How environmental effort drives performance through competitive advantage in the Indonesian recycling industry

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Abstract

This study explores the influence of corporate efforts in managing natural resources (ESD) on sustainable performance, specifically its economic and social dimensions, in Indonesia's recycling industry, emphasizing the mediating role of competitive advantage. Additionally, it examines the effects of corporate social responsibility (CSR) and green innovation (GI) as control variables. Data were collected through an online survey involving 129 recycling companies across various Indonesian provinces. The research employs structural equation modeling using the partial least squares (SEM-PLS) method to test both direct and indirect relationships among variables. The results reveal that corporate efforts in managing natural resources significantly enhance competitive advantage, which in turn positively influences both economic and social dimensions of sustainable performance. Furthermore, competitive advantage serves as a key mediator in the relationship between environmental efforts and sustainable outcomes. CSR and GI also exhibit significant effects on economic performance, underlining their strategic importance. However, the impact of environmental initiatives on social performance remains limited without strong integration with sustainable development practices. The study highlights that achieving sustainability in the recycling industry requires an integrated approach that combines environmental management, competitive strategy, and innovation. These findings offer practical insights for industry stakeholders aiming to enhance long-term sustainability and competitiveness in an emerging market context.

Introduction

In the modern era, businesses are required not only to innovate in products, competitiveness, operations, and finance but also to consider their environmental impact. Environmental issues have become central in global economic discourse, especially regarding sustainability. The triple bottom line concept (Elkington, 1997) emphasizes development that meets present needs without compromising future generations (Pouresmaieli et al., 2024). To address this, many companies—especially in manufacturing have adopted eco-friendly practices. Knowledge, awareness, and attitudes toward environmental safety influence individuals' contributions to sustainability and resource management (Sabihaini et al., 2018). Corporate social responsibility programs reflect companies' commitments to sustainable development and social well-being (Hang et al., 2022; Long et al., 2020). Beyond corporate social responsibility, green innovation is increasingly recognized as a strategic capability to achieve long-term sustainability, involving innovations in products, processes, and management (Zhang et al., 2019; Abu Seman et al., 2019). These efforts contribute to developing a competitive advantage and improving firm performance (Hang et al., 2022; Novitasari & Agustia, 2023; Sabihaini et al., 2024). Recycling is the process of converting

waste materials into new materials to reduce the use of natural resources and environmental impact (Kosoe et al., 2021; Kara et al., 2022; Wu et al., 2022).

According to stakeholder theory, businesses must satisfy the demands and expectations of various stakeholders, including consumers, employees, communities, and the environment (Freeman et al., 2010). In the context of this study, corporate social responsibility serves as a tangible expression of a company's obligation to its stakeholders, particularly within Indonesia's recycling industry (Almasyhari et al., 2025). By integrating sustainability principles and green innovation, companies can maintain strong relationships with stakeholders while enhancing their competitiveness (Liu et al., 2022). Ultimately, this relationship positively influences firm performance, as satisfied stakeholders and a well-preserved environment support business continuity and the effective, long-term achievement of organizational goals (Ahmed et al., 2020).

Environmental issues, particularly waste management, remain a critical concern in Indonesia amid rapid economic growth and industrialization. During the 40th UNESCO General Conference in 2019, Indonesia reaffirmed its commitment to sustainable development (Ministry of Foreign Affairs of the Republic of Indonesia, 2019). According to data from the Indonesian Recycling Association, reported by the Ministry of Industry (Waluyo, 2024), Indonesia's recycling industry can process about 2.54 million tons of waste annually. This sector not only aids in waste reduction but also holds significant economic potential, attracting investments up to IDR 20 trillion, generating 3 million jobs, and opening new export markets. However, the National Waste Management Information System (SIPSN, 2024) reports that Indonesia produces approximately 33 million tons of waste yearly, with plastics constituting 19.64%, followed by wood, paper, rubber, and other materials. Notably, around 40.06% of this waste remains unmanaged, underscoring ongoing challenges in achieving effective waste management and environmental sustainability.

This study aims to examine the mediating role of competitive advantage in the relationship between environmental sustainable development and sustainable performance in Indonesia's recycling industry. Previous studies have investigated eco-friendly practices across various business sectors, such as companies listed on the Pakistan Stock Exchange (C. Ma et al., 2023), manufacturing firms in Pakistan (Sarfraz et al., 2023; Shahzad et al., 2020), manufacturing companies in Ecuador (Padilla-Lozano & Collazzo, 2022), and firms participating in the corporate performance rating program in environmental management listed on the Indonesia Stock Exchange (Novitasari & Agustia, 2023). Additionally, studies have been conducted on SMEs in Indonesia (Sabihaini et al., 2024) and service companies in the Maldives and Morocco (Simmou et al., 2023). However, most of these studies focus on the impact of eco-friendly practices on competitive advantage, economic performance, and environmental outcomes, with limited attention to the social dimension. Therefore, this study emphasizes Indonesia's recycling industry to provide a more comprehensive analysis of sustainability and to bridge existing research gaps.

