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Effects of Green Human Resource Management Practices on Environmental Performance of the Organization: The Mediating Role of Green Innovation and Corporate Social Responsibility and the Moderating Role of Green Transformational Leadership

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Abstract

Purpose: This research examines the environmental sustainability of manufacturing companies with a focus on preserving the planet for future generations. It aimed to empirically test the factors (i.e., green human resource management practices (GHRMP), green innovation (GIN), and corporate social responsibility (CSR)) influencing the environmental performance of the organization (EPO) using the natural resource-based view theory. This research also examines the moderation effect of green transformational leadership (GTL) as well as the indirect effects of GIN and CSR in Ghana's manufacturing industry.

Design/methodology: 369 manufacturing employees were selected using convenience sampling. Data was collected using an online survey and analyzed through SmartPLS version 4.1.

Findings: This research outcome includes the positive effect of GHRMP on GIN, CSR, and EPO. In addition, the GHRMP–EPO link is indirectly affected by GIN and CSR. Moreover, the GTL significantly moderated the GHRMP–CSR link. Overall, the study model explained 56.9% variance for the EPO in the manufacturing sector.

Research limitations: This research employed self-reported data, which limits causal inference. Considering this, this study suggests that upcoming studies use a longitudinal or multi-source research design to validate their study results and explore sectoral differences.

Originality/value: This study adds to the growing body of literature on green practices by providing evidence from a developing country context, where empirical studies remain limited. Considering the decision science perspective, these research findings offer a practical decision-making model for manufacturing managers, enabling them to strategically allocate resources to GHRMP, GIN, and CSR initiatives to optimize EPO.

Keywords: green human resource management practices; green innovation; environmental performance of the organization; manufacturing sector

JEL Classifications: L6, O31, Q01

1. Introduction

Today, the issues related to environmental and sustainable development are of significant importance, particularly in developed nations (M. Ahmad et al., 2024; Anser et al., 2024). Following the period of the Industrial Revolution, these concerns have gained increased attention, resulting in escalated environmental deterioration, heightened degradation of natural habitats, and a more pronounced severity of environmental pollution (Rana & Arya, 2024). There are a growing recognition and pressure from stakeholders that companies need to achieve a harmonious equilibrium between economic goals and environmental well-being by implementing eco-friendly business practices such as green human resource management practices (GHRMP), green innovation (GIN), green transformational leadership (GTL) and others (Qalati, Barbosa, & Ibrahim, 2023; Singh et al., 2020). Furthermore, the environmental performance of the organization (EPO) is a very important ingredient of sustainable development (Qalati, Barbosa, & Iqbal, 2023). It determines the health of the ecosystem and thus resource conservation and public well-being (Wu et al., 2024). How a "green" organization is going to aid environmental conservation in the present scenario by reducing carbon footprint, reducing wastes, and saving some natural resources in combating climate change (Hassan et al., 2024; Rana & Arya, 2024). A strong environmental performance within firms also improves the corporate reputation, meets regulatory requirements, and builds customer trust and loyalty (Kumari et al., 2021). Moreover, Qalati, Siddiqui, and Magni (2024) recently noted that studies are required to explore the antecedents of the EPO in the context of the manufacturing sector. Likewise, Siddiqui et al. (2024) also call for studies devoted to the factors impacting EPO in the context of African and Chinese manufacturing companies.

Considering this, the present study emphasizes the factors impacting EPO in the Ghanaian manufacturing sector. Due to the harmful consequences of manufacturing procedures on the ecosystem, various industries globally have supported regulations and guidelines aimed at mitigating the exhaustion of natural resources and minimizing the adverse effects of corporate actions on the community at a large scale (B. Ahmad et al., 2024). Apart from contributing 23.6% to the gross domestic product (Abokyi et al., 2019) and generating 71.2% of jobs (Abokyi et al., 2021), the industrial sector is a leading source of CO_2 emissions, accounting for 12.5% of total emissions (Bank, 2014). This sector has encountered challenges in the strict enforcement of emission regulations. Additionally, it has been reported that 76.7% of greenhouse gas emissions are attributed to CO_2 emissions, primarily originating from developing countries like Ghana (Abokyi et al., 2019).

Consequently, it is imperative for Ghanaian manufacturing enterprises to adhere to eco-friendly strategies to alleviate the adverse effects on natural resources. Within the context of ecological management, the integration of green human resource management is identified as a component of HRM that aims to effectively introduce environmentally conscious measures within organizations (Aftab & Veneziani, 2024). Presently, the landscape of GHRMP is experiencing rapid advancements, aligning with the escalating demands associated with global climate transformations (Zihan et al., 2024). Several nations have initiated efforts to integrate such green practices into their organizational framework while enhancing economic sustainability. Following the observation of evolving global dynamics, developing countries,

including Ghana, have also begun implementing green measures to improve eco-friendly practices within the manufacturing industry. Therefore, this study used GHRMP as one of the predictors of the enterprise's performance.

In particular, GHRM within an enterprise illustrates an organization's focus on the environment, encompassing various human resource management activities that prioritize green initiatives throughout the recruitment, selection, training, and management of performance appraisal cycles, in addition to reward and compensation management (Rana & Arya, 2024; Shah & Soomro, 2023). These activities concentrate on the fragility of ecosystems and the environmental impacts of corporations' economic endeavors. Implementation of GHRMP fosters a more environmentally sustainable workplace, resulting in enhanced operational efficiencies and heightened employee awareness of environmental initiatives (Amjad et al., 2021; Kanan et al., 2023).

Previous studies have indicated that green-oriented firms are better placed in developing human, business, and technological resources needed to build eco-capability, using sustainable innovation to gain a competitive advantage to achieve superior performance (Becker, 2023). However, for companies focused on sustainability, managers still need to work out how to strike a balance between being socially responsible in protecting the environment while at the same time being profitable and viable (Zhang & Walton, 2017). GIN seems to be considered a key 'win-win' strategy that reinforces economic and ecological performance simultaneously (Nureen et al., 2023; Shah & Ivascu, 2024; Zhang & Walton, 2017). At the same time, GIN is different from ordinary innovation in its strong emphasis on decreasing ecological impact and includes innovation in products, processes, organizational methods, as well as institutional and social structures (Zhang & Walton, 2017). Although the importance of GIN has been incrementally explored, research is still at a nascent stage, surrounded by debates regarding its effect on organizational outcomes (Nureen et al., 2023; Shah & Ivascu, 2024). Some argue that GIN exerts a positive influence on corporate performance, while others have said it might come surrounded by trade-offs since increasing costs and technological complexities cannot be avoided (Larbi-Siaw et al., 2023; Xuhua et al., 2023). This lack of consensus brings complexity to organizations that are oriented toward sustainability. Regarding this, the current study specifically focuses on GIN and its direct or indirect effects on organizational outcomes within manufacturing organizations (Zhang & Walton, 2017).

