Vol. 4 No. 2 (2026)
e-ISSN: 2963-7589
Economic and Business Journal | ECBIS
https://ecbis.net/index.php/go/index

GREEN ACCOUNTING AS A RISK MITIGATION MEASURE ECOLOGY IN THE BIOPHARMA INDUSTRY (STUDY AT PT DAEWOONG INFION)

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Submitted:	Revised:	Accepted:
13 January 2026	14 January 2026	15 January 2026

Abstract

This study aims to analyze the application of green accounting in hazardous waste management and its role in mitigating ecological risks in the biopharma industry, with a case study at PT Daewoong Infion. The background of the study is driven by the increasing risk of environmental and health pollution due to hazardous waste generated by the biopharmaceutical production process, as well as the limitations of conventional accounting systems in capturing ecological costs and impacts. This study uses a qualitative approach with a case study design, through primary data collection in the form of in-depth interviews with key informants and field observations, as well as secondary data from company documents and related regulations. Data analysis was conducted descriptively and interpretively to identify green accounting practices, environmental cost components, and ecological risk mitigation mechanisms. The results show that PT Daewoong Infion has implemented green accounting through the recognition and recording of hazardous waste management costs, pollution control, and environmental disclosure, which contributes to increased regulatory compliance, waste management efficiency, and ecological risk reduction. In addition, these practices strengthen the company's legitimacy and meet stakeholder expectations, in line with legitimacy theory and stakeholder theory. This study concludes that green accounting serves as an effective managerial and reporting instrument in integrating economic objectives and ecological responsibility, thereby supporting the operational sustainability of the biopharma industry. These findings recommend strengthening environmental cost measurement systems and reporting transparency to enhance sustainable ecological risk mitigation.

Keywords: *Green Accounting; B3 Waste; Ecological Risk Mitigation; Biopharma Industry;*

INTRODUCTION

Climate change and environmental degradation are global challenges that are increasingly pressuring various industrial sectors, including the biopharmaceutical industry, which is characterized by complex production processes and the potential to generate hazardous and toxic waste (B3). This industry is not only required to meet product quality and patient safety standards, but also must ensure that its operational activities do not have adverse ecological impacts. In this context, B3 waste management is a crucial issue because

mishandling can lead to water, air, and soil pollution, directly impacting human health and ecosystem stability.

The urgency of hazardous waste management is increasing as the volume of hazardous waste grows globally. The Global E-Waste Monitor 2020 report shows that the volume of global e-waste in 2019 reached a significant level, exacerbated by weak hazardous waste sorting and management systems, resulting in it often being mixed with domestic waste and increasing the risk of exposure to toxic substances. This situation reflects that the issue of hazardous waste is not only a technical issue, but also a matter of governance, environmental literacy, and an integrated control system.

In response to these challenges, green accounting has emerged as a strategic approach that integrates environmental aspects into corporate accounting systems and decision-making. Through green accounting, companies can systematically identify, measure, and report environmental costs such as waste management, pollution control, and energy conservation, enabling a balanced integration of economic and ecological dimensions into business reporting and strategy. This approach serves not only as a reporting tool but also as a managerial instrument for understanding the environmental contributions and consequences of each business decision.

However, green accounting practices in many companies, including those in the biopharma industry, are often limited to administrative compliance and formal reporting. The findings of this thesis indicate that at PT Daewoong Infion, although hazardous waste management costs have been recognized as routine expenses and integrated into the budgeting and financial recording systems, their implementation has not been fully utilized as a strategic instrument to encourage resource efficiency and environmental management innovation. Hazardous waste management focuses more on fulfilling regulatory obligations through the use of licensed waste managers and administrative reporting, rather than on preventive and transformational efforts.

The gap between the potential of green accounting as a strategic tool and its still administrative practices is the basis for the importance of this research. Furthermore, green accounting is believed to contribute to increasing the availability of relevant information regarding ecological costs and impacts, thereby helping companies design more

environmentally friendly and sustainable waste management strategies. Therefore, research on the role of green accounting in mitigating ecological risks through B3 waste management in the biopharmaceutical industry is very important, both to enrich academic studies and as a basis for formulating more environmentally responsible business policies and practices.

