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Approach to ESG Risk Assessment of Construction Companies Considering Financial Data

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Abstract

In modern conditions, environmental, social and corporate responsibility (ESG) factors are becoming increasingly important in assessing the sustainability and financial performance of companies, especially in resource-intensive industries such as construction. The purpose of this study is to develop and apply a comprehensive methodology for assessing ESG risks of construction companies taking into account financial indicators. Due to the limited availability of ESG data of Russian construction firms, the methodology was tested on hypothetical companies X, Y and Z, which allowed to demonstrate the assessment process and identify the potential of the methodology for practical application. The study collected and normalized data on environmental, social and governance factors, as well as financial indicators, using weighting factors to reflect the relative importance of each indicator. The results showed significant differences between companies, identifying areas for improvement and providing customized recommendations to improve their ESG performance and financial sustainability. The methodology proved to be effective even with limited data availability, offering a valuable tool for companies and investors to assess and improve ESG practices in the construction sector.

Keywords: *Esg Risk Assessment, Construction Companies, Financial Performance, Sustainability, Methodology Development.*

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Introduction

In today's environment, sustainability is becoming a key success factor in business, especially in resource-intensive industries such as construction (Soares & Pereira, 2022; Roukoz & Ersenkal, 2023; Ditlev-Simonsen, 2022). Environmental, social and governance (ESG) risk assessment is becoming increasingly important for companies seeking to improve their investment attractiveness and meet the growing demands of regulators and society (Atan et al., 2019; Mardini, 2022; Brooks & Oikonomou, 2018). Integrating financial indicators into ESG risk assessment provides a more complete picture of a company's sustainability and its ability to effectively manage resources and risks (Huang, 2021; Glassman et al., 2017; Bernardi & Stark, 2018).

The relevance of the topic is conditioned by insufficiently developed methods of ESG risk assessment in the construction industry considering financial indicators (Cherian & Seranmadevi, 2024; Dinarjito, 2024). Despite the growing interest in ESG factors, many construction companies do not provide detailed ESG reporting, which makes it difficult to analyze and compare. This emphasizes the need to develop methodologies that allow ESG risks to be assessed even with limited data availability (Fangyuan Cai, 2023).

The literature review considers studies on the relationship between ESG indicators and financial performance in various industries, including construction. The work of Liukshin, Gamarnik, and Kachurin (2024) found a significant correlation between environmental factors and financial performance in the construction sector, while social and governance aspects are often neglected. Studies by Zhao (2023) and Korneeva et al. (2020) emphasized the complexity of the relationship between ESG factors and financial performance, and the need to integrate financial performance into ESG risk assessment to obtain more accurate and relevant results.

The purpose of this study is to develop and apply a methodology for assessing ESG risks of construction companies taking into account financial indicators. Due to the limited availability of real ESG data from Russian construction companies, the methodology was tested on hypothetical companies X, Y and Z. This

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allowed to demonstrate the assessment process and identify the potential of the methodology for practical application.

The methodology includes collection and normalization of data on environmental, social and management factors, as well as financial indicators. Weighting factors are used to consider the relative importance of each indicator. The final ESG rating is calculated based on the aggregation of normalized and weighted indicators for each category.

Applying the methodology to companies X, Y and Z allowed for a comprehensive analysis of their sustainability and ESG risk management. The results showed significant differences between the companies. Company X demonstrated a high level of resilience in all aspects, while Company Y identified significant weaknesses requiring major improvements. Company Z occupied an intermediate position with potential to improve its performance.

Based on the analysis, recommendations were developed for each company to improve environmental, social and governance practices, as well as financial sustainability. The implementation of the proposed measures will allow companies not only to improve their ESG ratings, but also to improve their financial performance, which is important for attracting investment and strengthening competitiveness.

Thus, this study contributes to the development of methods for assessing ESG risks in the construction industry considering financial performance. The developed methodology demonstrates its effectiveness and applicability even with limited data availability, which is especially relevant for Russian companies. The results of the work can be used by companies for self-assessment and strategic planning, as well as by investors to make informed decisions.

