Journal of Management and Business Insight
P-ISSN: 3031-0261 | E-ISSN: 3031-0253
Volume 4, Issue 1, May 2026, Page 21-39

How green intellectual capital and green commitment shape environmental performance: The mediating role of pro-environmental behavior

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ARTICLE INFO

Article History
Received: 30-05-2026
Revised: 18-06-2026
Accepted: 22-06-2026
Published: 23-06-2026

Keywords
Green Intellectual Capital;
Green Commitment;
Pro-Environmental Behavior;
Environmental Performance.

Paper Type
Research Paper

ABSTRACT

Purpose-The demand for sustainable practices is driving businesses to improve their environmental performance. This performance is influenced by an organization's environmental resources and commitment. This study examines the positive effects of green intellectual capital and green commitment on environmental performance, with pro-environmental behavior serving as an intervening variable.
Methodology-This study employs a quantitative approach involving owners and operators of batik-related micro, small, and medium enterprises in Yogyakarta, Indonesia. A total of 160 samples were selected using purposive sampling. Data were collected through the distribution of questionnaires administered both online and offline. The primary data were analyzed using SmartPLS, including tests of validity and reliability, as well as hypothesis testing.
Findings-This study is limited to 160 batik micro, small, and medium enterprises in Yogyakarta; therefore, any generalization of the findings to other business sectors and regions should be made with caution. Additionally, using data based on respondents' perceptions may introduce subjective bias. Future research is recommended to expand the sample size, employ a longitudinal design, and consider other variables that may influence environmental performance.
Novelty-This study examines environmental performance by integrating the natural resource-based view and the ability–motivation–opportunity theories. It highlights the roles of green intellectual capital and green commitment in the context of micro, small, and medium enterprises, a topic that remains relatively under-explored in the literature. Furthermore, this study confirms the relationship pathway between green commitment as a predictor, pro-environmental behavior as a mediator, and environmental performance as an outcome. This relationship has been rarely explored in previous research.

1. Introduction

The degradation of ecosystems and the rise in greenhouse gas emissions have placed significant ecological pressure on the planet (Harpprecht et al., 2021). Industrial activity is a primary driver of these conditions through high energy consumption, waste generation, and emissions that exacerbate climate change (Panagiotopoulou et al., 2022). Choi and Kim (2025)

report that the industrial sector accounts for 12% of global CO_2 emissions, underscoring the need for improvements in corporate operational processes. As public, government, and investor attention to sustainability issues grows, companies are required to demonstrate their ability to manage their environmental impacts (Zarzycka & Krasodomska, 2021). This situation positions environmental management as an integral part of a company's business strategy to maintain legitimacy and long-term sustainability

Environmental performance is a measure that indicates a company's ability to reduce negative environmental impacts through waste management, resource efficiency, and emissions control (Xiao et al., 2023). The literature indicates that achieving environmental performance does not occur automatically but requires adequate internal resources. According to Dzhengiz and Niesten (2020), companies can optimize environmental performance by developing environmental competencies and capabilities that enable organizations to acquire, manage, and utilize green knowledge more effectively. Furthermore, green success is determined by a commitment to environmental sustainability supported by concrete actions (Lee et al., 2023). Integrating these capabilities should help companies achieve better environmental performance.

Nevertheless, environmental performance in many companies remains suboptimal (Wang et al., 2020). This is due to internal barriers to environmental protection, particularly limitations in competence and knowledge (Yafi & Tehseen, 2021). In fact, the failure rate of sustainability transformation reaches 90%, largely due to a lack of consistency in work behaviors that support eco-friendly practices (Benkarim & Imbeau, 2021). Consequently, the commitments promoted become nothing more than an organized lie without tangible performance (Rashid, 2022). This situation highlights a gap between theoretical expectations and on-the-ground realities, which still indicate low success rates in sustainability implementation. Therefore, research on environmental performance is crucial for understanding the internal factors that determine a company's success in achieving operational sustainability.

Various studies have identified several factors that contribute to improving environmental performance, one of which is green intellectual capital. Green intellectual capital refers to the totality of knowledge, capabilities, and relationships centered on environmental protection at the organizational level (Ahlawat et al., 2023). This asset enables companies to promote professional knowledge and raise employee awareness of environmentally friendly values and practices (Asiaei et al., 2023). This capability helps companies manage resources more efficiently, reduce environmental impacts, and strengthen the implementation of sustainable practices. Thus, this variable is recognized as an intangible capability that helps companies achieve both environmental performance and competitive advantage (Shehzad et al., 2026).

In addition, green commitment also plays a role in shaping environmental performance. Green commitment refers to the extent of an organization's commitment to environmental values, responsibilities, and goals in its operational activities (Faezah et al., 2023). A high level of commitment helps organizations develop and support environmental initiatives within their operations (Ahmad et al., 2023). Such commitment reinforces environmentally friendly practices such as waste reduction, emission control, and more efficient use of resources. Thus, these practices support a sustainability agenda that can lead to improved environmental performance (Ameen et al., 2026).

