

Effect of Green Leadership and Green Human Resources Management on Green Work Engagement: The Mediating Role of Green Organizational Culture

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Abstract

The electronics and semiconductor manufacturing sector in the Philippines is a resource-intensive industry and the country's largest exporter. As the demand for sustainable practices intensifies, fostering Green Work Engagement (GWE) has become essential to meeting environmental objectives. This study examined the effects of Green Human Resource Management (GHRM) and Green Leadership (GL) on GWE, with Green Organizational Culture (GOC) as a mediating variable. A descriptive-causal research design was employed, involving 191 employees from various departments within a selected electronics and semiconductor manufacturing company. Data were gathered through a structured questionnaire and analyzed using regression analysis, mediation testing, and ANOVA. Findings revealed that GHRM and GL significantly contributed to the development of GOC. In turn, both GHRM and GOC had significant direct effects on GWE. GOC was found to partially mediate the relationship between GHRM and GWE and fully mediate the relationship between GL and GWE. ANOVA results showed no statistically significant differences in GWE across demographic variables. These results underscore the critical role of green organizational culture in transforming HR and leadership initiatives into meaningful employee engagement in sustainability. The study recommends embedding green values into existing systems, expanding green HRM practices, and developing leaders as green culture ambassadors to promote a sustainability-oriented workforce and improve environmental performance through authentic employee engagement.

Keywords: green leadership; green human resources management; green work engagement; green organizational culture; Philippine Semiconductor and Electronics Manufacturing

1. Introduction

1.1 Background of the Study

The growing urgency of sustainability in business has driven organizations to adopt formal environmental management systems, such as ISO 14001, to enhance their environmental performance. Globally, climate change, resource depletion, and environmental degradation have heightened the need for sustainable practices. Governments and international bodies, such as the United Nations (UN, 2019) and the International Labour Organization (ILO, 2021), have pushed for corporate responsibility through stricter regulations and sustainability frameworks. Companies are now facing increasing pressure from stakeholders to implement greener practices and reduce their carbon footprint, making employee engagement in environmental initiatives more crucial than ever ((Intergovernmental Panel on Climate Change [IPCC], 2021). While ISO 14001 provides

a structured approach to environmental management, recent studies suggest that formal systems alone may not be sufficient to drive long-term sustainability. For example, in ISO 14001-certified organizations in Northern Europe, Johnstone (2021) found that the success of environmental initiatives depends significantly on employee involvement and leadership commitment. This highlights the importance of exploring factors beyond compliance—particularly in resource-intensive industries such as manufacturing.

The electronics and semiconductor manufacturing sector is the largest exporter in the Philippines, contributing 60% of the country's total exports (Philippine Statistics Authority, 2024). However, as a highly resource-intensive industry, it is also a major contributor to environmental pollution (Electronics Watch, 2020), placing firms under mounting pressure to adopt sustainable practices (ILO, 2023; Department of Trade and Industry, 2020). According to the 2022 Annual Survey of Philippine Business and Industry (ASPBI), this sector generated ₱830.09 billion in revenue, with ₱692.47 billion in expenses—accounting for 11.2% of the manufacturing sector's total costs—demonstrating both its scale and its environmental footprint. It also remains a significant employer, with 153,865 workers nationwide (Philippine Statistics Authority, 2024). Despite its economic contributions, the industry's operations underscore an urgent need for sustainability. Green Work Engagement (GWE) has emerged as a key factor in achieving corporate environmental goals (Tran, 2023; Marini et al., 2023). GWE refers to employees' enthusiasm, dedication, and proactive involvement in environmentally focused workplace initiatives (Karatepe, 2022). It ensures that sustainability programs are not only developed but also effectively implemented across the organization.

Research suggests that GWE is largely shaped by Green Human Resource Management (GHRM) practices, including environmental training, reward mechanisms, and leadership support designed to align employee behavior with organizational sustainability goals (Suliman et al., 2023; Aboramadan et al., 2020). However, achieving high levels of GWE remains a challenge. Many companies struggle to identify effective strategies for cultivating and sustaining it (Haque et al., 2024). Employees who are not meaningfully engaged may resist green programs, leading to weak implementation and poor outcomes. Although prior studies have linked GHRM with environmental performance (Hameed et al., 2023; Singh et al., 2020; Aftab et al., 2023), few have investigated the internal mechanisms—such as leadership and culture—that influence employee engagement in green initiatives. Most focus on final outputs, such as compliance or environmental metrics, while overlooking the role of leadership and workplace culture in shaping sustainable behavior.

This study addresses that gap by examining the influence of GHRM and Green Leadership (GL) on Green Organizational Culture (GOC), and GOC, in turn, enhances GWE. While previous research has explored these variables independently, their interplay—particularly within the Philippine context—remains underexplored (Flores et al., 2022). Existing studies also provide limited insight into the psychological and organizational dynamics that underpin sustainable employee behavior (Tran, 2023; Ababneh et al., 2021).

A recent study by Tran (2023) in Vietnam's agricultural sector found that both GHRM and GL significantly enhance GWE. Moreover, Green Organizational Culture—defined as a workplace culture in which employees feel responsible for environmental roles and outcomes—served as a key mediating factor. This study builds on those findings, focusing on the Philippine electronics and semiconductor industry, and investigates how GHRM and GL affect GOC, which in turn mediates GWE. By extending the discussion to this high-impact industry, this research contributes to the understanding of how internal organizational systems influence sustainability.