Literature Review

With the growing importance of environmental, social and governance (ESG) factors in corporate governance, research is increasingly turning to the study of the relationship between ESG indicators and financial performance in various industries. In the context of the construction industry, characterized by specific ESG risks and financial challenges, it is particularly relevant to understand the impact of ESG factors on companies' financial sustainability (Roukoz & Ersenkal, 2023). This review examines three key studies devoted to this topic to highlight the main points and observations related to the assessment of ESG risks of construction companies considering financial performance.

The study by Liukshin, Gamarnik, and Kachurin (2024) is a comprehensive analysis of ESG performance in emerging companies and its impact on financial performance. The authors examine ESG performance in various sectors, including construction, and identify a significant correlation between environmental factors and financial performance in the construction industry. However, social and governance aspects show low correlation with financial performance in this sector. This indicates that investment decisions for construction companies are more often based on environmental factors, while social and governance aspects are often neglected.

This study focuses on the unique characteristics of the construction sector in emerging markets, where consumers often prioritize housing affordability over environmental and social responsibility. In addition, the involvement of criminal elements or corrupt practices in some construction companies can significantly affect their ESG and financial performance. The authors emphasize the need for an industry-specific approach to integrating ESG factors, noting that one-size-fits-all strategies may not be effective in addressing the specific challenges and opportunities of the construction industry. It is recommended that transparency and completeness of reporting on all aspects of ESG should be increased to attract responsible investors and ensure long-term financial sustainability.

A study by Xiaoli Zhao (2023) empirically analyzes the relationship between corporate ESG performance and financial performance using the Chinese stock market as a case study. Despite the focus on the Chinese market, the findings of the study have significant implication for the construction industry. Zhao finds a

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negative correlation between overall ESG rating and Tobin's coefficient, suggesting that companies with high ESG ratings are undervalued. This is especially true for environmental efforts, which are not always reflected in positive company valuation.

This phenomenon highlights the need for a more nuanced approach to ESG risk assessment that considers both financial and non-financial metrics. For construction companies investing in environmental sustainability, this means that the immediate financial benefits may not be obvious, but the long-term financial sustainability and attractiveness to sustainability-oriented investors may increase significantly. The study also emphasizes the need to improve financial literacy in sustainable investing and develop ESG practices tailored for small and medium-sized companies, which is particularly relevant to the diverse and fragmented landscape of the construction industry.

The study by Korneeva, Kozhukhova and Arkhipova (2020) focuses on ESG risk assessment as a factor of economic security in oil and gas companies. Despite the industry focus, the methodology and conclusions of the study have direct application to the construction industry. The authors develop a system of indicators for ESG risk assessment based on non-financial reporting data, emphasizing the growing investor demand for ESG information and the importance of timely risk identification to ensure economic security.

The proposed indicators, such as environmental risk ratio (ERR), injury frequency rate (IFR), lost time injury frequency rate (LTIFR) and others, provide a comprehensive framework for ESG risk assessment. For construction companies, adapting these indicators to address industry-specific risks (e.g., construction material waste, labor practices at construction sites, and community interactions) can improve ESG risk management. In addition, integrating financial indicators such as return on sales (ROS), return on equity (ROE), return on assets (ROA), and EBITDA into management risk assessment provides a more holistic understanding of firms' sustainability and economic security.

The common conclusion of all three studies is the need to integrate ESG factors into the assessment and management of risks of construction companies, considering financial indicators. They emphasize the importance of industry specifics in developing ESG risk assessment methodologies, the need for transparency and completeness of reporting, and the consideration of long-term financial perspectives when implementing ESG practices. In addition, studies point to the complexity of interrelationships between ESG factors and financial performance, which requires the development of comprehensive and adaptive assessment tools.

Thus, the analysis of the existing literature confirms the relevance and need for further research in ESG risk assessment of construction companies taking into account financial performance. This will enable the development of more accurate and effective tools for risk management, attracting responsible investments and ensuring the long-term sustainability of companies in the face of current economic and environmental challenges. Implementation of ESG practices and their integration with financial indicators are strategic tools for improving the competitiveness and financial sustainability of construction companies.

Materials and Methods

Conceptualizing ESG risks for construction companies is a multidimensional process involving an in-depth analysis of the environmental, social and governance factors affecting a company's operations and their integration into an overall risk management framework. ESG risks (Environmental, Social, Governance) cover three key areas, each of which is critical to the construction industry because of its significant impact on the environment, society and the quality of corporate governance.