However, these two variables do not always directly result in environmental performance. Pro-environmental behavior is viewed as a crucial mechanism that translates environmental capabilities and commitment into concrete actions to minimize environmental impacts and support sustainability (Tam, 2025). Organizations possessing green intellectual capital tend to foster creativity and work systems that encourage positive environmental behavior (Soomro, 2024). On the other hand, a strong green commitment reinforces an organization's awareness of and responsibility for consistently engaging in pro-environmental behavior (Lee et al., 2023). An organization's involvement in pro-environmental practices

facilitates knowledge sharing and supports pollution prevention initiatives, thereby leading to superior environmental performance (Ojo et al., 2020).

Research on the relationship between green intellectual capital and environmental performance has yielded mixed results. Haldorai et al. (2022) and Asiaei et al. (2023) found that green intellectual capital positively contributes to environmental performance by strengthening organizational capacity and sustainable practices. However, Shah et al. (2021) reported that green intellectual capital does not directly affect environmental performance. This inconsistency in findings suggests that the influence of green intellectual capital on environmental performance likely depends on specific mediating mechanisms linking the two. On the other hand, research on green commitment reveals a different pattern. Khan et al. (2022) found that green commitment more consistently drives pro-environmental behavior than it does environmental performance directly. This finding is supported by Lee et al. (2023), who demonstrated that green commitment increases organizational engagement in sustainability-supporting behaviors. This finding suggests that organizational resources and commitment will only yield performance when manifested in work behaviors that support organizational goals (Werff et al., 2021).

Previous research has also explored the role of pro-environmental behavior as a mechanism explaining the relationship between variables. Nisar et al. (2021) highlighted the role of pro-environmental behavior as a mediator of the relationship between green intellectual capital and environmental performance, while Lee et al. (2023) demonstrated that green commitment drives pro-environmental behavior. On the other hand, green commitment has also been shown to contribute to environmental performance (Zahrani, 2024). Most studies still focus on green intellectual capital, pro-environmental behavior, or the environmental performance pathway, or examine the relationship between green commitment and pro-environmental behavior or environmental performance separately.

Thus, there is a gap in the literature regarding how green commitment translates into environmental performance through pro-environmental behavior. Furthermore, research that integrates green intellectual capital and green commitment into a single model to explain environmental performance remains limited. Therefore, this study aims to address this gap by examining the mediating role of pro-environmental behavior in the relationship between green intellectual capital and green commitment and environmental performance, thereby providing a more comprehensive understanding of how an organization's environmental capabilities and commitment translate into improved environmental performance.

Micro, small, and medium enterprises (MSMEs) in the batik sector play a strategic role as both drivers of the regional economy and guardians of national cultural heritage (Wijaya et al., 2026). In 2024, the Ministry of Industry noted that the domestic batik industry employs 200,000 workers across 201 industrial centers and 5,946 small and medium-sized enterprises in 11 provinces. Batik MSMEs in Yogyakarta, Indonesia are recognized as the primary pillars of both the local economy and cultural heritage, making the sustainability of batik MSMEs crucial to supporting regional development (Widiyowati & Sarungu, 2025). In addition to their economic contributions, batik SMEs are closely linked to environmental concerns due to the use of large amounts of water and chemicals, including synthetic dyes, which can generate liquid waste (Susanto & Putranto, 2022). This issue is exacerbated by the fact that the majority of batik MSMEs lack adequate wastewater treatment facilities, leading them to discharge wastewater directly without prior treatment (Sirait et al., 2023).

The implementation of environmentally friendly practices in the batik industry also falls below the green industry standards set by the Ministry of Industry, at 46%. This situation indicates that sustainability efforts have not yet been fully integrated into daily production activities. Given this situation, improving environmental performance has become a critical issue for the sustainability of batik MSMEs. On the other hand, these challenges indicate that improving environmental performance relies not only on the availability of resources and formal commitments but also requires consistent, tangible practices in business operations. Therefore, this study aims to analyze how green intellectual capital and green commitment

influence environmental performance through the mechanism of pro-environmental behavior among batik MSMEs in Yogyakarta.

2. Literature Review and Hypothesis Development

This study employs the natural resources-based view (NRBV) to explain the role of green intellectual capital, green commitment, and pro-environmental behavior in environmental performance. The NRBV theory by Hart (1995) emphasizes that organizational excellence and performance can be achieved through the development of the organization's internal resources and capabilities oriented toward the environment. This theory posits that organizations capable of developing environment-based strategic resources can enhance the company's environmental effectiveness (Bombiak, 2022). From the NRBV perspective, green intellectual capital is a strategic resource encompassing all environmental aspects of the organization.

In contrast, green commitment reflects the organization's capabilities and commitment to environmental issues. These two assets are regarded as environmental resources and capabilities aligned with the NRBV perspective, thereby having the potential to enhance environmental performance. Furthermore, pro-environmental behavior is viewed as the tangible application of environmental resources and capabilities, whereby organizations strive to minimize environmental damage in their daily activities (Tian & Liu, 2022). An organization's resources must be translated into concrete actions to achieve optimal environmental performance (Tram & Ngoc, 2024). Therefore, pro-environmental behavior is a key element in the NRBV framework that supports environmental performance. However, this theory offers limited insight into how pro-environmental behavior forms as a mediator in achieving the organization's ultimate goals.