This study also supports the United Nations Sustainable Development Goal 12: Responsible Consumption and Production (UN, 2024), by promoting workplace-level strategies for environmental sustainability. Through

its analysis of organizational dynamics, Definitions and related studies for each variable—GHRM, GL, GOC, and GWE—are discussed further to highlight their relevance and interconnections within the context of this research:

Green Human Resource Management. GHRM encompasses green recruitment, training, and performance management, creating opportunities for skill development while fostering a green organizational culture (GOC) (Mahdy et al., 2023; Chowdhury et al., 2023). This alignment ensures that employees are equipped with the tools and motivation needed to engage in green work practices effectively. In this regard, GHRM has been identified as a critical mechanism for companies transitioning toward sustainable organizations. GHRM integrates human resource practices that emphasize environmental and ecological sustainability, aligning them with the company's strategic goals and encouraging green behaviors among employees (Roscoe et al., 2019; Tran, 2023). Effective GHRM promotes green practices across recruitment, training, and performance management while fostering a culture of environmental responsibility within the workplace (Aboramadan et al., 2020; Zhao et al., 2021). It also reduces environmental impacts and enhances employee creativity, well-being, and satisfaction, strengthening organizational commitment to sustainability goals (Gill et al., 2023). Green HRM is pivotal in bridging the gap between sustainability goals and workforce readiness, making it an essential strategy for organizations striving to embed sustainability in their operations (Zacher et al., 2024).

Green leadership. Green leadership complements GHRM by influencing employee behavior and fostering organizational commitment to environmental performance. It is characterized by the ability of leaders to inspire and motivate employees to engage in pro-environmental behaviors through shared values and vision for sustainability (Huo et al., 2022; Begum et al., 2022; Khan et al., 2023). Leaders who adopt this style actively promote eco-friendly initiatives, green innovation, and organizational transformation, ensuring that their decisions align with both ecological and strategic objectives (Tran, 2023; Yang et al., 2024). Furthermore, green leadership emphasizes decision-making, and actions grounded in environmental values, empowering employees to contribute to the organization's sustainability goals (Kardoyo et al., 2020). This leadership approach is essential in shaping an organizational culture that prioritizes sustainability, aligning individual efforts with collective ecological objectives.

Green organizational culture. A green organizational culture is the integration of shared values, norms, and beliefs that emphasize ecological responsibility and sustainability. It establishes a framework for employees to align their behaviors and organizational processes with environmental goals (Khan & Terason, 2022; Ahmad et al., 2023). By embedding ecological sustainability into an organization's philosophy and daily operations, GOC motivates employees to actively contribute to the organization's environmental vision and integrate green practices into their routines (Zhao et al., 2021; Roscoe et al., 2019). This culture not only fosters pro-environmental behaviors but also strengthens the foundation for sustainable practices, which drive competitive advantage and employee engagement (Aboramadan et. al, 2020). Through shared values and norms, GOC bridges the gap between strategic sustainability goals and day-to-day organizational operations.

Green work engagement. Green work engagement builds on foundational practices such as GHRM, GL, and GOC. It encompasses employees' enthusiasm, dedication, and commitment toward environmentally conscious initiatives, translating sustainability policies into tangible outcomes (Karatepe et al., 2022; Gill et al., 2023). Employees with high levels of GWE proactively contribute to their organization's sustainability goals through eco-friendly behaviors, improving organizational performance and environmental outcomes (Aboramadan et al., 2020; Karatepe, 2022). Green leadership amplifies this effect by fostering a vision for sustainability, inspiring employees to adopt responsible practices, and aligning their behaviors with

organizational objectives. Similarly, GOC mediates between HR practices and GWE by instilling shared values that prioritize sustainability (Huo et al., 2022; Wang, 2019). This cultural alignment not only enhances environmental performance but also fosters innovation and collective commitment to sustainability (Fok et al., 2021).

Green Human Resource Management (GHRM), Green Leadership (GL), Green Organizational Culture (GOC), and Green Work Engagement (GWE) are interconnected strategies essential for embedding sustainability within organizations. GHRM integrates green recruitment, training, and performance management to equip employees with the skills and motivation for sustainable practices, while GL inspires eco-friendly behaviors and strategic alignment through visionary leadership. GOC fosters a shared framework of ecological values and norms, encouraging pro-environmental behaviors and embedding sustainability into daily operations. Previous studies suggest that these components could drive Green Work Engagement (GWE) by fostering employees' commitment to sustainability initiatives and aligning organizational goals with potential environmental and performance outcomes, which will be examined in the study.

1.2 Research Frameworks

This study is guided by two primary frameworks. The first is adapted from Tran (2023), which posits that Green Organizational Culture (GOC) mediates the relationship between Green Human Resource Management (GHRM), Green Leadership (GL), and Green Work Engagement (GWE). This conceptual model is presented in Figure 1.

Grounded in Conservation of Resources (COR) Theory, Tran's framework suggests that GHRM practices—such as green training and employee empowerment—enhance employees' green mindfulness, which in turn stimulates pro-environmental behavior. The presence of green transformational leadership is also a key moderator in this process, as it amplifies the impact of HRM practices by inspiring sustainable values and behaviors among employees.

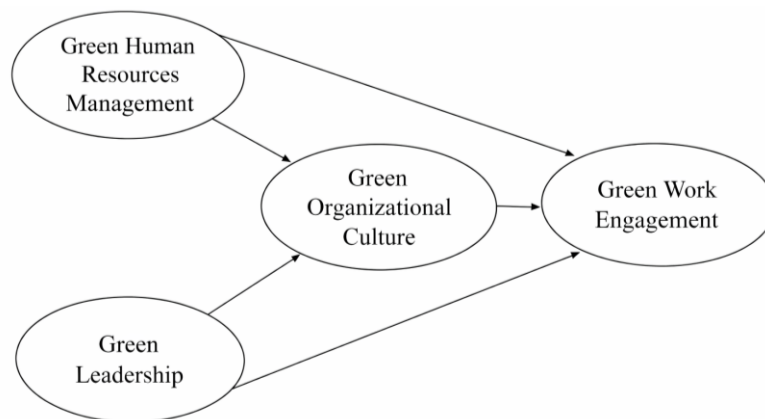


Figure 1. Conceptual Framework

Source: An empirical investigation on the impact of green human resources management and green leadership on green work engagement (Tran, 2023)

The study also draws on findings by Nusraningrum et al. (2024), which examined how demographic factors such as age, gender, educational attainment, and job position influence GWE. Their results showed that younger

employees and those in supervisory roles reported higher levels of engagement, while gender and educational attainment had limited impact. These findings highlight the importance of exploring individual and contextual factors when assessing the effectiveness of green leadership and HRM strategies.

