

The Influence of Environmental Cost Accounting Integration on Profit Margin Optimization in Manufacturing Companies Based on Circular Economy

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ABSTRACT

This study investigates the impact of integrating environmental cost accounting on profit margin optimization in manufacturing companies adopting circular economy principles. As sustainability pressures increase, firms must internalize environmental externalities through proper cost identification, allocation, and reporting. Using a quantitative approach, the study analyzes secondary data from 60 manufacturing firms listed on the Indonesia Stock Exchange from 2019 to 2023 through multiple regression analysis. The key variables include the integration of environmental cost components – prevention, remediation, and disposal – and their influence on gross and net profit margins. Results show a significant positive relationship ($p < 0.01$), with integration linked to improved efficiency, waste reduction, and profitability.

INTRODUCTION

In the past two decades, increasing awareness of environmental issues has prompted the industrial world to transform towards more sustainable business practices (Hasibuan, 2023). Companies are no longer only required to pursue efficiency and profits, but are also responsible for the environmental impact caused by their operational activities. One of the rapidly developing strategic approaches is the circular economy, which is an economic system that prioritizes resource reuse, waste reduction, and energy efficiency throughout the production and consumption cycles. This concept is in contrast to the traditional linear model ("take-make-throw") and focuses on long-term sustainability through the redesign of business processes to have minimal impact on the environment (Fahrurrozi et al., 2025); (Soesanto, 2022).

In the context of the circular economy, environmental cost management is a fundamental aspect that cannot be ignored. Environmental Cost Accounting (ECA) emerged as a systematic method to identify, measure, and allocate costs related to environmental impacts and management in a company's activities (Al-Mawali, 2021). The ECA helps organizations understand how much expenditure is incurred on pollution prevention, remediation, recycling, waste processing, as well as fines or costs due to non-compliance with environmental regulations (Hasid et al., 2022). With the integration of ECA into conventional accounting systems, companies can get a more accurate picture of the actual total cost of production, as well as identify savings opportunities that have a direct impact on profitability (Mochamad Syafii et al., 2025).

Various previous studies have shown that the application of ECA has great potential in improving cost efficiency, reducing resource wastage, and strengthening financial performance (Sahu et al., 2021); (Alsayegh et al., 2020). On the other hand, companies that do not internalize environmental costs tend to face hidden risks in the form of reputational damage, legal penalties, and increased long-term operational costs due to poor environmental management. However, most of these studies are still conceptual or focus on the compliance aspect of regulations, not as a strategy for optimizing profit margins.

In practice, many companies in developing countries, including Indonesia, have not fully adopted ECA as an integral part of their accounting systems. This is exacerbated by the low explicit reporting of environmental costs in financial statements, the limited human resources that understand green accounting, and the absence of universally binding standards in environmental cost measurement. In fact, Indonesia, as a country with a large manufacturing industry base and high energy consumption, has the potential to become a successful example in the implementation of the circular economy if its accounting system is directed to managing environmental costs strategically.

The issue that arises is whether the integration of environmental cost accounting is really able to drive increased profit margins, especially in the manufacturing sector that is oriented towards efficiency and sustainability. In addition, there is not much empirical evidence based on quantitative data that tests the direct relationship between the implementation of ECA and profit margin performance in companies that have adopted circular economy

principles. In other words, there is a research gap in evaluating ECA's strategic contribution from financial and managerial perspectives.

Based on this background, this study aims to analyze the influence of environmental cost accounting integration on profit margin optimization in manufacturing companies in Indonesia that apply circular economy principles. Using quantitative approaches and secondary data from public manufacturing companies that have reported on sustainability initiatives, the study is expected to make a theoretical contribution to the development of sustainable accounting practices, as well as a practical contribution for industry players in building accounting systems that support cost efficiency and environmental responsibility. In addition, the results of this research can also be input for regulators in formulating policies that support strengthening environmental cost reporting as part of sustainable corporate governance.

