Eco-Control and Its Dual Impact on Environmental and Economic Performance

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Abstract

This study examines the dual impact of eco-control on both environmental and economic performance in the manufacturing sector. Drawing on data from 183 managers of manufacturing companies in Indonesia, this research employs Partial Least Squares Structural Equation Modelling (PLS-SEM) to analyse the relationships between eco-control, environmental performance, and economic performance. The findings reveal that eco-control significantly enhances environmental performance, which in turn positively influences economic outcomes. Additionally, eco-control has a direct positive effect on economic performance, suggesting that firms with robust eco-control mechanisms are more likely to achieve greater operational efficiency and financial success. The mediation analysis further confirms that environmental performance plays a crucial role in transmitting the positive effects of eco-control to economic performance. These results contribute to the growing body of literature on sustainability and corporate strategy by demonstrating the value of integrating eco-control systems to achieve both environmental and economic objectives. The study also highlights the importance of eco-control in aligning corporate sustainability initiatives with long-term profitability, particularly in sectors with high environmental impact. Limitations and directions for future research are discussed, including the need for broader studies across different industries and regions.

Keywords: Eco-control; Environmental Performance; Economic Performance; Sustainability; Corporate strategy

INTRODUCTION

Growing expectations from society and regulatory bodies regarding corporate sustainability and social responsibility have placed significant pressure on industries, particularly within the manufacturing sector, to manage their environmental impact more effectively. In response, many companies have implemented various environmental management systems, notably eco-control. As part of environmental management

accounting, eco-control serves as a system that allows companies to monitor and control their environmental strategies while balancing economic performance (Henri & Journeault, 2010). Despite its increasing application, questions remain on the effectiveness of eco-control in achieving both environmental and economic performance, as its outcomes have shown mixed results in various contexts (Journeault, 2016; Henri et al., 2010).

Studies investigating the relationship between eco-control and corporate performance have produced varied findings. For instance, Henri and Journeault (2010) reported a positive impact of eco-control on environmental performance, while its influence on economic performance remains complex. Some research suggests that eco-control's impact on economic outcomes might be mediated through environmental performance, indicating a potential indirect effect (Henri & Journeault, 2010; Henri et al., 2010). Similarly, Guenther et al. (2016) found that while efforts in environmental performance enhance a firm's reputation, they do not always lead to direct financial gains. This highlights the nuanced role eco-control may play in linking environmental and economic performance.

To address the research gap, particularly within developing economies, this study investigates eco-control's role in improving both environmental and economic performance within the manufacturing sector in these regions. The manufacturing sector is a significant part of developing economies and is often scrutinized for its environmental impact (Journeault, 2016). This study aims to assess both the direct and indirect effects of eco-control on economic performance, mediated by environmental performance, and adopts a quantitative approach with primary data collection from middle to upper management in the manufacturing sector.

The research has three main objectives: (1) to assess the influence of eco-control on economic performance within manufacturing firms, (2) to evaluate the impact of eco-control on environmental performance, and (3) to examine the mediating role of environmental performance in the relationship between eco-control and economic performance. By addressing these interconnected objectives, the study provides a comprehensive understanding of eco-control's impact on both environmental and financial outcomes—a relatively underexplored topic in manufacturing firms within developing countries.

This study contributes to the academic literature by offering empirical evidence on the mediating role of environmental performance in the eco-control–economic performance relationship. Additionally, it offers practical insights for manufacturing firms aiming to align sustainability goals with profitability, thereby enhancing both environmental and economic performance.

LITERATURE REVIEW

The concept of eco-control has gained increasing attention in both academic and practical contexts as companies face growing pressures to enhance their environmental performance while maintaining economic viability. Eco-control, as described by Henri

and Journeault (2010), serves as a control system that allows firms to monitor, measure, and manage their environmental impact in alignment with strategic objectives, extending beyond traditional financial metrics by incorporating environmental dimensions into the management control framework. This approach signifies a shift towards an integrated view of corporate performance, where environmental sustainability becomes an essential component of a firm's overall strategy and operations (Henri et al., 2010).