While both Vietnam's agricultural industry and the Philippine electronics sector operate in emerging economies and face similar environmental challenges—such as pollution, resource depletion, and the push for sustainable development—their operational contexts differ significantly. The Vietnamese agricultural sector primarily emphasizes sustainable farming practices, such as reducing chemical inputs. In contrast, the Philippine electronics and semiconductor industry is characterized by complex manufacturing processes, extensive resource consumption, and the use of hazardous chemicals, which generate considerable electronic waste (Zihan et al., 2024).

Despite these challenges, the electronics sector offers substantial potential for sustainability transformation due to its large workforce and rapid technological innovation. These contextual differences underscore the need to tailor GHRM and GL practices to the unique conditions of each industry, making localized research both necessary and timely.

Following Tran's (2023) recommendation for further studies on Green Work Engagement (GWE), this research tests the same core variables but within the electronics and semiconductor manufacturing sector in the Philippines. The study expands on Tran's model by integrating the findings of Nusraningrum et al. (2024), specifically investigating whether GWE varies across demographic groups, including age, gender, educational attainment, work experience, and job position. The operational framework used in this study is presented in Figure 2.

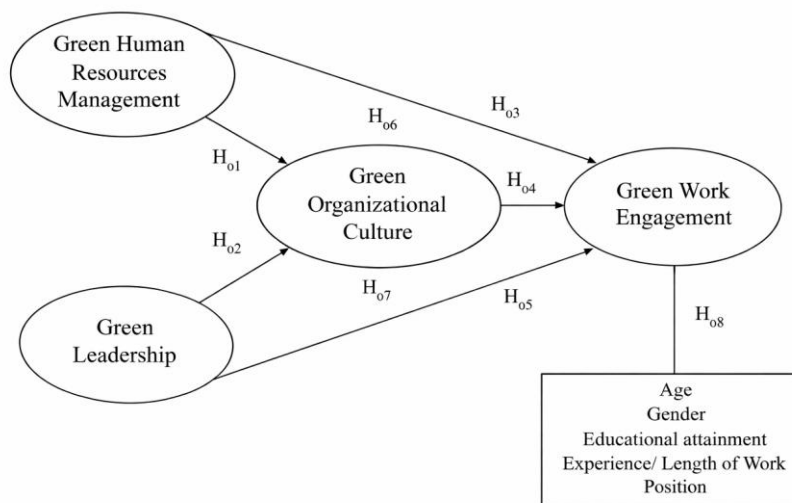


Figure 2.

Operational Framework

This framework offers a structured approach for understanding how GHRM and GL shape GOC, which in turn affects GWE. The study is further supported by the Theory of Contagion, which explains how leadership behaviors and cultural norms spread across an organization, and Social Exchange Theory (SET), which posits

that employees reciprocate perceived organizational support through positive attitudes and behaviors (Tran, 2023).

Specifically, the model posits that GHRM—which includes green recruitment, training, and performance management—and GL, characterized by leaders who promote sustainability, jointly contribute to shaping a shared green culture. This culture fosters an environment in which employees feel motivated and empowered to engage in environmentally responsible practices. Furthermore, prior studies suggest that individual demographic variables may influence the strength of these relationships (Nusraningrum et al., 2024).

By applying this integrated framework, the study aims to reveal not only the direct and indirect effects of organizational practices on green engagement but also the role of employee characteristics in shaping these outcomes.

1.3 Objectives of the Study

This research aims to investigate the effects of Green Human Resource Management (GHRM), Green Leadership (GL), and Green Organizational Culture (GOC) on Green Work Engagement (GWE) within the context of the electronics manufacturing industry. Specifically, the study seeks to:

1. describe the profile of the respondents in terms of age, gender, experience, tenure and position
2. assess the level of green human resources management (GHRM), green leadership (GL), green organizational culture (GOC) and green work engagement (GWE) of respondents
3. determine if green human resources management (GHRM) significantly affect green organizational culture (GOC);
4. determine if green leadership (GL) significantly affect green organizational culture (GOC);
5. determine if green human resources management (GHRM) significantly affects green work engagement (GWE);
6. determine if green organizational culture (GOC) significantly affects green work engagement (GWE);
7. determine if green leadership (GL) significantly affects green work engagement (GWE);

1.4 Hypotheses

Guided by the literature and conceptual framework adapted from Tran (2023), and with consideration of respondent demographics as explored by Nusraningrum et al. (2024), the following null hypotheses were tested:

H₀₁: Green human resources management (GHRM) has no significant effect on green organizational culture (GOC)

H₀₂: Green leadership (GL) has no significant effect on green organizational culture (GOC)

H₀₃: Green human resources management (GHRM) has no significant effect on green work engagement (GWE)

H₀₄: Green organizational culture (GOC) has no significant effect on green work engagement (GWE)

H₀₅: Green leadership (GL) has no significant effect on green work engagement (GWE)

H₀₆: Green organizational culture (GOC) does not significantly mediate the effect of green human resources management (GHRM) on green work engagement (GWE)

H₀₇: Green organizational culture (GOC) does not significantly mediate the effect of green leadership (GL) on green work engagement (GWE)

H₀₈: There are no significant differences in green work engagement (GWE) when respondents are grouped by different demographic profiles of employees, specifically age, gender, educational attainment, experience/length of work, and position

2. Methods

2.1 Research Design

This study employed a descriptive-causal quantitative research design to examine the relationships among Green Human Resource Management (GHRM), Green Leadership (GL), Green Organizational Culture (GOC), and Green Work Engagement (GWE) in an electronics manufacturing company in the Philippines. Causal research was appropriate as it aimed to identify cause-and-effect relationships between organizational practices and employee engagement. Unlike correlational designs, which only identify associations, causal designs evaluate the directional impact of independent variables on outcomes using tools such as regression analysis and ANOVA (Thomas & Zubkov, 2023). Descriptive analysis was also utilized to profile respondents and assess the levels of GHRM, GL, GOC, and GWE within the organization.

