Evaluating the Effectiveness of a Green Accounting Information System Prototype in Enhancing Environmental Transparency and Accountability among Green Tourism SMEs

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Abstract. Environmental sustainability has become a strategic priority in the tourism industry, requiring Small and Medium Enterprises (SMEs) to integrate environmental considerations into their business and accounting practices. However, conventional accounting systems rarely capture environmental costs and sustainability information, limiting transparency, accountability, and evidence-based decision-making. This study aims to develop and evaluate a Green Accounting Information System (GAIS) prototype to support environmental accounting in green tourism SMEs. A qualitative case study was conducted at Binar Coffee, a Teaching Factory (Tefa) enterprise, using requirements elicitation through semi-structured interviews, participatory observation, and document analysis. Interview findings were analyzed using thematic analysis following Braun and Clarke (2006), while Stakeholder Theory and Legitimacy Theory guided the interpretation of the results. The requirements elicitation process produced the functional requirements for the GAIS prototype, which integrates environmental cost recording, sustainability indicators, environmental impact reporting, and automated reporting into routine accounting activities. The findings indicate that the prototype enhances environmental transparency, strengthens organizational accountability, supports evidence-based managerial decision-making, and improves the credibility of sustainability reporting. This study contributes empirical evidence to the environmental accounting information systems literature and provides practical guidance for the digital transformation of environmental management in green tourism SMEs.

Keywords: Environmental Accountability, Environmental Transparency, Green Accounting Information System, Green Tourism SMEs, Requirements Elicitation, Sustainability Accounting.

1 Introduction

Environmental sustainability has become an essential consideration in the development of the tourism industry. Increasing public awareness of climate change, environmental degradation, and resource depletion has encouraged tourism businesses to adopt more sustainable business practices. At the same time, governments, customers, investors,

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and local communities are placing greater emphasis on corporate environmental responsibility and expect businesses to provide transparent information regarding the environmental impacts of their operations (Dunakhir et al., 2025). These developments have accelerated the growth of green tourism, which seeks to balance economic performance with environmental protection and social well-being.

Small and Medium Enterprises (SMEs) play a significant role in the tourism sector; however, many green tourism SMEs have yet to integrate environmental considerations into their accounting and reporting practices (Kholijah, 2024). Environmental expenditures, such as waste management, energy conservation, and water consumption, are often recorded as general operating expenses or remain undocumented. Consequently, managers lack reliable information for evaluating environmental performance, while stakeholders have limited ability to verify environmental commitments (Johnstone, 2021; Kannan & Gambetta, 2025).

Conventional Accounting Information Systems (AIS) primarily support financial reporting and business administration but rarely accommodate environmental costs, sustainability indicators, or resource consumption. As a result, environmental information remains disconnected from financial information, limiting organizations' ability to monitor environmental performance while reducing transparency and accountability (Abdillah, 2023). According to Stakeholder Theory (Daromes et al., 2023), organizations are expected to provide relevant information to stakeholders, whereas Legitimacy Theory suggests that transparent environmental reporting is essential for maintaining public trust. Achieving these objectives requires accounting systems capable of integrating financial and environmental information (Hariono et al., 2025).

Previous studies have mainly examined environmental disclosure, sustainability reporting, and green accounting practices across various industries (Ogunode, 2022). However, limited research has focused on developing and empirically evaluating Accounting Information Systems specifically designed to support environmental accounting in green tourism SMEs. In particular, little attention has been given to integrating environmental transactions and sustainability indicators into routine accounting processes through operational information systems (Yu et al., 2025).

To address this gap, this study develops and evaluates a Green Accounting Information System (GAIS) prototype for green tourism SMEs. The prototype integrates conventional accounting functions with environmental cost recording, sustainability indicators, environmental performance monitoring, and automated environmental reporting within a single platform. By combining financial and environmental information, the system is expected to improve environmental transparency, strengthen accountability, and support evidence-based managerial decision-making (Bakar et al., 2026).

This study contributes to environmental accounting literature by providing empirical evidence on the implementation and evaluation of a GAIS prototype in the context of green tourism SMEs. The findings are expected to demonstrate how environmental accounting principles can be operationalized through digital technology while offering practical guidance for SMEs, policymakers, and tourism practitioners seeking to strengthen environmental accountability and promote sustainable tourism management.

2 Methodology

2.1 Research Design

This study employed a qualitative case study approach to evaluate the effectiveness of a Green Accounting Information System (GAIS) prototype in enhancing environmental transparency and accountability among green tourism Small and Medium Enterprises (SMEs). A qualitative approach was considered appropriate because the study sought to explore participants' experiences, perceptions, and practices regarding environmental accounting and the implementation of the proposed system (Ekasari & Brilliant, 2025). Rather than measuring causal relationships, the research aimed to develop an in-depth understanding of how the prototype influenced environmental reporting practices and managerial decision-making within the organizational context.