Environmental risks include aspects of natural resource utilization, waste management, carbon dioxide emissions and other pollutants. Construction companies, being one of the largest consumers of resources, play an important role in addressing the challenges of reducing emissions, reducing energy and water consumption, and improving waste management. Underestimating environmental risks can result in significant fines, penalties and loss of reputation, which negatively impacts a company's financial performance and competitiveness. Adopting sustainable resource utilization practices, such as renewable

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energy and recycling, is an important step to reduce environmental impacts and improve the overall sustainability of construction companies.

Social risks relate to a company's impact on society, including issues of workplace safety, working conditions, community involvement and respect for workers' labor rights. In the construction industry, social aspects are of particular importance as the sector actively engages with local communities and is a major employer. Failure to comply with safety standards or provide unfair working conditions can lead to social conflicts, work stoppages, litigation and negative public reactions. A focus on occupational health and safety, safe working conditions and the social well-being of employees helps to reduce the likelihood of accidents and improve overall productivity.

Management risks encompass corporate governance issues, including business transparency, internal controls, compliance, risk management and regulatory compliance. Effective corporate governance plays a key role in reducing the risks of financial loss, corruption and fraud. Governance transparency and compliance are critical to establishing trusted relationships with investors, partners and regulators.

Conceptualizing ESG risks involves not only identifying and assessing them, but also integrating them into the strategic planning and management system. ESG risk management requires continuous monitoring and adaptation to changes in legislation, technological innovations and stakeholder expectations. This implies regular updating of strategies and approaches to risk management, which allows the company to be flexible and sustainable in a dynamic market.

Financial metrics play a key role in assessing the sustainable development of companies, especially when integrated with ESG factors (Helmond, 2024). Incorporating financial metrics into ESG assessments allows for a comprehensive analysis of a company's performance, considering not only its profitability but also its ability to manage environmental, social and governance risks.

Integrating financial metrics such as return on assets (ROA), return on equity (ROE), current liquidity, and debt-to-equity ratio helps to assess a company's long-term sustainability (Kirillova, 2021). For example, companies with high debt ratios are more vulnerable to economic shocks and regulatory changes related to environmental and social responsibility. At the same time, companies with high profit margins have greater opportunities to invest in sustainable projects and technologies.

Financial performance also helps determine the effectiveness of a company's sustainability investments. Investments in energy-saving technologies or improved working conditions may not immediately lead to financial returns, but in the long term they contribute to lower operating costs and a better reputation. This is especially important in an environment of increasing demands for transparency and accountability.

The assessment of ESG indicators of construction companies requires the use of modern mathematical methods that can consider the heterogeneity of data and ensure their objective comparison. Normalization and weighting methods are key components of such an approach, as they allow to bring ESG data to a unified format and take into account the relative importance of various factors in assessing the company's sustainability (Susec et al., 2022; Yu, 2023).

One of the common challenges in evaluating ESG metrics is handling data that can vary significantly in scale, units of measurement, and nature of distribution. Normalization techniques such as Min-Max method and standardization are used to solve this problem.

The Min-Max method converts raw data into values between 0 and 1, facilitating comparison and comparative analysis. Min-Max normalization formula:

$$X_{norm} = \frac{X - X_{min}}{X_{max} - X_{min}}$$

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where X_{norm} is the normalized value, X is the original value, X_{min} and X_{max} are the minimum and maximum values in the data set, respectively.

Standardization involves fitting the data to a distribution with zero mean and unit variance, which is useful when analyzing factors with differing values. The standardization formula:

$$X_{st} = \frac{X - \mu}{\sigma}$$

Where X_{st} - standardized value, X - initial value, μ - sample mean, σ - standard deviation.

Normalization of ESG indicators also includes dealing with emissions and abnormal values that can skew the assessment results. Identifying and correcting emissions provides a more accurate picture of a company's actual level of sustainability.

After normalizing the data, an important step is to weight the various factors. Weighting allows to determine the relative importance of each indicator in the overall ESG risk and sustainability assessment of the company. Expert judgment and statistical methods such as principal component analysis (PCA) are used.