Data were collected from primary sources through structured, self-administered questionnaires distributed exclusively via Google Forms. Participants were informed of the study's purpose, their voluntary participation, and their right to withdraw at any time. Approval to conduct the study was obtained from the company's Human Resources Department, along with approval of the final questionnaire.

2.2 Locale of the Study

The study was conducted in a multinational electronics and semiconductor manufacturing company located in Luzon, Philippines. Luzon is recognized as a key industrial hub, hosting the highest number of employees and registered companies in the sector (National Trade Union Congress of the Philippines, 2021; Philippine Economic Zone Authority, 2024). The research focused specifically on non-executive employees across multiple departments to capture a comprehensive view of engagement levels and perceptions influenced by HR and leadership practices. Executive-level staff were excluded to minimize response bias and better reflect employee experiences.

2.3 Respondents of the Study

The study targeted employees of an electronics and semiconductor manufacturing company located in Luzon, Philippines. Luzon is a key hub for the industry, with the highest number of employees in the electronics and semiconductor sector (National Trade Union Congress of the Philippines, 2021) and the most registered locator companies in the industry (Philippine Economic Zone Authority, 2024). The study focused on non-executive employees across various roles and levels, ensuring a comprehensive understanding of GWE. Executive-level employees were excluded from the survey to avoid potential bias and to better capture the authentic perceptions of employees directly impacted by HR and leadership practices.

2.4 Sampling Design

A purposive sampling approach was followed, prioritizing non-executive employees with at least six months of tenure. This criterion ensured that respondents were sufficiently familiar with company policies and practices, thereby providing insights relevant to leadership and HR strategies within the organization. Respondents were

required to have at least six months of tenure to ensure familiarity with company policies and practices. Executive-level staff were excluded to minimize response bias and to better reflect employee experiences.

Using G*Power software and the following parameters: four tested predictors, a power of 0.8, an alpha of 0.05, and an effect size of 0.25, the calculated sample size of 180. A power level of 0.8 was widely accepted as the minimum standard in research to reduce the likelihood of Type II errors, ensuring that the study had an 80% chance of detecting a true effect if it existed. The alpha value of 0.05 represented a 5% risk of committing a Type I error, which aligned with common scientific practice. An effect size of 0.25 corresponded to a medium effect, as defined by Cohen's guidelines, and was considered appropriate for behavioural and organizational studies (Serdar et al., 2021).

2.5 Research Tools and Instruments

The study adapted the questionnaire from 2023 study of Tran but employed a 6-point Likert scale to encourage respondents to express a definitive stance by eliminating a neutral midpoint. This forced-choice format helps reduce central tendency bias, prompting participants to engage more thoughtfully with each item and providing clearer insights into their attitudes (Rosenthal-von der Pütten et al., 2025). Responses from the 6-point Likert scale were categorized as follows: 1 – Strongly Disagree, 2 – Disagree, 3 – Somewhat Disagree, 4 – Somewhat Agree, 5 – Agree, 6 – Strongly Agree. Screening questions were found in Part 1 and Part 2 of the questionnaire. Questions per construct are summarized in Table 1.

TABLE 1. Questionnaire Specification per Variable

Variable	Corresponding Items
A. Green Human Resources Management	1 to 6
B. Green Leadership	7 to 11
C. Green Organizational Culture	12 to 17
D. Green Work Engagement	18 to 23

The instrument underwent reliability testing through a pilot study with 30 respondents from the same industry. Cronbach's alpha values for each construct exceeded the 0.80 threshold, indicating strong internal consistency but avoiding redundancy (Edelsbrunner et al., 2025). See Table 2 for results.

TABLE 2. Cronbach's Alpha per Variable based on Pilot Study

Variable	Cronbach's Alpha	Remarks/Interpretation
A. Green Human Resources Management	0.802	Very good; Acceptable
B. Green Leadership	0.848	Very good; Acceptable
C. Green Organizational Culture	0.805	Very good; Acceptable
D. Green Work Engagement	0.805	Very good; Acceptable
Overall Cronbach's Alpha of Questionnaire: 0.948: Very good; Acceptable		

The instrument was tested for reliability. Each set of questions was assessed for internal consistency using Cronbach's Alpha, with all constructs meeting the threshold of 0.7 or higher (Tavakol & Dennick, 2011), indicating excellent internal reliability (Pallant, 2020). Thirty employees engaged in electronics and semiconductor manufacturing participated in the pilot test. All questionnaire items were deemed valid, with Cronbach's alpha values exceeding 0.80 but not exceeding 0.95, indicating good internal consistency but not too high as to signal redundancy among items, implying that some questions may be measuring the same aspect of a construct rather than contributing unique information (Edelsbrunner et. al., 2025).

All questions were considered valid with Cronbach's alpha values greater than 0.80. The survey questionnaire was administered in printed form to the research study participants. Links to the online survey were distributed across all departments. In total, 202 responses were gathered, and out of the 202 questionnaires, 191 were considered valid, with 11 considered invalid due to less than 6 months employment.

2.6 Data Analysis and Interpretation

Upon data collection, the results were analyzed and interpreted to address the specific objectives of the study. The scale interpretation ranges were outlined in Table 3.