Furthermore, corporate social responsibility (CSR) is also one of the essential factors for the EPO, because it directly goes hand-in-hand with each other (Lee et al., 2016; Niazi et al., 2023). In developing their sense of CSR, companies reaffirm an everyday commitment to minimizing impacts on the environment through waste reduction, enhanced energy efficiency, and responsible sourcing (Chuang & Huang, 2018). This not only helps in lessening the negative impact of industries on the environment but also contributes towards compliance with regulation, thus reducing the possibilities of legal penalties (Kraus et al., 2020; Zhou et al., 2023). CSR also provides a corporate reputation and consumer trust and loyalty that help drive competitive advantage (Kumari et al., 2021). Further, CSR helps an organization harmoniously balance economic growth with environmental stewardship so there is a future for both the business and the community (Bhat et al., 2024). However, there is limited literature on the social sustainability aspect of

GHRMP (Jiang et al., 2024). Yasin et al. (2023) also noted the limited research on GHRM and CSR, especially in developing countries. Addressing this research gap, the current study examines the role of CSR not only as an outcome of GHRMP but also as a mediating construct in how GHRMP affects the EPO.

Moreover, GTL is the leadership behavior that presents a clear vision, encouragement, and enthusiasm to the employee (Niazi et al., 2023). It encourages the development of employees in order to achieve certain environmental goals regarding sustainable development. It is believed that transformational leaders achieve positive results by influencing and infusing a vision (Madi Odeh et al., 2023). In the present study, GTL has been looked at as an intervening variable that could strengthen the connection between the independent construct, namely GHRMP, and the mediator GIN. There are recent calls for testing the moderating role of GTL in the context of environment-based studies (Awan et al., 2023; Taleb & Pheniqi, 2023).

By addressing these gaps, this work makes three contributions: (1) it improves empirical understanding of how GHRMP influences EPO through the mediating role of GIN and CSR, (2) it introduces GTL as a moderator within this framework, responding to recent studies calls, and (3) it enriches the limited body of literature on green practices in developing country manufacturing sectors, specially in the Ghanaian context. Furthermore, this research contributes to the decision sciences field by offering an empirically grounded decision-making model that guides manufacturing firms in prioritizing and integrating GHRMP, GIN, and CSR to achieve superior environmental outcomes.

Thus, based on the above research discussions and identified gaps, our research aimed to answer the following research questions

1. How does GHRMP influence EPO?
2. Do GIN and CSR mediate the link between GHRMP and EPO?
3. Does GTL moderate the influence of GHRMP on GIN and CSR?

Considering the structure of the rest of the study, Section 2 details the literature review and formulation of the hypotheses. Section 3 includes the methodology, which explains how the study chose the sample and collected data. Section 4 covers the data analysis leading to the Section 5 discussion. The last section's conclusion details the theoretical and practical implications, as well as limitations and future directions.

2. Theoretical Background and Hypotheses Construction

2.1 Theoretical Framework

The establishment of our research model is founded on the grounds of the natural resource—based view theory by Hart (1995), underlining how organizations can achieve a competitive advantage through strengths and capabilities through which they support sustainable development. Last but not least, GHRMP and GIN complement each other to enhance the enterprise's ability to invest in CSR through

sustained development (Le, 2022). This will attract enterprises to invest in such activities and create an opportunity to increase CSR as well as EPO (Awan et al., 2023; Niazi et al., 2023). Moreover, a transformational leader can enable a vision, motivate employees, act as a role model, and lead by example. The GTL style of the manufacturing company leader, according to the natural resource-based view theory, can motivate a green vision among the employees and inspire them only when the company leader attains a green philosophy (Al-Ghazali et al., 2022). In that respect, GTL would justify the link between GHRMP and CSR (Niazi et al., 2023) and GIN (Awan et al., 2023) by being the approach that would meet the green objectives of the company and inspire them by applying such philosophies in their jobs.

2.2 Literature Review and Hypothesis Construction

2.2.1 GHRMP and EPO

GHRM places emphasis on promoting environmentally friendly behavior among employees of a company by implementing appropriate, effective, and relevant policies, systems, and initiatives to cultivate a work environment and organization that is eco-conscious, efficient, and socially accountable (Ly & Pathak, 2024). The recruitment process under GHRM is centered around environmental preservation; it involves communicating to potential candidates the company's dedication to environmental causes (Shah & Soomro, 2023). Rana and Arya (2024) contended that GHRMP serves as a mechanism for organizations to effectively engage, equip, and facilitate their workers in adapting to changes related to the execution of environmental strategies. Amjad et al. (2021) and Kanan et al. (2023) viewed GHRMP as the optimal approach for enhancing organizational environmental outcomes, asserting that organizations can enhance performance by fostering an environment where eco-friendly initiatives are embraced as common values among employees. The significance of GHRMP lies in its capacity to enhance organizational human capital, ultimately leading to improved organizational outcomes (Aftab & Veneziani, 2024). Moreover, numerous studies have transitioned their attention toward the domain of GHRM and GHRMP, emphasizing the correlation between GHRMP and favorable environmental performance (Aftab & Veneziani, 2024; Amjad et al., 2021; Awan et al., 2023; Kanan et al., 2023; Rana & Arya, 2024). Therefore, we stated that:

H1: *GHRMP significantly impacts EPO in the manufacturing sector.*

2.2.2 GHRMP and GIN

In a study by Rana and Arya (2024), it is posited that GHRM and GIN drive organizations to embrace activities that promote the utilization of clean energy sources, eco-friendly technologies, and systems that yield products with reduced emissions by optimizing resource usage. Similarly, Aftab et al. (2023) reported a significant influence of GHRM on Pakistani manufacturing companies' sustainability outcomes. Research by Awan et al. (2023) on 315 manufacturing SMEs also reported significant effects of GHRMP on SMEs' GIN (product and process). While the earlier research suggests a connection between GHRMP and GIN with consistent outcomes, Singh et al. (2020) contend that the relationship between GHRMP and

GIN is dynamic, leading to varying and conflicting findings. Additionally, Shah and Soomro (2023) assert in their recent research that GHRMP serves as the most reliable predictor of GIN. Hence, suggested that:

H2: *GHRMP significantly impacts GIN in the manufacturing sector.*

2.2.3 GHRMP and CSR

Previously, it was claimed that human resources play a crucial role in achieving sustainability and financial success in businesses, with environmental initiatives in HRM considered part of broader CSR programs (Stahl et al., 2020). Despite little change in the concept of CSR over the decades, it remains vital for company strategy development, evolving to include sustainability alongside socially responsible practices (Arena et al., 2018; Sabokro et al., 2021).

