	24
	0.2148	0.2712	0.0120	42
		0.3149	0.0140	35
	0.1091	0.4684	0.0247	13
		0.5316	0.0281	11
		0.1836	0.0319	9
		0.1947	0.0338	7
	0.3592	0.2014	0.0350	6
		0.2345	0.0407	1
		0.1859	0.0323	8
0.4837		0.2585	0.0393	3
	0.3142	0.2407	0.0366	4
		0.2386	0.0363	5
		0.2622	0.0398	2
		0.2434	0.0139	36
	0.1177	0.2472	0.0141	34
		0.2606	0.0148	32
		0.2488	0.0142	33
	0.0998	0.4800	0.0232	14
		0.5200	0.0251	12
		0.3752	0.0156	30
	0.2187	0.3266	0.0136	39
0.1902		0.2982	0.0124	41
		0.4405	0.0198	20
	0.2368	0.2570	0.0116	44
		0.3026	0.0136	37

		0.4139	0.0281	10
	0.3574	0.2712	0.0184	23
		0.3149	0.0214	17
	0.1872	0.5204	0.0185	22
		0.4796	0.0171	27
	0.1972	0.3342	0.0079	49
		0.6658	0.0157	29
		0.3594	0.0088	47
	0.2062	0.3023	0.0074	50
0.1193		0.3383	0.0083	48
	0.2071	0.5204	0.0129	40
		0.4796	0.0118	43
	0.2001	0.5701	0.0136	38
		0.4299	0.0103	46
	0.1894	1	0.0226	16

4.2. Calculation Steps of Topsis Method

(1) Build the initialization matrix.

$$X_{n \times n} = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{n1} & x_{n2} & \dots & x_{nn} \end{bmatrix} \quad (6)$$

(2) Standardize the data.

The processing of positive indicators is as follows:

$$b_{ij} = \frac{x_{ij} - \min(x_j)}{\max(x_j) - \min(x_j)} \quad (7)$$

The processing of negative indicators is as follows:

$$b_{ij} = \frac{\max(x_j) - x_{ij}}{\max(x_j) - \min(x_j)} \quad (8)$$

(3) Then process the data according to the following formula:

$$Y_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m (x_{ij})^2}} \quad (9)$$

(4) Construct the weighted normalized matrix.

$$v_{ij} = W_i \times y_{ij} \quad (10)$$

$$V_{n \times n} = \begin{bmatrix} v_{11} & v_{12} & \dots & v_{1n} \\ v_{21} & v_{22} & \dots & v_{2n} \\ \dots & \dots & \dots & \dots \\ v_{n1} & v_{n2} & \dots & v_{nn} \end{bmatrix} \quad (11)$$

(5) Determine the positive ideal solution V^+ and the negative ideal solution V^- .

(6) Calculate the Euclidean distances d^+ and d^- .

$$d_i^+ = \sqrt{\sum_{j=1}^n (v_{ij} - v_j^+)^2} \quad (12)$$

$$d_i^- = \sqrt{\sum_{j=1}^n (v_{ij} - v_j^-)^2} \quad (13)$$

(7) Calculate the relative closeness degree C_j .

$$c_j = \frac{d^-}{d^- + d^+} \quad (14)$$

5. Calculation results and analysis

5.1. Longitudinal analysis

J Enterprise's ESG Performance Scores from 2020 to 2024 are as shown in the following table.

Table 8. J Enterprise's ESG Performance Scores from 2020 to 2024

	Financial	Environmental	Social	Governance	Comprehensive
2020	0.491	0.451	0.498	0.301	0.454
2021	0.562	0.472	0.465	0.404	0.48
2022	0.323	0.5	0.371	0.386	0.426
2023	0.472	0.474	0.417	0.464	0.461
2024	0.57	0.552	0.596	0.657	0.575

5.2. Horizontal analysis

ESG Performance Scores for Industries in 2024 are as shown in the following table.

Table 9. ESG Performance Scores for Industries in 2024

	Financial	Environmental	Social	Governance	Comprehensive
J	0.53	0.51	0.503	0.563	0.518
G	0.28	0.445	0.554	0.513	0.449
S	0.393	0.523	0.375	0.238	0.442
Y	0.517	0.409	0.218	0.41	0.406

5.3. Problems with J Company's ESG Performance

5.3.1 Financial Dimension

The factors influencing J Company's financial performance mainly include: a long-term high level of the debt-to-asset ratio and a continuous decline in the accounts receivable turnover rate. On the one hand, a persistently high debt-to-asset ratio will increase the company's debt repayment pressure and financial risks. On the other hand, the continuous decline in the accounts receivable turnover rate not only directly leads to a reduction in operating cash inflows, further exacerbating the company's debt problem, but also brings the risk of an increase in bad debts. Moreover, due to the large amount of funds occupied by accounts receivable, the company's financial operation space in inventory procurement, technology investment, and other aspects is restricted, which will have an adverse impact on business expansion and market competitiveness.

