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Factors Influencing ESG Implementation among Manufacturing Enterprises in Hanoi

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Abstract

This study aims to identify the factors influencing ESG implementation among manufacturing firms in Hanoi, Vietnam. Based on the Technology–Organization–Environment (TOE) framework, Institutional Theory, and Stakeholder Theory, the study proposes a research model comprising five determinants: digital capability, top management commitment, financial resources, regulatory pressure, and customer pressure. Data were collected from 248 manufacturing firms and analyzed using IBM SPSS Statistics 26. The results indicate that all five factors have

significant positive effects on ESG implementation. Among them, top management commitment exerts the strongest influence, followed by regulatory pressure, digital capability, customer pressure, and financial resources. The findings contribute to the growing body of empirical evidence on the determinants of ESG implementation in emerging economies and provide practical implications for manufacturing firms and policymakers in promoting sustainable development.

Keywords: ESG Implementation, Technology-Organization-Environment (TOE), Manufacturing Firms, Sustainable Development, Vietnam

1. Introduction

Climate change has emerged as one of the most critical challenges to the sustainable development of the global economy. Extreme weather events, including heatwaves, wildfires, floods, and droughts, have become increasingly frequent and severe due to greenhouse gas emissions generated by human activities, particularly industrialization and the extensive use of fossil fuels (IPCC, 2023; World Meteorological Organization, 2025) [25, 60]. These changes not only cause significant environmental and social damage but also pose substantial risks to business operations, including supply chain disruptions, rising operating costs, reduced organizational resilience, and weakened competitiveness (World Bank Group, 2022; World Economic Forum, 2025) [58, 59]. At the same time, environmental pollution, natural resource depletion, and biodiversity loss have intensified worldwide, creating an urgent need to transition toward more sustainable development models (Food and Agriculture Organization of the United Nations, 2020; Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2019; United Nations Environment Programme, 2024) [16, 24, 52].

Against this backdrop, Environmental, Social, and Governance (ESG) has emerged as a crucial management framework for assessing and promoting corporate sustainability through environmental, social, and governance dimensions (United Nations Principles for Responsible Investment, 2006) [53]. Unlike the traditional approach that primarily emphasizes financial performance, ESG enables firms to manage non-financial risks, enhance transparency, meet stakeholders' expectations, and create long-term value (Alhoussari, 2025; Martiny *et al.*, 2024; Yoo, 2025) [3, 36, 62]. A growing body of research further suggests that effective ESG implementation can improve organizational performance, reduce the cost of capital, strengthen corporate reputation, foster innovation, and enhance firms' resilience to an increasingly uncertain business environment (Aich *et al.*, 2021; Bebic *et al.*, 2025; Friede *et al.*, 2015; Yao *et al.*, 2025) [1, 6, 18, 61].

In Vietnam, ESG implementation has become increasingly imperative as the Government actively promotes the National Green Growth Strategy for 2021–2030, with a vision to 2050, the National Climate Change Strategy to 2050, the Law on Environmental Protection 2020, and Decree No. 06/2022/ND-CP on greenhouse gas emission reduction and the development of the domestic carbon market, all of which support the country's commitment to achieving net-zero emissions by 2050 (Government of Vietnam, 2022; National Assembly, 2020; Prime Minister, 2021, 2022a, 2022b) [20, 38, 43, 44, 45]. Furthermore,

Vietnamese enterprises, particularly manufacturing and export-oriented firms, are facing growing pressure from European Union regulations such as the Carbon Border Adjustment Mechanism (CBAM), the Corporate Sustainability Reporting Directive (CSRD), and the Corporate Sustainability Due Diligence Directive (CSDDD), which require companies to reduce carbon emissions, improve ESG disclosure, and fulfill sustainability responsibilities throughout their supply chains (European Parliament & Council of the European Union, 2022, 2023, 2024) [13, 14, 15]. Under these circumstances, green transformation and ESG implementation have become not only regulatory compliance requirements but also strategic prerequisites for maintaining competitive advantages and integrating more deeply into global value chains (World Bank Group, 2022) [58].

Among Vietnamese localities, Hanoi is one of the country's largest industrial and manufacturing centers, hosting numerous industrial parks, industrial clusters, and manufacturing enterprises operating across various sectors, including mechanical engineering, electronics, textiles and garments, food processing, and supporting industries (Do, 2024; Hanoi Department of Industry and Trade, 2025) [11, 22]. The rapid expansion of the manufacturing sector has made significant contributions to the city's economic growth and export performance while simultaneously increasing the pressure on enterprises to strengthen environmental management, social responsibility, and corporate governance in order to comply with international market standards (Hanoi Department of Industry and Trade, 2025; Vietnam News Agency, 2024) [22, 55]. Nevertheless, despite growing awareness of ESG, the level of ESG implementation among Vietnamese enterprises remains relatively limited, particularly among small and medium-sized enterprises (SMEs), which continue to face considerable constraints in terms of financial resources, managerial capabilities, skilled human resources, and access to green technologies (Nguyen *et al.*, 2024; Organisation for Economic Co-operation and Development, 2021; World Bank Group, 2022) [39, 40, 58].