Literature Review and Hypotheses Development

Stakeholder Theory

Stakeholder theory explains that companies must meet the needs and expectations of various stakeholders, such as customers, employees, communities, and the environment (Freeman et al., 2010). In the context of this study, corporate social responsibility serves as a concrete manifestation of a company's commitment toward stakeholders, particularly in Indonesia's recycling industry (Almasyhari et al., 2025). By integrating green innovation and sustainability principles, companies not only maintain harmonious relationships with stakeholders but also enhance their competitiveness (Liu et al., 2022). This relationship ultimately positively influences firm performance, as satisfied stakeholders and a well-preserved environment support business continuity and the effective, sustainable achievement of corporate goals (Ahmed et al., 2020).

Corporate Efforts in Managing Natural Resources (ESD) and Competitive Advantage

The natural resource-based view (NRBV) theory emphasizes how firms can achieve a competitive advantage through the effective management of the natural environment (Hart, 1995). It proposes

that sustainable competitive advantage is attained when a firm's resources exhibit VRIN characteristics—valuable, rare, inimitable, and non-substitutable—and are integrated with specific strategic capabilities. Several previous studies have found that investing in managing natural resource practices can enhance their reputation, ultimately driving corporate profitability (Silva et al., 2021; Cao et al., 2022; Li et al., 2022). Drawing on these insights, the study proposes the following hypothesis:

H₁: Corporate efforts in managing natural resources (ESD) have a positive effect on the company's ability to outperform (CA).

Competitive Advantage and Sustainable Performance

Sustainable performance refers to a company's ability to integrate economic, social, and environmental dimensions into its overall performance evaluation (Dionisio et al., 2024). It is measured through three key indicators: environmental performance, which involves efforts to meet environmental standards by minimizing resource consumption and maximizing renewable resource use (Sarfraz et al., 2023; Khan et al., 2023), economic performance, which assesses success in profit growth, market share, and customer base expansion (Khan et al., 2023; Tiep Le et al., 2023), and social performance, which reflects contributions to community well-being, employee welfare, and safe working conditions (Elshaer et al., 2023).

In the context of this study, sustainable performance is examined through two key dimensions: economic sustainable performance (ECOSP) and social sustainable performance (SOCSP). This separation is adopted because, within Indonesia's recycling industry, both dimensions play a strategic role in driving value creation for firms while enhancing community well-being. Beyond promoting financial growth, effective environmental management also enables companies to strengthen social relationships with local communities, fostering long-term positive impacts (Putra et al., 2023; Hobeika et al., 2022).

Firm performance can be further enhanced through the adoption of competitive strategies. Competitive advantage (CA), as defined by (Porter, 2008), is the firm's ability to achieve superior performance through cost leadership, differentiation, or market focus strategies. Which are essential for addressing increasingly complex competitive challenges in dynamic markets (Zhou et al., 2020; Sabihaini et al., 2024; Jeng & Pak, 2016). These strategies not only open new market opportunities but also strengthen corporate reputation and brand image (Sabihaini et al., 2024; Covaci & Szolga, 2022). Additionally, they contribute significantly to improving financial outcomes and overall competitiveness in both domestic and global arenas (Goworek et al., 2020; Castro-Gonzales et al., 2017; Wang et al., 2023). Therefore, a deeper understanding of how competitive advantage contributes to both economic and social performance is essential for developing more comprehensive and practical sustainability strategies. Drawing on these insights, the study proposes the following hypothesis:

H₂: The company's ability to outperform (CA) has a positive effect on sustainable performance (ECOSP).

H₃: The company's ability to outperform (CA) has a positive effect on sustainable performance (SOCSP).

Corporate Efforts in Managing Natural Resources (ESD) and Sustainable Performance

Recent research by Sabihaini et al. (2024) highlights that the implementation of environmental orientation positively influences firm performance (Sabihaini et al., 2024; Darus et al., 2020). The adoption of sustainable practices such as effective resource management, emission reduction, and waste minimization plays a critical role in conserving natural resources while promoting long-term economic growth (Sarfraz et al., 2023; Hristov et al., 2023). Drawing on these insights, the study proposes the following hypothesis:

H₄: Corporate efforts in managing natural resources (ESD) have a positive effect on sustainable performance (ECOSP).

H₅: Corporate efforts in managing natural resources (ESD) have a positive effect on sustainable performance (SOCSP).

