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ARTICLE

Eco-Driven Leadership in Pharmaceutical Industry: The Impact of Knowledge Sharing, Innovation, and Shared Vision on Environmental Performance

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ABSTRACT

Corporate environmental sustainability has become a critical concern, particularly in resource-intensive industries such as pharmaceuticals, where regulatory pressures and stakeholder expectations continue to rise. Despite increasing attention to green leadership, limited research has explored how environmentally responsible leadership (ERL) influences corporate environmental performance (CEP) through employee-driven sustainability behaviors. This study addresses this gap by examining the mediating roles of green knowledge-sharing behavior (GKSB), green innovative behavior (GIB), and voluntary green behavior (VGB), as well as the moderating role of green shared vision (GSV) in the ERL-CEP relationship. The study is grounded in Resource-Based View (RBV), Knowledge-Based View (KBV), Environmental-Based View (EBV), and Triple Bottom Line (TBL) theories, which collectively explain how leadership-driven sustainability efforts create long-term competitive advantages, drive environmental responsibility, and balance economic, social, and environmental

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sustainability. A quantitative research design was employed, using survey data from 384 employees in Bangladesh's pharmaceutical sector. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) in Smart-PLS 4.0 to assess direct, indirect, and moderating effects. The results confirm that ERL has a significant positive impact on CEP, with GKSB, GIB, and VGB acting as mediators, while GSV strengthens the ERL-CEP relationship. This study provides novel empirical evidence on the mechanisms linking green leadership to corporate sustainability, extending the application of RBV, KBV, EBV, and TBL to leadership-driven environmental management. The findings emphasize the importance of leadership training programs, sustainability-focused organizational cultures, and shared environmental visions. Policymakers should consider incentives for companies adopting ERL practices, ensuring that sustainability becomes a strategic, rather than compliance-driven, priority. This study contributes to leadership and sustainability literature by offering a comprehensive framework for integrating ERL into corporate governance and environmental strategies.

Keywords: Environmentally Responsible Leadership; Corporate Environmental Performance; Green Knowledge Sharing; Green Innovation Behavior; Green Voluntary Behaviour; Green-Shared Vision

1. Introduction

The increasing emphasis on corporate sustainability and environmental responsibility has led to a significant shift in leadership practices, with environmentally responsible leadership (ERL) emerging as a critical driver of corporate environmental performance (CEP). Industries, particularly resource-intensive sectors such as pharmaceuticals, are under growing pressure to integrate sustainability into their business models due to heightened regulatory constraints, stakeholder expectations, and global sustainability commitments[1, 2]. As a result, companies are actively exploring leadership-driven strategies that align environmental objectives with business performance. While green business practices and corporate sustainability have been extensively studied, limited research has examined the behavioral mechanisms through which ERL enhances CEP. Specifically, the role of employee-driven sustainability behaviors, such as green knowledge-sharing behavior (GKSB), green innovative behavior (GIB), voluntary green behavior (VGB), and green shared vision (GSV), remains underexplored[3, 4]. Addressing this gap, this study contributes new insights by exploring the micro-level pathways that translate leadership commitment into measurable corporate sustainability outcomes.

Recent research has established that green leadership plays a crucial role in shaping corporate environmental practices, yet there remains a lack of consensus on how specific leadership styles impact organizational sustainability outcomes[5, 6]. Many studies have examined broader leadership frameworks, such as transformational leadership, ethical leadership, and servant leadership, viewing sustainability as one of several priorities[7]. However, ERL differs fundamentally from these approaches as it explicitly integrates environmental responsibility into leadership decision-making, policies, and employee engagement strategies[8]. Unlike conventional leadership theories, which focus on employee motivation and organizational growth, ERL prioritizes sustainability as a core corporate objective, ensuring alignment between environmental goals and business performance metrics[6]. Prior research has largely focused on policy-driven sustainability efforts and regulatory compliance, overlooking how leadership behaviors at the individual and organizational levels foster green workplace cultures[4]. By examining ERL as a direct antecedent of employee-driven sustainability behaviors, this study offers a nuanced perspective on how leadership fosters corporate environmental responsibility at the operational level.

A clear conceptual foundation is necessary for understanding GKSB, GIB, VGB, and GSV, as they have emerged as key constructs in recent sustainability and pro-environmental behavior research. GKSB refers to employees' exchange, dissemination, and application of sustainability-related knowledge, which enhances green innovation and problem-solving[9]. This aligns with pro-environmental citizenship behavior (PECB), where employees voluntarily support organizational environmental goals[10]. GIB describes employees' engagement in sustainability-focused innovation, including green technology adoption and eco-friendly business solutions, which is closely linked to the innovative work environment (IWE)

framework[11, 12]. VGB refers to self-initiated sustainability practices beyond job requirements, aligning with pro-environmental behavior (PEB), where employees advocate for and voluntarily participate in sustainability initiatives[13]. GSV represents a collective understanding and commitment toward sustainability goals, reinforcing a sustainability-oriented organizational culture[14]. By explicitly defining these behaviors and linking them to recent literature, this study strengthens its theoretical and empirical foundation, reinforcing the role of ERL in fostering an environmentally responsible corporate culture.

This study also addresses theoretical gaps by expanding its conceptual framework beyond Resource-Based View (RBV) to incorporate Knowledge-Based View (KBV) and Environmental-Based View (EBV). While RBV explains how organizations develop competitive advantage through internal resources, KBV emphasizes the role of knowledge-sharing (GKSB) in sustainability-driven innovation[15]. EBV extends RBV by focusing on how firms integrate environmental sustainability as a strategic resource, ensuring long-term ecological responsibility alongside corporate performance[16]. By integrating RBV, KBV, and EBV, this study constructs a more holistic theoretical foundation, ensuring that leadership-driven sustainability initiatives are analyzed from multiple perspectives. Beyond its theoretical contributions, this study carries economic, environmental, and social implications, particularly in Bangladesh's pharmaceutical sector, where sustainability efforts are increasingly linked to regulatory compliance, operational efficiency, and financial performance. The Triple Bottom Line (TBL) framework provides a comprehensive lens to understand why leadership-driven sustainability strategies are critical in this sector[1]. From an economic perspective, ERL fosters green innovation, leading to cost savings, operational efficiencies, and improved investor confidence[3]. Research shows that sustainability-driven leadership enhances market competitiveness, particularly for firms adopting eco-friendly supply chain management and sustainable product development[4]. From an environmental perspective, ERL fosters corporate environmental responsibility by encouraging waste reduction, carbon footprint minimization, and regulatory compliance[2]. From a social perspective, ERL fosters employee engagement and collective commitment to sustainability goals, ensuring that green practices are embedded in workplace culture and leadership strategies[14].

From a policy standpoint, this study's findings provide valuable insights into leadership-driven environmental strategies that can inform corporate governance and regulatory frameworks. Policymakers can design incentives for firms adopting green leadership approaches, such as tax benefits for sustainability-focused organizations and corporate recognition programs. Additionally, corporate governance models should integrate ERL as a performance metric, ensuring that sustainability becomes a core leadership responsibility rather than a compliance-driven requirement. By embedding sustainability within leadership frameworks, organizations can transition from reactive to proactive environmental strategies, ultimately contributing to global sustainability goals, including the United Nations Sustainable Development Goals (SDGs). By integrating leadership theory, sustainability behaviors, and economic sustainability principles, this study advances the discourse on sustainability-oriented leadership, offering valuable insights for corporate leaders, policymakers, and sustainability advocates. The findings reinforce the strategic importance of ERL in corporate governance, ensuring that environmental responsibility is not just a regulatory requirement but a key competitive advantage in today's business landscape.

1.1. Underpinning Theories of the Study

This study is underpinned by Resource-Based View (RBV) theory and Triple Bottom Line (TBL) theory. RBV, developed by[17] and[18], explains how intangible resources like environmentally responsible leadership (ERL) and employee-driven green behaviors enhance corporate environmental performance (CEP). TBL, introduced by Elkington[18], emphasizes balancing economic, environmental, and social sustainability. Together, these theories provide a strong foundation for understanding how leadership-driven sustainability strategies impact corporate environmental and financial performance[19].

