

# Green Business Leadership Model Development in Driving Green Performance Towards Sustainable Practices: A Simultaneous Approach in the Hospitality Industry

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## Green Business Leadership Model Development in Driving Green Performance Towards Sustainable Practices: A Simultaneous Approach in the Hospitality Industry

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**Abstract:** Green performance in the hospitality industry increasingly depends on how green business leadership mobilizes green intellectual capital and strengthens organizational green commitment. However, existing studies typically examine these elements separately, offering limited understanding of their combined interaction in driving sustainable practices. This study addresses this gap by developing an integrated model linking green business leadership, green intellectual capital, and green commitment to enhance green performance, particularly within hospitality contexts in developing regions. The study aims to develop and test a comprehensive model that explains the influence of green leadership, green intellectual capital, and green commitment on green performance within the hospitality industry in North Sumatra. Data were collected in 2025 through a survey administered in Indonesia, involving 170 employees from hotels located in the Lake Toba-Samosir tourism region and Simalungun Regency, including both operational and managerial staff. The survey consisted of structured questions, and the data were analyzed using partial least squares structural equation modeling (PLS-SEM) with SmartPLS software. The findings demonstrate that green leadership has a positive and significant effect on green performance ( $\beta = 0.234, p < 0.01$ ), indicating that sustainability-oriented leadership practices enhance environmental performance in hospitality firms. Green intellectual capital also has a significant effect on green performance ( $\beta = 0.398, p < 0.001$ ), suggesting that environmental knowledge, innovation capability, and organizational learning play a critical role in improving sustainability outcomes. Furthermore, green commitment significantly influences green performance ( $\beta = 0.210, p < 0.01$ ), confirming that sustained organizational dedication enhances the effectiveness of environmental initiatives. These findings provide valuable implications for future research and managerial practice in business leadership, particularly regarding the integration of leadership, knowledge resources, and organizational commitment to improve sustainable performance in the hospitality industry.

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## INTRODUCTION

Global climate change and environmental degradation have become strategic issues driving major transformations in business practices across sectors, including the hospitality industry (Akpa et al., 2022; Hashish et al., 2022).

A United Nations World Tourism Organization (UNWTO) report indicates that the tourism sector accounts for approximately 8% of global carbon emissions, with the hospitality industry contributing significantly through energy and water consumption and waste production (UNWTO, 2016).

In line with the 2030 Sustainable Development Goals (SDGs), particularly goals 12 and 13, the hospitality industry is required to adopt sustainable practices to minimize environmental impacts while maintaining long-term competitiveness (Zeng et al., 2023; Sobaih et al., 2022). Furthermore, at the national level, Indonesia faces serious challenges in environmental management in the tourism sector.

The Ministry of Tourism and Creative Economy reported that hotel energy consumption in major tourist destinations increased by an average of 6–8% per year following the pandemic, as the tourism sector recovered (Kemendag RI, 2014).

This situation reinforces the urgency of systematically implementing green practices, not only through environmentally friendly technologies but also through sustainability-oriented managerial and human resource approaches (Luu, 2020; Indajang et al., 2024).

In North Sumatra, particularly in strategic tourism areas such as Lake Toba, the growth of the hotel industry has been accompanied by increasing pressure on local ecosystems.

The Indonesian Central Statistics Agency (2020) reports a considerable growth in hotels and room occupancy rates in this area, which affects water, electricity, and trash management. Green performance strategies have not been incorporated into many hotels' leadership systems or organizational cultures (Nisar et al., 2021; Riva, 2021).

Limited leadership involvement in implementing sustainability initiatives remains a major concern in the hotel industry. Green leadership refers to a

leadership approach that guides environmental policies and drives organizational change, shaping pro-environmental visions, norms, and employee behaviors within the company to support sustainability goals and long-term environmental performance (Kim, 2022).

Research indicates that green-oriented executives significantly impact environmental innovation and corporate green performance (Özgül & Zehir, 2023).

The shift towards sustainable practices has emerged as a strategic priority in the worldwide hospitality business, given its substantial impact on energy consumption, water use, and trash production (Natalie et al., 2024; Siaw et al., 2022).

Multiple research studies demonstrate that enhancing organizational green performance is not only reliant on technology adoption but is significantly affected by managerial characteristics and organizational behavior (Riva et al., 2021; Suliman et al., 2023).

In this setting, green corporate leadership has become a pivotal influence on employees' environmental views, incentives, and pro-environmental behaviors inside firms (Özgül & Zehir, 2023). Leaders with a robust environmental focus may incorporate sustainability principles into organizational strategy, operational practices, and decision-making processes.

Nonetheless, despite the increasing focus on sustainability leadership, several research studies continue to analyze green leadership as a singular determinant of environmental performance (Ullah et al., 2023; Zhao & Huang, 2022).

This approach constrains the comprehension of how leadership engages with other internal organizational resources to produce sustainable results, especially in the hospitality industry of developing nations where resource constraints and structural obstacles are common.

In addition to leadership, green intellectual capital is a vital factor in enhancing the success of environmental efforts (Yadiati et al., 2019; Marco-Lajara et al., 2022).

"Green intellectual capital" denotes the aggregate environmental knowledge, competences, innovative capacities, and eco-centric skills held by people and companies (Renaldo & Augustine, 2022).

Previous research indicates that green intellectual capital serves as a strategic intangible asset that aids in the execution of sustainability plans, improves resource efficiency, and fosters environmentally focused innovation (Shah et al., 2021; Chao & Juo, 2021). In the hotel sector, workers' understanding of sustainable practices, waste management systems, and energy efficiency protocols is crucial to achieving optimal green performance.

Nonetheless, in several growing tourist locations, including areas like North Sumatra, investment in cultivating workers' green competences remains somewhat constrained.

Consequently, firms often have difficulty translating sustainability principles into efficient operational practices.

Current research mostly categorizes green intellectual capital as either a mediating variable or emphasizes manufacturing sectors and small- to medium-sized firms, resulting in a relative paucity of empirical data within the hospitality industry.

A crucial organizational characteristic that enhances environmental performance is green commitment (Chawewong & Naipinit, 2024; Khan et al., 2022).

Organizational green commitment denotes the degree to which management emphasizes sustainability via resource allocation, environmental standards, and the constant enforcement of eco-friendly policies (Zhou et al., 2021; Iftikhar et al., 2021). Empirical research indicates that robust management dedication to environmental objectives may enhance energy efficiency, promote waste reduction, and foster green innovation inside firms (Haldorai et al., 2022; Khan et al., 2022).