TABLE 3. Response Category and Interpretation

Mean Range	Level and Interpretation
1.00 - 1.83	Very Poor
1.84 - 2.67	Poor
2.68 - 3.50	Fair
3.51 - 4.33	Good
4.34 - 5.17	Very Good
5.18 - 6.00	Excellent

Frequency and percentages were used to describe the age, gender, educational qualification, experience/length of work, and position of the respondents. Likewise, mean and standard deviation were used to describe the status of GOC, GHRM, GL, and GWE. Multiple linear regression was utilized to examine whether GHRM and GL had a significant effect on GOC. Further, multiple linear regression was utilized to examine whether GHRM, GL, and GOC significantly affected GWE. A p-value of <0.05 indicated a significant effect, while the standardized beta coefficient indicated which of the predictors had the greatest contribution to GWE.

The Baron and Kenny mediation approach using simple and multiple regression was employed to determine whether GOC significantly mediated the relationship between GHRM and GWE, as well as the relationship between GL and GWE; an approach widely recognized as a mediation analysis method for behavioral and organizational research. According to this method, partial mediation occurs when the predictor variables (GHRM or GL) remained significant even after accounting for the mediator (GOC), while full mediation is established when the predictor variables no longer significantly affected the outcome variable (GWE) once the

mediator was included in the model. To strengthen the analysis and confirm the statistical significance of the indirect effects, the Sobel test was also conducted. The Sobel test complements the Baron and Kenny approach by providing a formal statistical test of the mediation effect, specifically evaluating whether the product of the paths between the predictor and mediator (a) and the mediator and outcome (b) is significantly different from zero. By combining Baron and Kenny and the Sobel test, the study ensured a more robust and credible evaluation of the mediating role of GOC in influencing green work engagement (Heymans et al., 2021).

Lastly, Analysis of Variance (ANOVA) was conducted to determine whether significant differences in GWE existed across groups for age, educational attainment, experience/length of work and position. and for gender, t-test was used. A p-value of <0.05 is an indication of a significant difference.

2.7 Ethical Considerations

This research strictly adhered to the ethical standards and codes of conduct outlined in the De La Salle Lipa Graduate School Research Ethics Policy and complied with the provisions of the Data Privacy Act of the Philippines (Republic Act No. 10173). Surveys were distributed exclusively via Google Forms, with prior approval from the company's Human Resources Department. The principal investigator ensured that all respondents were fully informed about the research through explanation of the study's objectives, procedures, and potential impacts. Each respondent received a project information sheet detailing the purpose of the research, the individuals and organizations conducting the study, and how the findings would be disseminated and applied. Respondents' dignity, autonomy, and rights were respected, and informed consent was obtained before their participation. To uphold privacy and confidentiality, the company's name was not disclosed, and all collected data were anonymized and securely stored in compliance with the Data Privacy Act, ensuring respondents were not exposed to any risks or harm because of their participation in the study.

3. Results and Discussion

3.1 Descriptive Statistics and Respondent Profile

Out of the 191 valid participants, 58.1% were male, while 41.9% were female. This distribution aligns with the gender composition often observed in manufacturing operations, where production and technical roles tend to be male dominated. In terms of age, most respondents (47.1%) were between 30 and 45 years old, followed by those aged 20 to 30 (41.9%). A smaller proportion were over 45 years old (6.8%) or under 20 (4.2%), suggesting a workforce that is generally mature and experienced, contributing positively to workplace stability and engagement.

Regarding educational attainment, 49.74% of respondents were college graduates, while 21.47% held vocational or technical qualifications. Those who completed secondary education comprised 26.18%, which is typical for entry-level production roles. Only 2.62% had postgraduate education, which reflects the industry's focus on operational rather than research-based roles. In terms of job position, 67.5% of respondents were associates or individual contributors, 24.1% were supervisors or line leaders, and 8.4% held managerial or senior management roles. As for experience, 58.6% of respondents had more than five years of work experience, indicating a seasoned and stable workforce. Meanwhile, 21.5% had been employed for less than one year—possibly due to recent hiring or expansion—while 19.9% had between one and five years of experience.

Overall, the respondent profile reflects a technically skilled, predominantly associate-level workforce, with a strong representation of experienced and long-tenured employees. Full demographic breakdowns are presented in Table 4.

Table 4. Profile of the Respondents

Description	Frequency	Percentage
<i>Gender</i>		
1. Male	111	58.1
2. Female	80	41.9
<i>Age</i>		
1. Less than 20 years old	8	4.2
2. 20 to 30 years old	80	41.9
3. 30 to 45 years old	90	47.1
4. Greater than 45 years old	13	6.8
<i>Educational Attainment</i>		
1. Secondary Education (High School, Senior High)	50	26.18
2. Vocational/Technical Education	41	21.47
3. College Graduate (bachelor's degree)	95	49.74
4. Postgraduate Education (Masteral or Postdoctoral Studies)	5	2.62
<i>Position</i>		
1. Associate or Individual Contributor	129	67.5
2. Supervisor or Line Leader	46	24.1
3. Manager/ Senior Manager	16	8.4
<i>Experience</i>		
1. 6 months to Less than 1 year	41	21.5
2. 1-5 years	38	19.9
3. More than 5 years	112	58.6

The study assessed the level of Green Human Resource Management (GHRM), Green Leadership (GL), Green Organizational Culture (GOC), and Green Work Engagement (GWE) as perceived by the respondents in the electronics and manufacturing company. Based on the descriptive statistics, the overall level of Green Work Engagement (GWE) was the highest, with a mean score of 4.97 (SD = 0.67), indicating that respondents generally agreed with the statements reflecting their engagement in environmentally sustainable work practices. This was followed closely by Green Organizational Culture (GOC) with a mean of 4.98 (SD = 0.75), suggesting a positive perception of the company's embedded green values and norms. Green Human Resource Management (GHRM) had a mean of 4.87 (SD = 0.80), reflecting moderately high implementation of green HR practices such as environmentally focused recruitment, training, and performance evaluation. Lastly, Green Leadership (GL) registered the lowest among the four constructs, with a mean score of 4.76 (SD = 0.87), though still within the "agree" range on the Likert scale, implying that leadership support for environmental initiatives was evident, albeit slightly less emphasized compared to other areas. Overall, the results suggest that the respondents perceive their organization as actively supporting sustainability through culture, HR practices, leadership, and engagement, summarized in Table 5.