1.1.1. Resource-Based View (RBV)

The Resource-Based View (RBV) theory, originally developed by Wernerfelt[17] and later expanded by Elkington[18] posits that organizations achieve sustainable competitive advantage by leveraging valuable, rare, inimitable, and non-substitutable (VRIN) resources[20]. The theory suggests

that firms must develop unique internal capabilities to outperform competitors rather than solely relying on external market conditions. RBV emphasizes that intangible resources such as leadership, knowledge, and organizational culture are critical drivers of long-term corporate success [20]. In the context of this study, environmentally responsible leadership (ERL) is positioned as a strategic resource that enables organizations to enhance corporate environmental performance (CEP). Leadership commitment to sustainability fosters a culture where employees engage in pro-environmental behaviors, such as green knowledge-sharing behavior (GKSB), green innovative behavior (GIB), and voluntary green behavior (VGB). These behaviors align with RBV's emphasis on knowledge-based and human capital resources as key drivers of firm performance [2]. By integrating sustainability into leadership practices, firms can build an organizational culture that supports continuous innovation, resource efficiency, and regulatory compliance, leading to superior environmental outcomes [3]. Furthermore, green-shared vision (GSV) moderates the ERL-CEP relationship by reinforcing collective sustainability goals among employees. According to RBV, a well-defined shared vision serves as a firm-specific asset that enhances alignment between leadership objectives and employee behaviors, ensuring that sustainability initiatives are effectively implemented [15]. This study extends RBV by demonstrating that ERL, when combined with a strong GSV, can enhance an organization's ability to achieve superior environmental performance. Thus, RBV underpins the argument that sustainability-oriented leadership and employee-driven green behaviors are critical intangible resources that contribute to corporate environmental sustainability.

1.1.2. Triple Bottom Line (TBL) Theory

The Triple Bottom Line (TBL) theory, introduced by [18], expands traditional business performance metrics by integrating three key dimensions: economic, environmental, and social sustainability. The theory challenges firms to move beyond profit-driven strategies and adopt a holistic sustainability approach, ensuring long-term value creation for all stakeholders [18]. TBL suggests that businesses must achieve financial success (profit), environmental responsibility (planet), and social equity (people) to maintain sustainable operations and competitive advantage. This study applies TBL theory to examine how environmentally responsible leadership (ERL) enhances corporate environmental performance (CEP) by promoting employee-driven green behaviors. Leadership commitment to sustainability aligns with TBL's environmental dimension by encouraging organizations to reduce carbon emissions, improve resource efficiency, and adopt eco-friendly innovations [1]. Additionally, employee behaviors such as green knowledge-sharing (GKSB) and green innovative behavior (GIB) contribute to the firm's ability to integrate sustainability into its operational processes [3]. The economic dimension of TBL theory further supports this study's argument that sustainability-driven leadership contributes to financial performance by reducing environmental compliance costs, improving corporate reputation, and attracting sustainability-conscious investors [6]. Firms that proactively engage in environmental responsibility initiatives benefit from improved risk management, operational resilience, and long-term profitability. By incorporating TBL theory, this study underscores the importance of leadership-driven sustainability initiatives in achieving a balance between environmental performance and economic viability, reinforcing the role of ERL in fostering corporate sustainability.

1.2. Operational Definitions of the Key Variables

Corporate Environmental Performance (CEP): The measurable outcomes reflecting a pharmaceutical company's environmental sustainability efforts, including waste management, energy efficiency, and adherence to environmental regulations.

Environmentally Responsible Leadership (ERL): Leadership behaviors and practices within an organization that prioritize and promote environmental sustainability. ERL involves setting and championing environmental goals, integrating green practices into decision-making processes, and inspiring stakeholders to adopt and support sustainable initiatives.

Green Knowledge Sharing Behavior (GKSB): Employees' actions in sharing environmental knowledge and best practices within the organization to promote sustainable initiatives and improve environmental performance.

Green Innovative Behavior (GIB): Employees' proactive involvement in generating and implementing novel eco-friendly ideas, products, or processes to enhance the company's environmental sustainability.

Voluntary Green Behavior (VGB): Employees' vol-

untary engagement in environmentally friendly activities beyond their job requirements, such as reducing personal carbon footprints or participating in green initiatives.

Green Shared Vision (GSV): The collective and shared understanding among organizational stakeholders regarding environmental goals and strategies, guiding efforts towards integrating sustainability into corporate vision and operations.

2. Literature Review and Hypothesis Development

The literature review and hypothesis development section critically examines existing research on environmentally responsible leadership (ERL) and corporate environmental performance (CEP). Grounded in RBV, KBV, EBV, and TBL theories, this section identifies research gaps, integrates recent empirical findings, and formulates hypotheses linking ERL, employee-driven sustainability behaviors, and environmental performance outcomes.

2.1. Corporate Environmental Performance

Corporate Environmental Performance (CEP) has become an essential metric for evaluating organizations' commitment to sustainability, particularly in industries with high environmental footprints, such as pharmaceuticals. Recent studies emphasize that sustainability-driven corporate strategies contribute to financial resilience, regulatory compliance, and long-term competitive advantage [21–23]. Organizations increasingly integrate green innovation, circular economy practices, and carbon footprint reduction into their strategic objectives to enhance environmental performance [2], [24]. For instance, [22] examined the financial implications of environmentally responsible strategies, showing that firms with stronger environmental policies demonstrate greater risk resilience and market stability. Similarly, [23] highlighted the role of membrane separation technology in reducing industrial waste and improving environmental efficiency within pharmaceutical firms. These findings align with recent research emphasizing the role of technology adoption and operational efficiency in enhancing CEP [15]. Moreover, research suggests that global environmental governance and investor expectations are reshaping corporate environmental strategies. For example, [1] found that firms integrating sustainability reporting and carbon neutrality commitments experience improved environmental performance and greater investor confidence. [3] argue that corporate social responsibility (CSR) initiatives and eco-friendly supply chains significantly contribute to reducing environmental impact while fostering positive stakeholder engagement. Despite these advancements, limited research has examined the behavioral mechanisms driving CEP at the employee level, particularly the role of environmentally responsible leadership (ERL) in shaping corporate sustainability. Prior studies have predominantly focused on policy-level interventions, technological innovation, and market-driven sustainability incentives [4, 25]. However, the leadership-employee interaction remains an underexplored avenue in corporate environmental research. This study aims to address this gap by investigating how ERL influences CEP through employee-driven sustainability behaviors, specifically green knowledge sharing behavior (GKSB), green innovative behavior (GIB), and voluntary green behavior (VGB).

2.2. Environmentally Responsible Leadership

Leadership plays a pivotal role in fostering sustainability, as leaders' commitment to environmental values influences employee engagement, corporate policies, and innovation in green practices [6, 7]. Environmentally Responsible Leadership (ERL) is a leadership style that integrates sustainability into decision-making processes, encouraging employees to embrace eco-friendly behaviors and contribute to corporate environmental goals [8]. Recent studies highlight the growing importance of leadership in environmental governance and sustainability-driven business transformation. For instance, Ogiemwonyiet al. [22] found that firms with proactive environmental leadership adapt more effectively to evolving regulatory frameworks and investor expectations. Similarly, Hossain et al. [23] argue that leadership is essential in fostering green innovation and ensuring the adoption of advanced environmental technologies within organizations. Moreover, empirical research suggests that ERL directly influences employee-driven sustainability initiatives. Studies indicate that leaders who promote environmental values cultivate a workforce more engaged in sustainable practices, extending beyond compliance to include voluntary pro-environmental behaviors such as knowledge sharing, innovation, and collaboration [5, 26]. Yang and Li [4] found that leadership commitment to sustainability enhances employee

willingness to participate in eco-friendly workplace initiatives, reinforcing the role of ERL in shaping environmental outcomes. Despite these insights, few studies have systematically examined the mechanisms through which ERL drives CEP in the pharmaceutical industry, particularly through mediating factors such as GKSB, GIB, and VGB. Most existing research focuses on macro-level policy interventions and regulatory compliance rather than individual behavioral influences[2, 24]. This study seeks to address this gap by exploring how ERL fosters employee-driven sustainability behaviors, ultimately enhancing corporate environmental performance.

2.3. ERL and CEP

The Resource-Based View (RBV) theory, originally proposed by Wernerfelt[17] and later expanded by[18, 20], asserts that a firm's sustainable competitive advantage is derived from valuable, rare, inimitable, and non-substitutable (VRIN) resources. Environmentally Responsible Leadership (ERL) exemplifies such a resource, serving as a critical intangible asset that fosters an organizational culture centered on environmental sustainability. Leaders who embed environmental responsibility into their strategic vision establish a strong precedent for corporate environmental practices, motivating employees to engage in green initiatives that enhance corporate environmental performance (CEP). This alignment is essential, as sustainability-oriented leadership encourages organizations to integrate environmental responsibility into core business strategies, leading to improved environmental outcomes[2, 3]. Recent empirical studies have reaffirmed the positive impact of ERL on CEP by highlighting how sustainability-driven leadership facilitates the adoption of green technologies, innovation, and eco-friendly operational practices[27, 28]. Leadership that prioritizes environmental responsibility ensures that employees actively participate in sustainability efforts, fostering a culture of knowledge-sharing, innovative green solutions, and voluntary environmental behavior[6]. Additionally, research by Celestin et al.[11] indicates that firms led by environmentally responsible leaders tend to perform better in carbon footprint reduction, resource efficiency, and environmental regulatory compliance, thereby strengthening their competitive advantage. The Triple Bottom Line (TBL) theory, introduced by Elkington[18], further supports this relationship by emphasizing that organizations must balance economic, environmental, and social sustainability to achieve long-term success. ERL aligns with TBL by driving corporate environmental initiatives that reduce operational costs, mitigate environmental risks, and enhance corporate reputation, ultimately contributing to both environmental and financial performance[6]. Through sustainability-driven leadership, firms can create a harmonized balance between profitability and environmental responsibility, reinforcing ERL's role in fostering long-term environmental sustainability[2]. Thus, ERL functions as a strategic asset that integrates the principles of RBV and TBL theories, positioning environmental responsibility as a source of competitive advantage. By fostering a culture of sustainability, green innovation, and regulatory compliance, ERL significantly enhances corporate environmental performance, substantiating the following hypothesis:

H1. *ERL has a significant positive influence on CEP.*

2.4. Mediating Role of GKSB

Green knowledge-sharing behavior (GKSB) refers to employees' exchange of environmental knowledge, experiences, and sustainable practices, contributing to corporate sustainability[9]. This behavior is particularly vital in pharmaceutical organizations, where green innovation, process efficiency, and regulatory compliance drive sustainable growth[3]. By fostering knowledge-sharing cultures, organizations enhance their absorptive capacity, facilitating continuous learning, innovation, and environmental performance improvements[2]. The Resource-Based View (RBV) theory identifies knowledge as a valuable, rare, inimitable, and non-substitutable (VRIN) resource, driving sustainable competitive advantage[20]. Knowledge gains value when shared, enabling firms to innovate and integrate sustainability into operations[29]. ERL acts as a key enabler of GKSB by cultivating an organizational culture that prioritizes sustainability, collaboration, and green knowledge exchange[15]. Leaders who emphasize environmental responsibility offer strategic guidance, sustainability training, and motivation, creating an environment where GKSB flourishes[27]. The Triple Bottom Line (TBL) theory reinforces the role of knowledge-sharing in balancing economic, environmental, and social sustainability[18]. Encouraging GKSB enhances green innovation and process efficiency, reducing operational costs and improv-

ing environmental performance[1]. Employees reciprocate green knowledge-sharing behaviors when they perceive environmentally responsible leadership, fostering commitment and sustainability best practices[30]. Thus, ERL stimulates GKSB, maximizing corporate environmental performance by promoting continuous learning and innovation[3].

H2. *GKSB has a significant mediating effect in the relationship between ERL and CEP.*

2.5. Mediating Role of GIB

The Resource-Based View (RBV) theory, initially proposed by Wernerfelt[17] and later expanded by Barney[18], asserts that organizations achieve sustainable competitive advantage through valuable, rare, inimitable, and non-substitutable (VRIN) resources. Within this framework, Green Innovation Behavior (GIB) functions as a strategic intangible resource that mediates the relationship between Environmentally Responsible Leadership (ERL) and Corporate Environmental Performance (CEP). GIB refers to the proactive development and implementation of eco-friendly technologies, sustainable practices, and green process innovations that enhance an organization's environmental sustainability[31]. ERL fosters a culture of innovation and sustainability by encouraging employees to explore environmentally conscious solutions, aligning with RBV's emphasis on internal resource development[3]. Organizations led by environmentally responsible leaders accumulate green knowledge and innovative capabilities, ensuring compliance with environmental standards while fostering long-term environmental performance improvements[2]. This aligns with studies demonstrating that GIB enhances resource efficiency, waste reduction, and emission control, ultimately improving CEP[12, 27]. Additionally, the Triple Bottom Line (TBL) theory, introduced by Ogiemwonyi et al.[21], emphasizes that corporate innovation must balance economic, environmental, and social sustainability. Leaders who encourage GIB contribute not only to environmental sustainability but also to economic resilience by reducing compliance costs and increasing operational efficiency[1]. Empirical evidence supports the role of GIB in enhancing both regulatory compliance and competitive advantage, reinforcing its mediating effect between ERL and CEP[32]. Based on this theoretical and empirical foundation, we hypothesize:

H3. *GIB has a significant mediating effect in the relationship between ERL and CEP.*

2.6. Mediating Role of VGB

The Resource-Based View (RBV) theory posits that organizations gain sustainable competitive advantage by leveraging valuable, rare, inimitable, and non-substitutable (VRIN) resources. Voluntary Green Behavior (VGB), referring to discretionary employee actions supporting environmental sustainability, serves as a strategic intangible resource that enhances corporate environmental performance (CEP)[3]. Employees engaging in green initiatives, waste reduction, and sustainability advocacy contribute to organizational learning, green innovation, and operational efficiency[2]. Environmentally Responsible Leadership (ERL) fosters a culture of environmental commitment, inspiring employees to engage in VGB through sustainability-driven expectations, motivation, and support[30]. Leaders emphasizing environmental responsibility encourage employee participation in pro-environmental behaviors, improving corporate sustainability outcomes[6]. Organizations embedding VGB as an internal capability experience higher environmental efficiency, with employees voluntarily contributing to waste reduction, resource optimization, and emission control[27]. The Triple Bottom Line (TBL) theory underscores the integration of environmental, social, and economic sustainability for long-term success. VGB aligns with TBL's social dimension, driving employee-led sustainability efforts, leading to cost savings, regulatory compliance, and corporate reputation enhancement[1]. Employees voluntarily participating in green initiatives contribute to both environmental and financial sustainability, reinforcing ERL's broader impact beyond compliance[30]. Thus, VGB serves as a crucial mediator between ERL and CEP, reinforcing leadership's role in fostering a sustainability-oriented organizational culture.

H4. *VGB has a significant mediating effect in the relationship between ERL and CEP.*

2.7. Moderating Role of GSV

Environmental factors play a crucial role in shaping sustainability practices within organizations. Understanding how these factors intersect with environmentally responsible leadership (ERL) and eco-conscious behaviors is essential

for effective sustainability management. Green Shared Vision (GSV) is a key moderating factor that influences these relationships by aligning organizational members toward common sustainability goals [33]. The Resource-Based View (RBV) theory asserts that firms achieve sustainable competitive advantage through valuable, rare, inimitable, and non-substitutable (VRIN) resources. In this context, GSV acts as a strategic resource that strengthens the relationship between ERL and corporate environmental performance (CEP). A strong GSV fosters employee engagement in sustainability efforts, ensuring that leadership-driven environmental initiatives translate into measurable improvements [14]. Organizations with a clear green vision cultivate an innovation-driven sustainability culture, reinforcing their ability to meet and exceed regulatory requirements [34]. GSV also enhances regulatory compliance efforts by providing internal motivation for sustainability beyond external pressures [35]. When organizations embed GSV into their strategic framework, employees become proactive in environmental initiatives, amplifying the impact of ERL on CEP (Lin & Chang, 2020). Empirical evidence suggests that firms with a strong GSV outperform those without it in environmental efficiency and green innovation adoption [36]. Thus, GSV strengthens ERL's influence on CEP, ensuring that leadership-driven sustainability efforts lead to meaningful corporate environmental improvements.

H5. *GSV moderates the relationship between ERL and CEP.*

2.8. Conceptual Framework

The proposed conceptual framework investigates the impact of ERL on CEP within pharmaceutical companies in Bangladesh, supported by the RBV theory. The framework includes ERL as the independent variable and CEP as the dependent variable, with three mediating variables: GKSB, GIB, and VGB. Additionally, GSV serves as a moderating variable. This framework aims to explore how ERL influences CEP directly and through the mediating effects of GKSB, GIB, and VGB, while also examining how GSV enhances this relationship. By integrating these variables, the framework provides a comprehensive understanding of the pathways through which ERL can drive superior environmental performance in the context of Bangladeshi pharmaceutical companies (**Figure 1**).

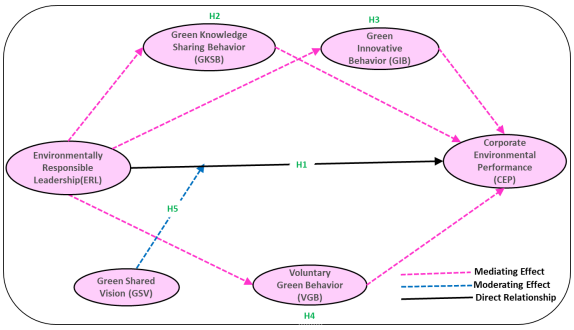

Figure 1. Proposed research framework.