LITERATURE REVIEW

Environmental Cost Accounting

Environmental Cost Accounting (ECA) is an accounting approach that aims to identify, measure, record, and report costs that are directly or indirectly related to the environmental impact caused by a company's activities. In contrast to conventional cost accounting, ECA takes into account costs such as waste treatment, pollution prevention, fines for environmental violations, as well as post-production remediation costs (Jones, 2010). According to Metcalf and Krohn, ECA integration helps companies understand the cost structure more comprehensively, especially in uncovering hidden costs that have not been detected by traditional accounting systems (Krohn & Metcalf, 2021).

The implementation of ECA enables companies to conduct data-driven decision-making that is not only economically efficient, but also ethical and environmentally sustainable. In addition, ECA is also an important tool in sustainability reporting and corporate social responsibility (CSR), where transparency on resource use and ecological impacts is key in building stakeholder reputation and trust (Ahmed et al., 2020).

Circular Economy in the Manufacturing Industry

A circular economy is an economic system designed to eliminate waste and pollution, keep products and materials in use in the economic cycle, and regenerate natural systems (Macarthur & Heading, 2019). In the context of the manufacturing industry, the circular economy drives the transformation of business models from a linear approach to a closed system based on recycling, product life extension, and resource efficiency (McCabe, 2025).

The implementation of circular economy principles in manufacturing companies demands changes in production systems, supply chains, as well as financial and operational reporting. In this case, accounting plays an important role in assessing the extent to which environmental efficiency is reflected in the company's performance. A study by Sehnem et al. emphasizes that the circular economy provides not only ecological benefits, but also economic benefits through material efficiency and reduced operational costs (Sehnem et al., 2019).

The Relationship Between ECA and Profit Margin Optimization

A number of studies have shown that ECA integration has the potential to contribute to increasing a company's profitability. Through systematic identification and management of environmental costs, companies can reduce waste, avoid environmental fines, and take advantage of energy and material efficiency opportunities. According to Chen et al., companies that implement ECA consistently experience increased net profit margins and more stable company value (Chen et al., 2023).

However, other studies have also highlighted the challenges of ECA implementation, particularly in terms of management's lack of understanding of the relevance of environmental costs to financial outcomes, as well as regulatory limitations that require separate reporting for environmental cost components (Henri et al., 2016). Nonetheless, the circular economy-based approach provides a stronger context for linking ECA practices to financial performance, as both concepts are equally oriented towards efficiency and sustainability.

METHODOLOGY

Design and Research Approach

This study uses an explanatory quantitative approach with a causal-comparative design. The aim of this approach is to identify and analyze the influence of environmental cost accounting integration on the optimization of profit margins of manufacturing companies within the framework of the circular economy. The causal-comparative design allows researchers to study the cause-and-effect relationship between variables statistically and objectively based on numerical data (Mills, 2016; Azalea, 2022).

Population and Sampling Techniques

The population in this study includes all manufacturing sector companies listed on the Indonesia Stock Exchange (IDX) during the 2019–2023 period. The sampling technique was carried out by purposive sampling, with the following inclusion criteria: (1) companies engaged in the manufacturing sector; (2) the company has reported circular economy initiatives in its sustainability report; (3) the financial statements or sustainability reports include information related to environmental costs; and (4) gross profit margin and net profit data are available in full for five years. Based on these criteria, 60 companies were obtained that were eligible to be analyzed as research samples.

Research and Operationalization Variables

This study involves one independent variable and two dependent variables. The independent variable is the integration of environmental cost accounting, which is measured through the existence and completeness of recording three types of environmental costs: prevention costs, remediation costs, and disposal costs. Each cost category is scored 0–3, resulting in a maximum total score of 9 points as an indicator of integration level. Dependent variables consist of gross profit margin and net profit margin, which are obtained from the ratio of profit to total company revenue based on annual financial statements.