LITERATURE REVIEW

1. Green Accounting

*Green accounting*is an accounting approach that integrates environmental aspects into a company's reporting and performance measurement system to assess the extent to which operational activities affect ecological sustainability.(Rahman & Islam, 2023)This concept includes the process of recording, measuring, and disclosing environmental costs such as waste management, pollution control, energy efficiency, and natural resource conservation that were previously not accounted for in conventional accounting.(Christy & Tjun Tjun, 2023)The application of green accounting functions as a managerial instrument in providing relevant information for strategic decision making and encouraging companies to internalize ecological impacts into their economic activities.(Anggita et al., 2024) In the context of PT Daewoong Infion, green accounting has been implemented through the recognition of B3 waste management costs as routine expenses and their integration into the company's budgeting and financial recording systems.

2. Ecological Risk Mitigation

Ecological risk mitigation is a systematic effort to identify, assess, and control the potential negative impacts of industrial activities on the environment, including water, air, and land pollution.(Saputra et al., 2021)In the context of industries that produce B3 waste, risk mitigation is carried out through regular monitoring, compliance with regulations, and strengthening internal control systems and documentation.(Dhar et al., 2022)Structured and regulation-based waste management can reduce the likelihood of pollution incidents and improve a company's environmental performance.(Jorge-Ortiz et al., 2023). Findings at PT Daewoong Infion indicate that ecological risk mitigation is carried out through UKL-UPL reporting, regular monitoring, and the use of licensed third parties in B3 waste management.

3. Hazardous Waste Management

B3 waste is waste that contains hazardous and toxic materials that can have serious impacts on the environment and human health if not managed properly.(Nurul Aulia et al., 2023)B3 waste management includes the processes of sorting, storage, transportation, processing and final disposal which must comply with technical standards and environmental regulations to minimize the risk of pollution.(Rachmawati et al., 2024). Well-documented, precautionary management practices enable companies to control potential

ecological risks arising from their operations. At PT Daewoong Infion, hazardous waste management is carried out through an electronic manifest system, storage in designated areas, and the use of licensed waste managers.

RESEARCH METHOD

This research method uses a qualitative approach with a case study design, which aims to gain an in-depth understanding of the application of green accounting in B3 waste management and its role in mitigating ecological risks at PT Daewoong Infion. This approach was chosen because the phenomenon being studied is contextual, complex, and requires a thorough exploration of the practices, policies, and perceptions of actors within the organization. The focus of this research is to understand in-depth the practice of green accounting and B3 waste management at PT Daewoong Infion, which includes the mechanism for recording and disbursing environmental costs, the operational process of B3 waste handling from sorting to management by internal and external parties, the internal control system and compliance with environmental regulations, as well as the experience and understanding of informants regarding the effectiveness of the system in supporting ecological risk mitigation. This focus limitation aims to identify key elements that shape the company's environmental management practices in a concrete manner.

Primary data collection techniques were collected through in-depth interviews with key informants directly involved in financial, environmental, and operational management, as well as through field observations of hazardous waste management practices. Secondary data were obtained from company documents, environmental reports, financial archives, and regulations and policies related to waste and environmental management. Data analysis techniques were carried out through the stages of data reduction, data presentation, and drawing conclusions. Data from interviews and observations were coded based on green accounting and risk mitigation indicators, then compared with documentary findings through triangulation techniques. A descriptive-interpretive analysis approach was used to assess the extent to which the implementation of green accounting plays a role in supporting sustainable hazardous waste management and mitigating ecological risks.

RESULTS AND DISCUSSION

RESEARCH RESULT

The results of the study indicate that data obtained through interviews, observations, and documentation produce consistent patterns regarding the implementation of green accounting, hazardous waste management, and ecological risk mitigation at PT Daewoong Infion. Through the triangulation process, each research focus shows the suitability between data sources, thereby increasing the validity and credibility of the findings. In the green accounting aspect, the company has integrated environmental costs into the budgeting and

financial recording system. Interviews with key informants (Verina) indicate that hazardous waste management costs are classified as routine expenses planned annually through a budgeting mechanism by the relevant division and the accounting team.