Alongside these practical developments, the existing literature reveals several notable research gaps. First, most ESG studies have focused on examining the impact of ESG on financial performance, firm value, or ESG disclosure, whereas relatively little attention has been paid to ESG implementation as the dependent variable itself—that is, identifying the determinants that drive firms to genuinely implement ESG practices rather than merely disclose ESG-related information (Aldowaiash *et al.*, 2022; Khamisu *et al.*, 2024; Mohaghegh *et al.*, 2026; Rizwanullah *et al.*, 2026) [2, 27, 37, 47]. Second, the majority of empirical studies have been conducted in developed economies, particularly the United States and Europe, while empirical evidence from emerging economies, especially Vietnam, remains limited (Daugaard & Ding, 2022; Gallagher *et al.*, 2026; Kim & Yang, 2026; Lunawat *et al.*, 2025) [9, 19, 28, 33]. Third, studies conducted in Vietnam have primarily concentrated on listed companies or specific sectors such as banking, logistics, and foreign-invested enterprises (FDIs) (Martiny *et al.*, 2024; Phan *et al.*, 2025; Tran *et al.*, 2025) [36, 42, 51], whereas non-listed manufacturing firms, particularly those located in Hanoi, have received relatively little scholarly attention. Finally, although the Technology–Organization–Environment (TOE) framework has been widely applied in studies on

technological innovation, digital transformation, and the adoption of management systems, its application to ESG implementation remains relatively limited. Moreover, existing studies rarely integrate the TOE framework with Institutional Theory and Stakeholder Theory to establish a comprehensive analytical framework that simultaneously captures technological, organizational, and environmental factors, institutional pressures, and stakeholder expectations in explaining ESG implementation. This theoretical gap constitutes the primary focus of the present study.

Motivated by these research gaps, this study aims to identify the determinants of ESG implementation among manufacturing enterprises in Hanoi by employing the Technology–Organization–Environment (TOE) framework (Tornatzky & Fleischer, 1990) [50] as its primary theoretical foundation. In addition, the study incorporates Institutional Theory (DiMaggio & Powell, 1983) [10] to explain the influence of institutional pressures and Stakeholder Theory (Freeman, 1984) [17] to capture the role of stakeholder expectations in encouraging ESG implementation. Specifically, the study pursues three objectives: (1) to identify the technological, organizational, and environmental factors influencing ESG implementation; (2) to examine the magnitude of these effects through an empirical survey of manufacturing enterprises in Hanoi; and (3) to propose managerial and policy implications to facilitate ESG implementation within manufacturing firms.

This study is expected to make both theoretical and practical contributions. From a theoretical perspective, it extends the ESG implementation literature by integrating the Technology–Organization–Environment (TOE) framework, Institutional Theory, and Stakeholder Theory to explain ESG implementation behavior in the context of manufacturing enterprises operating in an emerging economy. From a practical perspective, the findings are expected to provide valuable insights for enterprises in identifying the key drivers of ESG implementation while assisting policymakers in designing appropriate policies and support mechanisms to enhance business competitiveness and promote sustainable development.

2. Hypotheses Development

Technological Context

Digital capability: Digital capability refers to an organization's ability to develop, integrate, and effectively leverage digital technologies to enhance operational performance and adapt to changes in the business environment (Warner & Wäger, 2019) [57]. In the context of ESG implementation, digital capability enables firms to utilize advanced technologies such as artificial intelligence (AI), big data, the Internet of Things (IoT), and cloud computing to collect, process, and manage ESG-related data, thereby improving the monitoring, measurement, and disclosure of environmental, social, and governance information (Lee *et al.*, 2024; Luo *et al.*, 2026; Ren, 2025) [30, 34, 46]. According to the Technology–Organization–Environment (TOE) framework proposed by Tornatzky and Fleischer (1990) [50], the technological context reflects an organization's technological readiness and constitutes one of the key determinants of innovation adoption in managerial practices. Firms with strong digital capabilities are better positioned to integrate ESG practices into their production and management processes while enhancing their capacity to comply with increasingly stringent sustainability

requirements (Gallagher *et al.*, 2026; Lee *et al.*, 2024) [19, 30]. Previous studies have also demonstrated that digital capability facilitates sustainable transformation, improves ESG implementation, and strengthens firms' competitive advantage (Isiaku *et al.*, 2026; Kwan *et al.*, 2026; Lee *et al.*, 2024; Luo *et al.*, 2026; Sun, 2026) [26, 29, 30, 34, 48].