To address this limitation, the ability-motivation-opportunity (AMO) model is used to explain the behavioral mechanisms underlying the relationship between independent and dependent variables. This theory explains that individual behavior emerges through a combination of ability, motivation, and support that enables such actions to be carried out (Appelbaum et al., 2000). Green intellectual capital is viewed as a component of ability because it provides environmental knowledge and competencies, while green commitment is viewed as a component of organizational motivation that encourages consistent pro-environmental behavior (Nisar et al., 2021; Alam et al., 2023). Within the AMO framework, the combination of ability and motivation shapes pro-environmental behavior as a behavioral outcome within the organization. By integrating NRBV and AMO theories, this study aims to understand how organizational resources and assets shape environmental behavior and outcomes at the organizational level.

Green Intellectual Capital

Green intellectual capital is defined as the total intangible assets at the organizational level that encompass knowledge, capabilities, and relationships related to environmental protection (Begum et al., 2023). Green intellectual capital comprises green relational capital, green human capital, and green structural capital, which collectively strengthen an organization's capacity to manage knowledge and collaboration related to environmental issues (Li et al., 2023). Green intellectual capital enables organizations to integrate environmental considerations into operational activities, comply with environmental regulations, and meet consumers' sustainability needs, thereby enhancing organizational performance (Sarwar & Mustafa, 2023). This aspect also helps capture sustainability opportunities and improve efficiency in managing environmental impacts, ultimately enhancing environmental performance (Zahid et al., 2024).

Green Commitment

Green commitment refers to the extent to which an organization demonstrates a commitment to protecting the environment and implementing green initiatives in its operations (Hoang et al., 2025). Green commitment serves as a strategic driver that reflects internal motivation, a sense of duty, and emotional engagement toward environmental conservation in

the workplace (Afridi et al., 2023). Green commitment plays a crucial role in helping organizations understand the industry's role in preventing environmental damage, thereby fostering more sustainable outcomes for the company (Zhang et al., 2023). Consistent implementation will help companies integrate eco-friendly practices into business operations, thereby shaping overall environmental performance (Sachdeva et al., 2024).

Pro-Environmental Behavior

Pro-environmental behavior can be defined as intentional actions that reduce environmental impact through sustainable practices, such as preserving the environment (e.g., recycling) or refraining from harming it (e.g., avoiding activities that generate hazardous waste) (Mikuła et al., 2021). This behavior is reflected in environmentally oriented policies and operational practices as part of corporate strategy (Liu & Green, 2024). Pro-environmental behavior strengthens a company's identity as an environmentally conscious entity, thereby encouraging the implementation of more sustainable policies (Sharpe et al., 2021). Consistent implementation in the workplace, such as limiting energy consumption, managing waste, and other environmental initiatives, directly contributes to overall improvements in environmental performance (Yu et al., 2021).

Environmental Performance

Environmental performance refers to the extent to which an entity successfully manages the environmental impacts resulting from its economic and production activities (Boleti et al., 2021). Environmental performance refers to an organization's constructive, consistent management of its activities to achieve long-term goals for conserving natural resources without compromising business productivity (Zhang et al., 2022). This aspect can be improved by using recycled materials from production, clean production sources, and operational activities, as well as by reducing environmentally harmful waste and pollutant emissions (Aftab et al., 2023). Companies with strong environmental performance tend to gain greater legitimacy from stakeholders and have a better opportunity to demonstrate proactive strategies and environmental commitment to external stakeholders (Lu & Wang, 2021).

Green Intellectual Capital and Environmental Performance

NRBV explains that organizational performance is influenced by a company's ability to develop environmental resources (Hart, 1995). Green intellectual capital is an intangible asset that enhances a company's capacity to manage ecological issues more effectively (Yafi & Tehseen, 2021). This asset facilitates the development of the skills needed to identify environmental issues, develop solutions, and implement them in operational practices (Alnaim & Metwally, 2024). Through this process, organizations can minimize the detrimental environmental impacts of business activities, thereby achieving environmental performance (Tram & Ngoc, 2024). According to Marco-Lajara et al. (2022), green intellectual capital represents an organization's commitment to addressing negative externalities arising from waste management in production and to improving productivity, thereby enhancing the organization's environmental performance. This factor plays a crucial role in ensuring organizations adopt environmentally responsible practices to achieve environmental performance and sustainable development goals (Yadiati et al., 2019). **H_1: Green Intellectual Capital Has a Positive Effect on Environmental Performance**

Green Commitment and Environmental Performance

NRBV posits that organizations gain a competitive advantage by developing environmentally oriented resources and capabilities (Hart, 1995). Green commitment reflects an organization's commitment to managing environmental issues, directing the organization's attention, support, and practices toward the sustainability agenda (Saleem et al., 2021). This strategic orientation helps companies implement environmental protection measures and reduce environmental impacts, thereby directly improving environmental performance (Liu et al., 2024). Green commitment can influence environmental performance by enabling organizations

to develop proactive, eco-friendly initiatives and serve as change agents in operational activities (Ahmad et al., 2023). Furthermore, this commitment fosters a sense of organizational responsibility to maximize the sustainable use of resources, ultimately driving stronger dedication to achieving environmental performance (Sachdeva et al., 2024). **H_2: Green Commitment Has a Positive Effect on Environmental Performance**