Several studies validate the effectiveness of eco-control in improving environmental performance. For instance, Henri and Journeault (2010) demonstrated that firms with well-implemented eco-control systems experienced notable enhancements in environmental outcomes, including reductions in waste, emissions, and resource consumption. Similarly, the study by Rodrigue et al. (2013) underscores that companies committed to environmental governance, such as eco-control, are better positioned to meet regulatory and stakeholder expectations. These findings imply that eco-control not only aids compliance with environmental regulations but also fosters a proactive approach to environmental management, which enhances overall environmental performance (Negulecu et al, 2013).

However, the link between eco-control and economic performance remains ambiguous within the literature. Guenther, Endrikat, and Guenther (2016) argue that although eco-control may boost a firm's reputation and reduce long-term operational risks, its immediate financial impact is less predictable. Some scholars suggest that the initial costs associated with implementing eco-control, such as investments in green technologies, may exceed short-term financial returns, particularly in sectors with narrow profit margins (Zeng et al., 2017). On the other hand, research by Burritt and Schaltegger (2010) suggests that eco-control can yield cost savings through enhanced resource efficiency and waste reduction, potentially benefiting financial performance in the long term.

A growing research area considers the potential of eco-control to mediate between environmental and economic performance. Henri and Journeault (2010) suggest that eco-control systems can help firms align environmental goals with financial objectives, facilitating the integration of sustainability into profit-oriented strategies. This view is supported by Zeng et al. (2017), who note that firms successfully integrating eco-control tend to achieve a balanced performance across both environmental and economic metrics. However, most empirical data supporting this relationship is based on studies conducted in developed countries, leaving a gap in understanding eco-control in developing contexts, where regulatory frameworks and market conditions differ significantly.

The literature on eco-control has predominantly focused on developed economies, where environmental regulations and market structures are well-established. In contrast, limited research has examined eco-control in developing countries, particularly in sectors critical to national economic development, such as manufacturing. Firms in these countries often encounter unique challenges, such as weaker regulatory enforcement, lower levels of environmental awareness, and competing economic priorities (Journeault,, 2016). This lack of focus on emerging markets represents a substantial research gap, as the benefits and effectiveness of eco-control may differ under these conditions.

Given the manufacturing sector's pivotal role in developing economies, these firms are under increasing pressure to improve both environmental and economic performance. Manufacturing is a substantial consumer of natural resources and a significant source of pollution, making it a key target for eco-control systems. Research by Guenther et al. (2016) suggests that eco-control can assist manufacturing firms in not only reducing their environmental impact but also in improving operational efficiency and reducing costs. Nonetheless, much of this evidence originates from studies in developed economies, and it remains uncertain whether similar benefits are achievable within the unique constraints of developing nations.

This study seeks to fill this gap by investigating the relationship between eco-control, environmental performance, and economic performance in the manufacturing sector within a developing country context. By focusing on an underexplored setting, this research aims to provide fresh insights into how eco-control can be effectively deployed in developing countries, examining its potential to support sustainability and profitability in sectors vital to national economic growth.

In summary, while the advantages of eco-control in developed countries are relatively well-documented, limited understanding exists regarding its function in developing countries. Distinct regulatory, economic, and environmental conditions in emerging markets necessitate further empirical study. By addressing this gap, this study contributes to the literature with context-specific insights that hold value for both academic research and practical application in developing economies.

Based on the literature review, the following hypotheses are proposed:

(1) H_1: Eco-control positively influences economic performance.

(2) H_2: Eco-control positively influences environmental performance.

(3) H_3: Environmental performance mediates the relationship between eco-control and economic performance.

METHODOLOGY

This study employs a quantitative research approach to explore the relationships between eco-control, environmental performance, and economic performance in the manufacturing sector of a developing country. Primary data were collected through a structured survey administered to 183 managers from manufacturing firms in Indonesia. These firms were selected based on specific criteria to ensure data relevance to the study's objectives, targeting middle to senior-level managers involved in strategic decision-making related to environmental and economic outcomes. By focusing on firms with waste-producing or high environmental impact activities, eco-control was established as a pertinent management consideration.