Competitive Advantage as a Mediating Role

Corporate efforts in managing natural resources sustainably have a positive impact on sustainable economic performance (Galletta & Mazzù, 2023; Xin & Xie, 2023). This is because corporate natural resource management practices promote resource use efficiency, waste reduction, and the adoption of environmentally friendly technologies, which can lower operational costs and enhance company productivity (Kalaitzi et al., 2019; Regmi et al., 2023; Saunila et al., 2019). However, the direct impact of corporate efforts in managing natural resources on economic performance may not reach its full potential without the company's ability to outperform, acting as a mediating variable (Çağlıyan et al., 2022; Asante-Darko & Osei, 2024). The company's ability to outperform enables firms to leverage competitive advantages gained from sustainable practices into added value within competitive markets (Coca et al., 2019; Çağlıyan et al., 2022; AlKhars et al., 2024). Through this ability to outperform, companies can integrate innovation, product differentiation, and cost efficiency to improve profitability and market share (Lee & Jung, 2016; Porter, 2008; Barforoush et al., 2021). Therefore, the company's ability to outperform mediates the relationship between corporate efforts in managing natural resources and sustainable performance, thereby strengthening the positive effect of these efforts on overall economic performance (Ullah et al., 2024; Regmi et al., 2023; Fernandes et al., 2021). Drawing on these insights, the study proposes the following hypothesis:

H_6: Corporate efforts in managing natural resources (ESD) have a positive effect on sustainable performance (ECOSP) through the company's ability to outperform (CA).

H_7: Corporate efforts in managing natural resources (ESD) have a positive effect on sustainable performance (SOCSP) through the company's ability to outperform (CA).

Corporate Social Responsibility and Green Innovation as Control Variables

Corporate social responsibility is defined as an ethical commitment to economic development, environmental sustainability, and social welfare (WBCSD, 1999; Elkington, 1997). Corporate social responsibility includes initiatives toward the environment, community, and consumers, focusing on eco-friendly practices, social safety, and product safety, which can enhance company performance, particularly economic performance (C. Ma et al., 2023; Sarfraz et al., 2023; Shahzad et al., 2020; Simmou et al., 2023).

Green innovation encompasses physical and virtual innovations in products and processes aimed at energy conservation, pollution prevention, and eco-friendly design (Chen et al., 2006; Singh et al., 2020). Investing in the development of green innovation enables companies to experience rapid growth and gain greater economic benefits (Zhang et al., 2019). However, green innovation requires substantial investment and considerable time in R&D, environmentally friendly technologies, and certifications, which are often seen as a financial burden for companies (Mansour et al., 2024).

Drawing on these insights, this research introduces corporate social responsibility (CSR) and green innovation (GI) as control variables that influence economic performance. Their inclusion helps minimize estimation bias and ensures valid causal relationships among the main variables. More importantly, treating CSR and GI as control variables enables the model to reflect a more realistic view of how sustainability strategies function in the recycling industry.

Research Methods

This study employs a quantitative methodology to examine the role of competitive advantage (CA) in mediating the relationship between environmental sustainable development (ESD) and sustainable performance. This study focuses on two dimensions of sustainable performance—economic and social performance- that reflect an effort to understand how environmental management can influence economic and social outcomes, two dimensions considered more strategic in the context of value creation and the enhancement of community well-being. To strengthen and refine the research findings, two control variables, corporate social responsibility (CSR) and green innovation (GI), are included. The research framework is illustrated in Figure 1.

Population and Samples

This study focuses on the recycling industry in Indonesia, specifically targeting companies that operate waste bank systems and process waste materials—such as plastic, paper, textiles, and wood—to produce value-added products, including furniture, organic fertilizers, and handicrafts. The selection of this industry is motivated by the limited research available on the recycling sector. Moreover, this industry actively promotes sustainability and is increasingly acknowledged as a viable alternative solution to environmental challenges, demonstrating strong potential for future development in Indonesia (Prayudhia, 2024).

Data Collection and Procedures

Data for this study were collected through an online survey using a structured electronic questionnaire (Google Forms), which was distributed to company representatives via contact information obtained from official websites and social media platforms. A five-point Likert scale was used to measure all variables, aiming to evaluate the relationships among predefined constructs. This study involves independent, dependent, mediating, and control variables. The measurement indicators were carefully refined to ensure reliable responses and minimize bias, with a detailed description provided in Table 1.

Table 1. Definition of Variables

Latent Constructs	Definition	Items Code	Theme Indicators
Corporate efforts in managing natural (ESD) (Shahzad et al., 2020)	Corporate efforts in managing natural resources responsibly reflect a commitment to environmental stewardship and sustainable development.	ESD1 ESD2 ESD3	Handled or stored toxic waste responsibly Eco-friendly processes and products Mitigation of environmental impacts resulting from production processes
Company's ability to outperform (CA) (Qiu et al., 2020; Sabihaini, 2020; Shehadeh et al., 2023)	The company's ability to outperform other companies in the same industry or market. It is achieved through leveraging the company's unique characteristics and resources (Porter, 1980).	CA1 CA2 CA3 CA4 CA5 CA6	The resulting value Rareness Imperfectly non-imitable Product differentiation R&D capabilities Managerial capabilities
Sustainable Performance (ECOSP); (SOCSP) (Elshaer et al., 2023; Sabihaini et al., 2024)	The level of achievement or outcomes attained, considering economic, social, and environmental aspects in performance evaluation.	ECOSP1 ECOSP2 ECOSP3 ECOSP SOCSP1 SOCSP2 SOCSP3	ROA (return on assets) Profit growth Sales growth Market share growth Improved relationship with the community and stakeholders Enhance the living quality of the local community Improved work safety
Corporate Social Responsibility (CSR) (C. Ma et al., 2023)	A company's concern for its surrounding environment reflects a strategic commitment that contributes to achieving sustainable performance.	CSREN1 CSREN2 CSREN3 CSREN4 CSRCO1 CSRCO2 CSRCS1 CSRCS2	Engagement in environmental preservation efforts Allocates investments to benefit future generations Implements programs to minimize its negative impact on the natural environment Long-term sustainability orientation Contributes financially to charities Contributes to the well-being of society Commits to protecting consumers beyond the minimum legal standards Accessible and honest information