Human resource activities such as recruitment, training, performance management, and talent retention support CSR development and implementation, creating synergy between HRM and CSR (Ma'erat et al., 2024). Typically managed by human resources or a dedicated team, these activities translate CSR strategies into practical measures. Effective coordination between GHRM and CSR enhances employee involvement, promotes new human resource practices, and clarifies the significance of green concepts (Sabokro et al., 2021). Employees' perceptions of CSR significantly impact organizational commitment, company development, behavior formation, and performance improvements (Silva et al., 2023; Vuong & Bui, 2023). GHRMP has emerged in response to CSR demand (Jiang et al., 2024), indicating the need for future GHRMP research to incorporate CSR measures (Pham et al., 2020; Ren et al., 2018).

Furthermore, GHRMP, such as e-interviews and recruitment, supports CSR. Such a GHRMP helps the enterprise reduce resource exploitation and waste generation. Often, GHRMP exercised within a firm gives rise to CSR activities (Chowdhury et al., 2017). However, GHRM literature has also been criticized because the dominant GHRM literature discusses intra-organizational management activities and therefore has paid little attention to interactions with the external environment during its discussion of CSR activities (De Stefano et al., 2018). Previously, Sabokro et al. (2021) tested a sample of 384 randomly selected managers and employees and reported a significant impact of GHRMP on CSR. Similarly, Niazi et al. (2023) also evidenced a positive impact of GHRMP in the context of the banking sector. Hence, suggested that:

H3: *GHRMP significantly impacts CSR in the manufacturing sector.*

2.2.4 GIN and EPO

Numerous studies have indicated a direct correlation between GIN and organizational sustainability outcomes, as emphasized by Becker (2023), Kanan et al. (2023), Rana and Arya (2024), Shah and Soomro (2023), and Singh et al. (2020). Aftab et al. (2023) have defined GIN as the advancement of technology in manufacturing and administrative processes, enabling firms to enhance production output and environmental performance. Meanwhile, other scholars, including Bhatia (2021) and Niazi et al. (2023), consider GIN a strategy for adjusting systems, products, and procedures for superior EPO and

sustainability. More recently, Chen et al. (2024) explored the significant impact of GIN on societal outcomes. Furthermore, GIN relates to the environmental management approach of an organization and is a driver of its sustainability outcomes (Bhat et al., 2024). Researchers have suggested that these practices should be seen as a strategic and proactive approach for increasing EPO and gaining a competitive advantage, rather than being perceived as a reactive answer (Becker, 2023; Kraus et al., 2020; Shah & Ivascu, 2024). That's why we suggested that:

H4: *GIN significantly impacts EPO in the manufacturing sector.*

2.2.5 GIN and CSR

GIN not only improves EPO but also helps improve organizational CSR (Niazi et al., 2023). Notably, green processes and product innovations reduce the environmental impact of businesses and enhance social and financial performance by reducing waste and costs of respective businesses (Novitasari & Tarigan, 2022). Previous literature has shown that GIN should not be regarded as an instrumental approach to stakeholders putting pressure, but rather as a proactive measurement of organizational practices aimed at achieving the expected EPO and competitive advantage (Kratzer et al., 2017). The theory of the Natural Resource-Based View is that green products and process innovation are organizational resources that are cardinal for companies to invest in CSR-related activities (Niazi et al., 2023). Therefore, the following hypothesis was proposed.

H5: *GIN significantly impacts CSR activities in the manufacturing sector.*

2.2.6 CSR and EPO

Chuang and Huang (2018) collected data from 358 Taiwanese manufacturing companies and found that incorporating environmental CSR-related activities enhances EPO. Furthermore, CSR is seen as a strategic tool for improving EPO (Bhat et al., 2024). CSR facilitates progress in various areas, including the environment, economy, and ethics (Simmou et al., 2023; Xin et al., 2023). Similarly, Luo and Qu (2023) noted that a commitment to organizational CSR increases EPO. Khaddage-Soboh et al. (2024) also described a significant positive relationship between CSR and EPO. Thus, organizations' direct and indirect investments in CSR-related initiatives are expected to enhance EPO. Based on this, the study proposed the following hypotheses

H6: *GIN significantly impacts EPO in the manufacturing sector.*

2.2.7 Mediating role of GIN

Organizations in the modern world are constantly seeking to develop new sustainable initiatives and integrate environmental management practices to enhance organizational sustainability and competitive advantage (Awan et al., 2023). In this context, a GHRM model comprising recruitment practices, performance appraisal, and training and development programs is essential to develop (Rana & Arya, 2024). The emergence of green practices in the workplace is mainly attributed to the growth and

development of technology and innovation (Fernando et al., 2019), and thus, it is critical that the GHRM philosophy adopted by the organizations is well-aligned with the organizational objectives. Even though some studies have been conducted on the impact of GHRM on organizational sustainability-related outcomes, very few studies have been conducted to understand the underlying process through which GHRMP affects organizational outcomes in developing countries such as Ghana. Given the contemporary importance of innovative GHRMP, it is pertinent to investigate the role played by GIN in this relationship. GIN has been identified as a mediator in the correlation between GHRM and EPO (Aftab et al., 2023), suggesting that introducing a mediating variable can enhance the understanding of the association between GHRMP and organizational sustainability outcomes. Awan et al. (2023) also reported their significant mediation effect in the context of Pakistani SMEs. In addition, Rana and Arya (2024)also recently reported the positive mediating role among Indian and Chinese SMEs, respectively. Hence, recommended that

H7: *GIN significantly mediates the relationship between GHRMP and EPO in the manufacturing sector.*

2.2.8 Mediating Role of CSR

Previous literature has significantly reported a direct connection between GHRMP, CSR, and EPO (Niazi et al., 2023; Sabokro et al., 2021; Yasin et al., 2023; Zhou et al., 2023). Efficient management of organizational resources and capabilities is essential for achieving objectives, with HRM playing a key role (Stahl et al., 2020). This study argues that GHRMP cultivates an eco-friendly culture within organizations and directs resource investment towards sustainable practices (He et al., 2024).