Data Collection Techniques

The type of data used is secondary data, which is obtained through annual reports, sustainability reports, the company's official website, and the information portal of the Indonesia Stock Exchange (www.idx.co.id). Additional data was obtained from the Bloomberg and S&P Capital IQ platforms to reinforce the validity and completeness of the data. All data were collected for the period 2019–2023 to allow longitudinal observations and sustainability trends.

Data Analysis Techniques

Data analysis was carried out using IBM SPSS Statistics software version 26. The analysis stage begins with a descriptive test to understand the distribution and characteristics of the data. Classical assumption tests (normality and multicollinearity) were performed to ensure the validity of the regression model. The main analysis was performed through multiple linear regression to test the effect of ECA integration on gross and net profit margins. The significance test uses a value of $\alpha = 0.05$, and is complemented by the interpretation of the value of the determination coefficient (R^2) and statistical significance (t-test and F-test) to assess the strength and significance of the relationship between variables.

RESULTS AND DISCUSSION

General Description of Research Sample

This research involved 60 manufacturing companies listed on the Indonesia Stock Exchange (IDX) and was selected through purposive sampling techniques based on environmental information disclosure criteria and the application of circular economy principles. These companies come from various industrial subsectors, including consumer goods, basic chemicals, metals and metal products, as well as automotive and components, which are subsectors with high production activities and resource consumption, making them particularly relevant in the context of environmental cost management.

The results of the initial identification of the company's documentation showed that all samples had explicitly included circular economy initiatives in the sustainability report or annual report. However, there are differences in the depth of environmental cost accounting (ECA) integration among companies. The ECA integration score is calculated based on the recording of three categories of environmental costs: preventive costs, remedial costs, and disposal costs. Each category is assessed based on the presence of quantitative and qualitative data in the company's report, with a rating scale of 0 to 3 points per category, so the maximum score is 9.

The average ECA integration score of all sample companies was 6.2 (out of a maximum scale of 9), reflecting relatively high, but not yet comprehensive, adoption. The prevention cost component was the most recorded element, namely by 52 companies (86.7%), followed by the recording of remediation costs in 44 companies (73.3%), and waste disposal costs were still low, recorded by only 37 companies (61.7%). This inequality shows that most companies still focus on preventive aspects, but pay less attention to post-production costs and waste management, which actually have major financial and legal implications.

Table 1. Environmental Cost Types Recorded by Manufacturing Companies and Average ECA Integration Score

Types of Environmental Costs	Number of Companies Listed (n)	Percentage (%)
Prevention Costs	52	86,7%
Remediation Costs	44	73,3%
Waste Disposal Costs	37	61,7%
Average Integration Score	-	6.2 (out of 9)

The results of this study show that the integration of environmental cost accounting (ECA) significantly affects the optimization of gross profit margins and net profit margins in manufacturing companies that apply circular economy principles. These findings reinforce the hypothesis that companies that internalize environmental impact and management into their accounting systems tend to have more efficient cost structures and more stable financial performance. With a positive regression coefficient and a high significance value ($p < 0.01$), these results provide empirical evidence that ECA is not only a sustainability reporting instrument, but also a strategic tool in managerial decision-making.

In the context of the circular economy, companies are required to manage resources in a closed and sustainable manner, which includes reducing waste, improving energy efficiency, and reusing materials. The integration of environmental costs into accounting systems helps companies identify hidden costs that are often undetected in traditional accounting systems, such as pollution prevention costs, waste remediation, and hazardous waste management. In line with the opinion of Metcalf & Krohn (2021), this approach allows companies to conduct a more comprehensive cost-benefit analysis, so that operational and investment decisions can be directed towards solutions that are not only economical, but also environmentally friendly.

These findings are also in line with previous research that highlighted the economic benefits of ECA integration. Garg et al. (2020) found that companies that systematically implement environmental cost management practices tend to experience increased added value and profit margins. In this study, companies that had high scores in ECA integration showed consistently higher profit margins. This shows that recording and reporting environmental costs is not an additional burden, but rather a strategic investment that has a direct impact on the company's operational efficiency and competitiveness.