Latent Constructs	Definition	Items Code	Theme Indicators
		CSRCS3	Ensuring customer satisfaction is a top priority
Green Innovation (GI) (Padilla-Lozano & Collazzo, 2022; Singh et al., 2020)	Green innovation, which focuses on creating eco-friendly products, processes, or technologies, highlights the efficient use of resources and seeks to minimize negative impacts on the environment.	GI1 GI2 GI3 GI4	Recycled materials Product recycling Use of resources Green production system

Data Analysis Technique

This study employs descriptive analysis to examine the characteristics of recycling companies and respondent profiles. The collected data are analyzed using the partial least squares (PLS) method, a component of structural equation modeling (SEM), which is applied to evaluate and interpret causal relationships among variables.

Results and Discussion

To collect data, 241 questionnaires were distributed to recycling companies in Indonesia, yielding 129 valid responses, corresponding to a 53.5% response rate. The collected data were further analyzed by considering the company characteristics presented in Table 2, the geographic distribution of respondents in Table 3, and the demographic characteristics of respondents in Table 4. This analysis provides a deeper understanding of both the respondents' backgrounds and the profiles of the companies involved in the study.

Table 2. Characteristic of the Corporate

Type	Category	Frequency (n=129)	Percentage (%)
Recycling Type	Plastic	60	46.5
	Paper	12	9.3
	Textile	9	7
	Glass	3	2.3
	Domestic waste	18	14
	Used cooking oil (UCO)	9	7
	Organic	12	9.3
	Electronic	3	2.3
	Wood	3	2.3
Business Experience	Less than 3 years	57	44.2
	3-6 years	33	25.6
	7-9 years	30	23.3
	More than 10 years	9	7

Source: SmartPLS data output, 2025

Table 2 presents the types of recycling activities and the business experience of the respondents. Plastic recycling is the most dominant activity, reported by 46.5% of companies, followed by domestic waste (14%), paper and organic waste (each 9.3%), used cooking oil (7%), textiles (7%), and smaller proportions for glass, electronics, and wood (each 2.3%). Regarding business experience, the majority of companies have been operating for less than 3 years (44.2%), followed by those with 3–6 years (25.6%), 7–9 years (23.3%), and more than 10 years (7%).

Table 3 shows that the majority of respondents come from regions with high levels of economic activity and population density, while other areas exhibit more limited data distribution. The highest number of respondents was from the Special Region of Yogyakarta, with 29 individuals (22.5%), followed by DKI Jakarta (16.3%), Central Java (15.5%), and West Java (15.5%).

Table 3. Geographical Scope of Data Distribution

Province	Frequency (n=129)	Percentage (%)
D.I. Yogyakarta	29	22.5
DKI Jakarta	21	16.3
Central Java	20	15.5
East Java	11	8.5
West Java	20	15.5
Bali	7	5.4
Riau	2	1.6
Banten	9	7.0
South Kalimantan	3	2.3
East Nusa Tenggara	3	2.3
Central Kalimantan	2	1.6
Riau Island	1	0.8
Lampung	1	0.8

Source: SmartPLS data output, 2025

Table 4. Characteristics of the Respondents

Category	Description	Frequency (n=129)	Percentage (%)
Gender	Male	82	62.8
	Female	48	37.2
Educational level	Junior high school	3	2.3
	Senior high school	30	23.3
	Bachelor	78	60.5
	Master	18	14
Position	Owner	63	48.8
	Manager	66	51.2

Source: SmartPLS data output, 2025

In this study, 63 respondents who completed the questionnaire were company owners, while the remaining 66 held managerial positions. The majority of participants were male, accounting for 62.8% of respondents, whereas female respondents comprised 37.2%. Regarding educational background, most respondents held a bachelor's degree (60.5%), followed by high school graduates (23.3%), master's degree holders (14%), and 2.3% with a junior high school education. This indicates that the majority of respondents possess relatively high educational qualifications and occupy strategic roles, enabling them to participate in management and decision-making within their companies actively.

Descriptive Statistics

Since SmartPLS is recommended for models with mediators, small sample sizes, and second-order components, it was used for data analysis. Furthermore, SmartPLS offers several validity tests, such as discriminant and convergent validity, which are not available in SPSS (Laily et al., 2025). Table 5 presents the descriptive data. The skewness and kurtosis values confirm that the data follow a normal distribution, as no value exceeds the recognized cutoff of ±2 (Laily et al., 2025).