In fact, some hospitality firms continue to see environmental measures primarily as reactions to legal or commercial demands rather than as fundamental company principles. Moreover, empirical evidence about the impact of green commitment on environmental performance remains incongruous.

Significantly, prior studies hardly analyze green commitment concurrently with green business leadership and green intellectual capital within a unified framework (Sabellah et al., 2025; Haldorai et al., 2022). This study addresses the existing gap by

developing a simultaneous model that integrates green business leadership, green intellectual capital, and green commitment to elucidate how these organizational factors collectively enhance green performance and promote sustainable practices in the hospitality sector.

There is a lack of research on the topic; thus, it is crucial to develop a model that explains how these three strategic factors interact to drive green performance toward sustainable practices simultaneously.

Since the success of sustainable practices is not determined by a single element but rather by the synergy of leadership, intellectual capital, and organizational commitment, it is considered that a simultaneous approach would give a more thorough understanding than a fragmented approach.

This research is dedicated to designing and evaluating a model of green leadership, green intellectual capital, and green commitment in the North Sumatran hotel business, with the goal of pushing green performance towards sustainable practices.

Improving green performance in the North Sumatran hotel business may be achieved by enhancing our knowledge of all three aspects at once. This research adds to the conversation on sustainability by creating a framework that shows how green business leadership, green intellectual capital, and green commitment all work together to affect the green performance of organizations in the hospitality sector.

The study advances a simultaneous model, yielding profound theoretical insights into the internal organizational mechanisms that promote sustainable practices, while also presenting strategic implications for hospitality firms aiming to integrate environmental sustainability into their long-term competitive and operational frameworks.

## LITERATURE REVIEW

### Theoretical Framework

In recent years, research on green performance has experienced a paradigm shift toward a perspective that emphasizes behavior, leadership, and intangible resources.

17 Within the framework of the resource-based view (RBV) and dynamic capabilities theory, sustainability within an organization is crucial, built on hard-to-imitate intangible assets, environmentally oriented leadership, green intellectual capital, and 79 organizational commitment to sustainability (Sobaih et al., 2020; Asadi et al., 2020; Saleem et al., 2025). Within the organizational structural hierarchy, sustainability issues are crucial to understand and implement in every policy as a form of organizational commitment to supporting sustainability issues (Pham et al., 2023; Han et al., 2019).

Green leadership extends transformational leadership theory in the context of sustainability, where leaders shape environmentally friendly visions, values, and strategic orientations (Kim, 2022; Suliman et al., 2023). From the RBV perspective, green intellectual capital is positioned as a strategic asset encompassing employee knowledge, competence, innovation, and environmental awareness. This capital functions as a cognitive infrastructure that enables organizations to translate sustainability visions into operational practices (Martinez-Falcó et al., 2023; Chao & Juo, 2021).

However, its direct contribution to green performance in the service sector, particularly in the hospitality industry of developing regions, remains underdeveloped. Meanwhile, green commitment represents the internalization of sustainability values into organizational policies and practices.

Although proven to strengthen the consistency of environmental strategies, previous research remains fragmented (Elzek et al., 2021; Sabellah et al., 2025). Therefore, the main theoretical gap lies in the lack of integrative models that simultaneously examine green leadership, green intellectual capital, and green commitment.

This study proposes a conceptual framework that positions these three constructs 34; direct, mutually reinforcing determinants of green performance, particularly in the North Sumatran hotel industry.

### 34 Green Leadership and Green Performance

Green leadership is characterized by leaders who prioritize environmental concerns, integrate sustainability into decision-making processes, and inspire employees to adopt environmentally friendly

behaviors (Shah et al., 2023; Liu et al., 2023). Several studies have shown that green leadership positively influences green performance, encompassing energy efficiency, waste reduction, and the adoption of environmentally friendly technologies (Perez et al., 2023; Özgül & Zehir, 2023; Riva et al., 2021). 64 Suliman et al. (2023), Ullah et al. (2023), Hidayati et al. (2024), and Saleem et al. (2025), emphasize the importance of a green leadership style that empowers employees to innovate and initiate environmentally sustainable initiatives. In addition, organizational support and commitment to sustainability goals significantly influence green performance outcomes (Úbeda-García et al., 2021; Sobaih et al., 2022).

Researchers have highlighted the need for leaders to demonstrate proactivity, vision, and commitment to environmental responsibility to drive green performance with 90 their organizations effectively (Kim, 2022; Perez et al., 2023; Asadi et al., 2020).

Furthermore, several recent 72 studies have demonstrated that green transformational leadership enhances environmental performance at both the individual and organizational levels by promoting green innovation, resource efficiency, and pro-environmental employee behavior (Riva et al., 2021; Özgül & Zehir, 2023).

However, their findings are not entirely consistent in explaining the magnitude and stability of these effects.

In some contexts, the effects of green leadership appear relatively direct when green leadership is institutionalized within organizational strategy and supported by incentive systems and environmental performance controls, while in other contexts, the effects are predominantly indirect through psychological and social mechanisms such as green work engagement, green creativity, and an organizational climate supportive of environmental practices (Sobaih et al., 2022; Suliman et al., 2023; Balant et al., 2020).

A significant research gap exists in the service sector, particularly in the hospitality industry of developing regions, where green performance is strongly influenced by the intensity of energy and water use, service characteristics, and pressure from destination stakeholders.

Therefore, based on the results of several previous studies, we develop the following hypothesis:

*H1: Green leadership management influences green performance.*

### Green Intellectual Capital and Green Performance

Green intellectual capital (GIC) is a concept that refers to the knowledge, skills, and capabilities of individuals or organizations in the context of environmental sustainability (Yadiati et al., 2019; Sohu et al., 2024; Khan et al., 2021).

Chawewong and Naipinit (2024), Renaldo and Augustine (2022), and Haldorai et al. (2022), show that the adoption of green intellectual capital positively influences green performance in various ways, such as increasing the efficiency of natural resource use, reducing negative environmental impacts, and creating environmentally friendly product and process innovations.

Factors such as environmental awareness, knowledge of sustainable practices, and the ability to implement environmentally friendly solutions are key in linking green intellectual capital with green performance (Nisar et al., 2021; Shah et al., 2021; Tjahjadi et al., 2023).