For manufacturing enterprises in Hanoi, possessing strong digital capabilities is expected to facilitate ESG implementation by improving data management, enhancing the monitoring of production activities, and optimizing resource utilization. Accordingly, the following hypothesis is proposed:

H1: *Digital capability has a positive effect on ESG implementation among manufacturing enterprises in Hanoi.*

Organizational Context

Successful ESG implementation requires firms not only to possess an appropriate technological foundation but also to have the necessary internal conditions to support the transformation process. Within the Technology–Organization–Environment (TOE) framework, the organizational context reflects a firm's internal resources and organizational characteristics, including managerial capabilities, leadership support, and the ability to mobilize organizational resources (Tornatzky & Fleischer, 1990) [50]. These factors determine an organization's readiness to integrate ESG into its corporate strategy and operational activities. Accordingly, this study identifies leadership commitment and financial resources as the two key organizational factors representing the organizational context of the TOE framework.

Leadership commitment: Leadership commitment, also referred to as top management commitment, is defined as the extent to which senior management recognizes the importance of implementing an organizational initiative and is willing to provide the vision, resources, and necessary support to ensure its successful implementation (Liang *et al.*, 2007) [31]. In the context of ESG, leadership commitment is reflected in the integration of sustainability objectives into corporate strategy, the allocation of resources, the cultivation of an ESG-oriented organizational culture, and the encouragement of business units to actively engage in ESG-related initiatives (Bebic *et al.*, 2025; Huan & Tung, 2026; Yoo, 2025) [6, 23, 62].

Top management plays a pivotal role in shaping strategic direction and driving organizational change. When senior executives recognize the strategic value of ESG and demonstrate a strong commitment to its implementation, firms are more likely to invest the necessary resources, establish appropriate policies, and motivate employees to participate actively in ESG initiatives (Bebic *et al.*, 2025; Martiny *et al.*, 2024; Paridhi *et al.*, 2024) [6, 36, 41]. Furthermore, under increasing pressure from regulators, investors, and other stakeholders, strong leadership commitment enables firms to respond more effectively to sustainability requirements and strengthens their capacity to implement ESG practices successfully (Gallagher *et al.*, 2026; Isiaku *et al.*, 2026; Liou *et al.*, 2023) [19, 26, 32]. Previous studies have consistently identified leadership commitment as one of the most critical organizational factors facilitating the adoption of innovation and the implementation of sustainable business practices (Liou *et al.*, 2023; Martiny *et al.*, 2024; Paridhi *et al.*, 2024; Yoo,

2025) [32, 36, 41, 62]. Accordingly, the following hypothesis is proposed:

H2: *Leadership commitment has a positive effect on ESG implementation among manufacturing enterprises in Hanoi.*

Financial resources: Financial resources refer to an organization's ability to mobilize and allocate the financial capital necessary to invest in and achieve its strategic objectives (Bourgeois, 1981) [7]. In the context of ESG implementation, financial resources constitute a fundamental prerequisite that enables firms to invest in clean technologies, innovate production processes, establish environmental management systems, develop employee capabilities, and implement systems for collecting, managing, and disclosing ESG-related information (Martiny *et al.*, 2024) [36]. Consequently, a firm's ability to access and allocate financial resources directly influences the scope and extent of its ESG implementation.

Implementing ESG initiatives typically requires substantial upfront investments, whereas the associated economic benefits are generally realized over the medium to long term (Andini & Rachmawati, 2026; Liou *et al.*, 2023; Zulkefli *et al.*, 2025) [4, 32, 65]. Therefore, firms with stronger financial resources are better positioned to invest in sustainability initiatives, comply with environmental, social, and governance requirements, and enhance their ability to adapt to changing market conditions and regulatory frameworks (Aldowaihi *et al.*, 2022; Lunawat *et al.*, 2025) [2, 33]. Conversely, financial constraints may discourage or delay ESG implementation, as firms may lack the capacity to invest in advanced technologies, infrastructure, and programs aimed at improving operational performance (Gallagher *et al.*, 2026; Maerdan *et al.*, 2026; Ren, 2025; Zulkefli *et al.*, 2025) [19, 35, 46, 65].