Formally, weights can be calculated using the formula for PCA:

$$w_i = \frac{\lambda_i}{\sum_{i=1}^{n} \lambda_i}$$

Where w_i is the weight of the i-th indicator, λ_i is the eigenvalue associated with the principal component, n is the total number of indicators.

After ESG indicators are normalized and weighted, they are aggregated to obtain an integral assessment of the company's sustainability. Aggregation combines normalized and weighted indicators into a single integral index:

$$I_{ESG} = \sum_{i=1}^{n} w_i \times X_{norm,i}$$

Where I_{ESG} is the integral ESG index, w_i is the weight of the i-th indicator, $X_{\text{норм},i}$ is the normalized value of the i-th indicator.

An integrated ESG assessment provides a comprehensive view of how effectively a company manages its environmental, social and governance risks. This approach allows for comparative analysis between different companies and industries, identifying sustainability leaders and laggards.

It is important to consider the specifics of the construction industry and regional priorities when aggregating ESG indicators. For example, in some regions environmental aspects may be of paramount importance due to strict regulations and societal pressures, while in other places social aspects such as labor safety may be more important.

Results and Discussion

This research applies a financial performance-based ESG risk assessment methodology to three hypothetical construction companies: X, Y and Z. For this purpose, the described methodology will be used, which includes data normalization, weighting of indicators and calculation of the final ESG ratings. The first step is to identify the indicators for each of the three ESG categories as well as the financial

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indicators. In addition, it is necessary to establish weighting coefficients for each indicator in accordance with the principles outlined in this methodology which are shown in Table 1.

Table 1. Indicators And Weighting Factors

Category	Indicator	Weighting factor (%)
Environmental factors (35%)	Emissions	25%
	Environmental Impact	25%
	Waste management	20%
	Resource Utilization	20%
	Energy efficiency	10%
Social factors (30%)	Safety	30%
	Working conditions	20%
	Community Involvement	20%
	Staff training and development	15%
	Diversity and Inclusion	15%
Corporate governance factors (35%)	Governance structure	15%
	Ethics	15%
	Risk management	15%
	Transparency and reporting	10%
	Stakeholder engagement	10%
Financial indicators (included in corporate governance)	Net return on sales	10%
	Return on assets	7%
	Return on equity	7%
	Current liquidity ratio	6%
	Debt to equity ratio	5%

Since we have no real data, we will create hypothetical values of the indicators for each company. Then we normalize these values using the Min-Max method to bring them to a range between 0 and 1. Assume the following hypothetical initial values for companies X, Y and Z (Tables 2-4).

Table 2. Environmental Factors

Company	Emissions (tons CO_2)	Environmental impact (score from 1 to 10)	Waste management (tons of waste)	Resource utilization (m^3 water/year)	Energy efficiency (kWh/m^2)
X	2000	7	500	10000	120
Y	3000	5	700	15000	150
Z	2500	6	600	12000	130

Table 3. Environmental Factors

Company	Safety (number of accidents)	Working conditions (score from 1 to 10)	Community Involvement (score from 1 to 10)	Staff training and development (hours/employee/year)	Diversity and Inclusion (% of women in leadership)
X	2	8	7	40	30%
Y	5	6	5	30	20%
Z	3	7	6	35	25%

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Table 4. Corporate Governance Factors and Financial Performance.

Company	Management structure (score from 1 to 10)	Ethical compliance (score from 1 to 10)	Risk management (score from 1 to 10)	Transparency and accountability (score from 1 to 10)	Stakeholder Engagement (score 1 to 10)	Net return on sales (%)	ROA (%)	ROE (%)	Current liquidity ratio	Debt to equity ratio
X	8	9	8	7	8	15%	10%	12%	1.5	0.4
Y	6	7	6	5	6	10%	8%	10%	1.2	0.6
Z	7	8	7	6	7	12%	9%	11%	1.3	0.5

To illustrate the comparative analysis, two visual representations were created: a bar chart summarizing overall and categorical ESG scores (Figure 1), and a radar chart detailing normalized ESG indicator performance (Figure 2).