Furthermore, some literature emphasizes the need for investment in the development of sustainable intellectual capital, both through training and education, and through an organizational culture that supports sustainability initiatives (Marco-Lajara et al., 2022; Clift & Luo, 2021). Several cross-sector studies have found that organizations with high levels of GIC tend to demonstrate better energy efficiency, consistent waste reduction, and superior green innovation capabilities (Anik & Sulisty, 2021; Shah et al., 2021; Augustinah et al., 2022).

However, a synthesis of these findings reveals significant variation in the effects. Some studies report a direct effect of GIC on green performance, particularly when environmental knowledge is internalized in operational routines and management systems (Sohu et al., 2024; Yadiati et al., 2019).

Conversely, other studies confirm that the effect of GIC is predominantly indirect through mechanisms such as green innovation, green human resource

management, or pro-environmental employee behavior, indicating that green intellectual capital requires institutional channels to generate measurable environmental performance (Rustiarini et al., 2022; Anik & Sulisty, 2021; Chao & Luo, 2021).

A significant research gap exists in the lack of contextual studies in developing regions that examine the direct contribution of GIC to green performance, considering the operational complexity of the service sector. Therefore, based on several previous studies, the following hypothesis is developed:

*H2: Green intellectual capital influences green performance.*

### Green Commitment and Green Performance

Green commitment encompasses an organization's commitment to adopt and practice environmentally friendly behaviors and to achieve sustainability goals (Zhang & Walton, 2017; Basana et al., 2022; Khan et al., 2022). Sharma et al. (2021), Khar et al. (2021), and Mushtaq et al. (2019), demonstrate that the level of green commitment has a positive influence on green performance in various ways, including reducing waste and emissions, increasing resource efficiency, and developing more environmentally friendly innovations.

Factors influencing green commitment include sustainability-oriented leadership, a supportive organizational culture, and pressure from external stakeholders (Somjai et al., 2020; Elshaer et al., 2022; Alharbi et al., 2023).

Studies, e.g., Riva et al. (2021) and Sabellah et al. (2025), also highlight the importance of transparently measuring and reporting environmental performance as a means to strengthen green commitment and motivate behavioral change. However, cross-study synthesis reveals differing findings regarding its impact mechanisms. Some studies find a direct effect of GIC on green performance, particularly when green knowledge and competencies are institutionalized in organizational systems, procedures, and work routines (Shah et al., 2021; Migdadi, 2023).

Conversely, other studies confirm that the influence of GIC is predominantly indirect through

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green innovation, green human resource management, or employee pro-environmental behavior, suggesting that green intellectual capital requires institutional mechanisms to generate measurable environmental performance (Nisar et al., 2021; Haldorai et al., 2022; Úbeda-García et al., 2021).

These differences in results are also influenced by the industry context and the level of organizational maturity; empirical evidence is relatively strong in the manufacturing and SME sectors, while in the service sector, particularly the hospitality industry, results are still limited and inconsistent (Renaldo & Augustine, 2022; Iqbal et al., 2024).

A prominent research gap lies in the lack of contextual studies in developing regions that examine the direct contribution of GIC to green performance, as well as the limited separate analysis of GIC dimensions to identify the most important components.

Therefore, based on several previous studies, the following hypothesis is developed:

*H3: Green commitment influences green performance.*

This research synthesizes the three aforementioned hypotheses by including green leadership, green intellectual capital, and green commitment into a cohesive conceptual framework to elucidate green performance within the hospitality industry.

While prior research has analyzed these characteristics individually, there is a paucity of studies investigating their concurrent impact within a singular empirical framework, especially in service-oriented sectors where environmental policies are intricately linked to operational procedures and staff conduct.

In the hospitality sector, sustainability performance is influenced by management guidance, the organization's knowledge assets, and the collective dedication of workers to environmental objectives. So, looking at all three of these aspects together gives us a better idea of how policies that focus on sustainability lead to observable environmental results.

Additionally, the hotel industry in developing areas has its own set of problems, such as a lack of access to technology, personnel who are not very

environmentally conscious, and growing demand from tourist stakeholders to embrace sustainable practices.

## METHODOLOGY

### Research Design

This study uses a library and field research design with a quantitative approach. The approach used is a simultaneous approach that considers the interaction between these three factors within a single analytical framework.

The research location is the hotel industry in the tourist attraction of Lake Toba, located in Samosir and Simalungun regencies, North Sumatra. This tourist attraction was selected because it has significant potential in the hotel industry and is a key destination in the context of North Sumatra tourism.

The presence of hotels around Lake Toba, Samosir, and Simalungun Regency offers variations in size, class, and business model, allowing for a more comprehensive analysis of the influence of green leadership models, green intellectual capital, and green commitment on green performance.

### Sample and Data Collection

The population of this study comprises entrepreneurs and employees from all hotels operating in the Lake Toba Samosir tourist attraction, North Sumatra. This tourist attraction was chosen because it serves as a major hub of tourism activity in the region.

The research sample will be selected purposively from this population, accounting for variations in hotel size, class, and business model. Inclusion criteria for sample selection include the presence of policies or practices related to environmental sustainability and the availability of relevant data for analysis.

According to Hair et al. (2019), if the population size is unknown, the sample size can be determined from 5-10 times the number of indicators used in a single construct.

This study utilizes 17 indicators from four existing variable dimensions, resulting in a total of  $17 \times 10 = 170$  research samples. The characteristics of the respondents in this study are explained in Table 1.

Table 1. Descriptions of Research Respondents

Category	Detail	Amount	Percentage (%)
Gender	Men	106	62.35
	Woman	64	37.65
Age (years)	< 25	22	12.94
	26-35	48	28.23
	36-45	70	41.18
	46-55	20	11.75
	> 55	10	5.88
Level of education	SENIOR HIGH SCHOOL	85	50
	Diploma	35	20.59
	Bachelor	45	26.47
	Masters	5	2.94
Length of Service (years)	< 1	22	12.94
	1-5	58	34.12
	6-10	60	35.29
	> 10	30	17.65
Title/Position	Operations Manager	19	11.18
	General Manager	10	5.88
	Supervisory	31	18.24
	Front Office	40	23.54
	Executive Staff	20	11.76
	Employee	50	29.4

Source: Data processing results (2025).

11 According to the data in Table 1, the demographic characteristics of the respondents in this study are categorized into several primary categories, including gender, age, education level, length of service, and job title or position.