Table 5. Descriptive Statistics Summary of Green Constructs

Variable	Mean	Std. Dev	Interpretation
Green Human Resources Management	4.87	0.80	Very Good
Green Leadership	4.76	0.87	Very Good
Green Organizational Culture	4.98	0.75	Very Good
Green Work Engagement	4.97	0.67	Very Good

3.2 Inferential Analysis of the Effects of GHRM and GL on GOC and GWE

Regression Matrices

To examine the predictive relationships among the core constructs of this study—Green Human Resource Management (GHRM), Green Leadership (GL), Green Organizational Culture (GOC), and Green Work Engagement (GWE)—a series of linear regression analyses were performed. These aimed to assess how GHRM and GL influence GOC and GWE, and to determine the extent to which GOC, in turn, affects GWE. The statistical outcomes serve not only to validate the hypothesized model but also to contribute to the theoretical enrichment of green human resource and leadership studies, particularly in the context of emerging manufacturing industries.

Green Human Resource Management was found to have a statistically significant and strong positive effect on Green Organizational Culture ($B = 0.801$, $p < .001$). This result underscores the capacity of green HR practices—such as environmentally focused training, performance appraisals, and incentive systems—to influence and shape organizational norms, beliefs, and behaviours. It affirms the theoretical assertion of Tran (2023) that GHRM lays the groundwork for an organization's sustainability orientation. Yang et al. (2024) further contextualize this within the Resource-Based View (RBV), positioning GHRM as a strategic asset that fosters internal cultural transformation. Given the significance of this finding, H_{01} is rejected.

Table 6. Regression Coefficients for the Effect of GHRM on GOC

Predictor	(B)	SE	t	p	Stand. Estimate (β)
Intercept	1.024	0.1737	5.90	<.001*	
GHRM	0.801	0.0352	22.78	<.001*	0.856

a. $R = 0.856$ b. $R^2 = 0.733$, c. *Significant

The relationship between Green Leadership and Green Organizational Culture was likewise significant and positive ($B = 0.747$, $p < .001$), indicating that green-minded leaders are instrumental in embedding sustainability into the cultural fabric of the organization. Leaders act as both symbolic and practical agents of change by modelling environmental commitment and aligning behaviours with ecological goals. These findings support Tran's (2023) view of leadership as a behavioural contagion that spreads environmental values, and Yang et al. (2024), who argue that GL is a strategic driver of green culture in manufacturing. Accordingly, H_{02} is rejected.

Table 7. Regression Coefficients for the Effect of GHRM on GWE

Predictor	(B)	SE	t	p	Stand. Estimate (β)
Intercept	1.600	0.1708	9.37	<.001*	
GHRM	0.691	0.0346	19.99	<.001*	0.824

a. $R = 0.824$ b. $R^2 = 0.679$, c. *Significant

Green Human Resource Management also significantly predicted Green Work Engagement ($B = 0.691$, $p < .001$), suggesting that environmentally supportive HR practices cultivate an engaged, proactive workforce. Employees who perceive that their employer values sustainability through green HR policies tend to reciprocate through increased motivation, vigour, and involvement in green work tasks (Marini et al., 2023; Tran, 2023). This is consistent with the principles of Social Exchange Theory (SET), where positive organizational support is met with increased employee commitment. As the effect is significant, H_{03} is rejected.

Table 8. Regression Coefficients for the Effect of GL on GOC

Predictor	(B)	SE	t	p	Stand. Estimate (β)
Intercept	1.371	0.1508	9.09	<.001*	
GL	0.747	0.0312	23.97	<.001*	0.867

a. $R = 0.867$ b. $R^2 = 0.753$, c. *Significant

The results also indicate a significant positive relationship between Green Organizational Culture and Green Work Engagement ($B = 0.754$, $p < .001$). A strong culture of sustainability not only aligns employee values but also reinforces behaviours that support green outcomes, resulting in deeper emotional and cognitive engagement. As highlighted by Marini et al. (2023), GWE thrives in environments where

sustainability is ingrained in daily norms, while Nusraningrum et al. (2024) emphasized that supportive green environments enhance motivation and performance. Given these findings, H_{04} is rejected.

Table 9. Regression Coefficients for the Effect of GOC on GWE

Predictor	(B)	SE	t	p	Stand. Estimate (β)
Intercept	1.255	0.1761	7.13	<.001*	
GOC	0.754	0.0353	21.34	<.001*	0.841

a. $R = 0.841$ b. $R^2 = 0.707$, c. *Significant

Finally, Green Leadership was found to have a significant positive effect on Green Work Engagement ($B = 0.579$, $p < .001$). This underscores the ability of leaders to inspire, motivate, and energize employees to participate in sustainability initiatives. Consistent with the work of Yang et al. (2024), green transformational leaders are essential to enhancing employee involvement by aligning leadership behaviours with green organizational values and innovation. Tran (2023) also affirmed that leadership behaviours influence work engagement through emotional and reciprocal exchanges. Therefore, H_{05} is also rejected.

Table 10. Regression Coefficients for the Effect of GL on GWE

Predictor	(B)	SE	t	p	Stand. Estimate (β)
Intercept	2.213	0.1799	12.3	<.001*	
GL	0.579	0.0372	15.6	<.001*	0.750

a. $R = 0.750$ b. $R^2 = 0.562$, c. *Significant

Mediation Matrices

To assess whether Green Organizational Culture (GOC) mediates the relationship between Green Human Resource Management (GHRM) and Green Work Engagement (GWE), the study followed the four-step procedure proposed by Baron and Kenny (1986). As shown in Table 8, all preliminary steps to test mediation were met: GHRM significantly predicted both GWE and GOC, and GOC significantly predicted

GWE. When GOC was included in the model, the effect of GHRM on GWE was reduced but remained significant, indicating partial mediation.