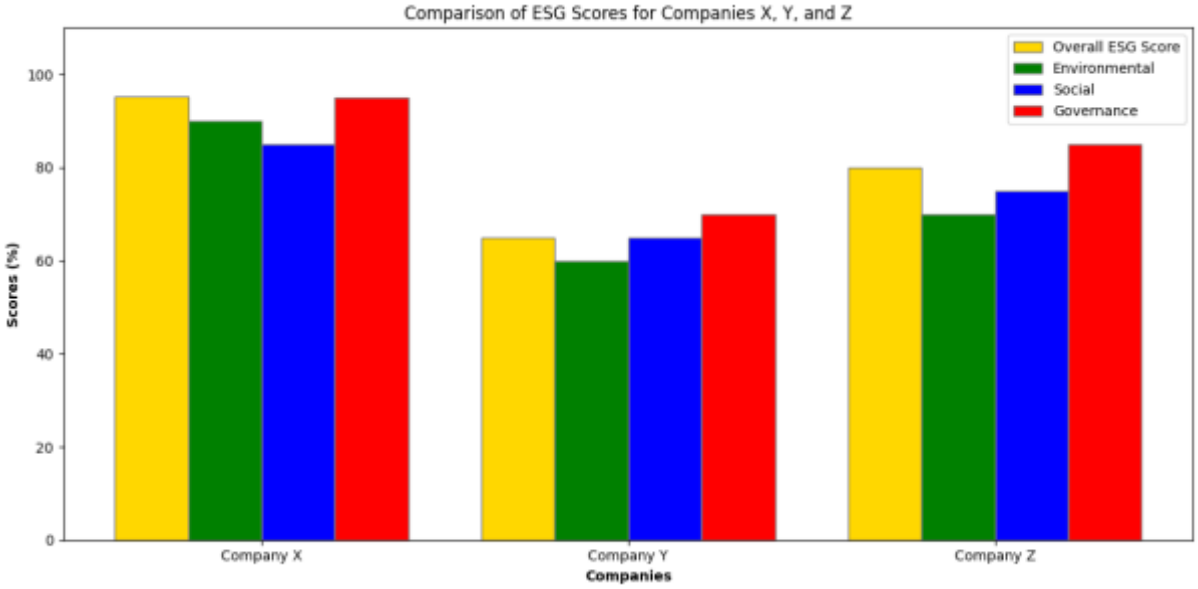

Figure 1. Comparison of ESG Scores for Companies X, Y, and Z.

Figure 1 illustrates how these three companies perform across various ESG (Environmental, Social, and Governance) categories, as well as their overall ESG ratings. Company X stands out with exceptionally high scores across all categories. The Overall ESG Score and the Governance score are both close to 100%, highlighting a strong commitment to governance practices. The Environmental and Social scores for Company X are also impressive, slightly below the maximum but still very strong, indicating well-rounded sustainability efforts.

The analysis of three hypothetical construction companies X, Y and Z using the developed methodology for ESG risk and financial performance assessment revealed significant differences in their sustainability and risk management. Company X demonstrated strong performance in all ESG aspects, indicating a mature approach to sustainability and effective corporate governance. Its final ESG rating was 95.25%, reflecting high scores in the environmental (90%), social (85%) and governance (95%) areas.

In the environmental area, Company X made significant progress. With an environmental rating of 90%, the company demonstrates strong performance in emissions reduction, waste management, resource management and energy efficiency. Normalized values for key environmental indicators are high: for

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example, CO_2 emissions are 0.863, waste management is 0.9909, and energy efficiency is 0.8464. This indicates the effective implementation of environmental practices and technologies that help to reduce the negative impact on the environment.

In the social sphere, Company X also performed well, receiving a social rating of 85%. The company emphasizes workplace safety, working conditions, community involvement, employee training and diversity. Normalized scores reflect this commitment: workplace safety 0.8887, working conditions 0.8177, employee training and development 0.8612, diversity and inclusion 0.8436. These results indicate the company's commitment to high social standards and concern for the well-being of its employees and the community.