Based on *gender*, the majority of respondents were male, comprising 106 people (62.35%), while female respondents numbered 64 (37.65%), indicating a 28 predominance of male participation in the study. In terms of *age*, the largest group of respondents was in the 36-45 years age range, with a total of 70 people (41.18%), followed by the 26-35 years age group, with 48 people (28.23%).

Respondents aged under 25 years numbered 22 people (12.94%), while the 46-55 years and above 55 years age groups each comprised 20 people (11.75%) and 10 people (5.88%), indicating that most respondents fell within the productive age range with relatively mature work experience. In terms of *educational level*, the majority of respondents had a

high school education background, with 85 people (50%), followed by Bachelor's graduates (45 people, 26.47%) and Diploma graduates (35 people, 20.59%). Meanwhile, respondents with a Master's degree were relatively few, namely 5 people (2.94%).

Based on the *length of service*, respondents with 6-10 years of service were the largest group, comprising a total of 60 people (35.29%), followed by respondents with 1-5 years of service, who totaled 58 22 people (34.12%).

Respondents with more than 10 years of work 22 experience numbered 30 people (17.65%), while respondents with less than one year 28 work experience numbered 22 people (12.94%). In terms of *position*, the majority of respondents were in the employee category, comprising 50 people (29.4%), followed by front office positions, which included 40 people (23.54%), and supervisors, who numbered 31 people (18.24%).

Meanwhile, respondents serving as operational managers and general managers numbered 19 (11.18%) and 10 (5.88%), respectively, while executive staff numbered 20 (11.76%). Overall, this composition indicates that the study respondents came from diverse demographic backgrounds and job positions, thus comprehensively representing the research population.

#### Measurement Instruments

Operational definitions of research variables are developed to provide conceptual clarity and empirical guidance in the measurement process for each variable studied. These definitions aim to translate abstract theoretical concepts into indicators that can be systematically observed and measured.

With operational definitions, each research variable has clear boundaries regarding its meaning, dimensions, and measurement methods, thereby reducing the potential 36 or differences in interpretation during both the data collection and analysis stages. 10

Furthermore, operational definitions play a crucial role in ensuring the consistency, validity, and reliability of research instruments, as well as ensuring that the measurements taken truly represent the intended constructs in accordance with the research's conceptual framework.

Table 2. Operational Definition of Research Variables

Variables	Code	Item	Source
Green Leadership	GL1	Sustainable Vision and Mission	Perez et al. (2023); Suliman et al. (2023)
	GL2	Ability to Inspire and Motivate	
	GL3	Skills and Knowledge Development	
	GL4	Involvement in Sustainable Initiatives	
Green Intellectual Capital	GIC1	Knowledge of Sustainable Practices	Sohu et al. (2024); Chawewong and Naipinit (2024)
	GIC2	Implementation of Sustainable Practices	
	GIC3	Innovation and Creativity	
	GIC4	Personal Awareness and Commitment	
Green Commitment	GC1	Leadership and Management Commitment	Basana et al. (2022); Iftikhar et al. (2021)
	GC2	Investments and Resources	
	GC3	Sustainability Policies and Standards	
	GC4	Participation in External Initiatives	
Green Performance	GP1	Energy Efficiency	Pham et al. (2023); Han et al. (2019)
	GP2	Waste Management	
	GP3	Water Conservation	
	GP4	Use of Environmentally Friendly Materials	
	GP5	Green Education and Awareness	

Source: Constructed by the authors using prior research (2025).

As shown in Table 2, operational definitions of the research variables were developed to provide conceptual clarity and empirical guidance in measuring each construct.

*Green leadership* is defined as a leader's ability to direct, influence, and inspire organizational members

to integrate sustainability principles into their vision and work practices. This variable is measured through indicators of sustainable vision and mission (GL1), ability to inspire and motivate (GL2), skills and knowledge development (GL3), and involvement in sustainable initiatives (GL4).

*Green intellectual capital* is defined as the accumulation of knowledge, skills, creativity, and environmental awareness of individuals and organizations as strategic assets in supporting green performance. Measurements include knowledge of sustainable practices (GIC1), implementation of sustainable practices (GIC2), innovation and creativity (GIC3), and personal awareness and commitment (GIC4).

*Green commitment* is defined as the level of seriousness and consistency with which an organization internalizes sustainability values into its policies, resource allocation, and managerial practices. This variable is measured through leadership and management commitment (GC1), investments and resources (GC2), sustainability policies and standards (GC3), and participation in external initiatives (GC4). Meanwhile, *green performance* refers to the level of achievement of an organization in managing environmental impacts effectively and sustainably, which is measured through energy efficiency (GP1), waste management (GP2), water conservation (GP3), use of environmentally friendly materials (GP4), and green education and awareness (GP5).

#### Conceptual Framework

*Green leadership*, *green intellectual capital*, and *green commitment* are the primary factors that determine *green performance* in the hospitality business. This study conceptual framework aims to explain the causal link between these three variables. An organization's environmental performance is seen in this research as the outcome of exploiting internal assets that are tangible and difficult to mimic. This perspective is based on the resource-based view and dynamic capacities theory. By setting an example of environmentally conscious conduct and providing opportunities for staff to take initiative, *green leadership* may influence an organization's long-term goals and objectives in a

positive way. The capacity to effectively implement the organization's sustainability goal is made possible by *green intellectual capital*, which serves as a cognitive and inventive facilitator by offering green knowledge, skills, and creativity. *Green commitment*, on the other hand, is an institutional system that makes sure that green practices are consistently and sustainably implemented by integrating sustainability ideals into policies, resource allocation, and operational standards. *Green performance* is defined here as an improvement in areas such as

energy efficiency, water conservation, waste management, and environmental education and awareness. This improvement is believed to be the result of a direct and complementary influence from these three constructs. By examining all three factors at once, it was investigated to learn more about the interplay between leadership, intellectual capital, and organizational commitment as they pertain to the hotel industry's pursuit of sustainability. Therefore, Figure 1 below shows the conceptual framework model that was applied in this study.

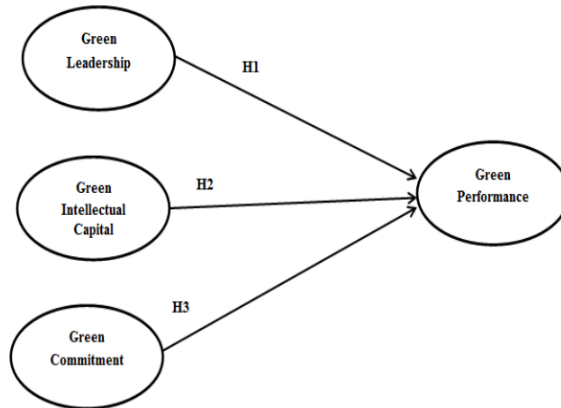


Figure 1. Research Framework Model

Source: Constructed by the authors using prior research (2025).