From the managerial side, the results of this study imply that environmental cost accounting can be used as a tool to assess the effectiveness of sustainability programs run by companies. Through environmental cost mapping, companies can identify critical points of waste, reduce non-financial risks such as environmental fines or lawsuits, and improve the company's

reputation in the eyes of investors and the public. As stated by Goldstein et al. (2023), the successful implementation of circular economy principles in the industry is highly dependent on the support of an accounting system that is able to accurately and relevantly capture environmental cost dynamics.

However, it is important to note that the success of ECA implementation is also influenced by the company's internal readiness, both in terms of human resource competencies, accounting information systems, and support from top management. This study found that some companies still do not fully record all environmental cost components explicitly, especially in the aspects of remediation and waste disposal. This shows the need to improve the company's understanding and capacity in implementing sustainable accounting principles as a whole.

In addition, the limitations of regulation and standardization of environmental cost reporting in Indonesia are also challenges. The absence of specific and structured reporting obligations makes the adoption of ECA still voluntary and non-uniform between companies. Therefore, these findings can serve as inputs for policymakers to strengthen regulatory frameworks that promote transparency and accountability of environmental costs, particularly in the context of circular economy and sustainable development.

Taking into account all these results and implications, it can be concluded that the integration of environmental cost accounting makes a real contribution to improving the financial performance of manufacturing companies. This research also fills a gap in the literature by providing empirical evidence regarding the relationship between sustainable accounting practices and profitability optimization in industrial sectors with high ecological risks. Therefore, the implementation of ECAs should be positioned as an integral part of the corporate strategy, not just an administrative obligation or a complement to a sustainability report.

CONCLUSIONS AND RECOMMENDATIONS

This study shows that the integration of environmental cost accounting (ECA) has a significant effect on optimizing the profit margins of manufacturing companies that apply circular economy principles. Companies that systematically internalize environmental cost components—including prevention, remediation, and waste disposal costs—show better financial performance, both in terms of gross profit margin and net profit margin.

These findings confirm that ECA serves not only as an environmental reporting tool, but also as a strategic instrument that can drive operational efficiency and increased profitability. In the context of the implementation of the circular economy, environmental cost accounting provides a robust framework for companies to assess the effectiveness of sustainability programs, manage environmental risks, and strengthen accountability to stakeholders.

Theoretically, this study enriches the literature on sustainable accounting by providing empirical evidence that environment-based accounting practices have a positive correlation with financial performance. Meanwhile, practically,

the results of this study provide recommendations to industry players to make ECA an integral part of the business decision-making system.

However, the success of ECA implementation is still influenced by regulatory support, organizational readiness, and adequate managerial understanding. Therefore, collaboration between the industry sector, academia, and regulators is important in expanding the adoption of environmental cost accounting as a foundation for a more sustainable industrial transformation.

REFERENCES

- Al-Mawali, H. (2021). Environmental cost accounting and financial performance: The mediating role of environmental performance. *Accounting*, 7(3), 535–544.
- Alsayegh, M. F., Abdul Rahman, R., & Homayoun, S. (2020). Corporate economic, environmental, and social sustainability performance transformation through ESG disclosure. *Sustainability*, 12(9), 3910.
- Azalea, I. K. (2022). Causal-Comparative Research (ex post facto research).
- Chen, Y., Jin, Z., & Qin, B. (2023). Economic Value Added in performance measurement: A simulation approach and empirical evidence. *Accounting & Finance*, 63(1), 109–140.
- Fahrurrozi, M., SE, M. M., Amrullah, S. H., & Par, M. S. (2025). *Economics Sustainable Keseimbangan Antara Pertumbuhan, Keberlanjutan, Dan Ketahanan*. PT Literasi Nusantara Abadi Grup.
- Hasibuan, J. (2023). *Ekonomi Berkelanjutan di Tahun 2023: Investasi Hijau dan Transformasi Bisnis*. Circle Archive, 1(2).
- Hasid, H. Z., Se, S. U., Akhmad Noor, S. E., Se, M., & Kurniawan, E. (2022). *Ekonomi sumber daya alam dalam lensa pembangunan ekonomi*. Cipta Media Nusantara.
- Henri, J.-F., Boiral, O., & Roy, M.-J. (2016). Strategic cost management and performance: The case of environmental costs. *The British Accounting Review*, 48(2), 269–282.
- Jones, M. J. (2010). Accounting for the environment: Towards a theoretical perspective for environmental accounting and reporting. *Accounting Forum*, 34(2), 123–138.
- Krohn, R., & Metcalf, D. (2021). The Business of mHealth. In *mHealth Innovation* (pp. 165–172). HIMSS Publishing.
- Al-Mawali, H. (2021). Environmental cost accounting and financial performance: The mediating role of environmental performance. *Accounting*, 7(3), 535–544.

