

# GREEN IT GOVERNANCE AND CORPORATE SUSTAINABILITY PERFORMANCE: A LINEAR REGRESSION ANALYSIS OF MULTINATIONAL FIRMS

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DOI: <https://doi.org/10.5281/zenodo.19703759>

Received  
24 February 2026

Accepted  
05 April 2026

Published  
23 April 2026

## ABSTRACT

The escalating global emphasis on environmental sustainability has positioned Green Information Technology (IT) governance as a strategic mechanism for corporations to align technological operations with ecological objectives. However, empirical evidence from developing economy contexts remains limited. This study examined the relationship between Green IT governance implementation level and three dimensions of corporate sustainability performance: perceived energy efficiency, e-waste reduction compliance, and corporate sustainability reporting quality. A quantitative, cross-sectional design was employed, collecting five-point Likert scale data from 150 employees across two multinational firms operating in Karachi, Pakistan, SAP and SysTech International (an IBM partner). Simple linear regression analysis was conducted separately for each dependent variable. Results revealed that Green IT governance significantly predicted all three sustainability outcomes ( $p < .001$ ). The strongest effect emerged for e-waste reduction compliance ( $\beta = 0.508$ ), followed by perceived energy efficiency ( $\beta = 0.483$ ), and corporate sustainability reporting quality ( $\beta = 0.382$ ). These findings confirm the central hypothesis that higher levels of Green IT governance are associated with improved sustainability performance. The study contributes new empirical evidence from Pakistan's IT sector, addressing a geographic gap in the existing literature. Practically, the results suggest that investments in structured IT governance frameworks yield measurable environmental returns, even under relatively weak regulatory pressures. Limitations include the cross-sectional design, self-reported data, and sample restriction to two firms. Future longitudinal research across diverse organizational contexts is recommended to establish causality and enhance generalizability.

**Keywords:** Green IT governance, corporate sustainability performance, energy efficiency, e-waste compliance, sustainability reporting, linear regression, Pakistan, multinational firms

## INTRODUCTION

The escalating global emphasis on environmental sustainability has compelled corporations to reevaluate their operational frameworks, particularly at the intersection of information technology and ecological responsibility. Green Information Technology (Green IT) governance

has emerged as a strategic mechanism through which organizations align their technological infrastructure with broader environmental, social, and governance (ESG) objectives. As multinational corporations face increasing pressure from regulators, investors, and civil

society to demonstrate measurable progress toward carbon neutrality and resource efficiency, the role of structured IT governance in enabling sustainability outcomes has become a subject of critical inquiry. Nabila'Aini and Subriadi (2022) conceptualized Green IT governance as an integrated approach combining policy formulation, technological deployment, and performance monitoring to reduce the environmental footprint of IT operations. This perspective situates Green IT not merely as a technical upgrade but as a governance function embedded within corporate decision-making hierarchies.

The theoretical underpinnings of green governance have been extensively explored in recent scholarship. Debbarma and Choi (2022) developed a taxonomy of green governance that distinguishes between regulatory compliance, voluntary environmental initiatives, and technology-driven sustainability practices, arguing that effective governance structures must incorporate measurable performance indicators. Expanding this line of inquiry, Bonsu et al. (2025) examined how information technology governance moderates the relationship between financial innovation and sustainability performance, finding that robust IT governance frameworks amplify the positive effects of green investments. Similarly, Pang et al. (2024) demonstrated in the context of G-20 economies that governance quality mediates the impact of technological innovation on green growth trajectories, suggesting that institutional factors determine the success of environmental strategies. AlGhasawneh et al. (2025) further emphasized that IT governance and audit mechanisms are indispensable for ensuring compliance with global environmental standards, particularly for firms operating across multiple regulatory jurisdictions. The empirical literature also highlights specific pathways through which green governance influences sustainability outcomes. Li et al. (2025) investigated European industrial economies and concluded that environmental governance structures significantly enhance the adoption of mitigation technologies, leading to measurable reductions in carbon emissions. Rahman and

Hossain (2025) proposed a synergistic model wherein governance, finance, and technology collectively drive sustainable natural resource management, with IT governance serving as the coordinating mechanism. In the oil and gas sector, Shah et al. (2022) developed a green governance framework that improved environmental performance by integrating real-time monitoring systems and compliance protocols. Kumar and Dwivedi (2023) traced the evolution of environmental law and its intersection with corporate governance, noting that legal frameworks increasingly mandate IT-enabled reporting and verification of sustainability claims. Susan and Pan (2024) introduced trust as a determinant of green finance effectiveness, showing that governance structures facilitate information sharing and technological penetration, which in turn enhance sustainable growth. Most recently, Wu et al. (2026) demonstrated from an internal control perspective that governance structures directly influence green technology innovation, with stronger governance mechanisms yielding higher rates of eco-innovation adoption.