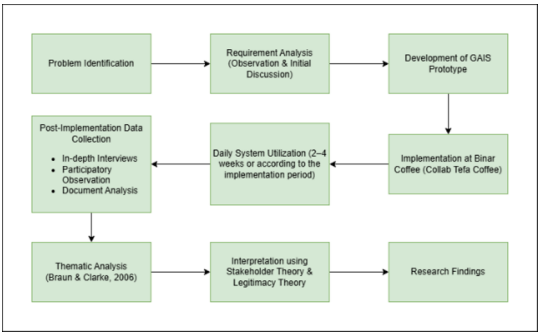


Figure 1. Research Workflow for the Development, Implementation, and Evaluation of the Green Accounting Information System (GAIS) Prototype

The study was informed by Stakeholder Theory and Legitimacy Theory. Stakeholder Theory provides a framework for understanding how environmental information addresses the expectations of various stakeholder groups, including customers, government agencies, investors, and local communities (Nigg & Peters, 2022). Legitimacy Theory explains organizations' motivation to disclose environmental information as a means of maintaining social acceptance and organizational legitimacy. Together, these theoretical perspectives guided both the development of the interview protocol and the interpretation of empirical findings.

The overall research workflow is presented in Figure 1. The study began with problem identification and requirement analysis through observations and discussions with stakeholders at Binar Coffee. Based on these findings, a Green Accounting Information System (GAIS) prototype was developed and implemented within the Teaching Factory (Tefa) environment. Following a two- to four-week implementation period, qualitative data was collected through in-depth interviews, participatory observation, and document analysis to evaluate the prototype. The data were subsequently analyzed using thematic analysis (Braun & Clarke, 2006), and the findings were interpreted through Stakeholder Theory and Legitimacy Theory to

examine the prototype's contribution to improving environmental transparency and accountability among green tourism SMEs.

2.2 Research Setting

The research was conducted at Binar Coffee, a Teaching Factory (Tefa) coffee shop that integrates sustainable practices, including waste reduction, responsible resource use, and environmentally conscious operations. As a Green Tourism-oriented SME, Binar Coffee was selected as an appropriate setting for evaluating the Green Accounting Information System (GAIS). Before evaluation, the GAIS prototype was implemented to complement existing accounting processes by integrating environmental accounting into routine financial management, including the recording of operational transactions, environmental expenditures, and sustainability-related activities.

2.3 Green Accounting Information System Prototype

The Green Accounting Information System (GAIS) prototype was developed to address the limitations of conventional accounting systems in managing environmental information. In addition to standard financial transaction recording, GAIS incorporates environmental accounting features to document and monitor sustainability-related activities.

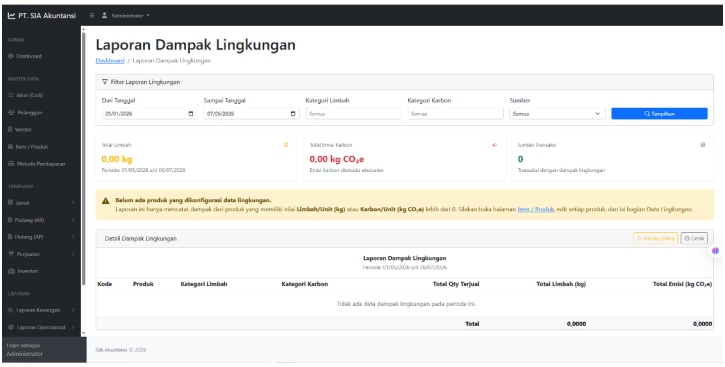


Figure 2. Environmental Impact Reporting Module of the Green Accounting Information System (GAIS) Prototype

The system integrates several modules, including financial transaction management, environmental cost recording, waste management expenditure tracking, energy and water consumption monitoring, sustainability indicators, and automated environmental reporting. By combining financial and environmental information on a single platform, GAIS provides managers with more comprehensive information for operational planning, performance evaluation, and sustainability reporting (Chamorro et al., 2023). The GAIS prototype also includes an Environmental Impact Reporting module for monitoring environmental performance alongside accounting information. As shown in

Figure 2, the module provides configurable reports by reporting period, waste category, carbon category, and environmental impact source. It automatically summarizes key indicators, including total waste generated, estimated carbon emissions (kg CO_2e), and environmentally related transactions. The module also integrates sales transactions with environmental metrics, enabling analysis of the environmental impacts of products and business activities. This functionality supports systematic environmental monitoring, evidence-based decision-making, and greater transparency and accountability in sustainability reporting among Green Tourism SMEs.

