

Artificial Intelligence, ESG Integration, Public Health Resilience, and Sustainable Management Practices: A Strategic Framework for Environmental and Organizational Performance

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HOW TO CITE: ABSTRACT:

Alok Kumar Bhargava, Rahul M Bhandari, Vipin Kumar, Htin Zaw Sam, Jyotirupa Devi, M Nithyalakshmi (2026). Artificial Intelligence, ESG Integration, Public Health Resilience, and Sustainable Management Practices: A Strategic Framework for Environmental and Organizational Performance International Journal of Special Education, 41(24s), 1107 - 1120

The increasing importance of sustainability, environmental stewardship, and organizational resilience has accelerated the adoption of Environmental, Social, and Governance (ESG) frameworks and advanced digital technologies across industries. This study examines the relationships among ESG integration, environmental performance, and organizational performance within the context of artificial intelligence, public health resilience, and sustainable management practices. Using a quantitative research design, data were collected from a dataset comprising 11,000 firm-year observations representing 1,000 companies across multiple industries and geographical regions between 2015 and 2025. An Environmental Performance Index was developed using carbon emissions, water usage, and energy consumption indicators, while Ordinary Least Squares regression analysis was employed to evaluate the effects of ESG dimensions on environmental and organizational outcomes. The findings revealed that the

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environmental dimension of ESG significantly and positively influenced both environmental performance and market capitalization, highlighting its critical role in improving sustainability outcomes and organizational value creation. In contrast, the social dimension exhibited no significant effect, while governance demonstrated a negative association with environmental performance and a non-significant relationship with organizational performance. The results further indicated that revenue and growth rate negatively affected environmental performance, whereas revenue and profit margin positively influenced organizational performance. The study contributes to the growing sustainability literature by proposing a strategic framework that integrates artificial intelligence, ESG practices, public health resilience, and sustainable management principles to enhance environmental and organizational performance. The findings provide valuable implications for managers, policymakers, and sustainability practitioners seeking to achieve long-term resilience and sustainable development.

Keywords: Artificial Intelligence, ESG Integration, Public Health Resilience, Sustainable Management Practices, Environmental and Organizational Performance

1. Introduction

The increasing complexity of environmental problems, threats to public health and the imperatives of organizational sustainability are forcing businesses and policymakers to develop new strategies that combine technological progress with sustainable development goals. Artificial Intelligence (AI) is a state-of-the-art technology that has emerged in the last years to improve organizational decision making, operational efficiency and sustainability-oriented initiatives in various sectors. At the same time, Environmental, Social, and Governance (ESG) frameworks have emerged as key strategic instruments in evaluating the sustainability performance of businesses and directing responsible business practices. The convergence of AI and ESG enables organizations to address environmental challenges, build resilience against new risks, and achieve sustainable management objectives, while maintaining organizational competitiveness and long-term value creation (Lim, 2024; Huang & Yao, 2025).

AI is becoming more important for sustainability

management because it can process large data sets, identify environmental risks, improve the use of resources and provide the evidence base for decisions. Recent studies have highlighted that the implementation of ESG has been improved by AI-based systems through sustainability reporting, stakeholder engagement, and increasing organizational accountability (Domingo, 2025; Mohamed Riyath & Inun Jariya, 2024). Besides, AI-powered governance mechanisms have been identified to contribute to greater transparency and organizational responsiveness to environmental and social challenges, thus improving the effectiveness of leadership, human resource management, and corporate sustainability initiatives (Sklavos et al., 2024). As organizations work towards achieving a better balance between economic growth and environmental stewardship, AI technologies have become a critical enabler to accelerate sustainable business practices and long-term organizational resilience. The era of climate change, resource scarcity and rising stakeholder demands has made environmental sustainability a

major issue for organisations. ESG integration provides a framework to help companies evaluate environmental impacts, encourage social responsibility and improve governance structures.