As shown in Figure 1, the research framework model illustrates the conceptual relationship between the main variables tested in this study, namely *green leadership*, *green intellectual capital*, and *green commitment*, as independent variables that influence *green performance*, the dependent variable.

The model shows that improving an organization's environmental performance is not influenced by a single factor but rather is the result of a synergy between sustainability-oriented leadership, green knowledge and innovation capacity, and the organization's institutional commitment to environmentally friendly practices.

The direction of the arrows in the model represents the hypothesized direct causal

relationship, where green leadership acts as a strategic driver in shaping pro-environmental vision and behavior, green intellectual capital functions as a cognitive and innovative enabler that allows the translation of the sustainability vision into operational practices, and green commitment acts as a normative and structural mechanism that ensures consistent implementation of green practices.

Thus, Figure 1 confirms the simultaneous approach used in this study, namely that green performance is achieved through the complementary interaction between leadership, intellectual capital, and organizational commitment, particularly in the context of the hospitality industry that faces high sustainability demands and ecological pressures.

## Data Analysis

The primary analytical approach used in this work was partial least squares-structural equation modeling (PLS-SEM) using SmartPLS software.

For models with reflecting measurement indicators in particular, PLS-SEM's strong predictive orientation and capacity to concurrently investigate complicated causal interactions among latent variables made it an ideal choice. There were two primary steps to the analytical procedure.

Following the procedures outlined by Hair et al. (2019), the validity and reliability of the research equipment were first checked by evaluating the measurement model, also known as the outer model. Tests for construct reliability included Cronbach's alpha and composite reliability indicators, while tests for convergent validity included analyzing outer loading values and AVE. To further ensure that each concept was empirically different from others, the Fornell-Larcker criteria was used to test discriminant validity. We moved on to the structural model (the inner model) after making sure the measurement model was up to scratch. At this point, we looked at the coefficient of determination ( $R^2$ ) to see how well the predicted correlations between latent variables explained the data, and it was investigated to measure the effect size ( $f^2$ ) to see how much of an

impact each predictor had. A thorough and reliable assessment of the suggested research model was achieved by conducting hypothesis testing using a bootstrapping approach to provide path coefficients,  $t$ -values, and  $p$ -values.

## RESULTS

### Measurement Model Assessment

Following standard analytical methods, the results from the questionnaire were evaluated using SmartPLS version 3.2.8. Validity and reliability tests were administered to the measurement model, which is also known as the outer model. By looking at factor loadings and AVE, it was possible to determine that the construct validity was sufficient; all indicator loadings were higher than the suggested threshold of 0.7, and the AVE values were higher than 0.5.

There was also an evaluation of construct reliability via the use of composite reliability (CR) and Cronbach's alpha. Both indicators provided satisfactory internal consistency with values over 0.7, as stated by Hair et al. (2019). The reliability and validity of the measuring equipment for further structural model analysis may be shown by their fulfillment of these requirements.

The findings of the validity and reliability evaluations are shown in detail in Figure 2.

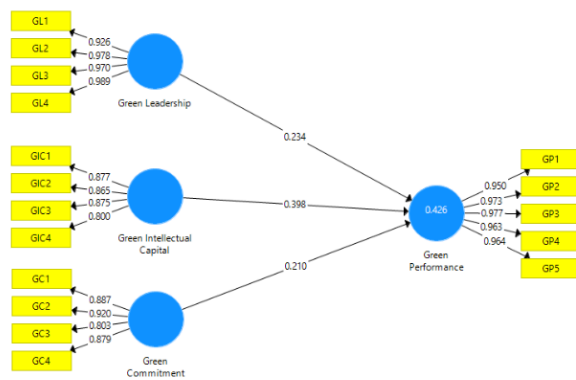


Figure 2. Measurement Model Analysis

Source: Constructed by the authors using prior research (2025).

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The measurement model analysis was performed to assess the reliability and validity of the constructs used in this research. This test makes sure that the indicators accurately reflect their latent variables before moving on to the structural model evaluation. The study 25 encompasses the evaluation of indicator loadings, internal consistency reliability, and convergent validity, often measured by composite reliability and the AVE.

These criteria verify that the assessment items consistently assess the specified constructs and adequately capture variation from 18 indicators.

Table 3 shows the findings of the assessment of the measurement model. It shows the indicator loadings, reliability coefficients, and validity measures for the constructs of green business leadership, green intellectual capital, green commitment, and green performance.

Table 3. Measurement Model Analysis

Construct/item	Code	Outer Loadings	Cronbach's alpha	CR	AVE
<b>Green Leadership</b>	25		0.976	0.982	0.933
Sustainable Vision and Mission	GL1	0.926			
Ability to Inspire and Motivate	GL2	0.978			
Skills and Knowledge Development	GL3	0.970			
Involvement in Sustainable Initiatives	GL4	0.989			
<b>Green Intellectual Capital</b>	2		0.877	0.916	0.731
Knowledge of Sustainable Practices	GIC1	0.877			
Implementation of Sustainable Practices	GIC2	0.865			
Innovation and Creativity	GIC3	0.875			
Personal Awareness and Commitment	GIC4	0.800			
<b>Green Commitment</b>			0.896	0.928	0.763
Leadership and Management Commitment	GC1	0.887			
Investments and Resources	GC2	0.920			
Sustainability Policies and Standards	GC3	0.803			
Participation in External Initiatives	GC4	0.879			
<b>Green Performance</b>			0.982	0.986	0.932
Energy Efficiency	GP1	0.950			
Waste Management	GP2	0.973			
Water Conservation	GP3	0.977			
Use of Environmentally Friendly Materials	GP4	0.963			
Green Education and Awareness	GP5	0.964			

Source: Analysis results from SmartPLS software (2025).

As shown in Table 3, the analysis results show that the four constructs have excellent reliability and validity. *Green leadership* recorded a CR value of 0.982 and an AVE of 0.933, with all indicators having outer loadings above 0.92, indicating a strong contribution from each indicator. *Green intellectual capital* was also reliable (CR 0.916; AVE 0.731), supported by adequate indicators despite their greater variation.