Table 5. Descriptive Statistics

Variables	Mean	Min	Max	Standard Deviation	Kurtosis	Skewness
Company's ability to outperform (CA)	0.000	-2.088	1.286	1.000	-1.137	-0.176
Corporate social responsibility (CSR)	0.000	-2.223	1.171	1.000	-0.620	-0.641
Corporate efforts in managing natural (ESD)	0.000	-3.228	0.729	1.000	1.885	-1.590
Green innovation (GI)	0.000	-2.810	0.830	1.000	-0.338	-0.954
Sustainable performance (ECOSP)	0.000	-2.842	1.500	1.000	-0.112	-0.252
Sustainable performance (SOCSP)	0.000	-3.099	0.887	1.000	0.569	-1.046

Source: SmartPLS data output, 2025

Factor Loading, Validity, Reliability, and Explanatory-Predictive Power

We employed an algorithmic approach to determine factor loadings, validity, and reliability when first implementing SmartPLS (see Figure 1). According to the data presented in Table 6, all items in our sample exhibit the intended factor loading (around or above 0.70), and no significant cross-loading between items is observed. Since the discriminant validity and convergent validity of each construct are greater than 0.70 and 0.50, respectively, they meet the validity requirements outlined by (Laily et al., 2025). Additionally, the composite reliability for all constructs exceeds the 0.70 cutoff, satisfying the reliability criteria established by (Laily et al., 2025). The validity and reliability results for each construct are shown in Table 6.
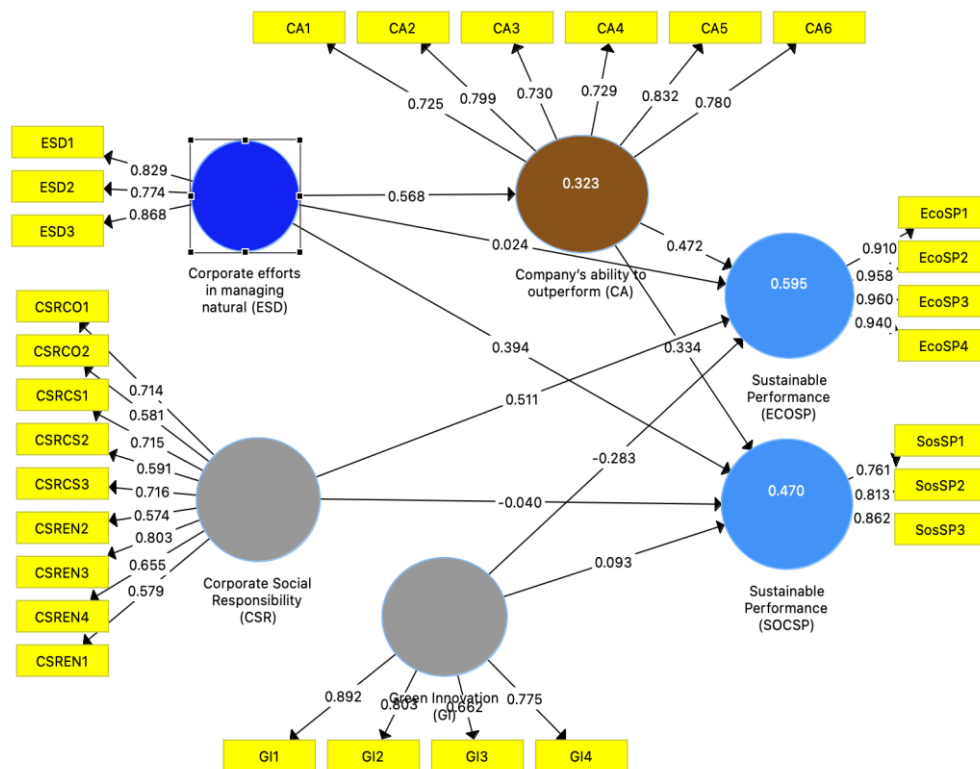

Figure 1. PLS Algorithm for Measurement Model

The R-squared table indicates that the company's ability to outperform (CA) accounts for 33% of operational success, with the remaining 67% influenced by external variables not within the scope of this study. Furthermore, according to the R-squared results, operational success explains 60% of sustainable performance (ECOSP), with the remaining 40% attributed to additional factors not addressed in this research. Operational success explains 47% of sustainable performance (ECOSP), with the remaining 58% attributed to additional factors not addressed in this research.

The threshold values for calculating f^2, as outlined by (Laily et al., 2025). The following are the thresholds: 0.02 denotes a small effect, 0.15 a moderate effect, and 0.35 a large effect, corresponding to minor, medium, and major impacts, respectively. With an effect size exceeding 0.15, the study demonstrates that corporate efforts in managing natural (ESD) have a significant moderate effect on both the company's ability to outperform (CA) and sustainable performance (ECOSP; SOCSP).