Previous research has shown that ESG-oriented strategies lead to better corporate performance, increased trust among stakeholders, and more effective sustainability outcomes (Gillan et al., 2021). Empirically, AI-driven ESG tools help in making more sustainable decisions, managing environmental risks, and building more resilient organizational systems that can adapt to environmental shifts (Sarker & Nuruzzaman, 2024; Omar & Habiba, 2025). The link between AI, ESG integration and sustainable management practices has attracted growing academic interest across a variety of industries. AI-enabled ESG are one of the areas that have embraced manufacturing systems. In this sector, advanced analytical tools help organizations to assess sustainability performance and optimize operational processes (Aljohani, 2025). In addition, AI-driven supply chain management strategies have also demonstrated the ability to enhance sustainability by optimizing resource use and making environmentally informed decisions (Chen, 2024; Hao & Demir, 2024). The introduction of AI and IoT technologies in the CSR activities has led to an overall greater capacity for companies to address multiple issues at once, such as financial risks, environmental issues, and challenges related to sustainable development (Shkalenko & Nazarenko, 2024).

An other key aspect of sustainability that has come to the fore in recent years is resilience in public health. With demographic shifts, environmental stress and emerging health threats, healthcare systems around the world are under increasing pressure to improve resilience, improve service delivery and ensure sustainable operations. ESG integration has been identified as a vital means of promoting healthcare sustainability through improved governance frameworks, resource management practices and stakeholder engagement mechanisms (Hyder, 2026). In addition, the combination of ESG principles and digital transformation has been recognized as a promising way to improve the resilience of

healthcare and support sustainable health systems that can effectively address future challenges (Sepetis et al., 2024). Recent research has also highlighted the role of AI in promoting ESG practices and fast-tracking sustainable development via digital transformation. AI technologies have been shown by research to be employed to measure ESG performance, sustainability reporting, and organizational learning, assisting firms to reach environmental and financial goals (Taleb & Kadhum, 2024; Chen & Zhang, 2025). However, the existing literature is fragmented with limited empirical evidence on the joint effect of AI-enabled ESG integration, public health resilience and sustainable management practices on environmental and organizational performance. Moreover, the channels through which ESG factors impact environmental outcomes and organizational value have not been sufficiently investigated across industries and regions. To fill such gaps, the present study develops and empirically tests a strategic framework that interlinks ESG integration and sustainable management practices with environmental and organizational performance outcomes. This paper employs a large multi-industry dataset to explore the role of ESG dimensions in environmental sustainability and organizational value creation and offers insights to policymakers, managers and sustainability practitioners. Drawing on the disciplines of AI-driven sustainable management, ESG adoption and resilience-based organizational approaches, this study makes a valuable contribution to the growing literature on sustainable development and responsible corporate behavior.

Research Objectives

- To examine the influence of ESG dimensions on environmental performance among organizations operating across diverse industries and regions.
- To investigate the impact of ESG integration on organizational performance as measured by market capitalization.
- To develop a strategic framework linking artificial intelligence, ESG integration, public health resilience, and sustainable management practices with environmental and organizational

performance outcomes.

2. Methodology

2.1 Research Design

This study employed a quantitative research design to examine the relationships between ESG integration, environmental performance and organizational performance. Using a longitudinal panel-data approach, given that the dataset includes repeated observations of the same firms over several years. This research explored how ESG dimensions influence environmental and organizational outcomes, and how they can be connected through a strategic framework of AI, ESG integration, public health resilience, sustainable management practices, environmental performance, and organizational performance. The quantitative approach was deemed suitable because it enabled the objective measurement of relationships between variables through statistical analysis and provided empirical evidence in support of the proposed framework.

2.2 Data Source and Sample Selection

The study used a public dataset on ESG and financial performance (Jagtap, 2025). The dataset covers 1,000 firms in nine industries and seven geographical regions for the period 2015-2025, including 11,000 firm-year observations. The dataset includes Healthcare, Manufacturing, Transportation, Consumer Goods, Finance, Energy, Utilities, Retail and Technology industries. Geographically, the firms were distributed across Asia, Oceania, the Middle East, Europe, North America, Latin America and Africa. The wide industry and regional coverage increased the diversity of the sample and the generalizability of the findings to different organizational and environmental contexts.