Previous studies have consistently identified financial resources as one of the key organizational conditions that facilitate the adoption of sustainability initiatives and enhance the level of ESG implementation (Andini & Rachmawati, 2026; Huan & Tung, 2026; Kwan *et al.*, 2026; Yao *et al.*, 2025) [4, 23, 29, 61]. Accordingly, the following hypothesis is proposed:

H3: *Financial resources have a positive effect on ESG implementation among manufacturing enterprises in Hanoi.*

Environmental Context

Regulatory pressure: Regulatory pressure refers to the extent to which firms are influenced by laws, government policies, and mandatory requirements imposed by regulatory authorities, compelling them to adjust their operations in order to comply with legal requirements and achieve organizational legitimacy within the institutional environment (DiMaggio & Powell, 1983; Teo *et al.*, 2003) [10, 49]. In the context of ESG, regulatory pressure is reflected in legal requirements related to environmental protection, greenhouse gas emission reduction, sustainability disclosure, and broader obligations concerning social responsibility and corporate governance (Andini & Rachmawati, 2026; Rizwanullah *et al.*, 2026; Yoo, 2025) [4, 47, 62].

According to Institutional Theory, organizations tend to adapt their behaviors in response to coercive pressures from the institutional environment in order to maintain legitimacy and enhance their long-term survival (DiMaggio & Powell, 1983) [10]. As environmental regulations and sustainability-related legislation become increasingly comprehensive and

rigorously enforced, firms are more likely to proactively integrate ESG principles into their corporate strategies and business operations to comply with regulatory requirements, mitigate legal risks, and strengthen their market reputation (Alhoussari, 2025; Rizwanullah *et al.*, 2026; Yao *et al.*, 2025) [3, 47, 61]. For manufacturing enterprises in Hanoi, such regulatory pressure has intensified due to the implementation of the Law on Environmental Protection 2020, regulations on greenhouse gas emission reduction, and the growing ESG requirements imposed by global supply chains.

Previous studies have consistently identified regulatory pressure as a key external driver encouraging firms to adopt sustainable business practices and enhance the level of ESG implementation (Lee *et al.*, 2024; Maerdan *et al.*, 2026; Sun, 2026; Vargas-Merino & Rios-Lama, 2026) [30, 35, 48, 54]. Accordingly, the following hypothesis is proposed:

H4: *Regulatory pressure has a positive effect on ESG implementation among manufacturing enterprises in Hanoi.*

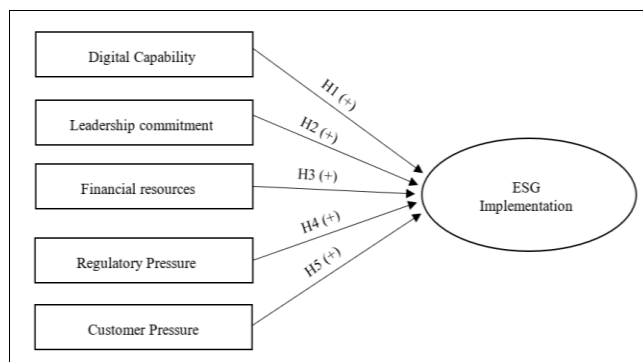
Customer pressure: Customer pressure refers to the extent to which firms are influenced by customers' demands, expectations, and pressures to adopt sustainable business practices, improve environmental performance, and implement ESG initiatives in order to meet evolving market requirements (Zhu *et al.*, 2007) [64]. As market competition intensifies and consumers become increasingly aware of sustainability issues, customers are placing greater emphasis on firms that demonstrate strong commitments to environmental, social, and governance responsibilities (Gallagher *et al.*, 2026; Kwan *et al.*, 2026; Yoo, 2025) [19, 29, 62].

According to Stakeholder Theory, customers are among the most influential stakeholders affecting firms' strategic decisions and business activities (Freeman, 1984) [17]. To satisfy customer expectations, maintain market share, and strengthen competitive advantage, firms are increasingly inclined to integrate ESG principles into their corporate strategies and operational activities (Bebic *et al.*, 2025; Gallagher *et al.*, 2026; Paridhi *et al.*, 2024; Zhang *et al.*, 2020) [6, 19, 41, 63]. This tendency is particularly evident among manufacturing enterprises participating in global supply chains, where international customers increasingly require suppliers to reduce greenhouse gas emissions, ensure product traceability, enhance transparency, and comply with ESG standards as prerequisites for maintaining business relationships and expanding into international markets. Previous studies have consistently identified customer pressure as a significant external driver of sustainable business practices and ESG implementation, as customers can directly influence firms' strategic orientation and investment decisions (Aich *et al.*, 2021; Christmann & Taylor, 2001; Huan & Tung, 2026; Lee *et al.*, 2024; Yao *et al.*, 2025) [1, 8, 23, 30, 61]. Accordingly, it is expected that manufacturing enterprises facing greater customer pressure

will be more likely to actively implement ESG practices. Therefore, the following hypothesis is proposed:

H5: *Customer pressure has a positive effect on ESG implementation among manufacturing enterprises in Hanoi.*

Based on the proposed research hypotheses, the conceptual research model is presented as follows:



Source: Developed by the author

Fig 1: Proposed Research Model

3. Research Methodology

Data Collection and Sampling

The research data were collected through a structured questionnaire survey to test the proposed research model and hypotheses. The target population comprised manufacturing enterprises operating in Hanoi, Vietnam. The respondents were individuals with a comprehensive understanding of their firms' management and operational activities, including business owners, senior executives, middle managers, and personnel responsible for production, environmental management, quality management, or sustainability-related functions. A non-probability sampling approach was employed, combining purposive sampling and snowball sampling to identify and recruit enterprises that met the objectives of the study. The questionnaire was administered through both online and face-to-face channels, with distribution facilitated by business associations, industrial parks, professional networks, and manufacturing enterprises located in Hanoi. Data collection was conducted between April and June 2026. Prior to participating in the survey, all respondents were informed of the purpose of the study and assured that the information they provided would be used solely for academic research purposes and treated with strict confidentiality.

Following data screening and the removal of incomplete and invalid responses, a total of 248 valid questionnaires were retained for subsequent analysis. According to Hair *et al.* (2022) [21], this sample size is adequate for conducting multivariate statistical analyses, including reliability analysis, Exploratory Factor Analysis (EFA), and multiple linear regression. All data were processed and analyzed using IBM SPSS Statistics 26.

Table 1: Characteristics of the Survey Sample

Category	Frequency (n)	Percentage (%)
Position		
Business Owner	42	16,9
Senior Management	60	24,2
Middle Manage	98	39,5
Department Head/Deputy Head	48	19,4
Type of Enterprise		
Limited Liability Company (LLC)	118	47,6
Joint Stock Company	72	29,0
Private Enterprise	30	12,1
Foreign-Invested Enterprise (FDI)	22	8,9
Others	6	2,4
Firm Size		
Fewer than 50 employees	68	27,4
50–199 employees	95	38,3
200–499 employees	47	19,0
500 employees or more	38	15,3
Manufacturing Sector		
Mechanical Engineering	58	23,4
Electronics	47	19,0
Textile and Garment	38	15,3
Food Processing	45	18,1
Others	60	24,2
Years of Operation		
Less than 5 years	32	12,9
5–10 years	67	27,0
11–20 years	88	35,5
More than 20 years	61	24,6

Source: Compiled by the author based on the survey data

Table 1 presents the characteristics of the survey sample. The respondents were predominantly middle managers (39.5%), followed by senior management (24.2%), department heads/deputy heads (19.4%), and business owners (16.9%), indicating that most respondents held managerial positions and possessed substantial knowledge of their firms' operations. Regarding the type of enterprise, limited liability companies (LLCs) accounted for the largest proportion (47.6%), followed by joint stock companies (29.0%). In terms of firm size, enterprises employing 50–199 employees represented the largest group (38.3%), while 65.7% of the sampled firms employed fewer than 200 employees. The sample also covered a wide range of manufacturing sectors, with mechanical engineering (23.4%) and electronics (19.0%) representing the largest proportions. Furthermore, most firms (60.1%) had been in operation for more than ten years, suggesting that the sample largely consisted of relatively established and experienced enterprises. Overall, the survey sample exhibited considerable diversity in terms of enterprise type, firm size, manufacturing sector, and years of operation, thereby enhancing the representativeness of the sample and the reliability of the data for testing the proposed research model.

Measurement Scales

The measurement scales used in this study were adapted from internationally validated instruments that have been widely employed in the fields of management, technological innovation, and sustainable development. The wording of the measurement items was refined to suit the context of manufacturing enterprises in Hanoi while preserving the original content and conceptual meaning of the established scales. Specifically, the Digital Capability scale was adapted

from Lee *et al.* (2024) [30] and Warner and Wäger (2019) [57]; Leadership Commitment was adapted from Banerjee (2003) [5] and Waldman *et al.* (2006) [56]; Financial Resources was adapted from Eiadat *et al.* (2008) [12] and Zhu *et al.* (2007) [64]; Regulatory Pressure was adapted from Teo *et al.* (2003) [49] and Zhu *et al.* (2007) [64]; Customer Pressure was adapted from Zhu *et al.* (2007) [64] and Christmann and Taylor (2001) [8]; and the ESG Implementation scale was adapted and refined from Lee *et al.* (2024) [30]. All constructs were measured using a five-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

Data Analysis

After data collection, the data were screened, cleaned, and processed using IBM SPSS Statistics 26. First, descriptive statistics were employed to summarize the characteristics of the survey sample. Next, the reliability of the measurement scales was assessed using Cronbach's alpha and the Corrected Item–Total Correlation. A Cronbach's alpha coefficient of 0.70 or above and a Corrected Item–Total Correlation greater than 0.30 were considered indicative of acceptable reliability (Hair *et al.*, 2019). Subsequently, Exploratory Factor Analysis (EFA) was conducted to evaluate the convergent and discriminant validity of the measurement scales. The scales were deemed acceptable when the Kaiser–Meyer–Olkin (KMO) measure exceeded 0.50, Bartlett's Test of Sphericity was statistically significant ($p < 0.05$), factor loadings were greater than 0.50, and the Total Variance Explained was at least 50% (Hair *et al.*, 2019). Finally, Pearson correlation analysis and multiple linear regression analysis were performed to test the proposed research hypotheses. A 5% significance level ($p < 0.05$) was adopted throughout the analyses (Hair *et al.*, 2019).