Green Intellectual Capital and Pro-Environmental Behavior

AMO explains that individual behavior arises from a combination of capabilities, motivation, and opportunities that drive such actions (Appelbaum et al., 2000). Green intellectual capital refers to an organization's ability to identify appropriate environmental choices and serves as the foundation for employees' environmental initiatives (Zhang et al., 2021). This condition helps organizations implement environmentally friendly operational practices such as conserving resources, recycling, and supporting sustainable work practices, which represent pro-environmental behavior at the organizational level (Liao et al., 2021). According to Ahmad et al. (2024), green intellectual capital facilitates an organization's knowledge and ability to adopt pro-environmental behavior. This factor also drives the implementation of environmentally friendly practices in daily operations, thereby consistently fostering pro-environmental behavior (Elshall et al., 2025). **H_3: Green Intellectual Capital Has a Positive Effect on Pro-Environmental Behavior**

Green Commitment and Pro-Environmental Behavior

Based on the AMO theory proposed by Appelbaum et al. (2000), which explains the role of motivation in shaping collective behavior, green commitment is viewed as a motivator that drives organizations to treat environmental issues as a strategic responsibility and increases their willingness to participate in eco-friendly activities (Lee et al., 2023). This motivation shapes the organization's conscious efforts to reduce the negative impacts of corporate operations such as recycling, waste conservation, and energy reduction, which are reflected in pro-environmental behavior (Bangwal et al., 2025). A strong priority for pro-environmental behavior stems from organizations with a strong commitment to the environment (Ghaleb & Al-Ameryeen, 2023). Green commitment can determine an organization's willingness to take significant environmental actions, including pro-environmental behavior (Alam et al., 2023). **H_4: Green Commitment Has a Positive Effect on Pro-Environmental Behavior**

Pro-Environmental Behavior and Environmental Performance

NRBV emphasizes the role of environmentally oriented resources in shaping organizational excellence while improving overall performance (Hart, 1995). Pro-environmental behavior is viewed as an organization's environmental capability, reflected in the implementation of environmentally friendly operational practices, such as waste classification, resource reuse, and environmentally friendly work procedures (Wan & Du, 2022). Consistency in these practices can reduce the negative impacts of business activities and minimize personnel practices that undermine environmental performance (Al-Sabi et al., 2024). Various positive environmental behaviors, such as limiting energy consumption, recycling, and managing waste, can directly impact an organization's overall environmental performance (Yu et al., 2021). Organizations that implement environmentally friendly practices tend to build systems and work environments that support sustainability through internalized rules, procedures, and operational standards, thereby further strengthening environmental performance (Sumiati, 2025). **H_5: Pro-Environmental Behavior Has a Positive Effect on Environmental Performance**

Green Intellectual Capital and Environmental Performance: Pro-Environmental Behavior as A Mediator

Green intellectual capital provides the capabilities and environmental support that help organizations understand and implement environmentally friendly work practices, thereby fostering pro-environmental behavior (Elshall et al., 2025). This relationship is grounded in the

AMO framework, which explains how capabilities such as green intellectual capital shape collective behavior (Appelbaum et al., 2000). Pro-environmental behavior further contributes to improving environmental performance through waste reduction, efficient resource use, and other environmentally supportive practices (Hart, 1995; Ojo et al., 2020). Although green intellectual capital can directly influence environmental performance, research has found that this relationship can be mediated by pro-environmental behavior. Research by Nisar et al. (2021) identified the role of pro-environmental behavior in linking the positive influence of green intellectual capital to environmental performance. Green intellectual capital provides the resources to implement pro-environmental behavior, which, when consistently practiced, leads to improved environmental performance (Liao et al., 2021; Fattah & Nugroho, 2024). **H_6: Green Intellectual Capital Has a Positive Effect on Environmental Performance, Mediated by Pro-Environmental Behavior**

Green Commitment and Environmental Performance: Pro-Environmental Behavior as A Mediator

AMO explains that organizational behavior is influenced and shaped by motivational factors (Appelbaum et al., 2000). Green commitment is viewed as a form of organizational commitment that reflects a strong orientation toward sustainability, thereby making organizations more willing to engage in pro-environmental behavior (Musaddiq et al., 2024). Pro-environmental behavior then becomes an organizational resource that helps reduce the environmental impact of operational activities and achieve environmental performance, as described by the NRBV (Al-Sabi et al., 2024). However, green commitment does not directly translate into environmental performance, as environmental commitment is essentially an organizational orientation and motivation that requires concrete implementation in operational activities (Perez et al., 2023). In this context, pro-environmental behavior serves as a mechanism that translates green commitment into concrete actions and generates environmental performance. Thus, green commitment explains the formation of pro-environmental behavior, which ultimately leads to the organization's environmental performance (Ojo et al., 2020; Ghaleb & Al-Ameryeen, 2023). **H_7: Green Commitment Has a Positive Effect on Environmental Performance, Mediated by Pro-Environmental Behavior**

Figure 1 illustrates the proposed research model. This study identifies green intellectual capital and green commitment as independent variables, environmental performance as the dependent variable, and pro-environmental behavior as the mediating variable.