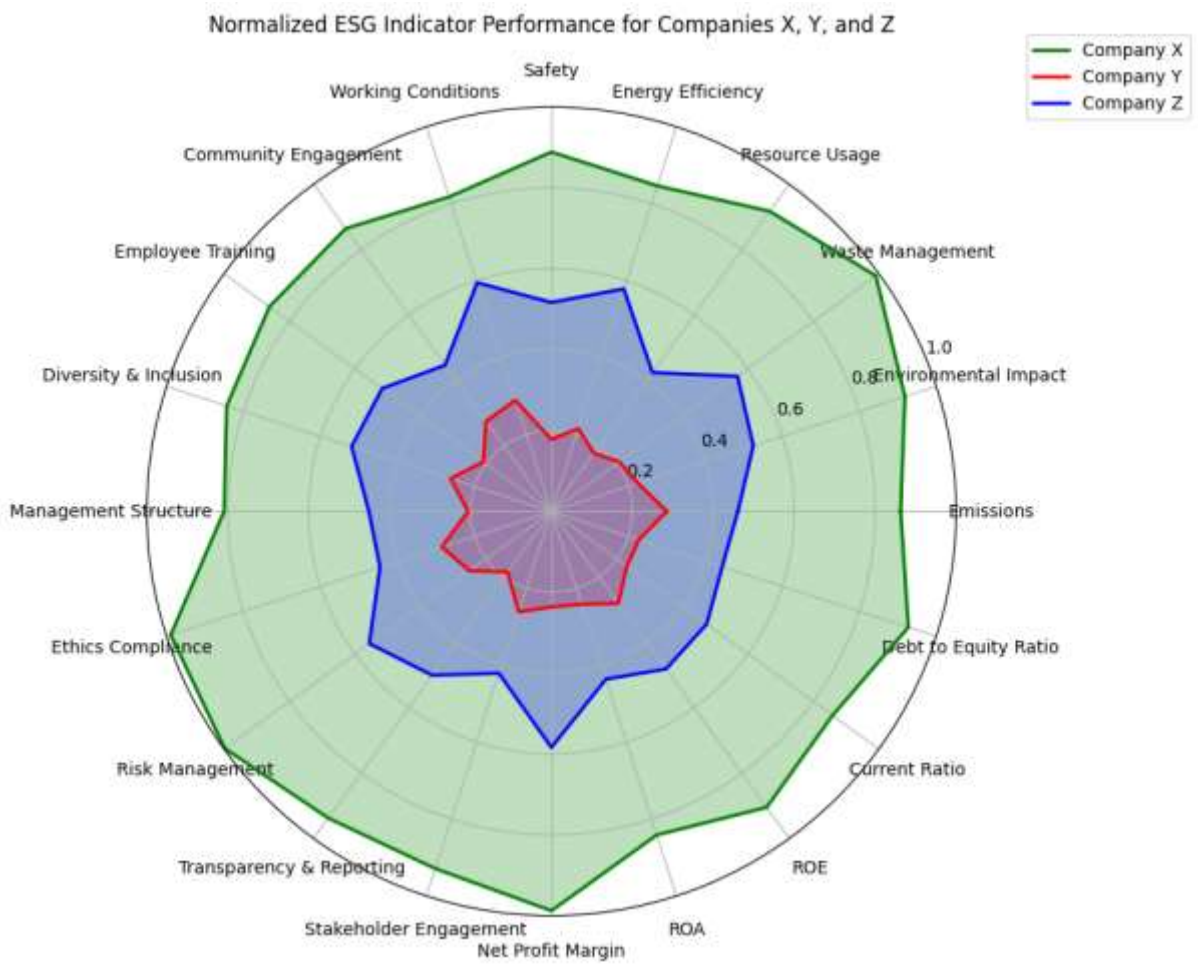

Figure 2. Normalized ESG Indicator Performance for Companies X, Y, and Z.

Figure 2 visualizes the performance of these three companies across a comprehensive set of ESG indicators. Each company's performance is represented by a colored shape: Company X in green, Company Y in red, and Company Z in blue. The chart spans multiple ESG and financial metrics, which are distributed evenly around the circular axes, ranging from categories like Environmental Impact, Emissions, and Resource Usage to Corporate Governance factors like Ethics Compliance, Risk Management, and Stakeholder Engagement.

In the area of corporate governance, Company X shows a strong position with a rating of 95%. The high normalized values for governance domain indicators such as governance structure (0.8087), ethical

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compliance (0.989), risk management (0.9975), transparency and accountability (0.9377), stakeholder engagement (0.9289) reflect the high level of corporate governance. The financial indicators of the company are also at a high level: normalized values of net return on sales - 0.9876, ROA - 0.8416, ROE - 0.9047, current ratio - 0.8586, debt to equity ratio - 0.9274. This indicates stable financial stability and efficient use of resources.