Furthermore, *green commitment* showed high consistency (CR 0.928; AVE 0.763), reflecting the organization's solid commitment to sustainable practices. Meanwhile, *green performance* obtained a

CR value of 0.986 and an AVE of 0.932, which was reinforced by very high outer loadings on all indicators, confirming that the organization's environmental performance falls into the very strong category.

Discriminant validity was tested to make sure that each concept in the study 16 model is different from the others in a real way. The Fornell-Larcker 7 criterion was used in this work to check for discriminant validity. This criterion compares the square root of the AVE for each construct to the correlations between constructs. This criterion states that 93 square root of the AVE for a construct must exceed its

correlations with other constructs, indicating that the construct shares a higher amount of variation with its indicators than with other variables in the model. Table 4 shows the results of the discriminant validity test using the Fornell-Larcker criterion. It shows

that the constructs of *green business leadership*, *green intellectual capital*, *green commitment*, and *green performance* meet the required level of discriminant validity.

**Table 4. Discriminant Validity: Fornell-Larcker Criterion**

	Green Commitment	Green Intellectual Capital	Green Leadership	Green Performance
Green Commitment	0.873			
Green Intellectual Capital	0.277	0.855		
Green Leadership	0.176	0.563	0.966	
Green Performance	0.361	0.588	0.495	0.965

Source: Analysis results from SmartPLS software (2025).

According to Table 4, all of the model's constructs show sufficient uniqueness, according to the discriminant validity evaluation using the Fornell-Larcker criterion. To be more precise, the square root of each construct's AVE is higher than its correlations with other constructs, indicating that each variable represents a distinct idea. With a score of 0.873, *green commitment* outperforms its relationships with other factors. Also, the related inter-construct correlations are lower than the values shown by *green intellectual capital* (0.855), *green leadership* (0.966), and *green performance* (0.965).

Based on these findings, it is clear that the measurement model meets the criteria for discriminant validity. The validity of the ensuing hypothesis testing is supported by the structural model analysis, which is resilient and credible since each construct may be evaluated individually without major overlap with other constructs.

#### Inner Model Measurement

Examining the proposed research model's structural links among latent variables is done via the inner model assessment in the SEM-PLS framework. The coefficient of determination ( $R^2$ ), which shows how much variation in endogenous variables is explained by exogenous variables, is one of the main indicators that are examined in this evaluation.

Also, the relative amount of impact exerted by each predictor construct is determined by analyzing the effect size ( $f^2$ ). Additionally, the assessment includes calculating path coefficients and determining if they are statistically significant using a

bootstrapping technique. This procedure gives us t-values and p-values, which we can use to see how strong the links are between the various constructs. Taken as a whole, these metrics reveal how well the model predicts outcomes and how sturdy its structure is.

According to Sarstedt et al. (2020), values of 0.19 for  $R^2$  imply poor explanatory power, 0.33 for moderate explanatory power, and 0.67 for good explanatory power. Ghazali (2014) provides evidence in support of this claim by stressing that an  $R^2$  value more than 0.67 indicates a robust association between exogenous and endogenous variables, suggesting a structural model that is well-suited for testing hypotheses.

**Table 5. Coefficient of Determination Result  $R^2$**

Notes	R-Squared	R-Squared Adjusted
Green Performance	0.426	0.416

Source: analysis results from SmartPLS software (2025).

According to Table 5, the *green performance* variable has an  $R^2$  value of 0.426 and an adjusted  $R^2$  of 0.416, as shown in the coefficient of determination analysis. Based on the results, it seems that the structural model accounts for about 42.6% of the variation in *green performance* with the predictor constructs that were considered.

The rest of the variation is likely caused by additional characteristics that were not taken into account by the model. The independent factors

contribute significantly and moderately strongly to explaining differences in *green performance*, as shown by the moderate explanatory category  $R^2$  value. However, this does suggest that other organizational, environmental, or contextual factors may be present; future research might benefit from including them to fully understand the effects of environmental performance.

The  $F$ -squared ( $f^2$ ) analysis inside the PLS-SEM framework was used to find the impact size of each exogenous construct on the endogenous variable in the structural model assessment. This test shows how useful each structural connection is in real life by assessing how much each predictor alters the  $R^2$  value when it is added to or taken out of the model. Cohen's criteria say that an  $f^2$  value of 0.02 means a minor impact, 0.15 means a medium effect, and 0.35 means a strong effect (Sarstedt et al., 2020).

Table 6 shows the findings of the impact size study. It shows how much *green business leadership*, *green intellectual capital*, and *green commitment* each contributed to explaining differences in *green performance* within the suggested structural model.

Table 6.  $F$ -Squared Value

	Green Performance
Green Commitment	0.071
Green Intellectual Capital	0.180
Green Leadership	0.065

Source: Analysis results from SmartPLS software (2025).

As shown in Table 6, the results of the  $F$ -squared analysis show that each predictor variable has a varying effect on *green performance*. *Green intellectual capital* has the most significant influence,

with a value of 0.180, which falls within the small to moderate effect category.

Therefore, its contribution to improving *green performance* is quite substantial. *Green commitment* has an  $F$ -squared value of 0.071, while *green leadership* shows a value of 0.065, both of which fall within the small effect category yet still play a role in influencing *green performance*.

This finding confirms that although all variables contribute, *green intellectual capital* is the most dominant factor in strengthening organizational *environmental performance*.

### Hypothesis Testing

In this study, the hypotheses were tested by examining the relationships among latent constructs within the research framework using the PLS-SEM method (Sarstedt et al., 2020). This approach allows the simultaneous evaluation of the significance, direction, and magnitude of the effects of exogenous variables on endogenous variables.

To assess the proposed relationships, a bootstrapping procedure was employed to estimate path coefficients along with their corresponding  $t$ -values and  $p$ -values. A hypothesis is considered supported when the  $t$ -statistic exceeds the critical value and the  $p$ -value is below the predetermined significance level.

The detailed results of the hypothesis testing are presented in Table 7, which summarizes the path coefficients,  $t$ -statistics, and  $p$ -values for each relationship in the structural model. This analysis provides empirical evidence regarding the strength and significance of the relationships proposed in the research framework.