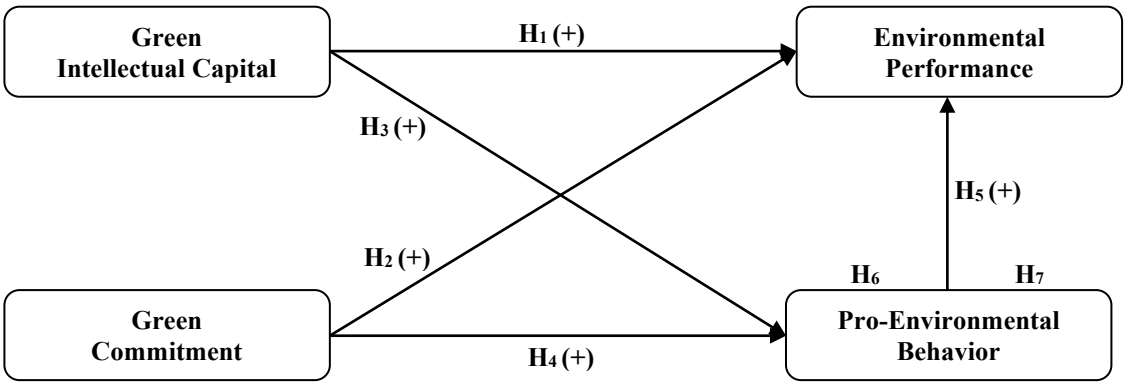

Figure 1. Research Framework

3. Research Methodology

This study employed a quantitative approach, with the study population comprising all owners and operators of batik MSMEs operating in Yogyakarta, Indonesia. Based on the data

collected, 160 respondents were identified as meeting the study criteria. This sample size meets the criteria established by Roscoe (1975), which state that quantitative studies should have 30–500 respondents. Respondents were selected using purposive sampling and had to meet the following criteria: (1) respondents are owners or operators of batik MSMEs in Yogyakarta, (2) the business has been operating for at least 1 year, (3) respondents are directly involved in the management and operational decision-making of the business.

This study requires that the business has been operating for at least one year to ensure that the respondents have sufficient experience in running business activities and are capable of evaluating the implemented environmental practices and performance. Additionally, respondents must be involved in the MSME's management and operational decision-making to ensure they possess sufficient knowledge of operational activities, environmental management, and policies related to green intellectual capital, green commitment, pro-environmental behavior, and environmental performance.

Data Collection Procedure

Data were collected through online and offline questionnaires using a 1–5 Likert scale. The study focused on batik business operators and MSME owners because batik MSMEs play a vital role in the local economy yet face significant environmental challenges associated with their production activities. This study formulated statement items aligned with the constructs, ensured the confidentiality of respondents' answers, particularly personal data, and crafted the statements as simply as possible to facilitate understanding and minimize common method bias. Data collected online first underwent a screening process to verify response completeness, respondents' eligibility according to research criteria, and the consistency of response patterns. Data that did not meet these completeness criteria were excluded and not included in further analysis. This procedure was conducted to ensure the data's suitability for statistical testing.

Table 1. Measurement Items

Construct
Green Intellectual Capital (GIC) (Anser et al., 2024)
GIC1: Employees at this business are engaged in productivity and contribute positively to environmental protection.
GIC2: Employees at this business possess adequate competencies related to environmental protection.
GIC3: Employees at this business provide high-quality services and products that support environmental protection.
GIC4: This business has a sound environmental protection management system.
GIC5: This business has formed a dedicated team to address environmental protection issues.
GIC6: This business has established clear and detailed environmental protection rules and procedures.
GIC7: Customers are satisfied with this business's environmental protection efforts.
GIC8: This business designs products or services in accordance with customers' environmental requirements.
Green Commitment (GC) (Le & Tham, 2026)
GC1: I care deeply about environmental issues in my business.
GC2: I feel it would be a mistake not to support environmental efforts in my business.
GC3: Environmental well-being in my business is important to me.
GC4: I feel I have a duty to support environmental efforts in my business.
GC5: I truly believe that environmental issues in my business are also my responsibility.
GC6: I feel a connection to environmental issues in my business.
GC7: I feel obligated to support environmental initiatives in my business.
GC8: I appreciate the environmental efforts made in my business.
Pro-Environmental Behavior (PEB) (Shafiei & Maleksaeidi, 2020)
PEB1: So far, I have been involved in eco-friendly activities such as waste management, waste sorting, and recycling in my business.
PEB2: I strive to conserve energy in my business's production processes.
PEB3: I strive to raise environmental awareness in the community surrounding my business.
PEB4: I reduce the use of single-use equipment or packaging in my business.
PEB5: I reuse materials that can still be utilized in my business operations.
Environmental Performance (EP) (Liu et al., 2024)
EP1: My efforts have successfully reduced emissions or air pollution in the production process.
EP2: My business has successfully reduced liquid waste generated from production activities.
EP3: My business has successfully reduced solid waste from production activities.
EP4: My business has reduced the use of hazardous or toxic materials in business operations.
EP5: My business has successfully reduced the risk of accidents that impact the environment.
EP6: Overall, environmental conditions in my business operations are improving.

The constructed measurement used indicators from previous studies, taking into account data reliability and validity. The green intellectual capital variable has 8 indicators from Anser et al. (2024), the green commitment variable has 8 indicators from Le and Tham (2026), the pro-environmental behavior variable has 5 indicators from Shafiei and Maleksaeidi (2020), and the environmental performance variable has 6 indicators from Liu et al. (2024).