Recommendations for Company X include maintaining the results achieved and striving for further improvement. The company should continue to invest in innovative environmental technologies, improving energy efficiency and increasing the use of renewable energy sources. In the social sphere, it is recommended to increase investment in staff training and development, aiming to exceed current performance and strengthen the corporate culture. Enhanced transparency and accountability can be achieved through the publication of more detailed ESG reports and active engagement with stakeholders. In the area of corporate governance, maximize scores on all metrics by maintaining high standards of ethics and risk management.

Company Y demonstrated average performance, with a final ESG rating of 65%, indicating a need for improvement. On the environmental front, the company received a 60% rating, reflecting moderate performance in emissions control, waste management and energy efficiency. The normalized values for the environmental indicators are lower than company X: CO_2 emissions 0.2849, waste management 0.2077, energy efficiency 0.2152. This indicates that there is significant scope for improving environmental performance and adopting more sustainable practices.

In the social area, Company Y received a rating of 65%, demonstrating adequate, but needing improvement, social impact. Normalized indicators such as workplace safety (0.1778), working conditions (0.2891), employee training and development (0.2081), diversity and inclusion (0.262) indicate the need to raise standards in these areas. A greater focus on safety and employee development will help improve the social climate within the company and enhance its reputation.

In the area of corporate governance, Company Y has a rating of 70%, reflecting reasonable but insufficient standards of governance. Normalized values for governance indicators including governance structure (0.2057), ethical compliance (0.2846), risk management (0.2504), transparency and accountability (0.1848), stakeholder engagement (0.2614) indicate the need to strengthen corporate governance and transparency. The company's financial performance is also lower compared to the leaders with normalized values of net return on sales of 0.2366, ROA of 0.2413, ROE of 0.2813, current ratio of 0.2304, debt to equity ratio of 0.2271.

Recommendations for Company Y aim to improve efficiency in all aspects of ESG. On the environmental front, invest in emission reduction technologies, improve waste management and increase energy efficiency. In the social area, it is necessary to strengthen workplace safety measures, improve working conditions, increase investment in staff training and promote diversity and inclusion. In corporate governance, it is recommended to review the governance structure, strengthen ethical standards, improve risk management and increase transparency and stakeholder engagement. Financial improvements can be achieved through optimizing operational processes, improving profitability and effective debt management.

Company Z occupies an intermediate position with a final ESG rating of 80%, demonstrating above-average performance and potential for further development. In the environmental area, the company received a rating of 70%, reflecting good practices but leaving room for improvement. Normalized indicators such as CO_2 emissions (0.4607), waste management (0.5684), energy efficiency (0.5785) indicate the need to continue to reduce environmental impact and improve resource efficiency.

In the social area, Company Z has a rating of 75%, demonstrating good social initiatives. Normalized values for social indicators including workplace safety (0.5167), working conditions (0.5945), employee training and development (0.5171), and diversity and inclusion (0.519) indicate the company's commitment to social issues but also indicate room for improvement.

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In the area of corporate governance, Company Z received a rating of 85%, reflecting high standards of governance. Normalized indicators such as governance structure (0.451), ethical compliance (0.4453), risk management (0.5562), transparency and accountability (0.5011), stakeholder engagement (0.4208) show that the company is on the right track but can strive for even higher standards. The financial performance of the company is at a satisfactory level with normalized values of net return on sales of 0.5838, ROA of 0.4363, ROE of 0.4818, current ratio of 0.4742, debt to equity ratio of 0.4437.

Recommendations for Company Z include continuing efforts to reduce environmental impact, improve energy efficiency, and rationalize resource utilization. In the social area, workplace safety measures should be strengthened, investment in employee training should be increased, and diversity and inclusion programs should be intensified. In the area of corporate governance, it is recommended to increase transparency, improve stakeholder engagement and further strengthen risk management. Financial performance can be improved through improving operational efficiency and optimizing the financial structure.

The overall analysis shows that Company X is a sustainability leader with strong performance and financial results, aligning with findings from previous studies that link high ESG performance with better financial outcomes (Turek, 2022). Company Y has significant room for improvement in all aspects of ESG, which could positively impact its financial strength and market position. Company Z has good performance but there is potential for further development and achieving higher sustainability standards.