Previous studies have shown a positive relationship between CSR and EPO (Bhat et al., 2024; Khaddage-Soboh et al., 2024) and between GHRMP and EOP (Aftab & Veneziani, 2024; Amjad et al., 2021; Awan et al., 2023; Kanan et al., 2023; Rana & Arya, 2024). Additionally, GIN's impact on CSR has been identified in earlier studies (Niazi et al., 2023). While direct relationships are well-established, the mechanisms by which GHRMP and GIN influence EPO are less clear. Thus, this study considers CSR as a mediator to explain how GHRMP and GIN affect EPO. Thus, the following hypothesis is suggested.

H8a: *CSR significantly mediates the link between GHRM and EPO in the manufacturing sector.*

H8b: *CSR significantly mediates the link between GIN and EPO in the manufacturing sector.*

2.2.9 Moderating Role of GTL

GTL is defined as “a leadership behavior that aims to communicate a clear vision, motivation, and inspiration to employees, alongside providing adequate development support to achieve environmental performance goals” (Singh et al., 2020). GTL motivates subordinates to gain new knowledge and be involved in activities concerning the GIN (B. Ahmad et al., 2024). Furthermore, GTL inspires and influences employees by promoting green visions aligned with the firm’s eco-friendly practices (Perez et

al., 2023). Consequently, organizations that implement GHRMP and GIN observe increased CSR (Niazi et al., 2023). In this context, leadership that fosters green visions strengthens the relationship between GHRMP, GIN, and CSR. Henceforth, suggested that

H9a: *GTL significantly moderates the link between GHRMP and CSR in the manufacturing sector.*

H9b: *GTL significantly moderates the link between GIN and CSR in the manufacturing sector*

3. Methodology

3.1 Research Design

This research is of a descriptive nature, encompassing the collection of responses from individuals employed in the Ghanaian manufacturing industry using a convenient random sampling approach.

A convenience random sampling method is justified in conditions where the inability to use a more stringently designed sampling method was brought on by constraints of time, resources, or accessibility. This sampling approach allows researchers to obtain data fairly quickly and inexpensively, particularly when access to the target population is difficult or if there is a need for an urgent response (Cao et al., 2024; Qalati, Siddiqui, & Magni, 2024). The sample for the study was selected using Kline's (2015) "10 rules of thumb" approach, which states that each item of a construct should be responded to by at least 10 participants. Therefore, since our research includes five variables comprising 31 items, a sample size of 310 participants is required. Cao et al. (2024) recently used the "10 rules of thumb" of Kline's (2015) approach for selecting sample size and explored factors influencing EPO.

3.2 Data Collection

Data about 340 participants was gathered between January–March 2024 using a web-based survey. Among the 369 participants, 247(66.9%) were male and 122(33.1%) were female. Most participants were aged 30–39 years (39%), held a bachelor's or master's degree (86%), and had 6–10 years of work experience (38%). Nearly 47% worked in medium-sized firms, while 25% held middle management positions**.** A web-based survey was used, given that it is less costly and enables researchers to reach a large audience and quickly return within a short period (Cao et al., 2024; Qalati, Siddiqui, & Yusheng, 2024; Xie et al., 2023). To mitigate potential biases in data collection, we shared a link via different phases (Qalati, Barbosa, & Iqbal, 2023). In the first phase, data were collected related to dependent (EPO) and independent (GHRMP) constructs. The second is related to the mediator (GIN), and the last is about the moderator (environmental orientation). Individuals with less than two years of experience within their current workplace were excluded from the final data analysis.

GHRMP was measured using a five-item multidimensional scale adapted from Aftab and Veneziani (2024), capturing environmentally oriented HR policies and practices. Additionally, GIN was measured

with eight items of Zhang and Walton (2017), reflecting eco-friendly product, process, and system innovations. CSR was measured with eight items of Gallardo-Vázquez and Sanchez-Hernandez (2014) focusing on ethical, environmental, and community-based activities. GTL was measured with a six-item scale of Chen and Chang (2013) assessing leadership behaviors that inspire environmental responsibility. Moreover, EPO was measured with seven items of Umrani et al. (2022), evaluating an organization's ability to improve ecological outcomes and minimize environmental harm.

Despite utilizing 5-point Likert-type scales, the data were regarded as interval-level to enable the application of PLS-SEM analysis. This approach is broadly recognized in current literature within the fields of management, behavioral sciences, and decision-making, since both simulation and empirical investigations have shown that Likert-type data, which approximate continuous distributions, provide unbiased parameter estimates when applied in PLS-SEM (Hair et al., 2011). Comparative studies that examined ordinal and interval treatment showed minimal variation in path coefficients, reliability, and validity indexes with sample sizes exceeding 200 and with item loadings over 0.70—requirements that this study exceeds (Cheah et al., 2018). Furthermore, Huh and Gim (2025) treat the Likert-type scales as continuous variables. Accordingly, this study's processing the responses on the Likert-scale as interval data is methodologically congruent with the prevailing best practices common to recent studies with PLS-SEM.

3.3 Measures

The study used a 5-point Likert scale to measure the items. GHRMP, 5-item scale adapted from Aftab and Veneziani (2024). An 8-item GIN scale adapted from Zhang and Walton (2017) and Singh et al. (2020). A 6-item scale for GTL was adapted from Chen and Chang (2013). Moreover, the 8-item for the CSR scale was adapted from Gallardo-Vázquez and Sanchez-Hernandez (2014). Lastly, 7 items for EPO were adapted from Umrani et al. (2022). The appendix represents the details of the scale items.

4. Data Analysis

Following the exclusion of responses containing missing data points, a total of 369 valid responses were utilized for analysis through structural equation modeling using SmartPLS 4 version 4.1. The study used partial least squares structural equation modeling (PLS-SEM) techniques using SmartPLS to evaluate the measurement and structural model of the research. PLS-SEM is considered to be superior to covariance-based SEM for research that focuses on prediction and theory development with no theory testing (Qalati et al., 2022). PLS-SEM is particularly good with complex models and smaller sample sizes, hence more flexible in cases where data distribution is non-normal and in the presence of formative constructs (Qalati, Barbosa, & Ibrahim, 2023).