Ethical Considerations

Respondents completed the questionnaire voluntarily and without coercion from any party. Respondents provided their personal information and were informed that the researcher would keep the data confidential. This personal information was used solely for research purposes to assess the respondents' demographic factors and was not disclosed to any third parties. Thus, this study has met ethical standards regarding the involvement of human participants.

The data were analyzed using SmartPLS 4.0 to assess validity and reliability and to test hypotheses. Convergent validity was evaluated using outer loadings and average variance extracted (AVE), with criteria of at least 0.70 and 0.50, respectively (Ghozali, 2021). Similarly, for reliability, the Cronbach's alpha and composite reliability coefficients must also meet the threshold of >0.70 (Ghozali, 2021). Additionally, multicollinearity was assessed using the variance inflation factor (VIF), with a recommended threshold of less than 5.00 (Hair et al., 2021). Finally, hypothesis testing was performed by examining the p-value (<0.05) and t-statistic (>1.96) (Ghozali, 2021).

4. Result and Discussion

Table 2 shows the distribution of the data, with the majority of respondents being women (83). By age, the average is 36–45, with a total of 61 respondents. The educational level is high school, with 81 people. The majority of them have been in business for more than 10 years, for a total of 86 respondents.

Table 2. Respondent Demographics

Characteristics	Count	Percentage
Gender		
Male	83	51.9
Female	77	48.1
Age (years)		
26-35 Years Old	24	15
36-45 Years Old	61	38.1
46-55 Years Old	52	32.5
>55 Years Old	23	14.4
Education Level		
Junior High School	32	20
Senior High School	81	50.6
Bachelor	47	29.4
Business Age		
1-3 years	3	1.9
4-6 years	34	21.3
7-9 years	37	23.1
>10 years	86	53.8

Based on Figure 2 and Table 3, all indicators have outer loading values above 0.70, thus meeting the validity criteria suggested by Ghozali (2021). The AVE values for each construct are also above 0.50, indicating good convergent validity. Furthermore, construct reliability was evaluated using Cronbach's alpha and composite reliability. A construct is considered reliable if it has Cronbach's alpha and composite reliability values above 0.70 (Ghozali, 2021). The test results show that all variables meet these criteria and can therefore be

considered reliable. Furthermore, no multicollinearity issues were found based on the VIF test results, as all VIF values were below the maximum threshold of 5.00 (Hair et al., 2021).

Table 3. Validity, Reliability, and Variance Inflation Factor (VIF) Test

Variable	Outer Loading	VIF	Cronbach's Alpha	Composite Reliability	AVE
Green Intellectual Capital			0.910	0.928	0.616
GIC1	0.786	2.202			
GIC2	0.703	1.862			
GIC3	0.856	2.883			
GIC4	0.804	2.216			
GIC5	0.811	2.496			
GIC6	0.825	2.414			
GIC7	0.772	2.462			
GIC8	0.712	1.789			
Green Commitment			0.920	0.934	0.641
GC1	0.753	2.076			
GC2	0.825	2.599			
GC3	0.835	2.541			
GC4	0.804	2.435			
GC5	0.824	2.551			
GC6	0.813	2.297			
GC7	0.767	1.912			
GC8	0.779	1.028			
Pro-Environmental Behavior			0.888	0.918	0.691
PEB1	0.843	2.808			
PEB2	0.861	3.026			
PEB3	0.816	1.991			
PEB4	0.807	2.047			
PEB5	0.829	2.238			
Environmental Performance			0.911	0.931	0.693
EP1	0.817	2.172			
EP2	0.774	1.939			
EP3	0.845	2.481			
EP4	0.856	2.685			
EP5	0.821	2.269			
EP6	0.877	2.958			

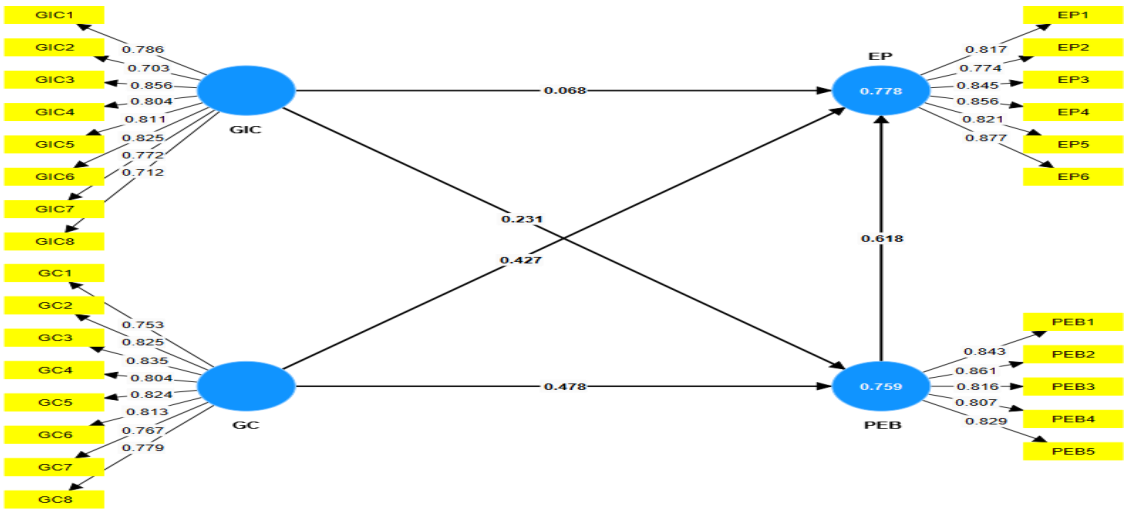

Figure 2. Research Framework

Table 4 shows the results of hypothesis testing using bootstrapping, where a hypothesis is accepted if it meets the criteria of a p-value (<0.05) and t-statistic (>1.96) (Ghozali, 2021). Based on the test results, all hypotheses in this study were accepted.