2.3 Variable Measurement

The main explanatory variables of the study were the ESG dimensions. The level of sustainability integration within organizations was measured by the ESG Environmental, ESG Social and ESG Governance scores. Environmental performance was operationalized by a composite Environmental Performance Index constructed from carbon emissions, water use and energy

consumption indicators. Organizational performance was evaluated in terms of market capitalization, which is widely accepted as a comprehensive measure of firm value and long-term performance. Revenue, profit margin, and growth rate were used as control variables to account for firm size, profitability, and growth dynamics that could influence environmental and organizational outcomes.

2.4 Data Screening and Preparation

Before the statistical analysis, the data set was subjected to an extensive data screening procedure. The missing-value assessment identified 1,000 missing observations for the GrowthRate variable. Further inspection showed that all missing values were in the year 2015 and were the first observation of each company. Since a growth rate is calculated using the value from the previous year, these missing observations were treated as structurally missing, rather than missing due to data quality. Therefore, no imputation procedure was used. The duplicate record analysis showed that the dataset had no duplicate observations. A descriptive assessment of the variables revealed significant variation across firms, especially for environmental resource-consumption indicators, which justified the subsequent standardization procedures used in constructing the environmental performance measure.

2.5 Construction of Environmental Performance Index

Using carbon emissions, water usage and energy consumption we created a composite Environmental Performance Index to get a comprehensive measure of environmental performance. For comparability of variables measured on different scales, each environmental variable was standardized by z-score transformation prior to analysis. Higher values of carbon emissions, water use, and energy use were associated with worse environmental performance, so the standardized values were reverse-coded so that larger index values indicated better environmental performance. The Environmental Performance Index was then calculated as the mean of the reversed standardized scores. This approach allowed the combination of multiple

environmental indicators into a single measure and provided a more complete picture of environmental performance than any individual indicator.

2.6 Descriptive and Correlation Analysis

Descriptive statistical analysis was carried out to summarize the characteristics of the dataset and to study the distribution of the study variables. For all continuous variables the measures of central tendency, dispersion, minimum and maximum value, and quartiles were calculated. Then, a correlation analysis was performed based on the Pearson correlation coefficients to examine the magnitude and the direction of the relationships among the variables. The correlation matrix provided initial evidence of associations between ESG dimensions, environmental indicators and organizational performance measures and helped in identifying potential multicollinearity issues.

2.7 Multicollinearity Assessment

Multicollinearity among the explanatory variables was tested by using Variance Inflation Factor (VIF) technique. VIF values were calculated for ESG Environmental, ESG Social, ESG Governance, Revenue, Profit Margin and Growth Rate. The results showed that all VIF values were within acceptable limits ranging from 1.300 to 5.611. The values indicated no serious multicollinearity and confirmed that the independent variables could be retained in the regression models without affecting the accuracy of the estimations.

2.8 Regression Analysis

To analyze the relationships of ESG dimensions, environmental performance, and organizational

performance, we performed ordinary least squares (OLS) regression analysis. Two different regression models were estimated. The first model analyzed the effect of ESG dimensions and control variables on environmental performance. The dependent variable was the Environmental Performance Index. The second model was used to examine the effect of the ESG dimensions and the control variables on the organizational performance, with the market capitalization as the dependent variable. Coefficient of determination (R^2) and adjusted R^2 values, F-statistics and statistical significance of regression coefficients were used to assess model adequacy. A significance level of 0.05 was used for the testing of the hypotheses and for the interpretation of the empirical results.

3. Results

3.1 Sample Characteristics

The final sample consists of 11,000 firm-year observations from 1,000 firms in nine industries and seven geographical regions during the period 2015-2025. The sample was spread out among the industrial sectors, thereby minimizing sector bias and improving the representativeness of results. Healthcare (12.1% of the observations) and Manufacturing and Transportation (11.7% of the observations) were the largest industry groups. It was the smallest group of observations in the technology companies (9.5%). The geographical distribution was also quite even with the biggest share of observations from Asia (15.2%) followed by Oceania (15.1%) and the Middle East (14.7%). The uniform distribution of industries and regions demonstrates that the dataset covers a wide range of organizational and environmental settings.

