

ESG integration in supply chain management and firm performance: Evidence from pharmaceutical and electronics firms in India

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Abstract

Environmental, social, and governance (ESG) principles provide a structured framework for enhancing corporate accountability and long term value creation, and as significant ESG risks increasingly arise within supply chains, integrating ESG into supply chain management (SCM) has become essential. This study examines the impact of ESG integration in SCM on firm performance, focusing on return on equity (ROE) and revenue growth among top pharmaceutical and electronics firms in India. Much of the existing literature remains conceptual, lacks a holistic approach to ESG, and offers limited evidence from emerging economies such as India. This study addresses these gaps through an empirical, quantitative research design based on secondary data. A sample of ten firms over five years was selected using purposive sampling, yielding fifty firm year observations. ESG scores were drawn from the Refinitiv database, while financial data were obtained from the Prowess IQ database, with ESG score treated as the independent variable and ROE and revenue growth as the dependent variables. Descriptive statistics, correlation, and regression analysis were conducted using SPSS. The results reveal moderate average ESG adoption (mean score of 63.72), a strong positive correlation between ESG and ROE (r equals 0.670, p less than 0.01), and a moderate positive correlation between ESG and revenue growth (r equals 0.341, p less than 0.05). Regression results confirm that ESG scores significantly predict firm performance, explaining 44.9 percent of the variance in ROE and 11.6 percent of the variance in revenue growth. These findings indicate that ESG integration in SCM meaningfully improves firm performance, particularly profitability, by enhancing operational efficiency, governance, and risk management. The study underscores the strategic importance of ESG driven supply chain practices for sustainable firm performance in India and offers implications for managers and policymakers seeking to promote ESG oriented supply chain strategies.

Keywords: ESG Integration, Supply Chain Management, Firm Performance, Return on Equity, Revenue Growth, India

JEL Classification: G32, M14, Q56

1. Introduction

In recent years, sustainability has been a major concern for businesses worldwide due to increasing environmental problems, social inequalities, and regulatory and stakeholder pressure. Organisations are expected to balance environmental, social, and governance (ESG) factors to achieve long-term value creation. Recent academic literature emphasises that sustainability is no longer peripheral but is deeply embedded in organisational value creation and long-term competitiveness, particularly within complex supply chain networks (Darren et al., 2025). In this context, ESG principles have emerged as a framework for guiding corporate responsibility and enhancing firm performance, providing organisations with a structured process to assess environmental, social, and governance responsibilities. Reviewed studies highlight that ESG adoption enhances transparency, improves risk management, and supports strategic alignment between sustainability objectives and operational performance (Alvarez-Rodríguez et al., 2023; Stan et al., 2023). As firms rely on globalised and multi-tier supply chains, the integration of ESG into SCM has gained major importance. Supply chains are primary sources of ESG performance outcomes, including environmental emissions, labour-related challenges, and governance risks, making them central to sustainability efforts (Echchakoui et al., 2024). Darren et al. (2025) note that ESG risks often originate within supplier networks, necessitating a supply chain-wide approach rather than isolated firm-level initiatives. An emerging stream of research has examined the relationship between ESG-integrated supply chain practices and firm performance. The literature indicates that firms implementing ESG-oriented supply chain strategies experience improvements in operational efficiency, supply chain resilience, and organisational legitimacy (Alvarez-Rodríguez et al., 2023; Echchakoui et al., 2024). A positive association exists between ESG integration in supply chain processes, financial performance, cost reduction, and enhanced stakeholder trust (Stan et al., 2023). Despite these insights, the literature has certain limitations. Several studies remain conceptual or review-based, highlighting the need for empirical validation of ESG–SCM frameworks (Darren et al., 2025). The impact of individual ESG dimensions within supply chains on firm performance remains underexplored (Echchakoui et al., 2024), and there is a lack of context-specific evidence from emerging economies such as India (Alvarez-Rodríguez et al., 2023). In response to these gaps, this study examines the integration of ESG in SCM and its impact on firm performance, focusing on top pharmaceutical and electronics firms in India. The study provides empirical evidence using secondary data and compares ESG–performance relationships across sectors, contributing to both academic understanding and managerial decision-making.