3. Methodology

The study targeted employees from 257 pharmaceutical companies operating in Bangladesh, employing a convenience sampling method. From these companies, we selected the top 20 and chose 410 respondents for the survey. Our data collection followed a meticulous approach. We systematically selected all 20 pharmaceutical companies and engaged their respective managers to explain the survey's objectives. It is essential to note that our data collection was strictly for academic research purposes, with no external involvement. Additionally, we assured managers of the confidentiality of participating employees' personal information and the companies' identities. To ensure clarity and precision, we designed a survey questionnaire using a 5-point Likert scale, with response options ranging from 1 (strongly disagree) to 5 (strongly agree). Various measurement items were incorporated to assess different constructs. For GKSB, we used five items adapted from Wong [37]. GIB was measured using seven items from [38]. VGB was assessed with six items from Scott and Bruce [39]. ERL relied on five items from Bass [40] and Su et al. [41]. CEP was appraised using seven items. Finally, GSV was examined using four items adapted from Ma et al. [42]. With managerial approval, we distributed questionnaires exclusively among employees in these pharmaceutical companies. Over one month, we successfully disseminated 690 questionnaires, of which 421 were returned. However, 11 questionnaires were incomplete, resulting in an analysis based on 410 participants. All items and variables in the questionnaire are listed in **Appendix A.2**.

3.1. Pre-Test and Pilot-Test

Before starting the main study, we conducted a pre-test with 15 respondents to gather feedback on the clarity and

effectiveness of the questionnaire. Their invaluable insights allowed us to refine the questionnaires, addressing any potential sources of confusion. Based on their suggestions, we made minor adjustments to enhance coherence and readability. Additionally, we assessed internal consistency through a pilot study involving 20 participants, calculating Cronbach's alpha coefficient for each construct. Encouragingly, all constructs demonstrated reliability scores exceeding 0.70, surpassing the threshold recommended by [43]. These results confirm the robustness of our measurement instruments and provide a strong foundation for the main study.

3.2. Demographic Profile of the Respondents

After filtering out outliers and addressing missing data, our final sample size was 410 respondents, yielding a response rate of 52.11%. In terms of gender distribution, 37.24% of respondents identified as male, and 62.76% identified as female. Regarding education, 52.86% of participants held a Master's degree, 35.68% had an undergraduate degree, and 11.46% had diplomas. Marital status varied, with 63.28% reporting being unmarried and 36.72% being married. Breaking down respondents by department, 25% were from production, 29.43% from quality, 15.89% from quality assurance, and 29.69% from other departments. This detailed demographic and professional breakdown provides valuable insights into the participant composition, enhancing our understanding of the diversity and representation within the sample. The respondents' demographic variables are provided in **Appendix A**.

3.3. Common Method Bias (CMB)

To assess the potential presence of common method bias (CMB), we followed [44] guidelines, focusing on the heterotrait-monotrait (HTMT) ratio and inner variance inflation factor (VIF) values. According to Nitzl's criteria, a correlation exceeding 0.90 between constructs may indicate the presence of CMB. Our findings revealed that all correlation values among constructs were below 0.90, with the highest correlation being 0.747, as shown in the HTMT table, suggesting an absence of CMB in our study. Additionally, we evaluated the inner VIF values, where a VIF exceeding 3.30 could indicate model contamination by CMB. Our highest VIF value was 2.460, as indicated in the structural model assessment table. This value is well below the 3.30 threshold recommended by [45], providing further evidence that CMB did not significantly affect our study results.

4. Data Analysis

The data analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS 4.0 to examine the direct, mediating, and moderating relationships among variables. Reliability, validity, and model fit assessments were performed, ensuring robust statistical findings that support hypothesis testing and the theoretical framework of the study.

4.1. Descriptive and Correlation Analysis

Table 1 provides a comprehensive overview of the descriptive statistics and intercorrelations among the constructs, highlighting significant correlations with sustainable technical innovation across all variables. Notably, VGB had the highest mean value at 3.681, indicating a strong commitment from participants towards environmental causes. Conversely, CEP had the lowest mean value at 3.197, suggesting potential areas for improvement in leadership practices to better support sustainability initiatives.

Table 1. Means, SD, Correlations, and Reliabilities of the Study Variables.

Constructs	ERL	GKSB	GIB	VGB	CEP	GSV	Mean	SD
ERL	1						3.620	0.611
GKSB	0.666**	1					3.741	0.638
GIB	0.616**	0.684**	1				3.593	0.651
VGB	0.485**	0.284**	0.287**	1			3.681	0.568
CEP	0.427**	0.385**	0.408**	0.270**	1		3.197	0.985
GSV	−0.040	−0.055	−0.083	0.018	−0.435**	1	3.392	0.968

Note: n = 384, * $p < 0.05$, ** $p < 0.01$(2-tailed).

4.2. Using Smart-PLS for Model Testing

The utilization of Partial Least Squares Structural Equation Modeling (PLS-SEM) via Smart-PLS 4.0 is a well-recognized and established method for examining composite-based path models, particularly when the research focuses on predictive accuracy and theory development rather than theory confirmation [46]. PLS-SEM was selected over Covariance-Based SEM (CB-SEM) and other similar modeling techniques due to several key advantages. First, PLS-SEM is well-suited for studies with complex models involving multiple mediation and moderation effects, as is the case in this research. Second, PLS-SEM is particularly effective when dealing with non-normally distributed data, small-to-moderate sample sizes, and formative measurement models, making it a preferred choice in social science and business research [45, 47]. Unlike CB-SEM, which focuses on theory testing and requires large sample sizes and multivariate normality assumptions, PLS-SEM is variance-based and emphasizes maximizing explained variance (R^2) in the dependent constructs. This approach aligns with the study's objective of exploring the relationships between environmentally responsible leadership (ERL), corporate environmental performance (CEP), and mediating and moderating variables. Additionally, PLS-SEM allows for the assessment of indirect effects more efficiently, which is essential given the multiple mediators (GKSB, GIB, and VGB) and moderator (GSV) incorporated in the model. The initial phase of data analysis involved data preparation using SPSS (version 26.0), including procedures such as assessing common method bias and linearity. Subsequently, Smart-PLS 4.0 was employed for hypothesis testing and executing the PLS-SEM analysis. This methodological choice ensures robust model evaluation while addressing the study's complexity and empirical needs.

4.3. Evaluation of Measurement Model (Outer Model)

To thoroughly examine the internal consistency and reliability of our variables, we adopted a comprehensive approach that integrated both Cronbach's Alpha and Composite Reliability (CR), following the protocols outlined by [48]. As shown in **Table 2**, our findings revealed commendable values exceeding 0.7 for both Cronbach's Alpha and CR across all variables, indicating robust internal consistency. Additionally, to validate the convergent validity of our measures, we adhered to the criteria set by [48, 49]. These standards require that each item has a factor loading (FL) exceeding 0.60 and an average variance extracted (AVE) surpassing 0.50. The data in **Figure 2** and **Table 2** demonstrates that all items significantly exceeded the recommended FL threshold, with factor loadings over 0.70, and each construct comfortably surpassed the AVE threshold, with values over 0.50. This robust validation confirms the strong convergent validity of our measures, aligning with the guidelines proposed by [48].

Table 2. Constructs validity and reliability.

Constructs	Items	F.L	CA	CR	AVE
CEP	CEP_1	0.911	0.955	0.958	0.788
	CEP_2	0.909			
	CEP_3	0.846			
	CEP_4	0.933			
	CEP_5	0.904			
	CEP_6	0.844			
	CEP_7	0.864			
ERL	ERL_1	0.794	0.893	0.901	0.703
	ERL_2	0.877			
	ERL_3	0.884			
	ERL_4	0.882			
	ERL_5	0.746			

Table 2. *Cont.*

Constructs	Items	F.L	CA	CR	AVE
GIB	GIB_1	0.822	0.935	0.938	0.721
	GIB_2	0.897			
	GIB_3	0.838			
	GIB_4	0.856			
	GIB_5	0.795			
	GIB_6	0.840			
	GIB_7	0.892			
GKSB	GKSB_1	0.856	0.892	0.896	0.701
	GKSB_2	0.896			
	GKSB_3	0.852			
	GKSB_4	0.842			
	GKSB_5	0.733			
GSV	GSV_1	0.911	0.914	0.924	0.795
	GSV_2	0.912			
	GSV_3	0.824			
	GSV_4	0.916			
VGB	VGB_1	0.693	0.894	0.912	0.658
	VGB_2	0.904			
	VGB_3	0.872			
	VGB_4	0.873			
	VGB_5	0.755			
	VGB_6	0.746			

Notes: CR: Composite Reliability; AVE: Average Variance Extracted; CA: Cronbach's Alpha.

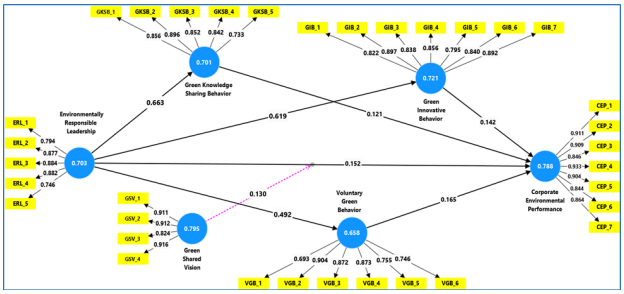

Figure 2. Measurement model with outer loadings and AVE values from PLS-Algorithm.