Table 1. Sample Characteristics of the Study Sample

Panel A: Industry Distribution	Frequency	Percentage (%)
Healthcare	1331	12.1
Manufacturing	1287	11.7
Transportation	1287	11.7
Consumer Goods	1276	11.6
Finance	1243	11.3

Energy	1188	10.8
Utilities	1177	10.7
Retail	1166	10.6
Technology	1045	9.5

Panel B: Regional Distribution	Frequency	Percentage (%)
Asia	1672	15.2
Oceania	1661	15.1
Middle East	1617	14.7
Europe	1540	14.0
North America	1540	14.0
Latin America	1507	13.7
Africa	1463	13.3

3.2 Descriptive Statistics

Table 2 presents descriptive statistics of the study variables. The average revenue was 4,670.85 and the mean market capitalization was 13,380.62, which suggests that there were significant differences in the size of the firms and in their market value. The average profit margin was 10.90% and the average growth rate was 4.83%. In terms of sustainability performance, the ESG Overall's average score was 54.62. Of the ESG

dimensions, Environmental scored highest on average (56.42), followed by Social (55.66) and Governance (51.77). The environmental indicators demonstrated a significant variation of firms, especially on the carbon emissions, water consumption and energy usage, showing major differences on the use of environmental resources and sustainability practices.

Table 2. Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Median	Max
Revenue	4670.85	9969.95	35.90	1902.30	180810.40
Profit Margin	10.90	8.76	-20.00	10.50	50.00
Market Capitalization	13380.62	39922.87	1.80	3096.45	865271.70
Growth Rate	4.83	9.42	-36.00	4.90	38.00
ESG Overall	54.62	15.89	6.30	54.60	98.80
ESG Environmental	56.42	26.77	0.00	55.60	100.00
ESG Social	55.66	23.36	0.00	55.15	100.00
ESG Governance	51.77	25.32	0.00	52.10	100.00
Carbon Emissions	1,271,462.35	5,067,760.30	2,042.20	292,073.45	174,104,700.00

Water Usage	560,044.15	1,565,686.22	1,021.10	203,880.45	52,231,420.00
Energy Consumption	11,658,393.75	50,958,356.02	5,105.50	1,221,745.45	1,741,047,000.00

Figure 1 further illustrates the average ESG dimension scores. Environmental ESG recorded the highest mean value, indicating that firms

demonstrated comparatively stronger environmental sustainability initiatives than governance-related practices.