2. Literature Review

In recent years, sustainability has emerged as a critical concern for organisations across sectors due to increasing environmental, social, and governance-related risks. ESG principles have gained major importance as a comprehensive framework for assessing organisational sustainability and

long-term value creation (Paul, 2025; Heeb, Kellers & Kölbel, 2020). Initially associated with large multinational corporations, ESG integration has become relevant to firms of all sizes because of its strategic importance in global supply chains. ESG encompasses three interrelated dimensions: environmental responsibilities, social accountability, and governance effectiveness. The environmental dimension focuses on energy efficiency, carbon emissions, waste management, and resource conservation. The social dimension addresses labour standards, occupational health and safety, ethical sourcing, and community engagement. The governance dimension encompasses ethical conduct, accountability, and compliance mechanisms (Esan et al., 2024). Prior studies suggest that firms adopting ESG practices are better positioned to manage risk, improve reputation, and achieve sustainable growth (Cek & Ercantan, 2023). Supply chain management (SCM) plays an important role in the implementation of ESG, as many environmental and social impacts originate beyond the firm's boundary. Supply chain activities—sourcing, procurement, production, logistics, and distribution—directly influence sustainability outcomes. Researchers highlight that ethical labour practices, environmental pollution, and governance failures often occur within supplier networks rather than inside firms themselves (Garefalakis et al., 2021). Integrating ESG principles into SCM has therefore become a strategic necessity. Sustainable procurement practices play a key role in improving ESG performance by prioritising responsible sourcing, supplier evaluation, and ethical purchasing decisions (Mutio & Machoka, 2025). Furthermore, ESG awareness within organisations significantly influences the adoption of green supply chain practices (Park & Kang, 2025).

Literature on sustainable and ethical SCM identifies transparency, traceability, collaboration, and regulatory compliance as core ESG integration techniques (Esan et al., 2024). Paul (2025) notes that ethical supply chain management following ESG principles improves innovation, value chain performance, and long-term competitiveness. ESG integration also supports the transition to circular supply chains by promoting resource efficiency, waste reduction, and sustainable production (Shaheera Banu & Vimala, 2024). The literature provides evidence that ESG integration in supply chains positively influences firm performance. Hua (2022) demonstrates that ESG performance improves green supply chain management practices, leading to better environmental and operational outcomes. Cek and Ercantan (2023) found that ESG and environmental innovation positively affect financial performance, with ESG acting as a moderating factor that strengthens the impact of sustainable practices on firm value. Governance mechanisms play a major role in translating ESG integration into performance outcomes. Garefalakis et al. (2021) argue that governance-oriented ESG practices reduce fraud and unethical behaviour within supply chains by enhancing transparency and accountability. ESG integration in supply chains has also gained attention for its role in resilience during global disruptions. Kang et al. (2024) found that integrating ESG with supply chain resilience significantly improves firm sustainability during crises, and that ESG initiatives are insufficient unless supported by adaptive

supply chain structures. Dantas and Mendes (2025) similarly report that combining ESG with agile supply chain practices enhances both operational and financial performance.

Technology has emerged as a key enabler of ESG integration in SCM. Digital tools such as AI, blockchain, and data analytics improve ESG monitoring, reporting, and decision-making across the supply chain (Rane et al., 2024; Sattar et al., 2025), enhancing traceability, reducing information asymmetry, and supporting ethical procurement. Despite the growing body of research, several limitations remain. Many studies are conceptual or bibliometric in nature (Angelaki et al., 2025; Paul, 2025), most focus on individual ESG dimensions rather than a holistic assessment (Cek & Ercantan, 2023; Kang et al., 2024), and context-specific empirical evidence from emerging economies like India at the firm level is lacking. This study addresses these gaps by empirically examining the impact of ESG integration in SCM on firm performance. The study has the following objectives:

1. To examine the ESG performance of the top Pharma and Electronics firms in India.
2. To analyse the impact on firm's financial performance of implementing ESG.
3. To compare ESG scores and financial performance of firms across different sectors.