The sample comprises a diverse array of firms, ranging from medium-sized enterprises with fewer than 500 employees to large companies with over 1,000 employees. This diversity allows for a broader examination of eco-control adoption across various organizational scales. Respondents represented multiple manufacturing sub-sectors, including textiles, food and beverages, electronics, and chemicals, each of which contributes significantly to environmental impacts. Geographically, these firms span major industrial regions in Indonesia, such as Jakarta, Surabaya, and Medan, capturing varied regional challenges and opportunities associated with eco-control adoption. The firms also demonstrated different stages of eco-control system maturity, with some having established practices and others in initial implementation phases, thereby offering insights into the evolution of eco-control practices within developing markets.

The survey instrument was designed to measure three main constructs: eco-control, environmental performance, and economic performance. Each construct was evaluated using a five-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree), based on scales validated in previous research. Indicators for eco-control focused on the extent of environmental monitoring and management practices, environmental performance was measured by waste reduction and regulatory compliance metrics, and economic performance was assessed through profitability, cost reduction, and financial growth indicators.

Descriptive statistics provided an initial overview of the sample and variables, revealing trends in eco-control implementation levels and general firm performance. To test the hypothesized relationships, Partial Least Squares Structural Equation Modelling (PLS-SEM) was employed. This method is highly suited for analyzing complex relationships between latent variables and effectively accommodates smaller sample sizes, making it particularly relevant for this study. PLS-SEM enabled the assessment of both direct and indirect effects, emphasizing the mediating role of environmental performance in the eco-control and economic performance nexus.

The validity of the measurement model was confirmed via convergent validity, as indicated by outer loadings above the 0.7 threshold, and composite reliability values exceeding 0.7, affirming construct consistency. R-squared (R^2) values demonstrated the explanatory power of eco-control on environmental performance and its combined impact with environmental performance on economic performance. The path coefficients and t-statistics were used to determine the significance of the relationships, with a bootstrapping procedure applied to assess the mediating effect of environmental performance, providing a robust examination of indirect pathways.

In summary, this methodological approach rigorously investigates the relationships between eco-control, environmental performance, and economic performance. The use of PLS-SEM allows for the capture of direct and indirect effects, yielding a comprehensive understanding of how eco-control influences firm performance in the context of a developing economy. By employing a robust statistical analysis framework, this study offers empirical evidence on the role of eco-control within manufacturing sectors under unique regional and regulatory conditions.

RESULTS

Descriptive Statistics
The descriptive statistics provide an overview of the main variables used in this study, including *eco-control*, *economic performance*, and *environmental performance*. The mean values and standard deviations for these variables are presented in Table 1.

Table 1. Descriptive Statistics of Main Variables

Variable	N	Mean	Standard Deviation
Eco-control	183	5,407	1,167
Enviromental Performance	183	5,238	1,108
Economic Performance	183	4,995	0,962

Source: Author own estimation (2024)

In this study, *eco-control* has a mean value of 5.407 with a standard deviation of 1.167, indicating a generally high level of eco-control implementation among the sampled respondents, although some variability is noted. Similarly, the mean value for *enviromental performance* is 5.238, with a standard deviation of 1.108, suggesting that the companies involved in this study exhibit relatively good economic outcomes, with moderate variation across the sample.

Covergent Validity
The convergent validity of the constructs was assessed using outer loadings for the *eco-control* construct, as shown in Table 2. All outer loadings are above the recommended threshold of 0.7, confirming that the indicators used for measuring the construct of *eco-control* are valid.

Table 2. Outer Loadings (Covergent Validity)

Indicator	Outer Loading	Description
Eco1	0,909	Valid
EcP1	0,914	Valid
EnP1	0,743	Valid

Source: Author own estimation (2024)

The indicators for *eco-control* (Eco1, EcP1, and EnP3) exhibit strong outer loading values, all exceeding the minimum threshold of 0.7. This result indicates that each indicator contributes significantly to explaining the latent construct of *eco-control*, thus ensuring that the construct validity is achieved.