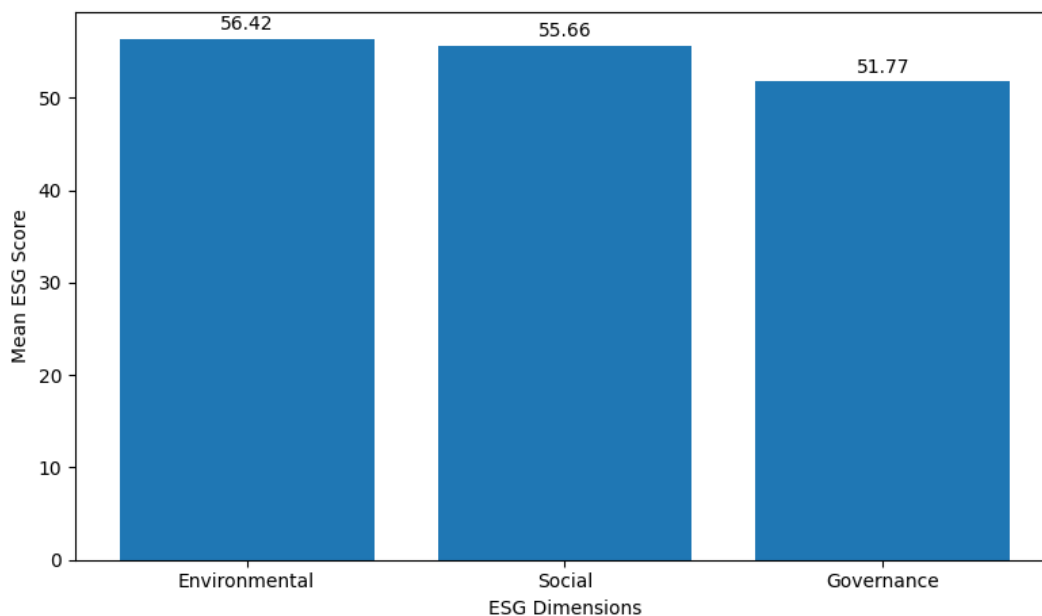


Figure 1. Average ESG Dimension Scores

3.3 Correlation Analysis

Table 3 presents Pearson correlation coefficients of the study variables. The market capitalization was strongly positively associated with revenue ($r = 0.837$), which is an indication that larger firms tended to command higher market valuations. ESG Environmental was positively correlated with revenue ($r=0.207$), profit margin ($r=0.219$) and market capitalization ($r=0.215$). Moreover, ESG

was negatively associated with carbon emissions ($r = -0.152$), water usage ($r = -0.168$) and energy consumption ($r = -0.158$), which suggested that better environmental sustainability practices led to better environmental outcomes of the firms. The environmental resource indicators were strongly correlated with each other, especially carbon emissions and energy consumption ($r = 0.997$), supporting the development of a composite Environmental Performance Index.

Table 3. Correlation Matrix (Selected Relationships)

Variables	Correlation Coefficient
Revenue – MarketCap	0.837
ESG Environmental – Revenue	0.207
ESG Environmental – Profit Margin	0.219
ESG Environmental – MarketCap	0.215
ESG Environmental – Carbon Emissions	-0.152

ESG Environmental – Water Usage	-0.168
ESG Environmental – Energy Consumption	-0.158
Carbon Emissions – Water Usage	0.969
Carbon Emissions – Energy Consumption	0.997
Water Usage – Energy Consumption	0.975

3.4 Multicollinearity Assessment

Prior to the regression analysis, the Variance Inflation Factor (VIF) analysis was performed to test for multicollinearity. The values of VIF (Table 4) are within the acceptable limits. The highest

VIF value was obtained for ESG Social (5.611), while the lowest value was observed for Growth Rate (1.300). The results indicate that multicollinearity was not a major problem and all explanatory variables could be retained in the regression models.

Table 4. Variance Inflation Factor (VIF) Results

Variable	VIF
ESG Environmental	4.583
ESG Social	5.611
ESG Governance	4.854
Revenue	1.309
Profit Margin	2.480
Growth Rate	1.300

3.5 Environmental Performance Regression Analysis

For the environmental sustainability outcomes, an Environmental Performance Index was developed based on standardized and reverse-coded measures of carbon emissions, water use, and energy use to examine the effect of ESG integration. The results of the regression are displayed in Table 5. The model was statistically significant ($F = 861.589$, $p < 0.001$) and explained 34.1% of the variation in environmental performance ($R^2 = 0.341$). ESG Environmental

had the highest positive regression coefficient ($\beta = 0.0105$, $p < 0.001$) for environmental performance. This means that firms with stronger environmental sustainability practices had better environmental performance. Profit Margin was also positively related ($\beta = 0.0025$, $p = 0.009$). However, ESG Governance ($\beta = -0.0022$, $p < 0.001$), Revenue ($\beta = -0.0001$, $p < 0.001$) and Growth Rate ($\beta = -0.0026$, $p = 0.004$) had significant negative effects. The correlation between ESG Social and environmental performance was not statistically significant.

Table 5. Regression Results for Environmental Performance

Variable	Coefficient	p-value
ESG Environmental	0.0105	0.000
ESG Social	0.0004	0.272

ESG Governance	-0.0022	0.000
Revenue	-0.0001	0.000
Profit Margin	0.0025	0.009
Growth Rate	-0.0026	0.004

Model Statistics	Value
R²	0.341
Adjusted R²	0.341
F-statistic	861.589
p-value	<0.001

Figure 2 visually confirms the positive association between ESG and environmental performance outcomes.