5.3.2 Environmental Dimension

J Company's performance in the environmental dimension is generally good, with its environmental performance score showing an upward trend year by year. However, the company

started late in environmental information disclosure and only began to disclose greenhouse gas emissions data in 2022. In terms of waste gas management, J Company still has room for improvement and needs to take more effective measures to control pollutant emissions. This article selects the total emissions of nitrogen oxides (NO_x) and sulfur dioxide (SO₂) as key indicators to measure waste gas management. Data shows that with the increase in the company's order volume, the waste gas emissions of J Company have generally shown an upward trend, reflecting that the company's emission reduction measures have not fully matched the speed of production expansion. Therefore, the company needs to increase investment and adopt more advanced treatment technologies to ensure effective control of pollutant emissions while achieving business growth.

5.3.3 Social Dimension

J Company has always prioritized employee safety and has effectively enhanced employees' safety awareness and operational skills through continuous improvement of the safety management system, including safety training, increased investment in safe production, and organizing emergency drills. In 2022, J Company had 17 days of work lost due to work-related injuries, while in other years, the number was 0, demonstrating the company's achievements in safety management. However, although there have been no employee fatalities due to accidents in recent years, there have still been days lost due to work-related injuries in the past five years, which warns the company that it must further strengthen safety education.

5.3.4 Governance Dimension

(1) Optimizing Governance Structure

J Company has always focused on optimizing its governance structure to enhance governance capabilities. This article measures the company's governance structure by the proportion of independent directors and female executives. As of the end of 2024, the company's board of directors has 9 directors, among whom only 2 are female, and the proportion of female management is only 22.22%. Moreover, the number of female employees in the company has been decreasing year by year. In the past five years, the proportion of female executives in the company has been between 20% and 40%, and it has decreased in 2023-2024, indicating that the company still needs to further strengthen efforts in promoting gender equality and diversified governance. Female managers typically exhibit a more cautious risk assessment tendency, which can prevent the adoption of overly aggressive development strategies and provide an important guarantee for the company's stable operation.

(2) Strengthening Compliance Management

The measurement of the qualitative indicator of integrity and compliance management in this article is mainly based on the following aspects: whether internal control special inspections, bidding supervision and inspection, integrity checks are carried out, and whether integrity commitment letters and responsibility letters are signed. J Company only conducted integrity checks in 2020-2021, but has gradually improved relevant measures for integrity and compliance management since 2023. In addition to strengthening integrity supervision over senior executives and all employees, the company also pays attention to a series of measures in bidding supervision, including contract review. Moreover, in recent years, J Company has continuously strengthened internal control management and continuously improved the company's internal governance system. Strengthening compliance management is an indispensable link for the company. The lack of compliance management can lead to internal management chaos, talent loss, low operational efficiency and other issues, and also affect the company's reputation and brand image. More seriously, the enterprise may also face legal and regulatory risks. Therefore, establishing a sound integrity and compliance management system is crucial for the sustainable development of the enterprise.

(3) Emphasize external supervision

This article takes the number of disclosure announcements and the results of audit reports in external supervision as indicators to measure the transparency of corporate governance. Through data

analysis, it can be found that the number of disclosure announcements of J Enterprise in 2022 decreased significantly. This change may weaken the timely understanding of external investors and shareholders about the company's operating conditions and ESG performance, thereby affecting the company's transparency and credibility. Enterprises usually provide financial data, management changes, and major strategic information to investors through announcements. If these key information is not disclosed, it will lead to a decline in the trust of suppliers, customers, and investors in the enterprise.

6. Summary

The research findings indicate that Company J requires optimization of its financial structure in the economic dimension, enhanced environmental information disclosure and pollution control in the environmental dimension, strengthened corporate safety and service efficiency in the social dimension, as well as improved governance structures, compliance frameworks, and external oversight in the governance dimension. This study demonstrates that an ESG-based corporate performance evaluation system is both scientifically sound and practically applicable. It not only provides innovative approaches for sustainable development of the case company but also offers valuable reference models for enterprises in the same industry.

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