3. Methodology

The study adopts a quantitative research design based on secondary data, employing a descriptive and analytical approach to examine the relationship between ESG integration in SCM and firm performance. The sample comprises 10 firms: the top 5 pharmaceutical sector companies and the top 5 electronics sector companies in India. Data spans five years, yielding 50 observations. Purposive sampling was employed based on revenue rankings and Forbes India magazine listings. The top 5 pharmaceutical firms are Sun Pharma, Divi's Laboratories, Torrent Pharma, Mankind Pharma, and Dr. Reddy's Laboratories. The top 5 electronics firms are BEL, Dixon Technologies, Havells India, Voltas, and Crompton Greaves. Secondary data were collected from the Prowess IQ database (financial data) and the Refinitiv ESG database (ESG scores). The ESG score is the independent variable; ROE (Return on Equity) and revenue growth are the dependent variables.

3.1 Hypotheses of the Study

H₀₁: ESG score has no significant impact on the performance of firms.

H₁₁: ESG score has a significant impact on the performance of firms.

H₀₂: There is no significant impact of ESG score on ROE and revenue growth.

H₁₂: There is a significant impact of ESG score on ROE and revenue growth.

3.2 Data Analysis Tools

The following statistical techniques were used in SPSS: (1) Descriptive statistics, to summarise ESG scores and financial performance indicators; (2) Correlation analysis, to examine the

relationship between ESG and firm performance; and (3) Regression analysis, to measure the impact of ESG on ROE and revenue growth.

4. Data Analysis and Results

4.1 Descriptive Statistics

The sample comprises 50 observations ($N = 50$) for all variables. The descriptive statistics are presented in Table 1.

Table 1. Descriptive Statistics ($N = 50$)

	Minimum	Maximum	Mean	Std. Deviation
ESG Score	57.6	73.5	63.720	3.2978
ROE (%)	25.0	40.0	32.418	7.7986
Revenue Growth (%)	5.0	27.4	13.998	5.4273

The mean ESG score is 63.72 (range: 57.6–73.5; $SD = 3.29$), indicating a moderate to relatively strong level of ESG integration within supply chain operations. The mean ROE is 32.418 (range: 25.0–40.0; $SD = 7.7986$), indicating noticeable variability in profitability across firms. Revenue growth ranges from 5.0 to 27.4 (mean = 13.998; $SD = 5.43$), reflecting moderate growth. Overall, the descriptive statistics indicate that firms demonstrate moderate ESG adoption and varying financial performance, making them suitable for examining the ESG–firm performance relationship.

4.2 Correlation Analysis

Pearson correlation analysis was conducted to explore relationships between ESG scores and firm performance indicators. Results are presented in Table 2.

Table 2. Correlation Analysis Results

Variable Pair	r value	p value
ESG Score → ROE	0.670	< 0.01
ESG Score → Revenue Growth	0.341	< 0.05

ROE → Revenue Growth	0.608	< 0.01
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ESG score and ROE show a strong positive correlation ($r = 0.670$, $p < 0.01$), indicating that firms with higher ESG integration tend to exhibit higher profitability. ESG score and revenue growth also show a statistically significant positive correlation ($r = 0.341$, $p < 0.05$), though the relationship is moderate. ROE and revenue growth show a strong positive correlation ($r = 0.608$, $p < 0.01$). The stronger correlation between ESG and ROE compared to revenue growth suggests that ESG practices have a more direct impact on operational efficiency than on top-line expansion, providing preliminary support for the research hypotheses.

4.3 Regression Analysis

Regression analysis was conducted with ESG score as the independent variable and revenue growth and ROE as dependent variables. Results are presented in Table 3.