Table 7. Hypothesis Test

Hypothesis	Coefficient	Standard Deviation	$t$ -count	$p$ -value	Conclusion
Green Leadership->Green Performance (H1)	0.234	0.082	2,872	0.004	Accepted
Green Intellectual Capital->Green Performance (H2)	0.398	0.076	5,245	0.000	Accepted
Green Commitment->Green Performance (H3)	0.210	0.044	4,764	0.000	Accepted

Note:  $t$ -count =  $T$ -statistic;  $p$ -value = probability value.

Source: Analysis results from SmartPLS software (2025).

According to the findings in Table 7, all of the study's assumptions are correct and significantly impact *green performance* in a good way. Leading with a focus on sustainability practices is known as "green leadership," and research shows that it helps organizations do better for the environment. Furthermore, *green intellectual capital* greatly improves *green performance* by bolstering an organization's skills in environmentally friendly knowledge, innovation, and intellectual resource management. In addition, *green commitment* is essential for making sure that the company's sustainability goals, culture, and values are well-integrated into daily operations. In sum, our results show that eco-friendly practices, environmentally conscious leadership, and long-term planning all contribute to an organization's environmental performance.

## DISCUSSION

The research findings suggest that *green leadership* plays a crucial role in enhancing the *environmental performance* of hotels in North Sumatra. This confirms that leadership that instills a vision of sustainability, provides ecological role models, and encourages employee participation can create a work environment conducive to green practices. The mechanism of this influence can be understood through transformational leadership theory, where leaders become the primary drivers of organizational behavioral change through idealized influence and inspirational motivation. When leaders demonstrate a genuine concern for the environment, employees are encouraged to adjust their behavior and performance in line with sustainability values. These results are consistent with the literature, which indicates that green transformational leadership fosters green creativity, eco-friendly innovation, and pro-environmental behavior, ultimately leading to enhanced environmental performance (Özgül & Zehir, 2023; Riva et al., 2021). In the context of the North Sumatran hotel industry, green leadership is increasingly relevant given the industry's resource-intensive nature and the need for cross-functional coordination to implement sustainable practices. Leaders who can integrate environmental policies into the organizational vision

not only strengthen employee commitment but also improve operational efficiency through more responsible energy, water, and waste management. Furthermore, green leadership creates a green climate that reinforces internal norms related to environmental awareness. Thus, the mechanism of green leadership's influence on green performance operates through the formation of a pro-environmental organizational culture, increased employee engagement, and the reinforcement of sustainability values as part of the hotel's business strategy. These findings reinforce the argument that shifting toward sustainable practices must begin at the leadership level as the primary driver of organizational transformation.

The research findings confirm that *green intellectual capital* is a crucial determinant of *green performance*. Environmentally oriented intellectual capital, encompassing employees' knowledge, skills, creativity, and ecological awareness, serves as the foundation for organizations to generate green innovations and implement sustainable operational practices. Based on the resource-based view, green intellectual capital is a rare and difficult-to-imitate intangible asset, enabling it to provide a competitive advantage in improving environmental performance. This finding aligns with previous research, which confirms that environmental knowledge and innovative capabilities facilitate the implementation of green strategies, such as energy efficiency, water conservation, and waste reduction (Shah et al., 2021; Nisar et al., 2021; Chao & Juo, 2021). At the mechanistic level, green intellectual capital acts as a cognitive enabler, enabling organizations to identify ecological opportunities and develop solutions that align with the environmental dynamics of the hospitality industry. Employees with a deep understanding of sustainable practices tend to be more proactive in finding new ways to minimize environmental impacts. In the context of North Sumatra, a hotel's success in improving green performance is strongly influenced by its internal ability to translate green knowledge into operational actions. The hospitality industry in the Lake Toba tourist area faces special demands to maintain environmental quality, making green intellectual capital a strategic necessity. Green intellectual capital

also enhances the effectiveness of sustainability policies through internal collaboration mechanisms, knowledge transfer, and environmentally oriented innovation. Thus, green intellectual capital not only supports the achievement of environmental performance standards but also builds organizational resilience to the demands of sustainable business.

The finding that *green commitment* significantly influences *green performance* underscores the importance of organizational commitment as a foundation for sustainability. Green commitment reflects the willingness of management and employees to prioritize environmental goals, allocate resources, and maintain consistent implementation of green policies. From a social exchange theory perspective, when an organization demonstrates a strong commitment to sustainability, employees respond by increasing their participation in green programs and exhibiting pro-environmental behavior, which ultimately enhances the company's environmental performance. Previous literature supports this finding, where green commitment has been shown to strengthen green innovation, environmental policy implementation, and resource utilization efficiency (Sharma et al., 2021; Somjai et al., 2020; Zhang & Walton, 2017). This influence mechanism works by strengthening an organizational culture that prioritises sustainability as a core value, as well as by creating formal structures such as green operational standards, environmental performance evaluation, and transparent reporting. Organizational commitment also reduces resistance to change because employees view sustainability not merely as an external demand but as an integral part of the organization's identity. In the context of the North Sumatran hospitality industry, green commitment is crucial because this industry operates in areas with high ecological sensitivity such as Lake Toba. Hotels that demonstrate a strong commitment to green practices are better able to maintain environmental quality, reduce their carbon footprint, and meet the expectations of increasingly eco-conscious travelers. A green commitment also ensures the sustainability of green practices through a long-term orientation, rather than just a short-term initiative. Therefore, this variable serves as a driver of consistency and

stability in the implementation of sustainability strategies, leading to sustained improvements in green performance.

## CONCLUSIONS

This research offers empirical data about the organizational determinants that foster *green performance* within the hotel sector by analyzing the concurrent effects of *green business leadership*, *green intellectual capital*, and *green commitment*. The results show that *green intellectual capital* has the biggest effect on *green performance* ( $\beta = 0.398, p < 0.001$ ). This means that environmental knowledge, employee skills, and the ability to come up with new ideas are all important resources for hospitality organizations that want to use good sustainability practices. These findings underscore the strategic significance of knowledge-driven environmental competencies in enhancing organizational sustainability. The analysis also shows that *green business leadership* has a positive effect on *green performance* ( $\beta = 0.234, p < 0.004$ ). This means that leaders who make strategic decisions that take the environment into account can encourage pro-environmental behavior and the use of sustainable practices throughout the organization. Furthermore, *organizational green commitment* has a strong positive impact on *green performance* ( $\beta = 0.210, p < 0.01$ ), underscoring the need for persistent management support, environmental policies, and resource allocation in maintaining environmental activities.