Additionally, we used PLS-SEM given the wide use and acceptability across the disciplines, including the manufacturing section. For instance, Qalati, Siddiqui, and Magni (2024) used it in Chinese manufacturing companies. Also, recently Siddiqui et al. (2024) employed structural equation modeling in the comparative study conducted in the manufacturing sector of China and Africa. Moreover, the Kolmogorov–Smirnov

test indicated significant deviations from normality for all constructs ($p < 0.05$), justifying the use of PLS-SEM over covariance-based SEM. In addition, this work utilizes cross-sectional survey data; time-series diagnostics such as unit root tests and autocorrelation checks (e.g., Durbin–Watson) are not applicable. Further, Harman's single-factor test revealed that the first factor accounted for 36.4% of the variance, which is below the 50% threshold, suggesting common method bias is not a major concern. Further, variance inflation factors (VIFs) were also examined, and all values were below the recommended cut-off of 3.3, indicating no multicollinearity concerns (see Table 1).

Before testing the structural model, reliability and validity analyses were conducted to ensure the measurement model.

Table 1. Reliability and Validity of the Measurement Model

Variable	Item	Loadings	CA	CR	AVE	VIF
Green human resource management practices (GHRMP)	GHRMP1	0.828	0.944	0.945	0.782	1.775
	GHRMP2	0.911				
	GHRMP3	0.893				
	GHRMP4	0.907				
	GHRMP5	0.864				
	GHRMP6	0.901				
Green innovation (GIN)	GIN1	0.773	0.924	0.943	0.647	2.386
	GIN2	0.758				
	GIN3	0.779				
	GIN4	0.765				
	GIN5	0.772				
	GIN6	0.858				
	GIN7	0.856				
	GIN8	0.862				
Corporate social responsibility (CSR)	CSR1	0.739	0.897	0.921	0.613	1.92
	CSR2	0.743				
	CSR3	0.723				
	CSR4	0.715				
	CSR6	0.879				
	CSR7	0.851				
	CSR8	0.811				
Green transformational leadership (GTL)	GTL1	0.856	0.913	0.914	0.742	1.431
	GTL2	0.827				
	GTL3	0.878				
	GTL4	0.874				
	GTL5	0.87				

Environmental performance of the organization (EPO)	EPO1	0.848	0.943	0.944	0.744	
	EPO2	0.897				
	EPO3	0.869				
	EPO4	0.870				
	EPO5	0.865				
	EPO6	0.867				
	EPO7	0.821				

Note: CA=Cronbach's alpha, CR=composite reliability, AVE=average variance extracted, VIF=variance inflation factor.

The data presented in Table 1 indicate that the main constructs exhibit acceptable reliability, with CA between 0.897 and 0.944, and CR values between 0.914 and 0.945, surpassing 0.70 (Chen et al., 2023; Hair et al., 2020; Sabol et al., 2023). Subsequently, the average variance extracted (AVE) values, between 0.613 and 0.782, surpassed the 0.50 threshold, providing evidence for convergent validity (Hair et al., 2020; Sabol et al., 2023; Tajeddini et al., 2023).

Table 2. Results of Discriminant Validity Analysis

Variable	CSR	EPO	GHRMP	GIN	GTL
Corporate social responsibility (CSR)					
Environmental performance of the organization (EPO)	0.698				
Green human resource management practices (GHRMP)	0.554	0.637			
Green innovation (GIN)	0.657	0.692	0.683		
Green transformational leadership (GTL)	0.626	0.702	0.464	0.465	

Note: HTMT<0.85 or 0.90

The Heterotrait-Monotrait (HTMT) ratio test was utilized to evaluate discriminant validity. Table 2 illustrates that the values depicted are below 0.85, suggesting that the research met the prescribed threshold of HTMT0.85 (Hair et al., 2020; Qalati, Barbosa, & Iqbal, 2023; Sabol et al., 2023).

Table 3. Results of the Fornell-Larcker Criterion

Variable	CSR	EPO	GHRMP	GIN	GTL
Corporate social responsibility (CSR)	0.783				
Environmental performance of the organization (EPO)	0.671	0.863			
Green human resource management practices (GHRMP)	0.531	0.604	0.884		
Green innovation (GIN)	0.683	0.676	0.650	0.804	
Green transformational leadership (GTL)	0.580	0.652	0.431	0.468	0.861

Note: Diagonal elements are the square root of AVE

Table 3 reflects that the square root of each variable AVE is greater than its connection with other variables. The square root of CSR, which is 0.783, is greater than all other constructs in the row and column. As shown, 0.783 is greater than EPO=0.671, GHRMP=0.531, GI=0.683, and GTL=0.580 in the column.

Likewise, the value of EPO, which is 0.863, is greater than that of other constructs in the line and the column.

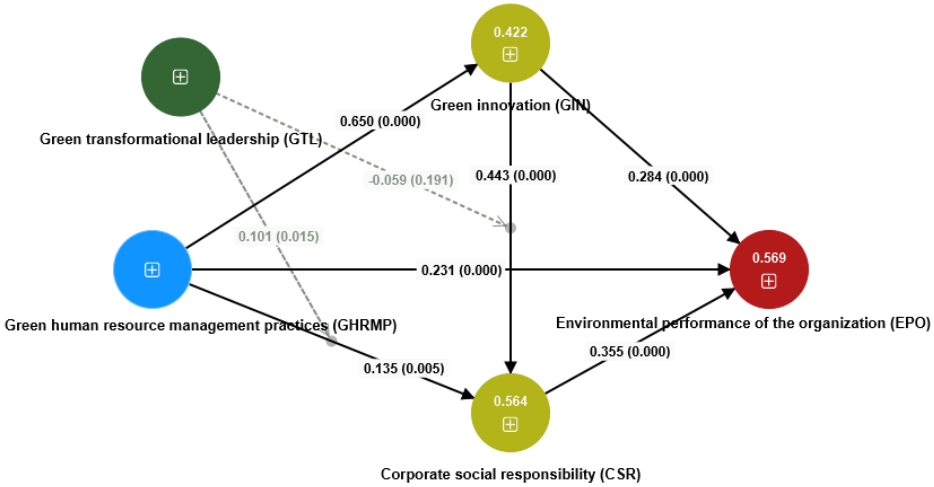
Table 4. Results of Structural Model Analysis