As noted by (Laily et al., 2025), predictive relevance for specific endogenous constructs is confirmed when the model's Q^2 value exceeds zero. Conversely, a Q^2 value of zero or less indicates a lack of predictive relevance. In this study, the company's ability to outperform (CA) variable has a Q^2 value of 0.459, surpassing the zero threshold and validating its predictive capability. Similarly, the sustainable performance (ECOSP; SOCSP) variable shows a Q^2 value of 0.657, further confirming its predictive relevance.

Table 6. Validity, Reliability, and R Square, f Square, Q Square Evaluation

Variables	Cronbach's Alpha	CR rho_A	CR rho_C	AVE
Company's ability to outperform (CA)	0.861	0.867	0.895	0.588
Corporate social responsibility (CSR)	0.842	0.863	0.874	0.761
Corporate efforts in managing natural (ESD)	0.766	0.783	0.864	0.680
Green innovation (GI)	0.797	0.830	0.866	0.620
Sustainable performance (ECOSP)	0.958	0.964	0.969	0.888
Sustainable performance (SOCSP)	0.757	0.829	0.854	0.661

Variables	R Square	R Square Adjusted		
Company's ability to outperform (CA)	0.323	0.318		
Sustainable performance (ECOSP)	0.595	0.582		
Sustainable performance (SOCSP)	0.470	0.453		

f Square	Company's ability to outperform (CA)	Sustainable performance (ECOSP)	Sustainable performance (SOCSP)
Company's ability to outperform (CA)		0.235	0.090
Corporate social responsibility (CSR)		0.234	0.001
Corporate efforts in managing natural (ESD)	0.477	0.001	0.129
Green innovation (GI)		0.087	0.007

Latent Constructs	Q Square
Company's ability to outperform (CA)	0.179
Sustainable performance (ECOSP)	0.511
Sustainable performance (SOCSP)	0.272

Source: SmartPLS data output, 2025

Heterotrait-Monotrait Ratio (HTMT) and Correlation

The sustainable performance (ECOSP; SOCSP) and the company's ability to outperform (CA) are strongly correlated, as shown in Table 7. The findings support their interconnectedness by demonstrating a positive correlation between sustainable performance (ECOSP; SOCSP) and a company's ability to outperform (CA). Additionally, the discriminant validity of these constructs is superior to that of other components, ensuring the robustness of the measurement model.

Table 7. Heterotrait-Monotrait Ratio, Discriminant Validity, and Correlation

Variables	CA	CSR	ESD	GI	ECOSP	SOCSP
Company's ability to outperform (CA)	**0.767**					
Corporate social responsibility (CSR)	0.737	**0.663**				
Corporate efforts in managing natural (ESD)	0.568	0.654	**0.825**			
Green innovation (GI)	0.600	0.642	0.697	**0.787**		
Sustainable performance (ECOSP)	0.693	0.693	0.429	0.345	**0.942**	
Sustainable performance (SOCSP)	0.584	0.523	0.622	0.542	0.545	**0.813**
Heterotrait-Monotrait Ratio (HTMT)	CA	CSR	ESD	GI	ECOSP	SOCSP
Company's ability to outperform (CA)						
Corporate social responsibility (CSR)	0.816					
Corporate efforts in managing natural (ESD)	0.671	0.759				
Green innovation (GI)	0.734	0.793	0.859			
Sustainable performance (ECOSP)	0.749	0.745	0.489	0.393		
Sustainable performance (SOCSP)	0.670	0.582	0.755	0.613	0.606	

Source: SmartPLS data output, 2025
Note. The bolded values adjacent to the correlations represent the Fornell-Larcker criterion.

To ensure the validity of structural relationships, established validity standards must be adhered to. Adequate discriminant validity is demonstrated by a heterotrait-monotrait (HTMT)

ratio of less than 0.90. The findings of our study, presented in Table 7, confirm that all HTMT values are below the 0.90 threshold, thereby meeting the required validity criteria.
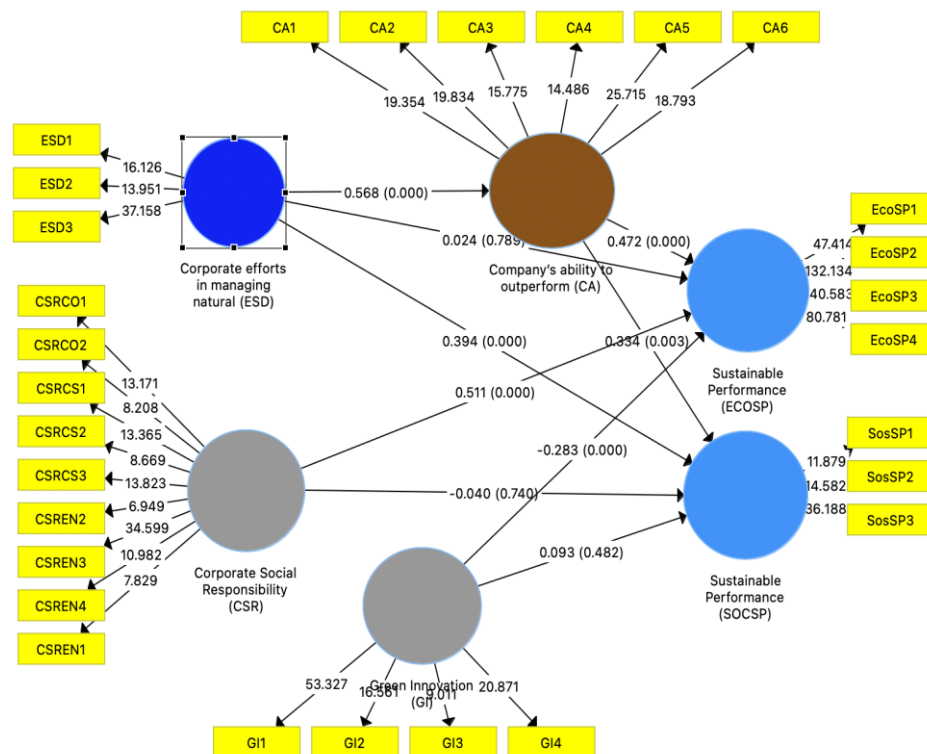