This work has several limitations that should be recognized, even if it made some important contributions. First, the study uses cross-sectional survey data from 170 hotel workers, which makes it hard to see how sustainable policies improve over time. As firms implement new sustainability initiatives, environmental performance and leadership practices may change. Longitudinal techniques might potentially provide more profound insights into causal links. Second, the research concentrates on hotels situated in North Sumatra, Indonesia, thereby limiting the applicability of the results to other areas or tourist destinations characterized by distinct institutional forces, regulatory frameworks, or degrees of environmental

consciousness. Third, the study focuses exclusively on three primary predictors: green leadership, green intellectual capital, and green commitment, omitting other pertinent factors such as green organizational culture, environmental technology adoption, stakeholder pressure, and regulatory support from the model.

Lastly, the information comes from workers' own perspectives, which might lead to response bias or a subjective judgment of how well the firm is doing in terms of sustainability.

This study presents several opportunities for further research and managerial practices, especially within the domains of corporate leadership and sustainability management. Subsequent research may enhance this model by integrating mediating or moderating variables, including green organizational culture, green innovation capability, digital environmental monitoring systems, or external stakeholder pressure, to elucidate the mechanisms connecting leadership and sustainability performance more effectively.

Comparative research across various tourist locations or countries may provide comprehensive insights into the impact of contextual variables on the efficacy of sustainability-oriented leadership. Longitudinal study designs may also elucidate the evolution of leadership tactics, knowledge resources, and organizational commitment over time, therefore influencing long-term environmental performance.

From a practical standpoint, the results underscore the necessity of fortifying sustainability-focused business leadership, creating environmental training initiatives that augment green intellectual capital, and instituting institutional policies that bolster organizational dedication to environmental objectives. These kinds of combined initiatives may help hospitality businesses do more for the environment while also making them more competitive in a tourist industry that is becoming more focused on sustainability.

#### Author Contributions

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#### Conflicts of Interest

The authors declare no conflict of interest.

#### Statement on the Use of AI Tools

AI tools were not used in the preparation, analysis, or writing of this manuscript.

#### Data Availability Statement

The authors were responsible for the entire process of conceptual development, research design, collecting data, analysis, interpretation of results, and final conclusions. The authors assume full responsibility for the content of this article.

#### Informed Consent Statement

This research received official approval from the Sekolah Tinggi Ilmu Ekonomi Sultan Agung prior to data collection. All respondents participated voluntarily after being explained the research objectives and procedures. The confidentiality of the information collected, including data and interviews with respondents, is guaranteed and will be used solely for academic purposes without disclosing the respondents' personal identities.

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## APPENDIX A

### Questionnaire Form

<b>GREEN LEADERSHIP</b>						
No	What is your opinion, attitude, and knowledge regarding the statement below?	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
<b>Sustainable Vision and Mission</b>						
1	Our hotel has a clear vision and mission to support environmentally friendly business practices.					
2	Company leadership consistently communicates the importance of sustainability in every operational activity.					
<b>Ability to Inspire and Motivate</b>						
3	Leaders at my workplace are able to inspire employees to care about environmental issues.					
4	I feel motivated to contribute to sustainability programs because of the support from my superiors.					
<b>Skills and Knowledge Development</b>						
5	We regularly receive training on sustainability practices in the hospitality industry.					
6	The company encourages employees to develop knowledge about green management and resource efficiency.					
<b>Involvement in Sustainable Initiatives</b>						
7	I am actively involved in environmental activities or programs organized by the hotel.					
8	My company works with local communities to run eco-friendly initiatives.					
<b>GREEN INTELLECTUAL CAPITAL</b>						
No	What is your opinion, attitude, and knowledge regarding the statement below?	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
<b>Knowledge of Sustainable Practices</b>						
1	I have a good understanding of sustainability principles in the hospitality industry.					
2	I know various methods to reduce environmental impact in hotel operations.					
<b>Implementation of Sustainable Practices</b>						
3	Our hotel actively implements environmentally friendly policies in its daily operations.					
4	Sustainability practices such as reducing single-use plastics and energy efficiency have been implemented in my workplace.					
<b>Innovation and Creativity</b>						
5	I am driven to create new solutions in implementing environmentally friendly practices.					
6	The place I work supports innovative ideas to improve sustainability.					
<b>Personal Awareness and Commitment</b>						
7	I feel responsible for supporting sustainability practices in the workplace.					
8	I am personally committed to practicing environmentally friendly work behavior.					
<b>GREEN COMMITMENT</b>						
No	What is your opinion, attitude, and knowledge regarding the statement below?	Very good	Good	Neutral	Not good	Very Bad
<b>Leadership and Management Commitment</b>						
1	The leadership where I work actively encourages the implementation of sustainability principles.					
2	Management consistently demonstrates commitment to environmentally friendly practices.					

3	Commitment to sustainability is an important part of the managerial strategy in our organization.					
<b>Investments and Resources</b>						
4	Our organization allocates a dedicated budget to support sustainability initiatives.					
5	The company provides adequate resources for training and implementation of sustainable practices.					
6	Investment in environmentally friendly technologies is a priority in operational development.					
<b>Sustainability Policies and Standards</b>						
7	The company has a written policy regarding sustainability practices.					
8	We follow nationally or internationally recognized sustainability standards.					
9	There are clear operational guidelines regarding environmental management and social responsibility.					
<b>Participation in External Initiatives</b>						
10	Our company is involved in sustainability programs initiated by the government or NGOs.					
11	We actively collaborate with external parties to support environmental and social goals.					
12	Our organization participates in certifications or awards related to sustainability.					
<b>GREEN PERFORMANCE</b>						
No	What is your opinion, attitude, and knowledge regarding the statement below?	99 Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
<b>Energy Efficiency</b>						
1	Our company actively uses energy-saving technologies in its operations.					
2	Energy usage in the workplace is monitored and optimized regularly.					
<b>Waste Management</b>						
3	Our company has an organized waste sorting and management system.					
4	We reduce the use of disposable materials in our operational processes.					
<b>Water Conservation</b>						
5	Our organization implements technology to conserve water usage.					
6	Employees are educated about the importance of maintaining efficient water use.					
<b>Use of Environmentally Friendly Materials</b>						
7	We choose raw materials that have minimal environmental impact in the production process.					
8	Our products are designed to reduce negative impact on the environment.					
<b>Green Education and Awareness</b>						
9	The company regularly holds training or campaigns on sustainability.					
10	Employees have a high awareness of the importance of protecting the environment.					

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