Hypothesis	Relationship	Beta	S. D.	*t*-value	*p*-value	Decision	R^2	f^2	Q^2
H1	GHRMP → EPO	0.231***	0.052	4.444	0.000	Supported	0.569	0.070	0.419
H2	GHRMP → GIN	0.650***	0.033	19.748	0.000	Supported	0.422	0.731	0.266
H3	GHRMP → CSR	0.135***	0.048	2.831	0.005	Supported	0.564	0.023	0.324
H4	GIN → EPO	0.284***	0.058	4.93	0.000	Supported		0.078	
H5	GIN → CSR	0.443***	0.047	9.341	0.000	Supported		0.025	
H6	CSR → EPO	0.355***	0.043	8.335	0.000	Supported		0.152	
H7	GHRMP → GIN → EPO	0.184***	0.039	4.671	0.000	Supported			
H8a	GHRMP → CSR → EPO	0.048***	0.017	2.793	0.005	Supported			
H8b	GIN → CSR → EPO	0.157***	0.026	6.027	0.000	Supported			
H9a	GTL x GHRMP → CSR	0.101**	0.042	2.426	0.015	Supported		0.021	
H9b	GTL x GIN → CSR	-0.059*	0.045	1.307	0.191	Not supported		0.01	

Note: GHRMP=green human resource management practices, EPO=environmental performance of the organization, GIN=green innovation, CSR=corporate social responsibility, GTL=green transformational leadership, S. D. = standard deviation.
*p<0.10, **p<0.05, ***p<0.01

Furthermore, hypothesis testing, explanatory power (R^2), effect size (f^2), and predictive relevance (Q^2) have been used to assess the structural model. The study hypotheses are assessed subsequent to an examination of the relationship between the constructs within our proposed framework. Following the acceptance criterion, Table 4 represents a total of eleven hypotheses, six direct, three indirect, and two moderation hypotheses, which were supported (p<0.05) except *H9b*.

Figure 1. Results of the PLS-SEM Structural Model Analysis.



Note: Values on paths represent standardized path coefficients with p-values in parentheses.
Values within the circles for endogenous constructs represent the coefficient of determination (R^2).

Figure 1 shows the path coefficients and their significance level on the link between circles, such as 0.135 (0.005), which shows the relationship of GHRM with CSR. It reflects that if GHRM increases by a single unit, CSR will increase by 13.5%. Similarly, the strongest direct effect is observed from GHRMP to GIN (β=0.650, p<0.001), underscoring the central role of GHRMP in stimulating innovation. The R^2 values within the circles show the proportion of variance explained by the predictors for each construct, for example, 56.9% for EPO, indicating substantial explanatory power of GHRMP, GIN, CSR, and GTL

R^2 elucidates the fluctuations in the dependent construct attributable to independent constructs. As illustrated in Table 4 and Figure 1, the R^2 values for the EPO, GIN, and CSR were 0.569, 0.422, and 0.564, respectively. The value of EPO (0.569) reflects that GHRMP, GIN, CSR, and GTL are responsible for a 56.9% variance in the EPO. Our study's R^2 value is above the acceptable threshold of 0.10, as recently suggested by Fan et al. (2024). Subsequently, the f^2 was also evaluated to determine if the suggested framework predictor variable significantly impacts the criterion variable. Following the guidelines, this research adhered to Olejnik and Algina (2000), the results indicate that GHRMP largely affects GIN (0.731) and CSR has a moderate effect on EPO (0.152), while the other factors have minimal effects (<0.15) as suggested that if "f^2 value of 0.35, 0.15, and 0.02 corresponds to a large, medium, and weak effect size, respectively" (Qalati, Barbosa, & Ibrahim, 2023). Thirdly, the Q^2 of our research model reveals that the Q^2 values for EPO, GIN, and CSR were 0.419, 0.266, and 0.324, respectively, Table 4. These values align with the medium and large categories of predictive validity (Cohen et al., 2002).

Figure 2. The Moderating effect of GTL on the link between GHRMP and CSR

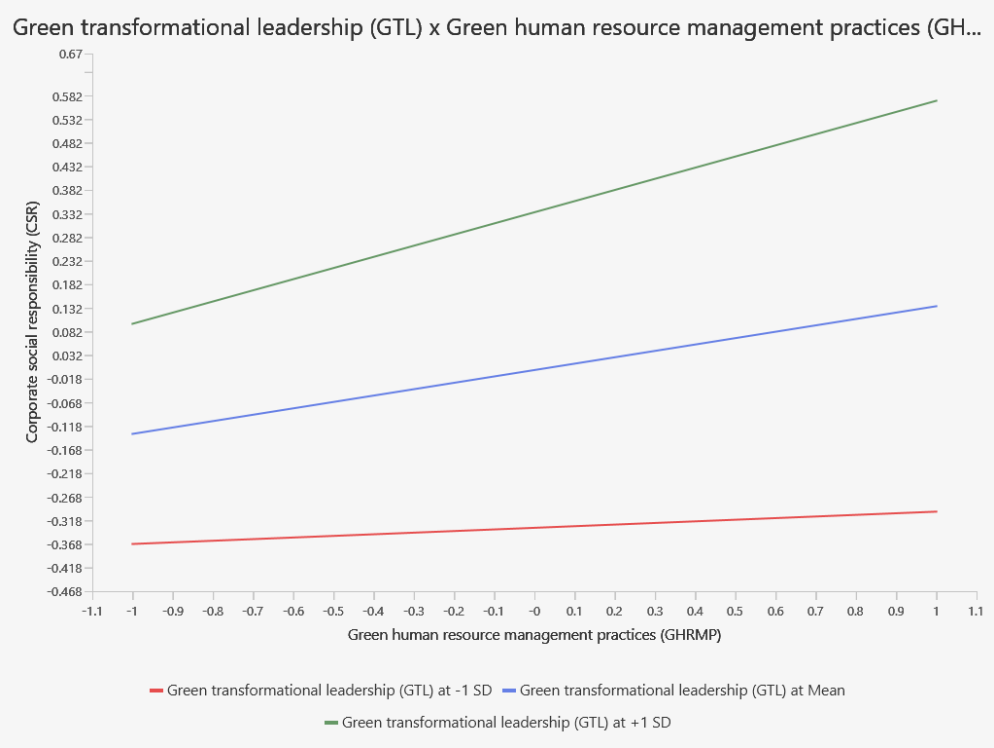


Figure 2 illustrates the interaction effect of GTL on the relationship between GHRMP and CSR. It demonstrates that the higher level of GTL, as illustrated by the green line at +1, increases the positive

relationship more than the average. This means that GTL positively moderates the effect of GHRMP on CSR, and the effect is strongest when GTL is high. For managers, this finding implies that even robust GHRMP initiatives require supportive transformational leadership to translate into strong CSR performance. Organizations aiming to maximize CSR outcomes should therefore invest in leadership development programs that cultivate environmental vision and inspiration.