To confirm the statistical significance of the indirect effect, the Sobel test was conducted. The resulting Sobel test statistic was 6.78 confirmed that the mediation effect was significant, with GOC accounting for 53% of the total effect of GHRM on GWE. These findings emphasize the importance of green organizational culture in translating HR practices into meaningful employee engagement in sustainability efforts.

Table 11. Summary of Baron and Kenny Mediation Steps for Mediation of GOC between GHRM and GWE

Step	Path	Model	Standardized		p-value	R²	Interpretation
			Beta (β)	t-value			
Step 1	X → Y	GHRM → GWE	0.824	19.989	.000	0.679	Significant
Step 2	X → M	GHRM → GOC	0.856	22.779	.000	0.733	Significant
Step 3	M → Y	GOC → GWE	0.841	21.339	.000	0.707	Significant
Step 4	X & M → Y	GHRM	0.390	5.502	.000	0.747	Significant
		GOC	0.506	7.139	.000		Significant
		DV: GWE					

a. Legend: X = Independent Variable; Y = Dependent Variable; M= Mediator

b. Sobel Test statistic = 6.78 and Percent Mediation = 53%

A similar analysis was conducted to test whether GOC mediates the relationship between Green Leadership (GL) and GWE. As outlined in Table 11, all Baron and Kenny preliminary steps were satisfied for mediation. While GL initially had a significant direct effect on GWE, this effect became non-significant when GOC was introduced as a mediator, and GOC remained highly significant, thus indicating full mediation.

Table 12. Summary of Baron and Kenny Mediation Steps for Mediation of GOC between GL and GWE

Standardized							
Step	Path	Model	Beta (β)	t-value	p-value	R²	Interpretation
Step 1	X → Y	GL → GWE	0.75	15.581	.000	0.562	Significant
Step 2	X → M	GL → GOC	0.867	23.975	.000	0.753	Significant
Step 3	M → Y	GOC → GWE	0.841	21.339	.000	0.707	Significant
Step 4	X & M → Y	GL	0.163	2.368	.295	0.708	Not Significant
		GOC	0.678	8.76	.000		Significant
		DV: GWE					

a. Legend: X = Independent Variable; Y = Dependent Variable; M= Mediator

b. Sobel Test statistic = 9.00 and % Percent Mediation = 89%

The Sobel test further confirmed the significance of the indirect effect, Sobel test statistic of 9.00 and showed that 89% of the effect of green leadership on green work engagement happens through green organizational culture, indicating that most of the impact is indirect and driven by the organization's culture. These findings strongly support the conclusion that green leadership fosters employee engagement in sustainability primarily by shaping a supportive green culture, rather than through direct influence alone.

Taken together, the mediation analyses highlight the central role of Green Organizational Culture (GOC) as a key mechanism through which both Green Human Resource Management (GHRM) and Green Leadership (GL) influence Green Work Engagement (GWE). While both GHRM and GL initially showed strong direct effects on GWE, their influence shifted once GOC was introduced as a mediator. In the case of GHRM, the effect remained significant but reduced, indicating partial mediation, whereas for GL, the effect became non-significant, indicating full mediation. These findings suggest that while green HRM practices can directly drive employee engagement in sustainability, the effect of leadership is more indirect and reliant on cultivating a strong green culture. Ultimately, these results highlight the importance of embedding environmental values into the organization, as doing so not only reinforces leadership efforts and GHRM practices but also significantly enhances employees' green work engagement.

Group Differences

To determine whether Green Work Engagement (GWE) significantly differs across various demographic and employment-related groups, a series of statistical tests were conducted. Results of an independent sample t-test revealed no significant difference in GWE between male and female respondents ($t(189) = -0.824$, $p = 0.411$). Likewise, one-way ANOVA tests showed no statistically significant differences in GWE when respondents were grouped by age ($p = 0.086$), educational attainment ($p = 0.255$), position level ($p = 0.481$), or length of work experience ($p = 0.068$). Although some trends were observed — such as higher mean GWE among younger respondents, those with less than one year of experience, and those with postgraduate education — none of these differences reached statistical significance. Results are shown in Table 13.

Table 13. Summary of Group Differences

Grouping Variable	Statistical Test	F or t Value	p-value	Remarks
Gender	Independent Samples t-test	-0.824	0.411	Not Significant
Age	One-way ANOVA	2.228	0.086	Not Significant
Educational Attainment	One-way ANOVA	1.365	0.255	Not Significant
Position	One-way ANOVA	0.734	0.481	Not Significant
Length of Work	One-way ANOVA	2.725	0.068	Not Significant

These findings suggest that GWE is relatively consistent across different respondent profiles, indicating that green engagement practices may be well-integrated and broadly experienced across demographic and organizational groups. This supports that green work engagement is not limited to a specific type of employee. In the study of Tran (2023) GWE can become a shared experience when green values are embedded throughout

the organization. Similarly, Marini et al. (2023) noted that GWE is influenced more by environmental support and organizational systems than by demographic variables.

4. Conclusion

This study examined the effects of Green Human Resource Management (GHRM), Green Leadership (GL), and Green Organizational Culture (GOC) on Green Work Engagement (GWE) within an electronics and semiconductor manufacturing company in the Philippines. Additionally, it explored the mediating role of GOC in the relationships between GHRM and GL on GWE and evaluated whether engagement levels differed across demographic and employment profiles.

The regression analyses revealed that both GHRM and GL had statistically significant and positive effects on Green Organizational Culture. This finding underscores the crucial role of green HR practices and sustainability-driven leadership in shaping the shared values and behaviours that define a green organizational culture. As a result, the study rejects H_{01} (GHRM has no significant effect on GOC) and H_{02} (GL has no significant effect on GOC).