4. Results

Reliability Analysis

Table 2: Reliability Analysis and Descriptive Statistics of the Measurement Scales

Observed Variable	Corrected Item–Total Correlation	Cronbach's Alpha if Item Deleted	Mean	Standard Deviation
<i>1, Digital Capability - Cronbach's Alpha = 0,856</i>				
DC1	0,674	0,828	3,23	1,280
DC2	0,700	0,817	3,26	1,338
DC3	0,704	0,816	3,33	1,348
DC4	0,722	0,808	3,30	1,279
<i>2, Leadership commitment - Cronbach's Alpha = 0,889</i>				
LC1	0,732	0,866	3,21	1,322
LC2	0,748	0,860	3,19	1,311
LC3	0,757	0,857	3,27	1,300
LC4	0,789	0,845	3,19	1,406
<i>3, Financial resources - Cronbach's Alpha = 0,881</i>				
FR1	0,766	0,838	3,38	1,353
FR2	0,717	0,857	3,31	1,252
FR3	0,734	0,850	3,35	1,248
FR4	0,752	0,843	3,34	1,309
<i>4, Regulatory Pressure - Cronbach's Alpha = 0,875</i>				
RP1	0,774	0,823	3,35	1,276
RP2	0,686	0,858	3,28	1,322
RP3	0,725	0,842	3,35	1,267
RP4	0,742	0,836	3,31	1,271
<i>5, Customer Pressure - Cronbach's Alpha = 0,873</i>				
CP1	0,681	0,856	3,18	1,212
CP2	0,738	0,834	3,06	1,321
CP3	0,759	0,825	3,05	1,367
CP4	0,738	0,834	3,13	1,247
<i>6, ESG Implementation - Cronbach's Alpha = 0,874</i>				
ESG1	0,622	0,867	3,41	1,247
ESG2	0,810	0,822	3,40	1,207
ESG3	0,662	0,859	3,45	1,361
ESG4	0,657	0,858	3,48	1,256
ESG5	0,778	0,830	3,37	1,213

Source: Author's analysis

The results of the Cronbach's alpha analysis indicate that all measurement scales demonstrate satisfactory reliability. Specifically, the Cronbach's alpha coefficients ranged from 0.856 to 0.889, exceeding the recommended threshold of 0.70 suggested by Hair *et al.* (2019). Furthermore, the Corrected Item–Total Correlation coefficients for all observed variables were above 0.30, ranging from 0.622 to 0.810, indicating that all items were adequately correlated with their respective constructs. In addition, the Cronbach's alpha if item deleted values for all observed variables were lower than the corresponding overall Cronbach's alpha coefficients, suggesting that none of the items reduced the internal consistency of their respective scales. Therefore, all 25 observed variables were retained for subsequent Exploratory Factor Analysis (EFA).

The mean values of the observed variables ranged from 3.05 to 3.48, indicating that the surveyed firms generally reported moderate to moderately high levels of digital capability, leadership commitment, financial resources, regulatory pressure, customer pressure, and ESG implementation. Among the constructs, ESG Implementation exhibited the highest mean scores (3.37–3.48), whereas Customer

Pressure recorded the lowest mean values (3.05–3.18). These findings suggest that manufacturing enterprises in Hanoi have initiated the implementation of ESG practices; however, the overall level of implementation remains moderate and continues to be substantially influenced by both internal organizational capabilities and external environmental pressures.

Exploratory Factor Analysis

Table 3: Exploratory Factor Analysis Results for the Independent Variables

Observed Variable	Factor				
	1	2	3	4	5
FR4	0,842				
FR1	0,811				
FR3	0,808				
FR2	0,799				
CP2		0,853			
CP3		0,830			
CP4		0,827			
CP1		0,797			
RP1			0,839		
RP4			0,798		
RP2			0,774		
RP3			0,772		
LC2				0,814	
LC4				0,792	
LC3				0,772	
LC1				0,765	
DC3					0,819
DC4					0,793
DC2					0,781
DC1					0,759

KMO = 0,890; Sig = 0,000; Total Variance Explained = 73,272 %; Eigenvalues = 1,342

Source: Author's analysis.