4.4. Discriminant Validity

In our pursuit of verifying the discriminant validity of our measures, we employed two robust techniques: the Fornell-Larcker criterion and the heterotrait-monotrait ratio (HTMT). Following the Fornell-Larcker criterion, we scrutinized the diagonal values (computed as the square root of AVE) concerning the correlation values positioned below them. As delineated in **Table 3**, our findings consistently indicate that the diagonal values exceed the correlation values below, thus affirming the presence of robust discriminant validity [50]. Additionally, we strengthened our assessment of discriminant validity by using the HTMT ratio. This method involves comparing the correlations between different constructs with those within the same construct. According to established guidelines, a ratio below 0.9 is deemed acceptable [51]. The highest HTMT value observed was 0.830, which falls within the acceptable threshold set by [51].

Table 3. Discriminant validity- Fornell Larcker.

Constructs	HTMT						Fornell Larcker					
	CEP	ERL	GIB	GKSB	GSV	VGB	CEP	ERL	GIB	GKSB	GSV	VGB
CEP							0.888					
ERL	0.461						0.435	0.839				
GIB	0.433	0.673					0.410	0.619	0.849			
GKSB	0.418	0.743	0.747				0.390	0.663	0.679	0.837		
GSV	0.465	0.077	0.091	0.084			−0.440	−0.041	−0.081	−0.056	0.892	
VGB	0.296	0.545	0.312	0.316	0.090		0.280	0.492	0.282	0.279	0.026	0.811

The off-diagonal values are the correlations between latent variables, and the diagonal is the square root of AVE.

4.5. Assessment of Structural (Inner) Model

After thoroughly examining the measurement model, we turned our focus to assessing collinearity within the structural model. This comprehensive evaluation included key indicators such as the inner Variance Inflation Factor (VIF), coefficient of determination (R^2) values, and effect size (f^2). As shown in **Table 4**, our results indicate that all predetermined thresholds for R^2, f^2, and inner VIF were comfortably met, indicating no significant collinearity issues. With collinearity properly addressed, we proceeded to rigorously test the hypotheses, as detailed below.

Table 4. Assessment of the structural model.

R-Square	Endogenous Variables	R Square		R Square Adjusted		0.26: Substantial, 0.13: Moderate, 0.02: Weak [52]
	CEP	0.428		0.419		
	GIB	0.383		0.381		
	GKSB	0.439		0.438		
	VGB	0.242		0.240		
Effect Size (F-Square)	Exogenous Variables	CEP	GIB	GKSB	VGB	0.35: Substantial, 0.15: Medium effect, 0.02: Weak effect [52]
	ERL	0.026	0.620	0.783	0.319	
	GIB	0.027				
	GKSB	0.021				
	GSV	0.338				
	VGB	0.034				
Collinearity (Inner VIF)	Exogenous Variables	CEP	GIB	GKSB	VGB	VIF <= 5.0 (Hair et al., 2017) [53]
	ERL	2.460	1.000	1.000	1.000	
	GIB	2.062				
	GKSB	2.290				
	GSV	1.076				
	VGB	1.408				

4.6. Hypotheses Testing Results

The results of hypothesis testing provide strong statistical evidence supporting the proposed relationships in this study. The findings, summarized in **Table 5** and presented in **Figure 3**, confirm the significance of the direct, mediating, and moderating effects within the research model. The first hypothesis (H1) proposed a direct positive relationship between environmentally responsible leadership (ERL) and corporate environmental performance (CEP). The results strongly support this hypothesis, with a β coefficient of 0.152, a t-value of 2.757 (above the critical threshold of 1.96), and a p-value of 0.006 (below the 0.05 significance level), confirming that ERL has a significant positive influence on CEP. The second hypothesis (H2) posited that green knowledge-sharing behavior (GKSB) mediates the relationship between ERL and CEP. The results indicate a significant mediation effect, with a p-value of 0.021, and confidence intervals for the lower limit (LL = 0.016) and upper limit (UL = 0.153) both above zero, confirming the mediating role of GKSB. This mediation is partial, as the direct relationship between ERL and CEP remains statistically significant. Similarly, the third hypothesis (H3) proposed that green innovative behavior (GIB) serves as a mediator in the ERL-CEP relationship. The results support this hypothesis, with a p-value of 0.040 and confidence intervals (LL = 0.014, UL = 0.183) indicating a significant indirect effect. This finding reinforces the idea that GIB plays a crucial role in transmitting the impact of ERL to CEP, although the mediation remains partial.

Table 5. Hypotheses testing result.

Hypotheses	**OS/Beta**	**SD**	**95% Bias Corrected Confidence Interval**		**T**	**P**	**Decision**	**Mediation**
			LL	**UL**				
H1: ERL ->CEP	0.152	0.055	0.057	0.265	2.757	0.006	Supported	
H2: ERL ->GKSB ->CEP	0.080	0.034	0.016	0.153	2.310	0.021	Supported	Partial
H3: ERL ->GIB ->CEP	0.088	0.043	0.014	0.183	2.054	0.040	Supported	Partial
H4: ERL ->VGB ->CEP	0.081	0.025	0.032	0.133	3.268	0.001	Supported	Partial
H5: GSV x ERL ->CEP	0.130	0.043	0.048	213.000	3.040	0.002	Supported	

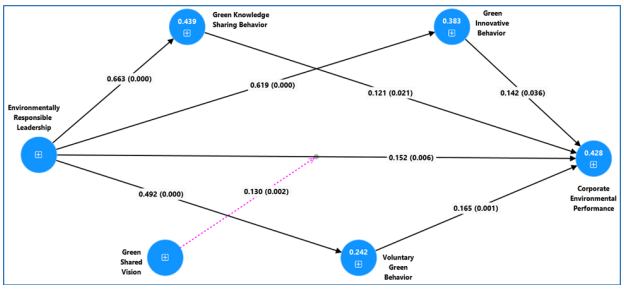

Figure 3. Structural Model with path coefficient (beta) and p-values from bootstrapping test.

The fourth hypothesis (H4) suggested that voluntary green behavior (VGB) mediates the ERL-CEP relationship. Empirical findings strongly support this hypothesis, with a p-value of 0.001 and confidence intervals (LL = 0.032, UL = 0.133) confirming the presence of a significant indirect effect. Similar to previous mediations, the mediation effect of VGB is partial, indicating that ERL continues to have a direct effect on CEP. Lastly, the fifth hypothesis (H5) examined the moderating effect of green-shared vision (GSV) on the ERL-CEP relationship. The results validate this hypothesis, as GSV significantly enhances the impact of ERL on CEP, with a β coefficient of 0.130, a t-value of 3.040, and a p-value of 0.002. These findings suggest that in organizations where GSV is strongly embedded, the influence of ERL on CEP is amplified, reinforcing the critical role of a unified sustainability vision in corporate environmental performance.

To provide a more comprehensive insight into the influence of GSV on the relationship between ERL and CEP, we have included **Figure 4**. This visual representation illustrates how the impact of ERL on CEP varies with different levels of GSV. As depicted in **Figure 4**, the effect of ERL on CEP becomes more pronounced as GSV levels increase, while it attenuates when GSV levels are low. Furthermore, to examine deeper into this dynamic relationship, we conducted separate path analyses for both high (i.e., 1 standard deviation above the mean) and low (i.e., 1 standard deviation below the mean) levels of GSV. The direct paths for ERL at both ends of the GSV spectrum are delineated in **Figure 4**. These path analyses aim to elucidate the variation in the ERL-CEP relationship based on the level of GSV. The results from these analyses reveal that when GSV is high, the ERL-CEP relationship is notably stronger, as evidenced by the larger beta coefficient. Conversely, when GSV is low, the ERL-CEP relationship appears to be weaker, indicated by the smaller beta coefficient. In essence, these findings underscore the pivotal role of GSV in shaping the connection between ERL and CEP, highlighting the nuanced interplay between ERL, GSV, and CEP.

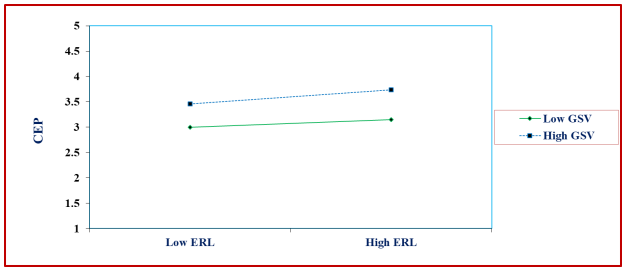

Figure 4. Interactive Effect of GSV in between ERL and GKSB.