GHRM and GOC also significantly predicted Green Work Engagement, indicating that employees are more engaged in sustainability-related work when green values are reinforced through human resource systems and organizational norms. These findings validate the importance of embedding environmental priorities into HR and cultural practices, leading to the rejection of H_{03} (GHRM has no significant effect on GWE) and H_{04} (GOC has no significant effect on GWE).

Moreover, Green Leadership was found to have a positive and significant direct effect on Green Work Engagement. This suggests that leaders who exemplify environmental responsibility and promote green values actively contribute to higher employee engagement in green initiatives. Accordingly, H_{05} (GL has no significant effect on GWE) is also rejected.

In summary, the results support the theoretical assertion that effective green leadership, human resource practices, and organizational culture are interlinked drivers of employee engagement in sustainability. These findings highlight the strategic importance of aligning leadership behaviour and HR systems with green organizational values to foster stronger, more engaged, and environmentally proactive workforces.

Mediation analysis confirmed that GOC partially mediates the effect of GHRM on GWE and fully mediates the effect of GL on GWE. Therefore, H_{06} and H_{07} (stating that GOC does not significantly mediate the effects of GHRM and GL on GWE, respectively) are both rejected. These findings therefore show the importance of GOC as the means through which green leadership and GHR practices translate into engaged green behaviour among employees.

Moreover, no statistically significant differences in GWE were observed across demographic and employment groupings, including age, gender, education, tenure, and position. While certain groups showed slightly higher engagement levels, the differences were not significant. Therefore, H_{08} (there are no significant differences in GWE across demographic and employment profiles) is accepted. This suggests that green engagement is a broadly shared phenomenon across various demographics.

Overall, the findings affirm that cultivating a strong green organizational culture is critical to enhancing green engagement. When leadership and HR systems consistently reinforce environmental values, they collectively drive employee participation and commitment to sustainability—especially in resource-intensive industries like electronics manufacturing. This study contributes to the understanding of how internal organizational dynamics influence employee behaviour and offers empirical support for integrated green strategies.

5. Recommendations

This study investigated the effects of Green Human Resource Management, Green Leadership, and Green Organizational Culture, on Green Work Engagement within an electronics and semiconductor manufacturing company in the Philippines. It also explored the mediating role of GOC in the relationship between GHRM and GL on GWE and examined whether engagement levels varied across demographic and employment profiles.

The results revealed that both GHRM and GL significantly predicted GOC, therefore showing their importance in fostering an environmentally conscious organizational culture. GHRM and GOC emerged as significant predictors of GWE. While GL initially demonstrated a significant direct effect on GWE, this relationship turned negative and non-significant when GOC was included in the model—suggesting that GL influences engagement only if there exists a green organizational culture. Mediation analysis confirmed that GOC partially mediates the effect of GHRM on GWE and fully mediates the effect of GL on GWE. These findings underscore the central role of GOC as the conduit through which leadership and HR practices translate into engaged green behaviour among employees.

As all regression models demonstrated strong explanatory power— R^2 values ranging from 0.562 to 0.753—this study confirms the robustness of Green Human Resource Management (GHRM), Green Leadership (GL), and Green Organizational Culture (GOC) as predictors influencing Green Work Engagement (GWE). Based on these results, the following practical recommendations are proposed for the company:

1. Strengthen Green Organizational Culture (GOC) as a Catalyst for Engagement

Among all predictors, GOC showed the strongest direct influence on GWE ($B = 0.754$; $\beta = 0.841$). This highlights the importance of embedding environmental values into everyday organizational culture. This includes integrating sustainability metrics in team performance evaluations and recognizing employees who exhibit eco-friendly practice. The action plan for this project is detailed on the succeeding Project Plan “Project Green: Strengthening Green Leadership and Green Culture”, which will be spearheaded by HR, EHS and the Sustainability lead, and will comprise of activities across the company within one year.

2. Expand Green HRM (GHRM) Systems Company-wide

Since Green Organizational Culture (GOC) was found to have the greatest contribution on Green Work Engagement (GWE) ($\beta = 0.590$), efforts may focus on enhancing environmental values into existing operational and people systems. This involves aligning current EMS and HR initiatives with engagement strategies, such as: reinforcing green values through ongoing awareness campaigns and internal communications; integrating sustainability metrics into individual and team performance evaluations and by recognizing and rewarding eco-friendly behaviours and contributions across all levels of the organization.

By building upon existing EMS frameworks and leadership structures, this approach ensures that green values are not only promoted but actively lived out in daily operations — fostering a deeper and more authentic engagement from employees.

3. Train Leaders to Act as Green Culture Advocates

Green Leadership showed a strong positive effect on GOC ($B = 0.747$; $\beta = 0.867$) and a significant direct effect on GWE ($B = 0.579$; $\beta = 0.750$), affirming the critical role of leaders in shaping employee behaviour and cultural alignment. Leadership development should also focus on values alignment, green communication

strategies. Moreover, no statistically significant differences in GWE were observed across demographic and employment groupings, including age, gender, education, tenure, and position. While certain groups showed slightly higher engagement levels, the differences were not significant. This suggests that green engagement is a broadly shared phenomenon that transcends individual characteristics when a strong organizational culture is in place.

Overall, the study concludes that fostering a robust green organizational culture is essential in translating leadership support and HR-driven sustainability initiatives into actual employee engagement. The research addressed a gap in understanding how internal organizational dynamics contribute to green engagement and provides empirical support for integrated strategies that drive environmental sustainability through people.

5.1 Limitations of the Study

The limitations of this study are acknowledged. First, the research was confined to a single electronics and semiconductor company in Luzon, restricting the generalizability of findings to other contexts. Second, reliance on self-reported questionnaires introduces potential social desirability bias, which may have inflated reported green behaviours. Third, the cross-sectional design captured data at one point in time, limiting causal inference and the assessment of temporal dynamics. Finally, the study focused exclusively on internal organizational factors such as HRM practices, leadership, and culture, while excluding external drivers such as regulatory pressures and market demands that may also influence sustainability engagement.

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