2.4 Participants

Participants were selected using purposive sampling based on their direct involvement in operating or managing the implemented GAIS prototype. Individuals were chosen because they possessed firsthand experience with accounting activities, environmental management, or organizational decision-making (Basri et al., 2023).

Participants were selected using purposive sampling based on their direct involvement in the implementation and evaluation of the Green Accounting Information System (GAIS) prototype at Binar Coffee. The selected informants represented strategic, operational, and accounting perspectives, providing comprehensive insights into the prototype's implementation, environmental reporting practices, and its contribution to environmental transparency and accountability. Their diverse roles enabled the study to capture multiple organizational viewpoints regarding the effectiveness of the GAIS prototype in supporting sustainable decision-making (Ilmiah et al., 2025).

The study involved three informants selected based on their roles in implementing and managing the GAIS prototype. The Owner, as the strategic decision-maker and business manager, was interviewed on GAIS, environmental transparency, sustainability reporting, and strategic decision-making. The Operational Manager, responsible for daily operational and environmental management, was interviewed on environmental monitoring, waste management, resource efficiency, and operational decisions. Meanwhile, the Accounting Staff, responsible for financial recording and environmental reporting, was interviewed on environmental cost recording, reporting, and organizational accountability.

2.5 Data Collection

Data collection was conducted after the Green Accounting Information System (GAIS) prototype had been fully implemented at Binar Coffee, enabling participants to evaluate the system based on practical experience. Semi-structured interviews were the primary data collection method, guided by an interview protocol covering environmental transparency, accountability, environmental cost recording, managerial decision-making, and system usability. Each interview lasted 45–90 minutes, was audio-recorded with participants consent, and transcribed verbatim for analysis.

To enhance data triangulation, participatory observation and document analysis were also conducted throughout the implementation period (Alenizi, 2022). Observations

focused on system usage, workflow integration, environmental reporting, and operational challenges, while organizational documents including accounting records, environmental expenditure reports, waste management records, sustainability documents, and GAIS-generated reports were reviewed. The integration of interviews, observation, and documentary evidence strengthened the credibility and trustworthiness of the study's qualitative findings.

2.6 Data Analysis

The collected data were analyzed using thematic analysis following the six-step procedure proposed by Braun and Clarke (2006). The analysis began with repeated reading of interview transcripts, observation notes, and organizational documents to develop familiarity with the data. Initial codes were then generated to identify meaningful patterns related to participants' experiences with the implemented system. Related codes were subsequently grouped into broader themes representing the perceived effectiveness of the GAIS prototype in improving environmental transparency, accountability, sustainability reporting, and managerial decision-making. Throughout the analytical process, emerging themes were interpreted using Stakeholder Theory and Legitimacy Theory to explain how the implemented system influenced organizational environmental reporting practices.

3 Results and Discussion

3.1 Result

Following Braun and Clarke's (2006) six-phase thematic analysis, the interview transcripts, observation notes, and supporting documents were repeatedly reviewed to identify meaningful patterns across participants' experiences. Initial codes were generated from recurring ideas and subsequently grouped into broader themes representing the perceived effectiveness of the Green Accounting Information System (GAIS). Six major themes emerged from the analysis.

Table 1. Development of Themes Following Braun and Clarke

No	Initial Codes	Categories	Themes
1	Manual records; fragmented data; centralized information	Environmental–financial integration	**Theme 1**. Integration of Environmental Information into Daily Business Operations
2	Structured documentation; automated reporting; traceable data	Environmental reporting	**Theme 2**. Improved Environmental Transparency through Structured Documentation
3	Resource monitoring; waste analysis; environmental indicators	Environmental performance management	**Theme 3**. vidence-Based Decision Making for Environmental Management

No	Initial Codes	Categories	Themes
4	Audit trails; verifiable claims; greenwashing prevention	Environmental accountability	**Theme 4**. Strengthening Environmental Accountability and Reducing Greenwashing Risk
5	Collaboration; shared responsibility; environmental awareness	Organizational learning and culture	**Theme 5**. Organizational Learning and Cultural Change
6	Staff adaptation; data inconsistency; system limitations	Implementation challenges	**Theme 6**. Remaining Challenges and Future Development

The findings indicate that GAIS supports stakeholder expectations through transparent environmental reporting while strengthening organizational legitimacy through verifiable sustainability information (Sharma, 2024). As shown in Table 3, the themes were interpreted using Stakeholder Theory and Legitimacy Theory to explain how GAIS improves environmental information, stakeholder communication, decision-making, credibility, and greenwashing prevention(Hariono et al., 2025). Overall, GAIS contributes beyond operational improvement by strengthening stakeholder trust and organizational legitimacy in green tourism SMEs.