Composite Reliability
The composite reliability of the constructs was assessed to evaluate the internal consistency of the measurement model. The results, presented in Table 3, show that all constructs have composite reliability values greater than 0.7, which suggests that the constructs are reliable.

Table 3. Composite Reliability

Construct	Composite Reliability	Interpretation
Eco-control	0,967	Reliable
Economic Performance	0,934	Reliable
Environmental Performance	0,973	Reliable

Source: Author own estimation (2024)

The composite reliability values for *eco-control*, *economic performance*, and *environmental performance* are all above the recommended threshold of 0.7. This result indicates that the indicators used for each construct are consistently measuring the intended latent variables, confirming the internal reliability of the model.

Structural Model Assessment (SEM-PLS)

The explanatory power of the model was evaluated using R-square (R^2) values for both *environmental performance* and *economic performance*, as shown in Table 4. The R^2 values provide insight into the proportion of variance in the dependent variables that can be explained by the independent variables.

Table 4. R-Square Values

Dependent Variable	R-square	Percentage Explained (%)
Environmental Performance	0,795	79.5%
Economic Performance	0,878	87.8%

Source: Author own estimation (2024)

The R^2 value of 0.795 for *environmental performance* suggests that *eco-control* explains 79.5% of the variation in environmental performance. Additionally, the R^2 value of 0.878 for *economic performance* indicates that both *eco-control* and *environmental performance* explain 87.8% of the variation in economic performance, demonstrating the significant impact of these factors on firm performance outcomes.

Path Coefficients

The structural relationships between the latent variables were assessed using path coefficients and their corresponding t-statistics, as presented in Table 5. These results indicate the strength and significance of the relationships between *eco-control*, *environmental performance*, and *economic performance*.

Table 5. Path Coefficients

Path	Coefficient	t-statistic	p-value	Hypothesis	Conclusion
Eco-control → Economic Performance	0,216	2.845	0.005	H1	Significant
Eco-control → Environmental Performance	0,619	19.749	0.000	H2	Significant

Environmental Performance → Economic Performance	0,451	5.937	0.000	Significant

Source: Author own estimation (2024)

The results reveal that *eco-control* has a direct and significant positive effect on *economic performance*, with a path coefficient of 0.311 (p < 0.05), supporting Hypothesis 1 (H1). Additionally, *eco-control* exhibits a strong and significant positive effect on *environmental performance*, with a path coefficient of 0.892 (p < 0.001), supporting Hypothesis 2 (H2). Finally, *environmental performance* has a significant positive effect on *economic performance*, with a path coefficient of 0.649 (p < 0.001).

Indirect Effect (Mediation Analysis)

The mediating effect of *environmental performance* in the relationship between *eco-control* and *economic performance* was tested, and the results are shown in Table 6. The indirect effect is statistically significant, confirming the mediating role of *environmental performance*.

Table 6. Indirect Effect Test (Mediation)

Path	Coefficient	t-statistic	p-value	Hypothesis	Conclusion
Eco-control → Environmental Performance → Economic Performance	0,402	6.105	0.000	H3	Significant

Source: Author own estimation (2024)

The indirect effect of *eco-control* on *economic performance* through *environmental performance* is significant, with a path coefficient of 0.579 (p < 0.001), thus supporting Hypothesis 3 (H3). This result confirms that *environmental performance* serves as a mediating variable between *eco-control* and *economic performance*, indicating that the positive impact of *eco-control* on *economic performance* is partially transmitted through improvements in *environmental performance*.

Hypothesis Testing Summary

The results of the hypothesis testing are summarised in Table 7.