Table 3. Regression Analysis: Impact of ESG Score on Revenue Growth and ROE

Statistic	Revenue Growth	Return on Equity (ROE)
R	0.341	0.670
R ²	0.116	0.449
Adjusted R ²	0.098	0.438
Standard Error	5.1551	5.6239
F-statistic	6.312	39.112
B (Unstandardised)	0.561	1.524
β (Standardised)	0.223	0.244
Significance (p)	0.015	0.000

For revenue growth, $R = 0.341$ and $R^2 = 0.116$, indicating that ESG score explains 11.6% of variance in revenue growth. The F-statistic of 6.312 ($p = 0.015$) confirms model significance. The unstandardised coefficient $B = 0.561$ indicates that a one-unit increase in ESG score is associated with a 0.561-unit increase in revenue growth.

For ROE, $R = 0.670$ and $R^2 = 0.449$, indicating that ESG score explains 44.9% of variance in ROE. The F-statistic of 39.112 ($p = 0.000$) confirms high model significance. The unstandardised coefficient $B = 1.524$ indicates that a one-unit increase in ESG score is associated with a 1.524-unit increase in ROE, reflecting a strong positive relationship between ESG integration and firm profitability. Since p-values for both models are below 0.05, the null hypotheses H_{01} and H_{02} are rejected and the alternative hypotheses H_{11} and H_{12} are accepted, confirming that ESG scores have a significant impact on both ROE and revenue growth, with a notably stronger effect on profitability.

4.4 Discussion

The findings demonstrate that ESG integration in supply chain management positively and significantly impacts firm performance among top pharmaceutical and electronics firms in India. The strong relationship between ESG scores and ROE ($r = 0.670$; $R^2 = 0.449$) indicates that firms with higher ESG integration achieve substantially better profitability. This aligns with Cek and Ercantan (2023), who reported that ESG practices and environmental innovation positively affect financial performance, and with Hua (2022), who demonstrated improvements in operational outcomes through green supply chain management. The moderate but significant relationship between ESG scores and revenue growth ($r = 0.341$; $R^2 = 0.116$) suggests that ESG integration supports top-line expansion, but its more immediate impact is on operational efficiency and profitability. This is consistent with the argument that ESG practices reduce costs, enhance governance, and minimise supply chain risks, thereby strengthening profit margins before translating into revenue growth (Stan et al., 2023). The stronger influence of ESG on ROE underscores the role of governance and operational efficiency in converting ESG investments into financial returns. Garefalakis et al. (2021) similarly highlighted that governance-oriented ESG practices reduce fraud and enhance transparency in supply chains, directly contributing to improved financial outcomes. These findings also support Kang et al. (2024), who argued that ESG integration enhances resilience and sustainability during disruptions, leading to more stable long-term performance. The moderate mean ESG scores (63.72) suggest considerable room for further ESG adoption among Indian firms, and that firms proactively investing in ESG-oriented supply chain strategies stand to gain a competitive advantage—particularly as ESG regulatory frameworks and investor expectations are increasingly shaping business strategy in India.

5. Conclusion, Implications, Future Research Directions

This study provides empirical evidence that ESG integration in supply chain management significantly enhances firm performance among top pharmaceutical and electronics firms in India. ESG scores explain 44.9% of the variance in ROE and 11.6% of the variance in revenue growth, confirming that ESG practices are valuable strategic tools for improving both profitability and growth. The stronger influence on ROE highlights the role of ESG in improving operational efficiency, governance, and risk management, while its moderate influence on revenue growth

points to its contribution to long-term value creation. The study contributes to the limited empirical literature on ESG–SCM relationships in emerging economies, addressing gaps identified in prior reviews (Darren et al., 2025; Echchakoui et al., 2024). The findings have important implications for managers, highlighting the strategic value of ESG-driven supply chain practices for sustainable and competitive performance in the Indian context. Policymakers and regulators may also use these insights to design ESG disclosure frameworks that incentivise firms to adopt comprehensive ESG-oriented supply chain strategies. Future research could extend this study by incorporating larger samples across multiple sectors, examining individual ESG dimensions (environmental, social, governance) separately, and employing longitudinal designs to capture the dynamic relationship between ESG integration and firm performance over time.