The results of the Exploratory Factor Analysis (EFA) indicate that the data were suitable for factor analysis. The Kaiser–Meyer–Olkin (KMO) measure was 0.890, exceeding the recommended threshold of 0.50, while Bartlett's Test of Sphericity was statistically significant ($p < 0.001$), confirming that the observed variables were sufficiently correlated to justify factor extraction (Hair *et al.*, 2019). The analysis extracted five factors, with the smallest eigenvalue of 1.342, which exceeded the recommended threshold of 1.0. Furthermore, the Total Variance Explained reached 73.272%, surpassing the minimum recommended level of 50%, indicating that the five extracted factors accounted for 73.272% of the total variance in the dataset.

In addition, all observed variables exhibited factor loadings greater than 0.70, ranging from 0.759 to 0.853. Each item loaded strongly on a single factor, with no evidence of cross-loadings. These results demonstrate that the measurement scales possess satisfactory convergent validity and discriminant validity. Accordingly, all 20 observed variables representing the five independent constructs were retained for subsequent Pearson correlation and multiple linear regression analyses.

Regression Analysis and Hypothesis Testing

Table 4: Multiple Linear Regression Results and Hypothesis Testing

Variable	B	Std. Error	Beta	t	Sig.	Tolerance	VIF	Hypothesis
(Constant)	-0,054	0,152		-0,353	0,725			
DC	0,214	0,039	0,229	5,547	0,000	0,696	1,437	Supported
LC	0,270	0,040	0,304	6,743	0,000	0,584	1,714	Supported
FR	0,134	0,037	0,145	3,629	0,000	0,740	1,351	Supported
RP	0,282	0,040	0,301	7,083	0,000	0,657	1,523	Supported
CP	0,167	0,035	0,179	4,732	0,000	0,831	1,203	Supported
$R^2 = 0,713$; R^2 hiệu chỉnh = 0,707; Durbin–Watson = 2,079								

Source: Author's analysis

The results of the multiple linear regression analysis indicate that the proposed model exhibits substantial explanatory power with respect to the dependent variable. Specifically, the model yielded an R^2 of 0.713 and an adjusted R^2 of 0.707, indicating that the five independent variables jointly explain 70.7% of the variance in ESG implementation among manufacturing enterprises in Hanoi, while the remaining 29.3% is attributable to factors not included in the model. The Durbin–Watson statistic was 2.079, which falls within the acceptable range of 1.5 to 2.5, indicating the absence of autocorrelation among the residuals. Furthermore, all Tolerance values exceeded 0.10 (ranging from 0.584 to 0.831), and the Variance Inflation Factor (VIF) values ranged from 1.203 to 1.714, well below the recommended threshold of 5.0, confirming that multicollinearity was not a concern in the regression model (Hair *et al.*, 2019).

The regression results further reveal that all five research hypotheses were supported, as all regression coefficients were positive and statistically significant at the 1% significance level ($p < 0.01$). Among the independent variables, Leadership Commitment exerted the strongest positive effect on ESG implementation ($\beta = 0.304$), followed by Regulatory Pressure ($\beta = 0.301$), Digital Capability ($\beta = 0.229$), Customer Pressure ($\beta = 0.179$), and Financial Resources ($\beta = 0.145$). These findings indicate that ESG implementation among manufacturing enterprises in Hanoi is jointly driven by both internal organizational factors and external environmental pressures, with leadership commitment and regulatory pressure emerging as the most influential determinants.

5. Discussion

The findings reveal that all five determinants—Digital Capability, Leadership Commitment, Financial Resources, Regulatory Pressure, and Customer Pressure—have significant positive effects on ESG implementation among manufacturing enterprises in Hanoi. These results support the Technology–Organization–Environment (TOE) framework and further confirm the explanatory roles of Institutional Theory and Stakeholder Theory in explaining firms' ESG implementation.

Among the determinants, Leadership Commitment has the strongest effect ($\beta = 0.304$), suggesting that ESG implementation is primarily a strategic decision driven by top management. Strong leadership commitment enables firms to integrate sustainability into corporate strategies, allocate resources effectively, and promote organization-wide participation in ESG initiatives. This finding is consistent with the TOE framework and previous studies by Liang *et al.* (2007) [31], Banerjee (2003) [5], Waldman *et al.* (2006) [56], and Lee *et al.* (2024) [30].

Regulatory Pressure is the second most influential factor ($\beta = 0.301$), indicating that environmental regulations and sustainability policies have become key drivers of ESG implementation. Increasing regulatory requirements, together with international frameworks such as CBAM, CSRD, and CSDDD, encourage manufacturing firms to strengthen ESG practices. This result supports Institutional Theory and is consistent with Teo *et al.* (2003) [49], Zhu *et al.* (2007) [64], and Lee *et al.* (2024) [30].