5. Discussion of Results

The study aimed to examine the impact of GHRMP on EPO, GIN, and CSR within the Ghanaian manufacturing industry. The results supported the *H1* of GHRMP positively influencing EPO (Beta=0.231, t=4.444, p=0.000) by facilitating the efficient utilization of resources, fostering environmental consciousness and ethical behavior, and aiding manufacturing companies in achieving sustainability objectives (Amjad et al., 2021). In the same perspective, Aftab et al. (2023) emphasized the essentiality of eco-friendly practices in the production sector. This outcome is consistent with several recent works by Kanan et al. (2023), Rana and Arya (2024), Shah and Soomro (2023), and Zihan et al. (2024).

The results supported that *H2* of GHRMP significantly influences GIN (Beta=0.650, t=19.748, p=0.000). The result signifies that companies can increase their GIN through the execution of GHRMP. A prior study by Aftab and Veneziani (2024), Fang et al. (2022), and Kanan et al. (2023) indicated that GHRMP motivates workers to be environmentally responsible and be part of sustainability undertakings. Therefore, the findings show that the manufacturing industry's adoption of green practices can spur innovation in green pursuits.

The results also supported that H3 of GHRMP significantly influences CSR (Beta=0.135, t=2.831, p=0.000). The result signifies that as companies implement GHRMP by 1 unit, their involvement in CSR efforts increases by 0.135 or 13.5%. It also suggests that when organizations prioritize GHRMP, they are more likely to improve their CSR continuous actions, which entail contributing to sustainable development and a better societal impact. Ma'erat et al. (2024) found that CSR activities were either being led by the HR department or a dedicated team that closely worked with the HR department. Further research in Pakistan showed the relationship of GHRMP with green CSR, as reported by Niazi et al. (2023). Our work results aligned with Sabokro et al. (2021), who reported a strong association between GHRM and CSR activities.

The study results supported the *H4* of GIN positively and significantly influencing the EPO (*B*eta=0.284, *t*=4.93, *p*=0.000), suggesting that the use of waste reduction processes, the application of eco-friendly technologies, and sustainable production methods has been known to have significant environmental benefits. These benefits include cost-saving opportunities from reduced energy consumption and waste disposal costs, improved efficiency in the use of resources, and enhanced value of products through branding as green products. Besides, firms that adopt GIN are likely to gain competitive advantages, attract the new, growing breed of eco-conscious consumers, and effectively comply with rising, stringent environmental regulation requirements. This alignment with sustainability can open up new market

opportunities and improve the firm's overall performance, as it taps into the growing demand for sustainable products. These outcomes are consistent with the recent studies of Awan et al. (2023), Niazi et al. (2023), Rana and Arya (2024), Singh et al. (2020), and Zhang and Walton (2017).

Our investigation also supported *H5*, which is about the significant effect of GIN on CSR activities (*B*eta=0.443, *t*=9.341, *p*=0.000). It indicates that when firms invest in sustainable technologies, processes, and product innovations, they tend not only to reduce their environmental footprint but also to contribute to the broader domain of socially responsible behaviors. Further, these results improved environmental stewardship and better compliance with regulatory standards, leading to an enhanced reputation among consumers, investors, and all other members of society. This outcome is supported by the work of Niazi et al. (2023), who also find an optimistic influence of sustainable innovation on green CSR activities.

The study outcomes supported *H6* of CSR positively and significantly influences EPO (*B*eta=0.355, *t*=8.335, *p*=0.000). This association suggests that a firm involved in CSR activities in manufacturing in Ghana would more likely adopt eco-friendly technologies, be efficient with resources, and comply with environmental regulations. Such firms do not just help sustain the environment but end up benefiting competitively, given that their operations are aligned with the other global standards in sustainability. This, therefore, supports the argument that CSR needs to be integrated into the core business strategy since it drives environmental and organizational benefits and fosters long-term sustainability in the manufacturing sector in Ghana. This finding is supported by the investigation of Khaddage-Soboh et al. (2024).

The study confirmed the *H7* indirect (mediating) influence of GIN between GRHMP and EPO (*B*eta=0.184, *t*=4.671, *p*=0.000). This implies that when GHRMPs are effectively executed, GINN prospers through employees' application of their motivation and knowledge to develop and use eco-friendly processes and technologies. Such innovation boosts EPO by improving operational efficiencies, cutting costs linked to waste and energy consumption, and capturing the attention of environmentally responsible consumers and regulators. Therefore, GIN acts as a mediator in the sense that it converts the eco-oriented human resource strategies of a firm into both economic and environmental benefits, hence confirming its role as a positive mediator in this dynamic. This intervening role is supported by the prior work of Kanan et al. (2023), Niazi et al. (2023), Rana and Arya (2024), and Singh et al. (2020).

In addition, our investigation supported the *H8a* and *H8b* intermediating influence of CSR between GHRMP and EPO (*B*eta=0.048, *t*=2.793, *p*=0.005) and between GIN and EPO (*B*eta=0.157, *t*=6.027, *p*=0.000). In particular, the fact that CSR acts between the influence of GHRMP and EPO with a positive and significant mediating effect testifies that if firms apply GHRMP, these practices enhance CSR activities. Improved CSR activities, in turn, have a positive impact on EPO in terms of reduced waste and improved use of resources. This study also shows that CSR mediates the link between GIN and EPO. To clarify, organizations operated with GIN, such as the development of sustainable products and processes, have their CSRs enhanced by these innovations. It is then that the enhanced CSR activities of the firm, which are driven by GIN, culminate in superior EPO. It can thus be assumed that CSR in a Ghanaian manufacturing context act as the essential link that will channel GHRMP and GIN into these visible

environmental benefits; as such, it stipulates the need to incorporate CSR in organizational strategies if the identity of achieving sustainability goals must be established. These outcomes align with the research of Niazi et al. (2023).

The research supported the *H9a* moderation effect of GTL on the link between GHRMP and CSR (*B*eta=0.101, *t*=2.426, *p*=0.015). This result means that the presence of a GTL will enhance 'the positive effect of GHRM practices on CSR activities'. In particular, leaders with high degrees of principle for environmental sustainability get to inspire and influence workers to adapt and incorporate green practices into daily operations. It is this style of leadership that not only reinforces GHRMP but also amplifies its effectiveness in driving CSR initiatives. In the manufacturing context of Ghana, such exclusivity to GTL plays a vital role in bridging the GHRMP with the set CSR goals. This aids in creating a culture of sustainability and social responsibility. This synergizes the effect where the GHRMP helps not just at the policy level but is actively embraced and executed for more substantial CSR outcomes with greater impacts. This finding is supported by the work of Niazi et al. (2023) and Perez et al. (2023).