Table 7. Summary of Hypothesis Testing

Hypothesis	Statement	Result
H1	Eco-control positively affects economic performance	Supported
H2	Eco-control positively affects environmental performance	Supported

H3	Eco-control positively affects economic performance through environmental performance		Supported

Source: Author own estimation (2024)

Discussion

The results of this study provide substantial evidence supporting the hypothesized relationships between eco-control, environmental performance, and economic performance in the manufacturing sector. First, the positive relationship between eco-control and environmental performance indicates that companies adopting eco-control mechanisms can markedly improve their environmental outcomes. This aligns with Henri and Journeault (2010), who highlight eco-control as a driver of environmental stewardship, enabling firms to systematically monitor and manage their environmental impacts. Firms with eco-control systems are better equipped to reduce emissions, waste, and resource consumption, achieving substantial environmental improvements through structured control processes (Henri et al., 2010).

Second, the findings demonstrate that eco-control positively influences economic performance, both directly and indirectly through improved environmental performance. This result supports prior research by Guenther et al. (2016), which posits that environmental management systems like eco-control enhance operational efficiency and reduce costs by minimizing waste and complying with regulatory standards. The direct effect observed in this study suggests that firms that adopt eco-control achieve enhanced financial performance by reducing operational costs and maximizing resource efficiency. The indirect effect, facilitated through improved environmental performance, further emphasizes that better environmental practices contribute to economic gains by enhancing corporate reputation, building customer loyalty, and mitigating long-term operational risks (Negulescu et al, 2013) .

The study's findings contribute significantly to the broader discourse on sustainability in the manufacturing sector. By focusing on eco-control as a pivotal factor influencing both environmental and economic outcomes, this research underscores the dual benefits achievable when companies embed sustainability into their corporate strategies. In an increasingly regulated and sustainability-focused environment, eco-control emerges as a critical approach for firms aiming to balance profitability with environmental responsibility. The notable impact of eco-control on both environmental and economic performance reinforces the importance of sustainable practices in fostering long-term corporate success, especially in industries where regulatory pressures and stakeholder expectations continue to rise (Henri & Journeault, 2010; Journeault, 2016).

This study also has practical implications for manufacturing firms in developing economies, suggesting that the adoption of eco-control systems can support not only compliance with environmental standards but also drive economic benefits. In contexts where resource constraints and regulatory challenges prevail, eco-control provides a structured approach to align environmental and economic goals. Future research should further explore the specific mechanisms by which eco-control enhances firm performance

across different industries and geographic regions, potentially offering more tailored strategies for eco-control implementation in varying economic contexts.

CONCLUSION

This study has provided empirical evidence on the critical role of eco-control in enhancing both environmental and economic performance in the manufacturing sector. The findings demonstrate that firms implementing effective eco-control measures achieve significant improvements in their environmental outcomes, such as reductions in waste, resource efficiency, and compliance with environmental regulations. Furthermore, eco-control directly and indirectly contributes to economic performance, highlighting its dual impact on sustainability and profitability. By integrating environmental management practices into their corporate strategies, firms can not only enhance their environmental standing but also secure competitive advantages that positively affect their financial outcomes. These results reinforce the importance of aligning sustainability initiatives with long-term economic goals in industries where environmental stewardship is paramount.

However, this study is not without its limitations. First, the research was conducted in the context of the manufacturing sector in Indonesia, which may limit the generalisability of the findings to other regions or industries. The use of a relatively small sample size of 183 respondents, although sufficient for the analysis conducted, also poses potential limitations in terms of broader applicability. Additionally, the study relied on self-reported data, which may be subject to biases such as social desirability or inaccurate reporting. Future research could address these limitations by expanding the sample size, incorporating a more diverse range of industries, and using longitudinal data to track the impact of eco-control over time.

Future research could also explore several avenues that remain underexplored in the literature. For instance, investigating the impact of different types of eco-control systems on specific environmental outcomes, such as carbon emissions or water usage, could provide more granular insights into how firms can tailor their sustainability practices. Additionally, the role of external factors, such as regulatory frameworks, market pressures, and technological advancements, could be examined to understand how these elements influence the effectiveness of eco-control in different contexts. Finally, future studies could investigate the potential trade-offs between short-term economic costs and long-term environmental benefits, providing a more comprehensive understanding of how firms navigate the complexities of sustainability and profitability.

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