Table 4. Hypothesis Test

Hypothesis	Original Sample (O)	Sample Mean (M)	Standard Deviation	T Statistic (|O/STDEV|)	P-Value
Green Intellectual Capital → Environmental Performance	0.332	0.338	0.123	2.708	0.007
Green Commitment → Environmental Performance	0.527	0.521	0.115	4.596	0.000
Green Intellectual Capital → Pro-Environmental Behavior	0.427	0.428	0.092	4.654	0.000
Green Commitment → Pro-Environmental Behavior	0.478	0.477	0.092	5.213	0.000
Pro-Environmental Behavior→ Environmental Performance	0.618	0.622	0.082	7.569	0.000
Green Intellectual Capital → Pro-Environmental Behavior→ Environmental Performance	0.264	0.265	0,064	4.136	0.000
Green Commitment →Pro-Environmental Behavior→ Environmental Performance	0.295	0.298	0.074	3.985	0.000

Discussion

Green Intellectual Capital and Environmental Performance

The research findings demonstrate the role of green intellectual capital in improving environmental performance. These results can be explained by the NRBV framework, in which an organization's ability to develop environment-based assets can contribute to its competitive advantage and overall performance (Hart, 1995). Green intellectual capital comprising the organization's capabilities, knowledge, and relationships oriented toward the environment serves as a critical resource for MSMEs to improve environmental performance while strengthening their competitive position (Alnaim & Metwally, 2024). In batik production, the use of water, dyes, and raw materials, as well as the management of liquid waste, requires adequate knowledge and capabilities.

Therefore, MSMEs with sufficient green intellectual capital tend to adopt more environmentally friendly production practices, helping them reduce negative environmental impacts and ultimately achieve more optimal environmental performance. According to Shah et al. (2021), green intellectual capital can help organizations identify and leverage their intangible resources to implement relevant environmental strategies, thereby enhancing the effectiveness of environmental management and, in turn, improving environmental performance. Green intellectual capital also enhances environmental performance by strengthening relationships and collaboration with stakeholders through information exchange that promotes sustainable practices (Sarwar & Mustafa, 2023). Thus, organizations that continuously enhance their green intellectual capital can improve growth, long-term performance, and overall environmental performance (Haldorai et al., 2022).

Green Commitment and Environmental Performance

Green commitment has also been found to shape environmental performance. This finding is explained through the NRBV perspective, which states that an organization's commitment to the environment serves as a strategic resource that drives the development of environment-based capabilities (Hart, 1995). Green commitment demonstrates an organization's dedication to environmental sustainability through proactive support and

advocacy for environmental protection (Alzghoul et al., 2024). Organizations with high green commitment tend to incorporate green initiatives into every policy, operational process, and decision-making (Tian et al., 2024). This enables organizations to use resources more efficiently and promote eco-friendly practices, thereby contributing to overall environmental performance (Memon et al., 2022). Research by Haldorai et al. (2022) further explains that organizations implementing green commitment understand that applying these practices helps reduce costs, expand market share, and meet ecological demands that affect environmental performance.

Green Intellectual Capital and Pro-Environmental Behavior

Green intellectual capital has been shown to foster pro-environmental behavior. This is supported by the AMO theory developed by Appelbaum et al. (2000), which posits that green intellectual capital drives individual behavior, including pro-environmental behavior. Green intellectual capital provides the knowledge and skills necessary for problem-solving and decision-making regarding an organization's environmental aspects (Ghosh & Haque, 2023). The availability of these capabilities encourages individuals to engage in pro-environmental behaviors, thereby increasing pro-environmental behavior (Nisar et al., 2021). Research by Liao et al. (2021) explains that when organizations implement green intellectual capital such as capabilities, knowledge, and relationships, they are more likely to make environmentally beneficial decisions, such as engaging in pro-environmental behavior. Green intellectual capital enhances pro-environmental behavior by supporting the implementation of environmentally friendly practices in organizational operations (Elshall et al., 2025).

Green Commitment and Pro-Environmental Behavior

This study found that green commitment plays a role in shaping pro-environmental behavior. According to Appelbaum et al. (2000), behavior is shaped and influenced by motivations that drive the willingness to take specific actions. Organizations with a strong green commitment tend to be motivated to engage in environmentally friendly activities to demonstrate consistency with their values and commitments (Rafiq & Xiuqing, 2026). This commitment drives organizations to demonstrate environmentally oriented behavior, thereby fostering a tendency toward pro-environmental behavior (Lee et al., 2023). Additionally, green commitment strengthens engagement and participation in workplace ecological activities, ultimately contributing to pro-environmental behavior (Khan et al., 2022).