4.7. Robustness and Reliability of Results

To ensure the reliability of our findings, we conducted multiple assessments using PLS-SEM, which is well-suited for complex models with mediation and moderation effects. First, bootstrapping with 5,000 resamples confirmed the stability of the parameter estimates. Second, variance inflation factor (VIF) values remained below the 3.30 threshold, ensuring that multicollinearity does not affect our results. Third, the heterotrait-monotrait (HTMT) ratio confirmed discriminant validity, further supporting the robustness of the constructs. Additionally, correlation analysis (**Table 1**) aligns with theoretical expectations, reinforcing the credibility of our findings. Given these factors, our results are considered reliable and robust without the need for alternative estimation methods.

5. Discussion

This study investigates the relationships between environmentally responsible leadership (ERL) and corporate environmental performance (CEP) through the lens of both Resource-Based View (RBV) and Triple Bottom Line (TBL) theories, focusing on the mediating roles of green knowledge-sharing behavior (GKSB), green innovation behavior (GIB), and voluntary green behavior (VGB) in the pharmaceutical industry of Bangladesh. It also examines the moderating role of green shared vision (GSV) in strengthening the ERL-CEP relationship. By incorporating TBL, this study highlights the economic, environmental, and social sustainability dimensions of ERL, reinforcing how sustainability-driven leader-

ship aligns corporate goals with long-term profitability and regulatory compliance. Hypothesis 1 tested the direct effect of ERL on CEP, revealing that ERL significantly enhances environmental performance within the pharmaceutical sector of Bangladesh. This aligns with TBL's premise that environmental responsibility is not only an ethical concern but also a strategic tool for long-term economic success. Empirical studies, such as [13], support this positive association, demonstrating how leadership commitment to sustainability fosters eco-friendly innovations, regulatory adherence, and operational efficiency. Given the growing regulatory pressures and stakeholder expectations in Bangladesh's pharmaceutical industry, our findings emphasize ERL's role in fostering proactive environmental stewardship, ensuring firms comply with international sustainability standards while maintaining financial resilience. Through the RBV perspective, ERL leverages internal capabilities and resources to drive sustainable practices, inspiring green innovation, employee engagement, and resource optimization. Leaders prioritizing environmental responsibility influence organizational culture, strategic decision-making, and investment in green technologies, reinforcing TBL's economic dimension by reducing costs, improving efficiency, and enhancing brand reputation. The environmental dimension of TBL is evident in waste reduction, energy efficiency, and pollution control, while the social dimension emerges as ERL fosters employee awareness, sustainability-focused training, and a shared vision for environmental responsibility. Our findings suggest that effective ERL practices—such as integrating green technologies, enforcing sustainability policies, and encouraging employee participation in sustainability efforts—directly contribute to improved CEP metrics. By aligning leadership strategies with environmental and economic objectives, pharmaceutical firms in Bangladesh can enhance competitive advantage, drive sustainable growth, and build stakeholder trust. This study underscores the imperative role of ERL in corporate sustainability, advocating for continued investment in leadership development programs that prioritize environmental responsibility as a core strategic asset.

Hypothesis 2 proposed that green knowledge-sharing behavior (GKSB) moderates the relationship between ERL and CEP. Our research findings provide valuable insights into the pharmaceutical industry in Bangladesh, highlighting the significant moderating role of GKSB in strengthening the impact of ERL on CEP. This finding aligns with Triple Bottom Line (TBL) theory, which underscores that organizations must integrate economic, environmental, and social sustainability to achieve long-term success. Empirical studies, such as [54] and [10], support this perspective, demonstrating that knowledge-sharing behaviors significantly influence the effectiveness of environmental management strategies. In Bangladesh's pharmaceutical sector, where companies face increasing regulatory pressures and stakeholder expectations for sustainability, our study emphasizes how GKSB facilitates the dissemination and implementation of environmentally responsible practices led by ERL. From the Resource-Based View (RBV) perspective, GKSB strengthens organizational capabilities by leveraging collective knowledge and expertise, which contributes to sustainable innovations and environmental performance improvements. TBL further supports this, as economic sustainability is enhanced when firms optimize resource use, improve efficiency, and reduce costs through green innovations. Leaders who cultivate a knowledge-sharing culture empower employees to contribute solutions for energy efficiency, waste reduction, and sustainable technologies, reinforcing TBL's environmental and social dimensions. Environmental sustainability is strengthened as employees proactively engage in green initiatives, while social sustainability is promoted through collaboration, employee training, and organizational commitment to sustainability goals. Our findings suggest that promoting GKSB not only strengthens internal collaboration but also enhances the effectiveness of ERL strategies, ultimately improving CEP. By integrating GKSB into leadership practices, pharmaceutical firms can navigate regulatory challenges more effectively and drive sustainability goals forward. This study reinforces the idea that knowledge-sharing is an essential resource that bridges leadership efforts with corporate sustainability, offering actionable insights for enhancing environmental performance in Bangladesh's pharmaceutical industry.

Hypothesis 3 posited that green innovation behavior (GIB) mediates the relationship between ERL and CEP. Our findings highlight the crucial role of GIB in enhancing corporate environmental performance (CEP) within Bangladesh's pharmaceutical industry, reinforcing the Triple Bottom Line (TBL) theory, which integrates economic, environmental, and social sustainability. This aligns with prior empirical

studies, such as Zhang et al.[12], and Fang et al.[55], which also emphasize the mediating effect of innovation behaviors on environmental performance. Given Bangladesh's increasing regulatory pressures and societal expectations for sustainability, our study confirms that ERL plays a vital role in stimulating GIB among employees, ensuring firms align with sustainability goals while maintaining competitiveness. The Resource-Based View (RBV) theory suggests that firms can gain a sustainable competitive advantage by leveraging green innovation as an intangible, valuable, and non-substitutable resource. Leaders who prioritize environmental responsibility foster a culture of green innovation, encouraging employees to develop and implement novel technologies, sustainable practices, and resource-efficient solutions that enhance environmental and economic performance. TBL further reinforces this relationship, as GIB-driven innovations contribute to economic sustainability by reducing costs, improving operational efficiency, and strengthening brand reputation. Environmental sustainability is enhanced through waste reduction, pollution control, and energy-efficient solutions, while social sustainability is promoted as employees engage in collaborative problem-solving and knowledge-sharing for sustainability-focused advancements. Thus, our findings suggest that ERL not only directly improves CEP but also exerts an indirect effect by fostering GIB, reinforcing the pharmaceutical sector's strategic alignment with global sustainability goals. By integrating green innovation within leadership-driven sustainability efforts, firms can enhance competitiveness, regulatory compliance, and stakeholder trust, while advancing broader environmental objectives.

Hypothesis 4 posited that voluntary green behavior (VGB) mediates the relationship between ERL and CEP. Our research provides compelling insights into the pharmaceutical industry in Bangladesh, emphasizing the critical role of VGB in enhancing corporate environmental performance (CEP) through leadership-driven sustainability initiatives. This aligns with Triple Bottom Line (TBL) theory, which integrates economic, environmental, and social sustainability, highlighting how voluntary employee engagement in green practices strengthens both environmental responsibility and business competitiveness. Empirical studies, such as[13], similarly emphasize the mediating role of voluntary behaviors in promoting environmental performance, reinforcing our findings. In Bangladesh's highly regulated pharmaceutical sector, where sustainability concerns are rising due to regulatory pressures and societal expectations, our study underscores how ERL fosters a culture of voluntary environmental participation. The Resource-Based View (RBV) theory suggests that organizations gain a sustainable competitive advantage by leveraging intangible resources, such as employee-driven green initiatives. Leaders who champion environmental responsibility embed sustainability values and norms, encouraging employees to engage voluntarily in eco-friendly behaviors, including waste reduction, energy efficiency, and sustainable sourcing. TBL further validates these findings, as VGB contributes to economic sustainability by enhancing resource efficiency, reducing operational costs, and improving corporate reputation. Environmental sustainability is reinforced through proactive employee participation in pollution reduction and conservation efforts, while social sustainability emerges as employees feel empowered to contribute to corporate environmental initiatives. Our findings suggest that fostering a culture of VGB not only aligns with regulatory compliance but also enhances sustainability-driven innovation and stakeholder trust. By embedding ERL into corporate sustainability strategies, pharmaceutical companies in Bangladesh can leverage VGB to improve operational efficiencies, reduce their environmental footprint, and strengthen their market positioning. This study contributes to understanding how leadership influences environmental performance in emerging markets, advocating for strategic investments in leadership development and voluntary sustainability initiatives within the pharmaceutical industry.