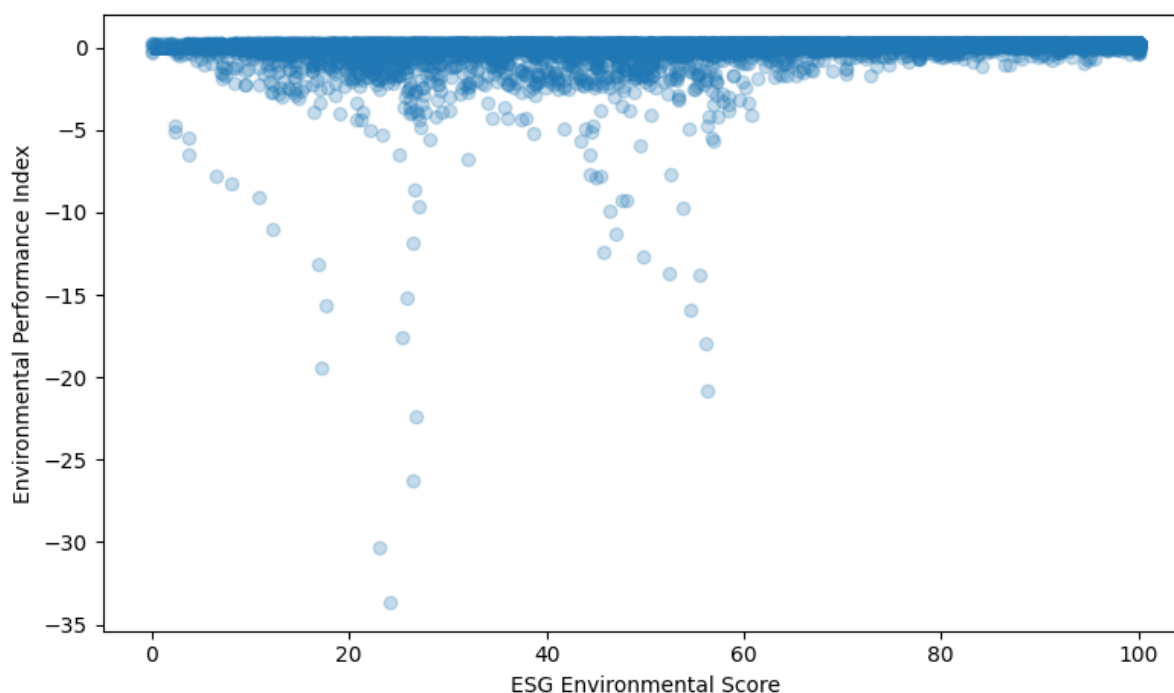


Figure 2. Relationship between ESG Environmental Score and Environmental Performance

3.6 Organizational Performance Regression Analysis

The second regression model was used to analyze the effect of ESG dimensions on organizational performance, where market capitalization was the dependent variable. The model was statistically significant ($F = 4320.922$, $p < 0.001$) and explained 72.2% of the variation in market capitalization ($R^2 = 0.722$), indicating that it has strong explanatory power. Environmental ESG (β

$= 22.2568$, $p = 0.009$) was shown to significantly improve organizational performance, indicating that firms with higher levels of environmental sustainability practices tend to have higher market valuations. Revenue ($\beta = 3.2547$, $p < 0.001$) and Profit Margin ($\beta = 689.9201$, $p < 0.001$) also indicated strong positive effects. Whereas, Growth Rate had a significant negative association with the market capitalization ($\beta = -65.1976$, $p = 0.005$). The Social and Governance dimensions of ESG

did not show statistically significant effects.

Table 6. Regression Results for Organizational Performance

Variable	Coefficient	p-value
ESG Environmental	22.2568	0.009
ESG Social	14.5137	0.135
ESG Governance	-6.5134	0.467
Revenue	3.2547	0.000
Profit Margin	689.9201	0.000
Growth Rate	-65.1976	0.005

Model Statistics	Value
R ²	0.722
Adjusted R ²	0.722
F-statistic	4320.922
p-value	<0.001

Figure 3 illustrates the positive relationship between ESG scores and market capitalization. The upward trend in the figure confirms the

results of the regression and shows the strategic importance of environmental sustainability in enhancing the organizational value.