Pro-Environmental Behavior and Environmental Performance

Furthermore, pro-environmental behavior has been shown to improve environmental performance. This relationship can be explained by Hart's (1995) NRBV theory, in which pro-environmental behavior serves as a capability—a set of actions that can affect organizational performance, including environmental performance. Pro-environmental behavior is a capability reflected in various actions that help reduce environmental impacts, such as waste reduction, energy conservation, and resource efficiency (Yu et al., 2021). These actions help mitigate pollution and excessive resource use, thereby supporting improved environmental performance (Ojo et al., 2020). Research by Nurulfadhilah and Emilisa (2022) explains that organizations that focus on employee engagement in eco-friendly activities, such as waste reduction, will positively influence environmental performance. Furthermore, implementing pro-environmental behaviors, such as energy conservation, and consistently executing eco-friendly projects and practices strengthen an organization's environmental performance (Sobaih et al., 2022).

Green Intellectual Capital and Environmental Performance through Pro-Environmental Behavior

The results of the hypothesis demonstrate the mediating role of pro-environmental behavior in linking the positive influence of green intellectual capital on environmental performance. AMO explains the role of organizational capabilities, such as green intellectual

capital, in shaping pro-environmental behavior (Appelbaum et al., 2000). Green intellectual capital provides strategic knowledge that helps organizations and employees understand the environmental impacts of business activities, thereby generating a responsible attitude that translates into pro-environmental behavior (Shah et al., 2021). Furthermore, NRBV explains pro-environmental behavior as an environmental capability that drives organizational excellence (Hart, 1995). Organizations that encourage employee engagement in pro-environmental behaviors, such as waste reduction, will achieve better environmental performance (Nurulfadhilah & Emilisa, 2022). These findings are also supported by research from Nisar et al. (2021), which confirms the role of pro-environmental behavior in linking green intellectual capital and environmental performance. Thus, green intellectual capital is recognized as capable of shaping an organization's pro-environmental behavior, which in turn aids in achieving future environmental performance (Shah et al., 2021).

Green Commitment and Environmental Performance through Pro-Environmental Behavior

Finally, the mediating role of pro-environmental behavior is also evident in the relationship between green commitment and environmental performance. These findings indicate that green commitment does not directly lead to environmental performance but must be translated into environmental performance through the implementation of environmentally friendly activities within organizational operations. Green commitment reflects an organization's sincerity and orientation toward addressing environmental issues in the workplace, thereby making it willing to actively engage in pro-environmental behavior (Ghaleb & Al-Ameryeen, 2023). Based on AMO theory, green commitment is a motivational factor that influences an organization's tendency to engage in behavior aligned with environmental goals. Furthermore, these findings align with the NRBV perspective, which positions pro-environmental behavior as an organizational capability that can create a competitive advantage and enhance environmental performance (Hart, 1995). When pro-environmental behavior is consistently applied, it ceases to be a misguided action and becomes an organizational capability that supports operational efficiency and improves environmental performance (Nisar et al., 2021). Thus, the positive influence of green commitment on environmental performance stems from its fostering of pro-environmental behavior as an implementation mechanism for enhancing an organization's environmental performance.

5. Conclusion

Improvements in environmental performance among batik MSMEs are driven by the organizations' ability to develop environmental knowledge and build a commitment to sustainability, supported by consistent eco-friendly practices in their daily operations. This study demonstrates that green intellectual capital and green commitment can enhance environmental performance and pro-environmental behavior. Pro-environmental behavior positively affects environmental performance and serves as a mediator linking the independent variables to the dependent variables. These findings indicate that environmental performance must be facilitated through environmental knowledge and the cultivation of environmental commitment to foster consistent eco-friendly behavior.

This research was conducted only on 160 batik MSMEs in Yogyakarta; therefore, generalizing the findings to other business sectors or regions must be done with caution. The characteristics of MSMEs, which are closely tied to culture and the environment, may differ from those of other business sectors. Additionally, all variables were measured using respondents' perceptions, so there is a possibility of subjective bias in the assessments. Given these limitations, future research is recommended to expand the study's scope to various MSME sectors and different regions to obtain more comprehensive findings. Furthermore, subsequent studies could adopt a longitudinal design by integrating perception data with objective environmental performance indicators. Additional research may also consider environmental dynamism and exploitative search as new predictors of environmental performance.

This study contributes to the literature on environmental performance by integrating the NRBV and the AMO framework to explain how an organization's environmental knowledge and commitment translate into concrete actions that yield environmental outcomes. These findings underscore the role of green intellectual capital and green commitment as internal, environment-based capabilities that generate organizational advantage. On the other hand, these two variables become the ability, motivation, and opportunity that are transformed into individual behavior, particularly pro-environmental behavior, as explained by AMO theory. Furthermore, this study expands the field of environmental performance research by confirming green commitment as a predictor of environmental performance, mediated by environmental behavior, and providing evidence that commitment consistently translated into daily activities leads to environmental improvements.

From the perspective of batik MSMEs, business owners need to provide their employees with education, understanding, and skills related to environmental issues, such as waste management, water efficiency, and the selection of environmentally safer production materials. Furthermore, systemic support must also be addressed, particularly regarding work regulations, the provision of facilities, and the leadership example set by business owners, so that environmentally friendly production practices can be implemented. Thus, environmental improvement is not merely an external demand or a formal commitment but rather evolves into a work culture that enhances the efficiency and sustainability of the batik business.

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