Hypothesis 5 posited that green shared vision (GSV) moderates the relationship between environmentally responsible leadership (ERL) and corporate environmental performance (CEP). Our research findings provide significant insights into the pharmaceutical industry in Bangladesh, underscoring the critical role of GSV in amplifying ERL's impact on CEP. This aligns with Triple Bottom Line (TBL) theory, which emphasizes the integration of environmental, economic, and social sustainability, reinforcing how a shared vision for sustainability strengthens corporate commitment to green initiatives while enhancing business resilience. Empirical studies, such as Wernerfelt[17] and Cheng et al.[56], support these findings, emphasizing that a unified vision in

environmental leadership strengthens corporate sustainability outcomes [57]. In Bangladesh's rapidly growing pharmaceutical sector, characterized by increasing environmental scrutiny and evolving regulatory expectations, our study highlights how a strong GSV aligns leadership-driven sustainability initiatives with employee engagement, enhancing the effectiveness of ERL strategies. The Resource-Based View (RBV) theory suggests that firms develop a sustainable competitive advantage by leveraging strategic resources, and GSV functions as a critical intangible asset that aligns organizational efforts towards sustainability-driven innovation and operational efficiency [58, 59]. Leaders who effectively communicate and cultivate a shared sustainability vision empower employees to integrate environmental considerations into daily operations, driving proactive waste reduction, eco-friendly production methods, and regulatory compliance initiatives. TBL further reinforces these findings, as GSV enhances economic sustainability by fostering cost-effective green innovations, reducing inefficiencies, and strengthening corporate reputation. Environmental sustainability is improved as organizations embed a collective commitment to green practices, while social sustainability emerges through employee alignment with corporate sustainability objectives, promoting long-term engagement and ethical leadership practices. Our findings suggest that nurturing a strong GSV not only fosters internal cohesion but also enhances ERL's effectiveness in achieving CEP. By integrating GSV into leadership strategies, pharmaceutical firms in Bangladesh can navigate regulatory challenges, strengthen stakeholder trust, and establish a sustainability-focused corporate culture. The study extends previous research by demonstrating that ERL's impact on sustainability outcomes is significantly amplified when organizations prioritize shared environmental goals, reinforcing sustainability-driven leadership as a strategic resource. Thus, this study underscores the critical role of GSV in moderating the ERL-CEP relationship, advocating for continued investment in leadership development programs that embed sustainability vision into corporate decision-making. By doing so, pharmaceutical firms can achieve long-term environmental and economic success, ensuring regulatory compliance, resource efficiency, and corporate sustainability leadership in an evolving global landscape.

5.1. Theoretical Implications

This study contributes to the theoretical understanding of corporate environmental performance (CEP) by integrating insights from both the Resource-Based View (RBV) theory and the Triple Bottom Line (TBL) theory. These frameworks explain how environmentally responsible leadership (ERL) fosters sustainability by leveraging intangible organizational resources and aligning environmental goals with economic and social performance. From the perspective of RBV, firms gain a sustainable competitive advantage by developing valuable, rare, inimitable, and non-substitutable (VRIN) resources. In this study, ERL serves as a strategic intangible resource that strengthens organizational culture, environmental responsibility, and innovation, all of which are essential for CEP. Leaders who integrate sustainability into corporate strategy create a culture where employees adopt green knowledge-sharing behavior (GKSB) and voluntary green behavior (VGB), enhancing environmental efficiency and regulatory compliance. The mediating role of GKSB and VGB supports RBV's assertion that knowledge exchange and employee-driven sustainability efforts are critical organizational capabilities contributing to long-term competitive advantage. The TBL theory further strengthens the theoretical foundation by emphasizing the integration of economic, environmental, and social sustainability. ERL aligns with TBL's principles, ensuring that organizations not only improve environmental performance but also achieve economic gains through cost reduction, efficiency improvements, and enhanced reputation. The study's findings reinforce the idea that firms embedding green leadership and employee-driven sustainability efforts can achieve financial resilience while exceeding regulatory requirements. Additionally, the moderating role of green shared vision (GSV) aligns with both RBV and TBL. RBV suggests that GSV enhances leadership's ability to direct environmental initiatives, making sustainability an integrated strategic asset. Meanwhile, TBL highlights that a well-defined shared vision aligns social and environmental priorities with corporate goals, ensuring employee engagement and long-term sustainability commitments. Thus, this study extends RBV and TBL by demonstrating how ERL, employee sustainability behaviors, and shared vision contribute to corporate environmental and financial success, reinforcing sustainability-driven leadership as a competitive asset in organizations.

5.2. Practical Implications

The practical implications drawn from our findings provide actionable insights for pharmaceutical companies in Bangladesh aiming to enhance their CEP through ERL practices. Firstly, fostering ERL within organizations is crucial for driving sustainable practices and achieving regulatory compliance. Our research highlights that leaders who prioritize environmental responsibility set a tone that permeates throughout the organization, influencing employees to adopt green initiatives. Practical implications include the development of leadership training programs that emphasize environmental stewardship, integrating sustainability goals into leadership performance evaluations, and appointing ERL champions who spearhead sustainability efforts within departments. Secondly, leveraging GKSB as a mechanism to enhance CEP is essential. Organizations can promote GKSB by establishing platforms for sharing best practices, organizing workshops or seminars on environmental sustainability, and incentivizing employees who contribute innovative green ideas. Practical steps include creating digital platforms for knowledge exchange, implementing cross-functional teams focused on sustainability projects, and fostering a culture where employees feel empowered to share their environmental knowledge and experiences. Moreover, encouraging VGB among employees is critical for sustaining environmental initiatives. Organizations can promote VGB by recognizing and rewarding employees who actively participate in sustainability initiatives, incorporating green metrics into employee performance evaluations, and fostering a supportive work environment that values environmental consciousness. Practical strategies include implementing green teams or committees responsible for organizing eco-friendly activities, providing training on sustainable practices, and celebrating achievements in reducing environmental impacts. Furthermore, cultivating a GSV can align organizational goals with environmental objectives, thereby enhancing the effectiveness of ERL initiatives. Practical implications involve communicating a clear and compelling vision for sustainability throughout the organization, integrating environmental goals into strategic planning processes, and engaging stakeholders (both internal and external) in dialogue about sustainable practices and goals. Leaders can facilitate GSV by conducting regular town hall meetings, creating sustainability task forces that include diverse stakeholders, and aligning corporate social responsibility (CSR) initiatives with environmental objectives. Additionally, integrating environmental considerations into supply chain management practices can further enhance CEP. Practical steps include conducting supplier audits to assess environmental compliance, establishing procurement policies that prioritize eco-friendly products and services, and collaborating with suppliers to implement green supply chain initiatives. By extending environmental responsibility beyond organizational boundaries, pharmaceutical companies can mitigate risks associated with supply chain disruptions, enhance brand reputation, and meet the expectations of environmentally conscious consumers and regulators. Our study offers practical implications that pharmaceutical companies in Bangladesh can adopt to enhance their corporate environmental performance through effective leadership, knowledge sharing, voluntary behaviors, and shared vision for sustainability. By implementing these strategies, organizations can not only achieve regulatory compliance and operational efficiencies but also foster a culture of environmental responsibility that enhances long-term competitiveness and stakeholder trust in the pharmaceutical sector.

5.3. Policy Implications

The findings of this study provide valuable insights for corporate leaders, policymakers, and environmental regulators aiming to enhance corporate environmental performance (CEP) through environmentally responsible leadership (ERL). The results indicate that ERL positively influences CEP, with green knowledge sharing behavior (GKSB), green innovative behavior (GIB), and voluntary green behavior (VGB) acting as essential mediators, while green-shared vision (GSV) strengthens this relationship. These findings highlight the need for organizations to integrate sustainability-driven leadership training into management development programs, fostering a corporate culture that encourages employees to engage in green initiatives. Businesses should establish incentive mechanisms that reward employees for participating in sustainability efforts, such as implementing eco-friendly production techniques and adopting green supply chain management practices. From a regulatory perspective, policymakers should design policies that incentivize organizations to adopt sustainability-oriented leadership approaches through tax benefits, sub-

sidies, or green certifications, encouraging firms to align corporate strategies with national and global environmental goals. Additionally, regulatory bodies should mandate the inclusion of green leadership metrics in corporate environmental performance assessments to ensure the widespread adoption of sustainability-driven leadership. The study's implications also align with global sustainability efforts, particularly the United Nations Sustainable Development Goals (SDGs), such as Goal 9 (Industry, Innovation, and Infrastructure) and Goal 13 (Climate Action), emphasizing the importance of leadership in driving sustainability. By implementing these policy recommendations, organizations and governments can create an environmentally conscious corporate ecosystem where leadership plays a proactive role in advancing sustainability, enhancing environmental performance, and fostering long-term economic resilience.