Table 2. Interpretation of Themes Using Stakeholder Theory and Legitimacy Theory

Theme	Stakeholder Theory Interpretation	Legitimacy Theory Interpretation
Theme 1. Integration of Environmental Information into Daily Business Operations	Integrated information enables consistent responses to stakeholder expectations.	Integrating environmental information into operations embeds sustainability in organizational practices
Theme 2. Improved Environmental Transparency through Structured Documentation	Transparent reporting improves communication with key stakeholders.	Structured documentation provides credible evidence for environmental disclosures.
Theme 3. Evidence-Based Decision Making for Environmental Management	Reliable environmental information supports decisions aligned with stakeholder sustainability interests	Data-driven decisions demonstrate commitment to responsible environmental management
Theme 4. Strengthening Environmental Accountability and Reducing Greenwashing Risk	Verifiable information and audit trails increase stakeholder confidence in sustainability claims.	Evidence-based reporting strengthens legitimacy and reduces greenwashing risk.
Theme 5. Organizational Learning and Cultural Change	Shared environmental information promotes collaboration and collective responsibility	Environmental awareness becomes embedded in organizational culture, strengthening long-term legitimacy.
Theme 6. Remaining Challenges and Future Development	Continuous improvement helps address evolving stakeholder expectations for environmental reporting.	Ongoing GAIS improvement supports stronger environmental accountability and legitimacy.

3.2 Discussion

This study evaluated the effectiveness of a Green Accounting Information System (GAIS) prototype in enhancing environmental transparency and accountability among green tourism SMEs. The findings show that GAIS not only improves environmental data recording but also supports evidence-based decision-making, strengthens accountability, and enhances stakeholder communication. These findings are interpreted through Stakeholder Theory and Legitimacy Theory.

Discussion on Green Accounting Implementation. The implementation of GAIS substantially improved environmental transparency. Before implementation, environmental information was manually recorded and dispersed across operational units, limiting comprehensive reporting. GAIS centralized financial and environmental information, enabling structured reports supported by historical records and audit trails. Consequently, environmental information became more accessible, consistent, and verifiable.

This finding supports previous research that digital accounting systems improve sustainability reporting by increasing data availability and reducing information fragmentation. However, this study further demonstrates that integrating environmental accounting into daily operations enables continuous collection of environmental data rather than treating GAIS solely as a reporting tool.

GAIS in Strengthening Environmental Accountability and Evidence-Based Decision-Making. GAIS strengthened environmental accountability by supporting data-driven decisions related to waste management, resource efficiency, energy and water consumption, and environmental investments. Environmental indicators enabled managers to identify abnormal resource consumption, monitor waste, evaluate environmental initiatives, and assess performance. Historical data also supported trend analysis and evaluation of environmental improvement programs.

By integrating environmental costs, sustainability indicators, and operational data, GAIS enables simultaneous evaluation of financial and environmental performance. From the perspective of Stakeholder Theory, reliable environmental information helps organizations respond to stakeholder expectations, support responsible resource allocation, and strengthen environmental accountability.

GAIS as a Mechanism for Building Organizational Legitimacy. GAIS also strengthened organizational legitimacy by supporting environmental claims with verifiable evidence, including environmental cost records, resource consumption data, waste documentation, and audit trails. This improved the credibility of sustainability reporting and reduced the risk of unsupported claims and greenwashing. From the perspective of Legitimacy Theory, such evidence helps organizations demonstrate conformity with environmental expectations and maintain stakeholder trust.

Despite these benefits, challenges remain, including staff adaptation, inconsistent data entry, internet dependency, and limited integration with existing accounting software. Participants also recommended improvements in carbon footprint calculation, mobile applications, automated benchmarking, and alignment with sustainability

reporting standards such as GRI. Thus, environmental legitimacy requires continuous technological development and organizational learning.

4 Conclusion

This study demonstrates that the Green Accounting Information System (GAIS) prototype enhances environmental transparency and accountability among Green Tourism SMEs by integrating financial and environmental information into routine accounting practices. The implementation improves environmental reporting, supports evidence-based managerial decision-making, and provides reliable, verifiable information that strengthens stakeholder communication and reduces greenwashing risk. These findings indicate that digital environmental accounting systems can support sustainable business management beyond conventional financial reporting.

Furthermore, GAIS strengthens organizational legitimacy by embedding environmental accountability into daily operations and supporting credible sustainability practices. Although challenges remain, particularly in staff adaptation, system integration, and advanced reporting features, the prototype provides practical guidance for SMEs adopting digital environmental management solutions and contributes empirical evidence to the literature on environmental accounting information systems and sustainable tourism.

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