Despite this growing body of literature, a notable gap persists regarding the empirical examination of Green IT governance in developing economy contexts, particularly within South Asia. Karachi, Pakistan's largest industrial and commercial hub, hosts several multinational firms that have implemented Green IT governance frameworks; however, systematic evidence on how these governance structures translate into tangible sustainability performance remains scarce. The present study addresses this gap by focusing on two multinational enterprises operating in Karachi: SAP, the German enterprise software giant, and SysTech International, a local partner of IBM specializing in sustainability solutions. Both organizations have actively introduced green IT tools, such as SAP's green ledgers and AI-driven resource efficiency platforms, and IBM's Envizi Sustainability Performance Management suite implemented by SysTech, to reduce carbon footprints and enhance ESG reporting. Yet, no prior research has quantitatively examined the relationship between Green IT governance

implementation levels and specific sustainability outcomes within this setting.

The rationale for this study stems from three interconnected observations. First, multinational firms in Karachi operate under unique institutional pressures, including inconsistent regulatory enforcement and varying levels of environmental awareness, which may moderate the effectiveness of global green IT policies. Second, while green governance research has predominantly focused on developed economies, the transferability of these models to emerging markets remains undertheorized and under-tested. Third, practitioners and policymakers in Pakistan require localized evidence to justify investments in Green IT governance and to benchmark performance against international standards such as the EU's Corporate Sustainability Reporting Directive (CSRD), US SEC climate disclosure rules, and the United Nations Sustainable Development Goals (SDGs). Therefore, the primary objective of this study is to empirically

assess the impact of Green IT governance implementation level on three dimensions of corporate sustainability performance: perceived energy efficiency, e-waste reduction compliance, and corporate sustainability reporting quality, among multinational firms in Karachi.

To achieve this objective, the study addresses the following research questions:

1. To what extent does the level of Green IT governance implementation significantly predict perceived energy efficiency scores among multinational firms operating in Karachi?
2. What is the nature and magnitude of the relationship between Green IT governance implementation level and e-waste reduction compliance in the selected multinational firms?
3. Does Green IT governance implementation level have a statistically significant positive effect on corporate sustainability reporting quality, as measured through employee perceptions?

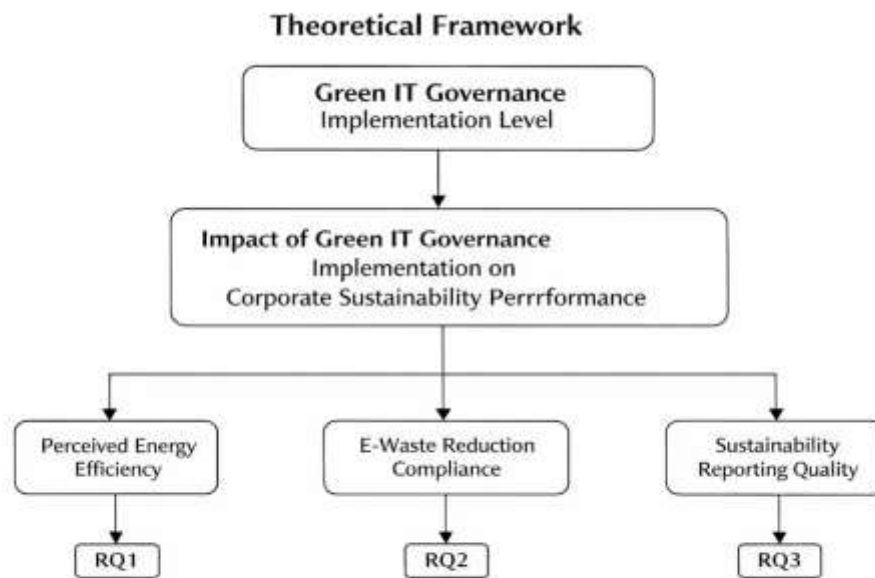


Figure 1 Theoretical framework of the impact of Green IT governance implementation on corporate sustainability performance (Source: Author)