5.4. Limitations and Future Research Direction

Despite its contributions, this study has several limitations that should be acknowledged. First, the cross-sectional research design limits the ability to establish causal relationships between environmentally responsible leadership (ERL) and corporate environmental performance (CEP). Future studies should employ longitudinal research designs to assess how ERL influences sustainability-related behaviors over time, providing a more robust understanding of causal mechanisms. Second, this study is industry-specific, focusing solely on the pharmaceutical sector in Bangladesh. While this approach enhances the study's contextual relevance, it limits generalizability to other industries or geographic regions. Future research should conduct comparative studies across different industries and cultural contexts to explore whether similar leadership-environmental performance relationships hold in other sectors. Additionally, while this study used PLS-SEM as the primary analytical method, alternative statistical approaches, such as covariance-based SEM (CB-SEM), hierarchical modeling, or machine learning techniques, could be explored in future research to validate the robustness of findings. Furthermore, future studies should examine additional moderating and mediating factors that may influence the ERL-CEP relationship. Potential variables such as corporate environmental policies, digital transformation in sustainability, or employee engagement could provide deeper insights into how ERL drives organizational environmental outcomes. Finally, stakeholder perspectives remain an underexplored dimension in ERL research. Future studies could incorporate qualitative methods, mixed-methods approaches, or stakeholder interviews to understand how ERL is perceived and implemented from multiple organizational levels, including employees, executives, policymakers, and investors. By addressing these areas, future research can contribute to a more comprehensive and multi-dimensional understanding of leadership's role in driving corporate sustainability.

6. Conclusion

This study examined the role of environmentally responsible leadership (ERL) in enhancing corporate environmental performance (CEP) within the pharmaceutical industry, with green knowledge sharing behavior (GKSB), green innovative behavior (GIB), and voluntary green behavior (VGB) as mediators and green-shared vision (GSV) as a moderator. The findings confirm that ERL significantly improves CEP, primarily through its influence on employee-driven sustainability behaviors. The moderating role of GSV further strengthens this relationship, suggesting that a unified sustainability vision within organizations amplifies the effectiveness of ERL. These insights contribute to the growing body of literature on sustainability leadership by demonstrating how leadership styles influence environmental outcomes beyond traditional regulatory compliance. Despite these contributions, this study has some limitations. First, the cross-sectional research design limits the ability to establish causal relationships. Future research should consider longitudinal studies to examine how ERL and employee-driven green behaviors evolve over time. Second, while this study focused on the pharmaceutical industry in Bangladesh, the findings may not be generalizable to other industries or geographical contexts. Comparative studies across different sectors and regions could provide a broader understanding of how ERL operates in diverse settings. Third, although PLS-SEM was an appropriate analytical approach, future studies could explore alternative methodologies, such as mixed-methods approaches, to provide deeper qualitative insights into leadership's role in sustainability. Future research should also explore additional moderating and mediating variables that may influence the ERL-CEP relationship. Fac-

tors such as organizational culture, digital transformation, or environmental policy frameworks could provide further insights into how companies embed sustainability in their leadership practices. Additionally, integrating perspectives from stakeholders, including policymakers, employees, and investors, would offer a more comprehensive understanding of the impact of ERL on corporate sustainability. In summary, this study highlights the critical role of leadership in promoting corporate sustainability, emphasizing the need for organizations and policymakers to embed sustainability-driven leadership frameworks into corporate strategies. By fostering a culture of green knowledge sharing, innovation, and voluntary environmental behavior, businesses can enhance their long-term environmental performance while aligning with global sustainability goals. These findings provide a foundation for future research and offer actionable insights for organizations striving to integrate sustainability into their core leadership and operational practices.

Author Contributions

N.A. conceived the study's main idea, designed the framework, and conducted data collection and analysis. M.O.A.B. contributed to methodology and questionnaire development, while F.H. wrote the discussion and conclusion. M.A.I.G. handled the introduction, editing and H.S.A. conducted the literature review. Z.M. ensured language accuracy and final editing. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

The research presented in this study was conducted in accordance with ethical standards and received approval from the University Ethics Committee. This ensures that the research complies with all ethical guidelines necessary to protect participants' rights throughout the research.

Informed Consent Statement

Not applicable.

Data Availability Statement

The author has access to the data and can provide it upon request.

Acknowledgement

We gratefully utilized the AI tool (ChatGPT) to ensure linguistic standardization throughout our research paper.

Conflict of Interest

The authors declare no conflicts of interest.

Appendix A. Questionnaire

Appendix A.1. Demographic Profile

(Please tick [✓] the appropriate option)

1. **Gender:**
   □ Male □ Female □ Prefer not to say
2. **Age Group:**
   □ Below 25 □ 25–34 □ 35–44 □ 45–54 □ 55 and above
3. **Educational Qualification:**
   □ High School □ Diploma □ Bachelor's □ Master's □ PhD □ Others
4. **Job Position:**
   □ Entry-level □ Mid-level □ Senior-level □ Managerial □ Executive

5. **Years of Experience:**
   □ Less than 1 year □ 1–3 years □ 4–6 years □ 7–10 years □ More than 10 years
6. **Department:**
   □ Production □ Research & Development □ Administration □ Human Resources
   □ Sustainability/Environmental Management □ Other (please specify): _____
7. **Organizational Size:**
   □ Small (1–50 employees) □ Medium (51–250 employees) □ Large (251+ employees)
8. **Type of Employment:**
   □ Full-time □ Part-time □ Contract □ Temporary
9. **Environmental Training Received:**
   □ Yes □ No □ Not sure

Appendix A.2. Research Variables

Please indicate the extent to which you agree with each statement on a five-point Likert scale:
1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

Construct	Code	Statement	1	2	3	4	5
Environmentally Responsible Leadership (ERL)	ERL1	My leader actively promotes environmentally friendly behaviors in the workplace.	1	2	3	4	5
	ERL2	My leader sets a clear vision for sustainability within the organization.	1	2	3	4	5
	ERL3	My leader encourages employees to engage in environmentally responsible initiatives.	1	2	3	4	5
	ERL4	My leader integrates environmental responsibility into decision-making processes.	1	2	3	4	5
	ERL5	My leader provides guidance and training on environmental sustainability practices.	1	2	3	4	5
Corporate Environmental Performance (CEP)	CEP1	Our organization effectively reduces waste through sustainable practices.	1	2	3	4	5
	CEP2	We have successfully minimized our carbon footprint over the past year.	1	2	3	4	5
	CEP3	The company actively promotes the use of renewable energy sources.	1	2	3	4	5
	CEP4	Our organization complies with environmental regulations and standards.	1	2	3	4	5
	CEP5	We have implemented green supply chain management practices.	1	2	3	4	5
	CEP6	Our organization regularly monitors and improves its environmental sustainability initiatives.	1	2	3	4	5
	CEP7	Employees are encouraged to contribute ideas for improving environmental performance.	1	2	3	4	5
Green Knowledge-Sharing Behavior (GKSB)	GKSB1	Employees frequently share environmental sustainability knowledge with colleagues.	1	2	3	4	5
	GKSB2	I discuss green practices with my coworkers to improve environmental performance.	1	2	3	4	5
	GKSB3	The company encourages the exchange of eco-friendly ideas and solutions.	1	2	3	4	5
	GKSB4	Employees collaborate to find sustainable solutions for operational issues.	1	2	3	4	5
	GKSB5	Our organization provides platforms for employees to exchange and document sustainability knowledge.	1	2	3	4	5
Green Innovative Behavior (GIB)	GIB1	I actively seek innovative solutions to improve environmental performance.	1	2	3	4	5
	GIB2	Our company supports the development of green technologies and sustainable solutions.	1	2	3	4	5
	GIB3	Employees are encouraged to propose new ideas for reducing environmental impact.	1	2	3	4	5
	GIB4	The organization invests in eco-friendly innovations and product development.	1	2	3	4	5
	GIB5	I experiment with new work methods that reduce environmental damage.	1	2	3	4	5
	GIB6	My organization encourages research and development of sustainable products and services.	1	2	3	4	5
	GIB7	I engage in brainstorming sessions focused on creating green business solutions.	1	2	3	4	5
Voluntary Green Behavior (VGB)	VGB1	I voluntarily engage in environmentally friendly actions beyond my job responsibilities.	1	2	3	4	5
	VGB2	Employees in my organization take personal initiative in sustainability efforts.	1	2	3	4	5
	VGB3	I actively participate in workplace initiatives that promote environmental awareness.	1	2	3	4	5
	VGB4	I take steps to reduce resource consumption even when not required.	1	2	3	4	5
	VGB5	I motivate my colleagues to engage in environmentally friendly practices at work.	1	2	3	4	5
	VGB6	I incorporate sustainability into my daily tasks without being instructed to do so.	1	2	3	4	5
Green Shared Vision (GSV)	GSV1	Our organization has a clearly defined environmental sustainability vision.	1	2	3	4	5
	GSV2	Employees align their work with the company's green objectives.	1	2	3	4	5
	GSV3	Leadership effectively communicates the importance of environmental responsibility.	1	2	3	4	5
	GSV4	There is a strong organizational commitment to long-term sustainability goals.	1	2	3	4	5

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