Lastly, the findings of the study show that GTL has an insignificant negative moderating effect on the relationship between GIN and CSR (*B*eta= –0.059, *t*=1.307<1.92, *p*=0.191>0.05). This means that when present, GTL neither strengthens nor weakens the effect of GIN on CSR activities in firms. Although GTL does not seem to affect whether and to what degree GIN translates into CSR efforts, this may indicate that other factors or mechanisms might be crucial in binding GIN to CSR. Thus, firms may have to opt for other strategies or leadership styles that can appropriately exploit GIN for CSR.

6. Conclusion

Our investigation proposed a model based on the natural resource-based view theory of Hart (1995). The proposed model comprises eleven hypotheses, which were tested in the manufacturing sector of Ghana using PLS-SEM techniques of SmartPLS 4.1. Except for eleven hypotheses, only one hypothesis (*H9b*) was not supported. The study evidenced a significant influence of GHRMP on EPO, GIN, and CSR in the manufacturing sector in Ghana. These findings supported the recent work of Qalati, Siddiqui, and Magni (2024) and Rana and Arya (2024) conducted in the manufacturing context. Additionally, we tested a positive direct and indirect (mediating) effect of GIN and CSR between GHRMP and EPO. This outcome provided support to the work of Niazi et al. (2023) conducted on 310 public and private institutions in Pakistan. The study also observed a positive moderating effect of GTL for the GHRMP–CSR relationship.

6.1 Theoretical Implications

Theoretically, first, it extends the scope of the natural resource-based view theory to the environment-related factors that influence EPO. Usually, studies used this theory for GHRMP (Niazi et al., 2023), however, our studies connected GIN, GTL, CSR, and EPO. Secondly, our investigation has value in depicting how GHRMP, GIN, and CSR, respectively, can enhance EPO. Most studies have previously focused on how GHRMP influences employee behaviors (He et al., 2024; Perez et al., 2023; Qalati, Barbosa, & Ibrahim, 2023; Sabokro et al., 2021); therefore, this research brings a new aspect to the

literature on GHRMP. This is attained by ascertaining its effect on practices and modifications of employee behaviors. Thirdly, our research supports the limited work available on the link between GHRMP, GIN, CSR, and EPO, respectively, within the context of the manufacturing industry in Ghana (Abiew et al., 2023; Suleman et al., 2022). Lastly, the investigation subsidizes the work on the mediating role of GIN and CSR and the moderating role of GTL in the context of the Ghanaian manufacturing sector.

6.2 Practical Implications

Practically, results suggested that it is imperative for companies to monitor and adapt the best environmental practices followed by other industry players to enhance economic performance and promote sustainable business growth. Senior managers, immediate supervisors, and policymakers should motivate their staff to launch eco-friendly campaigns, products, and services through innovative business approaches. Corporate entities need to cultivate a work environment that fosters innovation and creativity to stimulate healthy competition and a proactive atmosphere. Environmentally-friendly products contribute value and enhance a company's brand, leading to significant promotion and heightened awareness as a commitment to society. The role of human resource practitioners is crucial in designing and implementing GHRMP that impacts organizational citizenship and dedication. All these efforts would generate a mutually beneficial scenario for the diverse stakeholders of the organization. Consequently, the well-being of individuals, the planet, and financial prosperity can be considered for enhanced and sustainable development in the times ahead.

6.3 Limitations and Future Research Directions

As the research is conducted in the industrial sector of Ghana, its results can’t be generalized to other sectors, like the service sector. Thus, we suggest scholars replicate the model and test it in diverse sectors of the country. Secondly, limitations include the research design and data collection tools. Our study utilized a quantitative research strategy and an online survey to collect the data, which may have the potential for bias. Therefore, we suggest scholars employ a qualitative or mixed methods research design as well as a longitudinal approach. Last but not least, our study utilized GTL as a moderator; there could be many other moderators, such as sustainable culture and sustainable environmental orientations.

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Appendix

GHRMP

(1) "Our organization establishes environmental objectives for its staff members."
(2) "Our organization offers training to employees to instill and encourage eco-friendly values."
(3) "Our organization provides training to enhance employees' knowledge and skills essential for effective environmental management."
(4) "Our organization evaluates employees' eco-conscious actions in the workplace during promotion decisions."
(5) "Our organization ties employees' environmentally friendly workplace behaviors to rewards and compensation packages."
(6) "Our organization incorporates employees' workplace eco-friendly practices into performance evaluations."

GIN

(1) “Our organization utilizes materials that generate minimal pollution.”
(2) “Our organization utilizes materials that use less resources and energy.”
(3) “Our organization utilizes materials that to design eco-friendly products.”
(4) “Our organization utilizes materials that are easy to reuse, recycle, and decompose.”
(5) “Our organization acquires advanced sustainability support technologies.”
(6) “Our organization creates and launches new sustainable processes and products.”
(7) “Our organization pursues the newest guidance and ideas relevant to sustainable technologies.”
(8) “Our organization examines and develops emerging sustainability-conscious markets.”

CSR

(1) “Our organization undertake social initiatives that are community-oriented.”
(2) “Our organization involve our workforce in volunteer activities or joint efforts with NGOs.”
(3) “Our organization hold health and safety standards above the level of legislation.”
(4) “Our organization consider the importance of using consumables, raw materials, and processed products with minimal environmental impact.”
(5) “Our organization give strong consideration to the use of alternative sources of energy.”
(6) “Our organization participate actively in the protection and enhancement of the natural environment.”
(7) “Our organization support reducing gas emissions, minimizing waste production, and promoting recycling practices.”
(8) “Our organization recognize the importance of businesses planning their investments to mitigate their environmental impact.”

GTL

(1) “The seniors of the initiative for green product development inspire team members through the project's ecological goals.”

(2) “The leader brings together team members to work collaboratively towards common environmental objectives.”
(3) “The leader inspires members of the team to work to achieve the environmental objectives.”
(4) “The leader accounts for the ecological principles that the members of the team hold in making decisions.”
(5) “The leader inspires members of the team to explore and develop eco-friendly ideas.”

EPO

(1) “Our organization minimized waste.”
(2) “Our organization minimized the consumption of water.”
(3) “Our organization minimized the use of energy.”
(4) “Our organization reduced the overall expenses.”
(5) “Our organization strengthened market competitiveness.”
(6) “Our organization contributed to enhancing the firm reputation.”
(7) “Our organization limited the procurement of non-renewable chemicals, components, and materials.”