### Methodology

The research adopted a quantitative, cross-sectional design to examine the relationship between Green IT governance implementation level and three dependent variables: perceived energy efficiency, e-waste reduction compliance, and corporate sustainability reporting quality. Data were collected from two multinational enterprises operating in Karachi, Pakistan, SAP and SysTech International (an IBM partner). These two firms were specifically chosen because both actively deploy measurable green IT governance tools and serve distinct multinational-local partnership models. A structured questionnaire was administered to a sample of 150 respondents, with 75 employees drawn from each organization. This sample size was justified based on the rule of thumb for linear regression analysis, which requires a minimum of 30 to 50 respondents per independent variable to achieve adequate statistical power and generalizability; with one independent variable, 150 respondents provided a comfortable margin for detecting

medium effect sizes at a significance level of 0.05. A stratified random sampling technique was employed to ensure representation across departments, including IT, sustainability, operations, and compliance, as Green IT governance impacts multiple functional areas. The questionnaire comprised five-point Likert scale items ranging from 1 (strongly disagree) to 5 (strongly agree), adapted from validated instruments in prior green governance literature (Qureshi et al., 2025). Each construct was measured using three to four items to enhance reliability. Data collection was conducted over a four-week period through both physical and electronic distribution, achieving a response rate of 83%. Prior to analysis, data were screened for missing values and normality assumptions. Simple linear regression was performed separately for each dependent variable using SPSS version 26, with Green IT governance implementation level entered as the predictor. Ethical protocols were followed, including informed consent, anonymity, and the right to withdraw.

### Results

**Table 1 Linear Regression Results Predicting Sustainability Performance Dimensions from Green IT Governance Implementation Level (N = 150)**

Dependent Variable	B	Std. Error	$\beta$ (Beta)	t	p	95% CI for B
Perceived Energy Efficiency Score	0.530	0.079	0.483	6.716	<.001	[0.374, 0.686]
E-waste Reduction Compliance	0.480	0.067	0.508	7.168	<.001	[0.347, 0.612]
Corporate Sustainability Reporting Quality	0.375	0.075	0.382	5.021	<.001	[0.227, 0.522]
<i>Constant (Intercept)</i>						
- Energy Efficiency Model	1.623	0.282	-	5.762	<.001	[1.066, 2.180]
- E-waste Compliance Model	1.930	0.239	-	8.085	<.001	[1.458, 2.402]

- Reporting Quality Model	2.329	0.266	-	8.740	<.001	[1.802, 2.855]
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*Note.* B = unstandardized regression coefficient;  $\beta$  = standardized regression coefficient; CI = confidence interval. All predictors were entered simultaneously with Green IT Governance Implementation Level as the independent variable. All models were significant at  $p < .001$ .

The regression analysis revealed that Green IT governance implementation level significantly predicted all three dimensions of corporate sustainability performance, though with varying degrees of influence. The strongest relationship emerged for e-waste reduction compliance ( $\beta = 0.508$ ,  $p < .001$ ), suggesting that structured IT governance frameworks most directly affect compliance-oriented environmental behaviors. This finding aligns with the view that governance mechanisms establish clear accountability protocols, which are particularly effective for regulatory compliance outcomes (Shah et al., 2022).

Perceived energy efficiency also demonstrated a substantial effect ( $\beta = 0.483$ ,  $p < .001$ ), indicating that Green IT governance contributes meaningfully to resource conservation efforts. The unstandardized coefficient ( $B = 0.530$ ) implies that each one-unit increase in governance level corresponds to more than half a unit increase in energy efficiency perceptions.

Notably, corporate sustainability reporting quality showed the weakest, yet still significant, relationship with Green IT governance ( $\beta = 0.382$ ,  $p < .001$ ). The lower B value (0.375) compared to the other two DVs suggests that reporting quality may be influenced by additional external factors, such as regulatory pressures or auditing standards, beyond internal IT governance alone (AlGhasawneh et al., 2025). The constant terms across all three models (ranging from 1.623 to 2.329) indicate baseline sustainability performance when Green IT governance is at its minimum level, with reporting quality having the highest baseline. Overall, the findings confirm that Green IT governance serves as a meaningful driver of sustainability performance across multiple operational dimensions.