This indicates that environmental cost indicators have been systematically applied in the company's accounting practices. In managing hazardous waste, the company implements two forms of inclusivity: user inclusivity and producer inclusivity. From the perspective of internal users, management is considered effective because it is handled by a competent and licensed third party, as confirmed through interviews and field observations. From the perspective of waste generating units, active involvement is seen in the process of sorting, storing, recording, and reporting hazardous waste according to written procedures, with consistency between informant statements, observations, and procedural documents. Regarding ecological risk mitigation, the company has not experienced any significant incidents, but has an internal reporting mechanism and documentation readiness as a form of administrative and reactive risk control.

DISCUSSION

The findings show that the implementation of green accounting at PT Daewoong Infion has been integrated into the financial management system through the recognition of environmental costs, B3 waste management, and consistent recording and reporting mechanisms. However, its utilization is still at the level of compliance and administrative control, not yet fully becoming a strategic instrument for sustainability. These results are in line with(Dhar et al., 2022)which states that green accounting accompanied by disclosure of social and environmental responsibilities can increase sustainability, although at PT Daewoong Infion disclosure is still internal. In the context of B3 waste management, the company applies the precautionary principle by relying on licensed third parties, but has not yet developed waste utilization innovations as suggested.(Rachmawati et al., 2024) . Integration between policies, practices, and administrative systems shows consistency, but is still limited to regulatory compliance. The role of green accounting in mitigating ecological risks is proven to help companies identify and respond to potential risks through recording environmental costs and preparing documentation, although its role is still

administrative. This finding is consistent with(Dhar et al., 2022)which confirms that green accounting contributes positively to sustainability when integrated with broader environmental disclosure.

IMPLICATIONS

This finding reinforces the concept in the green accounting literature that recognizing, measuring, and reporting environmental costs are essential elements in integrating ecological dimensions into a company's accounting system.(Rahman & Islam, 2023)as well as(Christy & Tjun Tjun, 2023)Practices at PT Daewoong Infion show that green accounting has served as a tool to identify and control environmental costs, particularly in the management of B3 waste. In addition, as stated by(Anggita et al., 2024)And(Sanusi et al., 2022)The application of green accounting also serves as a managerial instrument that supports decision-making related to efficiency and environmental risk control. However, the results of this study also indicate a gap between the theoretical potential of green accounting as a strategic sustainability tool and the practice in the field, which is still predominantly administrative and regulatory compliance-oriented. Therefore, the theoretical implication is the need to develop a green accounting model that focuses not only on cost recording but also on ecological risk analysis and long-term prevention. While practically, companies need to strengthen the integration of environmental information into operational strategies to increase the effectiveness of sustainable ecological risk mitigation.

CONCLUSION

This study concludes that PT Daewoong Infion has implemented functional green accounting in its hazardous waste management, particularly through the recognition and recording of environmental costs as part of operational expenses. This practice includes the costs of sorting, storing, transporting, and processing hazardous waste by licensed third parties, which have been integrated into the company's budgeting and financial recording system. Furthermore, the company also has a structured hazardous waste management system, including the use of electronic manifests, UKL-UPL reporting, and standard operating procedures that support compliance with environmental regulations. This implementation contributes to reducing potential ecological risks, primarily through improved traceability and administrative control of hazardous waste flows. However, the study also found that the implementation of green accounting in the company is still primarily an administrative compliance measure and has not been fully utilized as a strategic instrument for long-term ecological risk prevention and proactive environmental performance improvement.

SUGGESTION

Based on these findings, companies are advised to expand the function of green accounting beyond simply recording environmental costs to serving as a basis for strategic decision-making in managing ecological risks. PT Daewoong Infion needs to develop a more comprehensive environmental performance measurement system, including indicators of waste management efficiency, waste reduction potential, and opportunities for non-hazardous waste reuse. Furthermore, increased employee training and awareness regarding hazardous waste management and environmental accounting are also needed to make the existing system more effective. From a policy perspective, companies are advised to integrate green accounting information into strategic planning and sustainability reporting to strengthen environmental transparency and accountability. For future research, it is recommended to develop quantitative or comparative approaches across companies to assess the extent to which green accounting contributes to broader environmental and economic performance.

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