Acknowledgement

The authors sincerely thank RV Institute of Management, Bengaluru, for providing the academic platform, institutional support, and research resources that facilitated the successful completion of this study.

The authors place on records their deepest gratitude to Dr. Tamizharasi, Professor, RV Institute of Management, Bengaluru, for her exceptional guidance, scholarly mentorship, and continuous encouragement throughout this research. Her expertise, constructive feedback, and unwavering dedication have been the cornerstone of this work.

The authors are grateful to the management and faculty of RV Institute of Management for their constant support and for fostering a research-oriented academic environment.

The authors also wish to acknowledge the Refinitiv ESG Database and Prowess IQ Database for providing the secondary data that formed the empirical foundation of this study.

The authors express their deepest appreciation to their parents and family members for their unconditional love, patience, and moral support throughout the research journey. Their encouragement and sacrifices have been a continuous source of inspiration and strength.

The authors also thank their colleagues and peers for their valuable inputs, stimulating discussions, and encouragement during the course of this research.

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Glossary

Accountability — The obligation of organisations to accept responsibility for their actions and decisions, and to disclose results transparently to stakeholders.

Agile Supply Chain — A supply chain strategy that emphasises flexibility and responsiveness to rapidly changing market conditions and disruptions.

Bibliometric Analysis — A quantitative method used to analyse published academic literature, measuring patterns of publication and citation within a specific field.

Blockchain — A decentralised digital ledger technology that records transactions across multiple systems, enhancing transparency and traceability within supply chains.

Carbon Emissions — The release of carbon dioxide and other greenhouse gases resulting from industrial and business activities, a key indicator under the environmental dimension of ESG.

Circular Supply Chain — A supply chain model that promotes resource efficiency, waste reduction, and reuse or recycling of materials, aligned with ESG principles.

Compliance — The process of adhering to laws, regulations, and ethical guidelines set by regulatory authorities, forming a core component of the governance dimension of ESG.

Corporate Governance — The system of rules, practices, and processes by which a company is directed and controlled, encompassing accountability, transparency, and ethical conduct.

Correlation Analysis — A statistical technique used to measure the strength and direction of the linear relationship between two variables, expressed as a correlation coefficient (r).

Data Analytics — The process of examining and modelling data to discover useful information and support decision-making, increasingly applied in ESG monitoring and reporting.

Dependent Variable — A variable whose value is influenced or predicted by one or more independent variables. In this study, ROE and revenue growth are the dependent variables.

Descriptive Statistics — Statistical methods used to summarise the main features of a dataset, including mean, standard deviation, minimum, and maximum values.

Emerging Economy — A nation with a rapidly developing market economy transitioning towards advanced economic status, such as India.

Environmental Dimension (ESG) — The ESG component that addresses an organisation's impact on the natural environment, including energy efficiency, carbon emissions, waste management, and resource conservation.

ESG (Environmental, Social, and Governance) — A framework used to evaluate an organisation's sustainability and responsibility across three dimensions: environmental, social, and governance.

ESG Integration — The systematic incorporation of environmental, social, and governance criteria into business strategies, operational processes, and supply chain management.

ESG Score — A quantitative rating assigned to a firm based on its performance across ESG dimensions, sourced from specialised databases such as Refinitiv.

Ethical Sourcing — The process of ensuring products and materials are obtained from suppliers adhering to ethical standards, including fair labour practices and environmental responsibility.

F-statistic — A value derived from an ANOVA test in regression analysis, used to assess whether the overall regression model is statistically significant.

Financial Performance — A measure of how effectively a firm generates revenue and manages its assets, typically assessed through indicators such as ROE and revenue growth.