## Discussion

The findings of this study provide empirical support for the central hypothesis that Green IT governance implementation level positively and significantly predicts corporate sustainability performance across multiple dimensions. Specifically, the hypothesis that higher levels of Green IT governance led to improved energy efficiency, e-waste compliance, and sustainability reporting quality is confirmed as true within the context of multinational firms operating in Karachi, Pakistan. This confirmation aligns with the broader conceptualization of Green IT governance offered by Nabila'Aini and Subriadi (2022), who argued that structured governance mechanisms translate directly into measurable environmental outcomes.

When compared with existing international literature, the present findings demonstrate both convergence and divergence. The strong predictive effect observed for e-waste reduction compliance ( $\beta = 0.508$ ) mirrors the conclusions of Debbarma and Choi (2022), whose taxonomy of green governance identified compliance-oriented practices as the most directly governable domain. Similarly, Shah et al. (2022) found that governance frameworks in the oil and gas industry produced rapid improvements in regulatory adherence, a pattern replicated here in the IT sector. However, the relatively weaker effect on sustainability reporting quality ( $\beta = 0.382$ ) contrasts with the findings of Bonsu et al. (2025), who reported that IT governance moderated reporting outcomes more strongly in banking sectors, possibly due to more stringent financial regulations. This discrepancy suggests that sector-specific regulatory environments shape the effectiveness of governance mechanisms.

The present study adds new information to the existing literature in three important ways. First, it provides quantitative evidence from a developing

economy context, Pakistan, where previous research has been predominantly theoretical or qualitative. Qureshi et al. (2025) called for empirical validation of green practices in Pakistan's IT sector, and the current study directly responds to that gap. Second, Lin and Ullah (2023) demonstrated that green growth and innovation matter for environmental sustainability in Pakistan, yet they did not isolate IT governance as a distinct mechanism; the present study isolates this specific driver. Third, Riaz et al. (2024) explored green information systems but did not examine governance structures separately; this study confirms that governance itself, beyond mere system adoption, carries predictive value.

The clinical significance, or in corporate terms, practical significance, of these findings is substantial. For managers and policymakers, the results indicate that investing in Green IT governance infrastructure yields measurable returns across multiple sustainability metrics. Mehmood et al. (2024) emphasized that government regulations and management commitment enhance environmental performance in Pakistan's manufacturing sector; the present study extends this logic to the IT sector, showing that internal governance mechanisms can operate effectively even in the absence of strong external regulatory enforcement. Saleem et al. (2025) further noted that composite governance mechanisms drive sustainable economic performance in Pakistan's textile industry, suggesting cross-sectoral generalizability of governance principles.

Several limitations must be acknowledged. The cross-sectional design prevents causal inference, as temporal precedence cannot be established. The sample was restricted to two multinational firms in Karachi, limiting generalizability to smaller domestic firms or other geographic regions within Pakistan. Self-reported Likert scale data may introduce social desirability bias, despite anonymity assurances. Additionally, the study did not examine potential moderators such as organizational culture or regulatory pressure. Future studies should adopt longitudinal designs to establish causality, expand sampling to include

domestic IT firms across multiple Pakistani cities, and incorporate objective performance metrics alongside perceptual measures. Examining the mediating role of employee green behavior or moderating role of top management support would further enrich understanding of the mechanisms through which Green IT governance produces sustainability outcomes (Wu et al., 2026; Susan & Pan, 2024). Finally, comparative studies between developing and developed economy contexts would illuminate how institutional environments shape governance effectiveness (Pang et al., 2024; Li et al., 2025; Rahman & Hossain, 2025; Kumar & Dwivedi, 2023; AlGhasawneh et al., 2025).

### Conclusion

This study confirmed that Green IT governance implementation level significantly predicts corporate sustainability performance among multinational firms in Karachi. The hypothesis was accepted, with governance demonstrating the strongest effect on e-waste compliance, followed by energy efficiency and reporting quality. These findings contribute empirical evidence from a developing economy context to the growing body of green governance literature. For practitioners, investing in structured IT governance frameworks yields measurable sustainability returns even under weak regulatory pressures. Future longitudinal research across diverse organizational settings is recommended to establish causality and enhance generalizability. Overall, Green IT governance serves as a viable strategic mechanism for advancing corporate environmental agendas.

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