Figure 2. Structural Model (Bootstrapping)

Table 8. Direct and Indirect Effects

Direct Effects	Original Sample	T-Statistics	P-Values	Information
H1. Corporate efforts in managing natural (ESD) → Company's ability to outperform (CA)	0.568	9.016	0.000***	Accepted
H2. Company's ability to outperform (CA) → Sustainable performance (ECOSP)	0.472	6.748	0.000***	Accepted
H3. Company's ability to outperform (CA) → Sustainable performance (SOCSP)	0.334	2.945	0.003**	Accepted
H4. Corporate efforts in managing natural (ESD) → Sustainable performance (ECOSP)	0.024	0.267	0.789	Rejected
H5. Corporate efforts in managing natural (ESD) → Sustainable performance (SOCSP)	0.394	3.769	0.000***	Accepted
Control Variables	Original Sample	T-Statistics	P-Values	Information
Corporate social responsibility (CSR) → Sustainable performance (ECOSP)	0.511	6.709	0.000***	Accepted
Green innovation (GI) → Sustainable performance (ECOSP)	-0.283	3.737	0.000***	Accepted
Indirect Effects	Original Sample	T-Statistics	P-Values	Information
H6. Corporate efforts in managing natural (ESD) → Company's ability to outperform (CA) → Sustainable performance (ECOSP)	0.268	5.093	0.000***	Accepted
H7. Corporate efforts in managing natural (ESD) → Company's ability to outperform (CA) → Sustainable performance (SOCSP)	0.190	2.777	0.006**	Accepted

Source: SmartPLS data output, 2025
Note. ***sig<0.000, **sig<0.01, *sig<0.05

The study employed 2,000 resamples and SmartPLS's bootstrapping technique to examine the proposed relationships. The findings confirm H1 (see Figure 2, Table 8), indicating that corporate efforts in managing the environment (ESD) significantly influence the company's ability to outperform (CA) (t = 9.016, p = 0.000***). Similarly, H2 is supported by the significant positive effect of the company's ability to outperform (CA) on sustainable performance (ECOSP) (t = 6.748, p = 0.000***). H3 is supported by the significant positive effect of corporate efforts in managing the environment (ESD) on sustainable social performance (SOCSP) (t = 2.945, p = 0.000***). H4 is not supported, as the effect of the company's ability to outperform (CA) on sustainable social performance (SOCSP) is not significant (t = 0.267, p = 0.789). H5 is supported by the significant positive effect of corporate efforts in managing the environment (ESD) on sustainable social performance (SOCSP) (t = 3.769, p = 0.000***). Among the control variables, corporate social responsibility (CSR) exerts a significant influence on economic sustainable performance (ECOSP) (t = 6.709, p = 0.000***). These results are consistent with those of previous studies (Khan et al., 2023; Sabihaini et al., 2024; Sarfraz et al., 2023; Tiep Le et al., 2023), suggesting that firms actively committed to social responsibility also tend to enhance their profitability. In contrast, green innovation (GI) shows a significant negative effect on economic sustainable performance (ECOSP) (t = 3.737, p = 0.000***), possibly indicating a gap between its implementation and the expected financial outcomes. The overall impact of these interactions is summarized in Table 8.

H6 and H7 are supported, indicating that corporate efforts in managing the environment (ESD) have a positive, though not statistically significant, direct effect on sustainable economic performance (ECOSP) (t = 0.267, p = 0.789). Furthermore, corporate efforts in managing the environment (ESD) indirectly affect sustainable economic performance (ECOSP) through the company's ability to outperform (CA), as shown in Table 8 and Figure 2. Although the direct effect on sustainable economic performance (ECOSP) is modest, the indirect effect via the company's ability to outperform (CA) is significant (t = 5.093, p = 0.000***). These findings highlight the crucial mediating role of the company's ability to outperform (CA) in enhancing corporate sustainability by fully mediating the effect of corporate efforts in managing the environment (ESD) on sustainable economic performance (ECOSP; SOCSP).