Firm Performance — The overall outcomes achieved by a company, encompassing both financial metrics such as ROE and revenue growth, and non-financial metrics such as reputation and sustainability.

Governance Dimension (ESG) — The ESG component that addresses an organisation's internal systems of control, ethical conduct, board accountability, regulatory compliance, and transparency.

Green Supply Chain Management (GSCM) — The integration of environmentally friendly practices into supply chain management, including green procurement, eco-friendly production, and sustainable logistics.

Independent Variable — A variable observed to determine its effect on a dependent variable. In this study, the ESG score is the independent variable.

Information Asymmetry — A situation in which one party in a transaction possesses more information than another; ESG disclosures help reduce information asymmetry between firms and stakeholders.

Labour Standards — Rules governing working conditions, employee rights, fair wages, and workplace safety, forming a key component of the social dimension of ESG.



Legitimacy — The perceived acceptance and approval of an organisation by its stakeholders, based on alignment with social norms, values, and expectations.

Long-term Value Creation — The process of generating sustained financial and non-financial returns for stakeholders over an extended period, central to ESG-oriented business strategies.

Occupational Health and Safety (OHS) — Policies and practices designed to protect the physical and mental well-being of employees in the workplace, a key aspect of the social dimension of ESG.

Operational Efficiency — The ability of an organisation to deliver products or services in the most cost-effective manner while maintaining high quality and minimising waste.

Procurement — The process of sourcing and acquiring goods and services from external suppliers, a critical function in supply chain management and ESG integration.

Prowess IQ Database — A comprehensive financial database developed by the Centre for Monitoring Indian Economy (CMIE), providing detailed financial and operational data for Indian firms.

Purposive Sampling — A non-probability sampling technique in which subjects are selected based on specific characteristics relevant to the research objectives.

R² (Coefficient of Determination) — A statistical measure in regression analysis representing the proportion of variance in the dependent variable explained by the independent variable(s).

Refinitiv ESG Database — A global financial data platform providing comprehensive ESG scores and ratings for publicly listed companies, used widely in academic and investment research.

Regression Analysis — A statistical method used to examine the relationship between independent and dependent variables and to predict the value of the dependent variable.

Resilience (Supply Chain) — The capacity of a supply chain to anticipate, respond to, and recover from disruptions while maintaining continuity of operations and performance.

Return on Equity (ROE) — A financial performance indicator measuring net income generated as a percentage of shareholders' equity, reflecting profitability and management effectiveness.

Revenue Growth — The percentage increase in a firm's total revenue over a specified period, used as an indicator of business expansion and market performance.

Risk Management — The process of identifying, assessing, and mitigating potential risks that could adversely affect an organisation's operations, finances, or reputation.

Secondary Data — Data previously collected and recorded by another party, subsequently used by researchers for further analysis.

Social Dimension (ESG) — The ESG component that addresses an organisation's relationships with employees, suppliers, customers, and communities, including labour standards and human rights.

SPSS (Statistical Package for the Social Sciences) — A widely used software platform for statistical analysis and data management in social science and business research.

Stakeholder — Any individual, group, or organisation that has an interest in or is affected by the activities and decisions of a firm, including investors, employees, customers, and communities.

Supply Chain Management (SCM) — The coordination and management of interconnected businesses involved in providing products and services to end consumers, encompassing sourcing, production, logistics, and distribution.

Sustainability — The ability of an organisation to operate in a manner that meets present needs without compromising future generations, integrating environmental, social, and economic considerations.

Traceability — The ability to track and verify the history and movement of products and materials throughout the supply chain, essential for ESG transparency and accountability.

Transparency — The practice of openly sharing information about an organisation's operations and performance with stakeholders, a fundamental principle of ESG governance.

Unstandardised Coefficient (B) — In regression analysis, the value representing the change in the dependent variable for a one-unit change in the independent variable, in original units of measurement.

Waste Management — The systematic collection, processing, and disposal of waste materials generated by business operations, a key focus area within the environmental dimension of ESG.