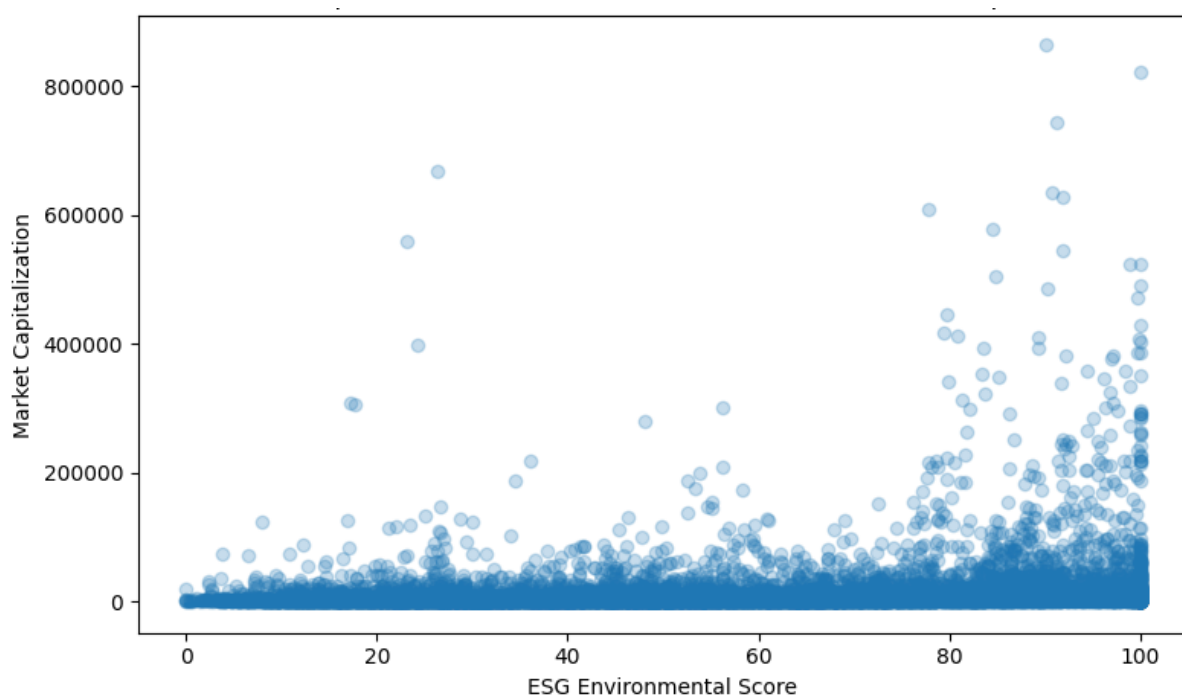


Figure 3. Relationship between ESG Environmental Score and Market Capitalization

4. Discussion

This research provides valuable insights into the potential benefits of integrating ESG for improving environmental and organisational performance. The results indicated that the environmental aspect of ESG was the most powerful sustainability factor, with significant positive effects on environmental performance and market capitalization. These results indicate that companies with an emphasis on environmental sustainability initiatives are more likely to generate better environmental results and also boost the market value. This fits with an emerging view that environmental sustainability has progressed beyond compliance to become a strategic business activity that can create ecological and economic value.

The results for the ESG Environmental scores are positively correlated with the EPI, indicating that companies with stronger environmental scores are more likely to be less resource-intensive and less harmful to the environment. As environmental factors – carbon, water and energy – were the basis for developing the Environmental Performance Index, the conclusions provide empirical evidence that environmental ESG activities lead to improved environmental results. This is consistent with previous research that has highlighted the importance of incorporating ESG data into business processes to enhance sustainability performance and enhance risk management capabilities (Kalyanam, 2024). The results thus indicate the need for environmental sustainability to be integrated into the organisation's strategy and not just as an activity of corporate responsibility.