Discussion

This study highlights the complex challenges faced by the recycling industry in achieving sustainable performance, particularly within the Indonesian context (Darus et al., 2020). It examines the mediating role of the company's ability to outperform in the relationship between corporate efforts in managing the environment and sustainable performance (Bui et al., 2022). Corporate efforts in managing the environment—whether oriented toward customers, communities, or the environment—tend to have a stronger direct impact on economic performance, while their influence on environmental and social aspects appears limited unless integrated with sustainable development practices (Bui et al., 2022; Javed & Husain, 2021).

Environmental sustainable development plays a crucial role in enhancing the effectiveness of corporate efforts in managing natural resources responsibly, particularly in improving environmental and social sustainability outcomes (Schoenherr, 2012; Putra et al., 2023; Hobeika et al., 2022). Corporate efforts directed toward environmental management not only support ecosystem preservation but also strengthen social relationships with surrounding communities (Lestari & Suyanto, 2024; Hobeika et al., 2022). Furthermore, the company's ability to outperform shows a significant positive relationship with environmental management efforts and directly contributes to improving sustainable performance (S. Ma et al., 2022; Bassetti et al., 2021). However, the mediating role of this ability remains limited, indicating that the implementation of green innovation in many companies is still at an early stage (Peng, 2024; Thomas et al., 2022). Therefore, better strategic alignment and greater investment are required for green innovation to deliver optimal long-term benefits (Nguyen et al., 2020; Shao et al., 2024).

It should be noted that competitive advantage is a key strategic asset that significantly influences all dimensions of sustainable performance and serves as an effective mediator in the

relationship between corporate efforts in managing natural resources and sustainable performance (Teixeira & Junior, 2019; Ameen et al., 2023). This advantage enables companies to optimally utilize their resources and capabilities optimally, thereby creating sustainable added value that differentiates them from competitors (Teixeira & Junior, 2019; Rahmandad et al., 2021). In the context of the recycling industry, companies that successfully integrate environmental management practices with product and process innovations are better positioned to maintain their competitive standing (Xu et al., 2023). Therefore, it is crucial for recycling companies to translate environmental efforts into unique business strategies that are difficult for competitors to imitate (Mukonza & Swarts, 2020; Ullah et al., 2024). Strategies such as sustainable innovation, process efficiency, and product differentiation can be key to overcoming market challenges while supporting the company's sustainability goals (Saqib & Satar, 2021). Thus, competitive advantage is not only a source of business strength but also a primary driver in achieving sustainable performance (Baumgartner & Rauter, 2017; Ameen et al., 2023).

CSR is found to enhance economic performance, as further discussed in the control variables. However, this study finds that green innovation has a significant negative effect on firms' economic performance. This finding indicates that increased green innovation may reduce a firm's economic performance. The study identifies a potential explanation in the form of short-term stagnation risks that firms may face during the initial phases of green innovation implementation, given that most respondents in this study have only recently begun operations. Green innovation is characterized by high capital investment, substantial risk, and long payback cycles (Hao et al., 2022), which can temporarily hinder firm performance—particularly in economic dimensions.

Overall, this study highlights that environmental initiatives do not solely drive sustainability in the recycling industry, but instead, through an integrated approach that combines corporate efforts in managing natural resources, the company's ability to outperform, and sustainable performance (Waheed & Zhang, 2022). This sustainability also involves interconnected aspects of sustainable development, innovation, and competitiveness (Dionisio & Paula, 2024; Jacomossi et al., 2021). In the context of Indonesia, although some recycling companies show potential, many are still in the early stages and face economic disparities across regions (Wulansari & Adhariani, 2023; Herrador & Van, 2024). Therefore, future research should consider more mature industries and explore how regional disparities influence the adoption and sustainability of environmentally friendly practices (Hristov et al., 2023; Kurniawan et al., 2024). Further studies are also expected to identify factors influencing the implementation of green innovation and examine effective strategies to enhance competitiveness in a market that increasingly prioritizes sustainability (Bataineh et al., 2024; Pitkänen et al., 2023).

Implication and Conclusion

This study shows that environmental initiatives do not solely influence sustainability in the recycling industry, but also through an integrated approach that includes corporate efforts in managing natural resources, the company's ability to outperform, and sustainable performance. Corporate efforts focused on environmental management tend to have a greater direct impact on economic performance; however, their influence on environmental and social aspects is limited unless integrated with sustainable development practices. On the other hand, the company's ability to outperform plays a significant mediating role in the relationship between environmental management and sustainable performance. However, this role is still limited due to the early-stage implementation of green innovation. Therefore, better strategic alignment and greater investment are needed to ensure the long-term success of green innovation.

Competitive advantage has proven to be a significant strategic asset, providing an advantage in utilizing resources and the company's capabilities to create sustainable added value. For recycling companies, strategies that include sustainable innovation, process efficiency, and product differentiation are key to maintaining competitive positioning. This study also suggests that future research should consider regional disparities and explore more mature industries, with a focus on the implementation of green innovation and practical strategies to strengthen competitiveness.

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