Digital Capability ranks third ($\beta = 0.229$), highlighting the role of digital technologies in supporting ESG implementation through improved data management, environmental monitoring, and sustainability reporting. However, its influence remains weaker than leadership commitment and regulatory pressure, implying that digital capability is most effective when supported by strategic leadership. This finding is consistent with Warner and Wäger (2019) [57] and Lee *et al.* (2024) [30].

Customer Pressure also positively influences ESG implementation ($\beta = 0.179$). As customers increasingly demand environmentally and socially responsible products, firms are encouraged to adopt ESG practices. Nevertheless, its relatively modest effect may reflect the fact that many surveyed firms primarily serve the domestic market, where ESG requirements are less stringent than in export markets. This finding supports Stakeholder Theory and agrees with Zhu *et al.* (2007) [64] and Christmann and Taylor (2001) [8].

Finally, Financial Resources have the weakest, yet still significant, effect ($\beta = 0.145$). This suggests that financial resources facilitate ESG implementation but are not the primary driver. Many firms continue to adopt ESG practices despite financial constraints due to regulatory and customer pressures, whereas firms with greater financial capacity may not prioritize ESG without strong leadership or external incentives. This finding is consistent with Bourgeois (1981) [7], Eiadat *et al.* (2008) [12], and Zhu *et al.* (2007) [64].

6. Conclusion and Implications

This study aimed to identify the factors influencing ESG implementation among manufacturing enterprises in Hanoi. Based on the integration of the Technology–Organization–Environment (TOE) framework, Institutional Theory, and Stakeholder Theory, a research model comprising five determinants of ESG implementation was developed and tested using data from 248 valid questionnaires analyzed with IBM SPSS Statistics 26. The results indicate that all five factors have positive and statistically significant effects on ESG implementation. Among them, Leadership Commitment has the strongest influence, followed by Regulatory Pressure, Digital Capability, Customer Pressure, and Financial Resources. The model explains 70.7% of the variance in ESG implementation (Adjusted $R^2 = 0.707$),

indicating that technological, organizational, and environmental factors provide strong explanatory power for ESG implementation among manufacturing enterprises in Hanoi.

From a theoretical perspective, this study contributes empirical evidence on the determinants of ESG implementation in manufacturing firms operating in an emerging economy. The findings confirm the applicability of the TOE framework in explaining ESG implementation while reinforcing the explanatory roles of Institutional Theory and Stakeholder Theory through the significant effects of Regulatory Pressure and Customer Pressure, respectively. Integrating these three theoretical perspectives provides a more comprehensive understanding of the drivers of ESG implementation.

From a practical perspective, the findings provide useful insights for manufacturing enterprises in identifying the key factors that should be prioritized in ESG implementation and offer evidence to support policymakers in designing policies that promote green transformation and sustainable development in Vietnam.

Implications for manufacturing enterprises: Manufacturing firms should strengthen Leadership Commitment by integrating ESG objectives into corporate strategies, allocating appropriate resources, and establishing effective ESG monitoring mechanisms. At the same time, firms should enhance Digital Capability and gradually increase financial investment in technological innovation, energy efficiency, and ESG data management to improve the effectiveness of ESG implementation.

Implications for business leaders and managers: Senior management should play a leading role in driving ESG implementation by developing a long-term sustainability vision, promoting an ESG-oriented organizational culture, and encouraging cross-functional participation. Managers should also proactively respond to changes in regulations, customer expectations, and sustainability trends to maintain long-term competitiveness.

Implications for policymakers: Government authorities should continue strengthening the ESG-related regulatory framework and provide clearer guidance on environmental compliance, sustainability disclosure, and greenhouse gas emission reduction. In addition, greater support should be provided—particularly for small and medium-sized enterprises (SMEs)—through financial incentives, training programs, ESG advisory services, and digital transformation initiatives to enhance firms' capacity to meet both domestic and international sustainability standards.

7. Limitations and Future Research

Despite achieving the research objectives, this study has several limitations. First, the study was conducted using data from 248 manufacturing enterprises in Hanoi, which may limit the generalizability of the findings to other regions or industries. Second, the research model examined only five determinants of ESG implementation, whereas other factors—such as organizational culture, innovation capability, investor pressure, supplier pressure, and managerial awareness—may also influence ESG implementation but were not included in the model. Finally, the study adopted a cross-sectional design, which does not capture changes in ESG implementation over time.

Future research could expand the survey to manufacturing enterprises in other regions and industries to improve the

generalizability of the findings. In addition, future studies may incorporate additional independent, mediating, or moderating variables to provide a deeper understanding of the mechanisms underlying ESG implementation. Applying more advanced analytical techniques, such as Structural Equation Modeling (SEM) or Partial Least Squares Structural Equation Modeling (PLS-SEM), together with longitudinal research designs, would also provide a more comprehensive understanding of the relationships among the determinants and the ESG implementation process.

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