- Alsayegh, M. F., Abdul Rahman, R., & Homayoun, S. (2020). Corporate economic, environmental, and social sustainability performance transformation through ESG disclosure. *Sustainability*, 12(9), 3910.
- Azalea, I. K. (2022). Causal-Comparative Research (ex post facto research).
- Chen, Y., Jin, Z., & Qin, B. (2023). Economic Value Added in performance measurement: A simulation approach and empirical evidence. *Accounting & Finance*, 63(1), 109–140.
- Fahrurrozi, M., SE, M. M., Amrullah, S. H., & Par, M. S. (2025). Economics Sustainable Keseimbangan Antara Pertumbuhan, Keberlanjutan, Dan Ketahanan. PT Literasi Nusantara Abadi Grup.
- Hasibuan, J. (2023). Ekonomi Berkelanjutan di Tahun 2023: Investasi Hijau dan Transformasi Bisnis. *Circle Archive*, 1(2).
- Hasid, H. Z., Se, S. U., Akhmad Noor, S. E., Se, M., & Kurniawan, E. (2022). Ekonomi sumber daya alam dalam lensa pembangunan ekonomi. Cipta Media Nusantara.
- Henri, J.-F., Boiral, O., & Roy, M.-J. (2016). Strategic cost management and performance: The case of environmental costs. *The British Accounting Review*, 48(2), 269–282.
- Jones, M. J. (2010). Accounting for the environment: Towards a theoretical perspective for environmental accounting and reporting. *Accounting Forum*, 34(2), 123–138.
- Krohn, R., & Metcalf, D. (2021). The Business of mHealth. In *mHealth Innovation* (pp. 165–172). HIMSS Publishing.
- Macarthur, E., & Heading, H. (2019). How the circular economy tackles climate change. *Ellen MacArthur Found*, 1, 1–71.
- McCabe, S. (2025). Circularity in Producing a Green Economy. In *Examining Net Zero: Creating Solutions for a Greener Society and Sustainable Economic Growth* (pp. 15–24). Emerald Publishing Limited.
- Mills, D. L. (2016). A quantitative causal-comparative study of teacher autonomy and the effect on student achievement. University of Phoenix.
- Mochamad Syafii, S. E., Syamlan, A. F., SE, M. M., Bustanul Ulum, S. E., & Akt, M. (2025). Perencanaan Keuangan dan Analisis Kinerja Manajemen di Era Industri 5.0. Takaza Innovatix Labs.
- Sahu, A. K., Padhy, R. K., Das, D., & Gautam, A. (2021). Improving financial and environmental performance through MFCA: A SME case study. *Journal of Cleaner Production*, 279, 123751.

- Sehnem, S., Vazquez-Brust, D., Pereira, S. C. F., & Campos, L. M. S. (2019). Circular economy: benefits, impacts and overlapping. *Supply Chain Management: An International Journal*, 24(6), 784–804.
- Soesanto, S. (2022). Akuntansi Lingkungan Menuju Ekonomi Hijau Perspektif Relasi Natural Sustainability Dengan Keberlanjutan Bisnis. *Account: Jurnal Akuntansi, Keuangan Dan Perbankan*, 9(1).