Additionally, the study revealed that market capitalization of the organisation was positively influenced by the environmental ESG performance. This result suggests that investors are becoming more aware of the importance of environmentally friendly business practices and reward companies that exhibit a higher degree of environmental commitment. The positive correlation between environmental sustainability and market value supports previous arguments positing that ESG-focused strategies are capable of improving organizational resilience,

competitiveness and long-term value creation (Leogrande, 2024). Therefore, environmental sustainability appears to provide both operational and financial benefits, thus being an important part of the modern business strategy. Another important implication of the findings pertains to the integration of ESG principles into operational and supply chain systems. The positive environmental outcomes in the present study support the idea that organizations can enhance sustainability performance through systematic integration of ESG principles into business processes. Previous studies have highlighted the importance of green supply chain management and ESG-based operational frameworks to enhance resource efficiency and reduce environmental risks (Yang, 2024).

Our results add to this understanding and demonstrate that environmental ESG performance is associated with tangible improvements in environmental performance for a wide set of firms. The results also contribute to the increasing discussion on the role of artificial intelligence in sustainability management. Although the variables related to AI are not directly measured in the dataset, this study conceptual framework suggests that AI can play an effective role to improve ESG implementation and sustainability reporting as an enabler mechanism. The studies have demonstrated that using AI and sustainability reporting fosters transparency, stakeholder engagement, and sustainability assessment processes (Mustafa et al., 2025). Thus, the positive effect of environmental ESG as revealed in this research indirectly contributes to implementation of AI-based systems to improve sustainability monitoring and decision making. The results also highlight the broader importance of integrating ESG for public health resilience and sustainable health systems. Increasing links between environment, sustainability and public health and long-term social wellbeing. Furthermore, sustainable organizational practices can contribute to establishing more resilient social systems, which lessen environmental pressures and promote responsible resource management. This

interpretative perspective aligns with the findings of researchers that have emphasized the need for ESG integration and digital transformation in the creation of sustainable healthcare models and enhancing resilience to future environmental and societal pressures (Sepetis et al., 2024). An interesting finding of the study was that social did not have a significant impact on either environment or organization. Similarly, there was a negative relationship with governance and environmental performance and no significant relationship between governance and organizational performance.

These results indicate that the impacts of the ESG dimensions differ for the concrete sustainability outcomes. Environmental activities seem to have more short-term and visible impacts than social or governance activities, especially in terms of environmental efficiency and market valuation. Finally, the negative effects of revenue and growth rate on environmental performance suggest that bigger and growing firms might face more environmental stress due to more complicated operations and resource use. The results indicate that there is a need for balancing economic growth and environmental responsibility. In this context, artificial intelligence can be an important tool to support climate resilience, resource optimization and sustainable development goals. The potential of AI-enabled solutions to enhance climate resilience and support environmental decision-making has been highlighted in the existing literature (Jaiswal, 2025). The findings support the proposed strategic framework by providing evidence that the integration of environmental ESG is an important pathway for organizations to enhance environmental performance, increase organizational value, and move toward sustainability and resilience goals.

5. Conclusion

The study examined the relationships among ESG integration, environmental performance, and organizational performance in the context of artificial intelligence, public health resilience, and sustainable management practices. We studied

11,000 firm-year observations across industries and regions, and found that the environmental dimension of ESG was the strongest sustainability factor, with a significant impact on both environmental performance and market capitalization. The results indicate that firms with better environmental sustainability practices have better environmental performance for lower resource use and higher environmental efficiency and better organizational value and market competitiveness. On the other hand, the social dimension did not significantly affect environmental or organizational performance. Governance had a negative relationship with environmental performance and no significant effect on market capitalization. These results suggest that the ESG dimensions have different contributions to sustainability outcomes. The study also found that revenue and growth rate had negative effects on environmental performance, showing the environmental pressures connected with organizational expansion, whereas revenue and profit margin had positive effects on organizational performance. These findings provide support for the development of a strategic framework, where artificial intelligence serves as an enabling mechanism for ESG implementation, sustainability reporting, environmental monitoring, and data-driven decision-making, thus enhancing environmental stewardship, organizational resilience, and long-term value creation. This study makes a contribution to the sustainability literature by providing empirical evidence that environmental ESG integration is an important pathway through which organizations can improve environmental performance and organizational success while supporting broader objectives related to public health resilience and sustainable development. Therefore, managers and policymakers should focus on environmental sustainability initiatives and use digital technologies to improve ESG integration, sustainability governance and resilience-oriented management practices to confront emerging environmental and social challenges.

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