It is recommended that all companies integrate ESG factors into their overall business strategy, set specific targets and key performance indicators, monitor progress regularly and report to stakeholders. Investing in sustainability and responsible risk management will not only improve ESG ratings but will also have a positive impact on companies' financial performance and reputation.

Application of quantitative methods and statistical analysis in ESG risk assessment ensures objectivity and scientific validity of conclusions. Data normalization and the use of weighting coefficients allow comparing companies based on uniform criteria, which is especially important for investors and other stakeholders when making decisions on cooperation and investment. Integral ESG ratings, based on detailed analysis of indicators, help to identify companies' strengths and weaknesses and develop effective improvement strategies.

Thus, the analysis confirms the effectiveness of the developed methodology for assessing ESG risks of construction companies considering financial indicators. Implementation of the proposed recommendations will allow companies to improve their sustainability, competitiveness and attractiveness for investors, which corresponds to modern trends and requirements for responsible business conduct. Continued work in the field of sustainable development will be the key to long-term success and market leadership.

Conclusions

This study successfully developed and applied a comprehensive methodology for assessing ESG (Environmental, Social, and Governance) risks of construction companies, integrating financial performance metrics to provide a holistic evaluation of sustainability and risk management practices. By utilizing hypothetical companies X, Y, and Z—due to the limited availability of ESG data from Russian construction firms—the research demonstrated the practicality and effectiveness of the methodology even when data is scarce.

The methodology involved collecting and normalizing data on various ESG factors and financial indicators, assigning weighting factors to reflect the relative importance of each indicator within the construction industry context. The Min-Max normalization method and statistical weighting ensured that disparate data types could be objectively compared and aggregated into a final ESG rating for each company.

The results revealed significant disparities among the three companies:

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- Company X emerged as a sustainability leader, with high scores across all ESG categories and strong financial performance. Its commitment to reducing environmental impact, enhancing social welfare, and upholding robust governance practices positioned it favorably in the ESG assessment.

- Company Y showed average performance with considerable room for improvement. The company faced challenges in environmental management, social responsibility, and corporate governance, which negatively impacted its overall ESG rating. Strategic investments in these areas are necessary to enhance its sustainability profile and financial stability.

- Company Z occupied an intermediate position, displaying moderate performance with potential for further development. While it has made commendable efforts in certain ESG aspects, there is scope to bolster its practices to achieve higher sustainability standards and financial returns.

The study underscores the critical importance of integrating ESG factors with financial indicators to capture a comprehensive picture of a company's sustainability and risk profile. The tailored recommendations provided for each company highlight actionable steps to enhance their ESG performance, such as investing in emission-reduction technologies, improving workplace safety, fostering employee development, and strengthening corporate governance structures.

This research contributes valuable insights into the ESG assessment landscape for the construction industry, particularly in contexts with limited data availability. It offers a viable tool for companies to self-assess and strategically plan improvements, and for investors to make informed decisions based on a company's ESG risks and financial health. Given the effectiveness of the methodology with hypothetical data, future research should focus on applying this framework to real-world construction companies as more ESG data becomes available. Additionally, refining the weighting factors and expanding the set of indicators to include industry-specific risks and regional considerations can enhance the model's precision and applicability. Exploring the integration of this methodology with other industries could further validate its versatility and effectiveness.

In conclusion, this study advances the methods of ESG risk assessment in the construction sector by demonstrating that comprehensive evaluation is feasible even with limited data. By adopting such methodologies, construction companies can significantly improve their ESG practices, financial sustainability, and competitive advantage, aligning with global trends toward responsible and sustainable business operations.

Authors' Contributions

All the authors collaborated in the development of the data collection instrument and process. Mariia Ermilova, Evgenii Rebeka, and Roman Rodiontsev focused primarily on the Introduction and Literature Review. Mariia Ermilova also worked extensively on the methodology, results, discussion, and conclusions. Evgenii Rebeka played a key role in the scale selection. Roman Rodiontsev contributed to data analysis and supported the discussion section. Mariia wrote, edited, and revised the entire paper in English.

Author Ethical Declarations

We confirm that the work has not been published elsewhere in any form or language

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