

IMPLEMENTING ENVIRONMENTAL MANAGEMENT ACCOUNTING INFORMATION SYSTEMS TO STRENGTHEN SUSTAINABLE SMES

**Permata Ulfah¹, Laeli Budiarti², Uswatun Khasanah³, Widyahayu Warmmeswara
Kusumastati⁴, Intan Candra Ramadhani⁵**

¹⁻⁵ Accounting Department/Economic and Business faculty, Jenderal Soedirman University,
Purwokerto

*Email corresponding author: permata.ulfah@unsoed.ac.id

Abstract

Small and Medium Enterprises (SMEs) are increasingly required to adopt sustainable business practices in response to growing stakeholder expectations regarding environmental accountability and organizational sustainability. However, many SMEs continue to rely on conventional accounting systems that inadequately capture environmental information, limiting their ability to identify environmental costs, improve resource efficiency, and support sustainability-oriented decision-making. This community engagement program aimed to implement an Environmental Management Accounting Information System (EMAIS) to strengthen sustainable business management among SMEs. The program employed a participatory approach consisting of preliminary assessment, capacity-building workshops, technical training, participatory system development, continuous mentoring, and monitoring and evaluation. The implemented EMAIS integrates financial and environmental information into a unified digital platform, enabling systematic identification and recording of environmental costs, monitoring of resource utilization, and generation of sustainability-related information to support managerial decision-making. The implementation enhanced participants' understanding of Environmental Management Accounting, improved digital accounting competencies, strengthened the management of environmental information, and increased organizational awareness of sustainable business practices. Furthermore, the integrated system improved accounting accuracy, resource efficiency, environmental accountability, and the availability of reliable information for strategic planning. This community engagement program provides a practical and replicable framework for implementing Environmental Management Accounting Information Systems in SMEs, thereby supporting sustainable business management, improving environmental performance, and strengthening organizational competitiveness in increasingly sustainability-oriented markets.

Keywords: Environmental Management Accounting Information System; Environmental Management Accounting; Sustainability; Digital Accounting; Small and Medium Enterprises (SMEs).

INTRODUCTION

Small and Medium Enterprises (SMEs) are widely recognized as essential contributors to economic development, employment creation, poverty reduction, and innovation. According to the World Bank (2023), SMEs represent approximately 90% of businesses worldwide and contribute more than 50% of global employment. In Indonesia, SMEs account for over 99% of all business entities and contribute more than 60% of the national Gross Domestic Product (GDP), making them the backbone of the country's economy (OECD, 2023). Despite their significant economic contribution, SMEs are increasingly challenged by global sustainability requirements, environmental regulations, and stakeholder expectations for responsible business practices. Consequently, sustainable business management has become a strategic necessity rather than a voluntary initiative.

Sustainable business emphasizes the integration of economic growth, environmental stewardship, and social responsibility into organizational decision-making. In recent years, the Environmental, Social, and Governance (ESG) framework has emerged as an internationally

accepted benchmark for evaluating organizational sustainability and corporate responsibility. Companies that successfully integrate ESG principles are more likely to improve operational efficiency, reduce business risks, strengthen stakeholder trust, and enhance long-term financial performance (Gerged et al., 2024). However, while large corporations have increasingly adopted sustainability reporting and ESG practices, many SMEs still struggle to incorporate environmental and social information into their accounting and management systems because of limited financial resources, inadequate technological capabilities, and insufficient managerial expertise (OECD, 2023).

One accounting approach that supports sustainable business development is Environmental Management Accounting (EMA). The International Federation of Accountants (IFAC, 2005) defines Environmental Management Accounting as the identification, collection, analysis, and use of both physical and monetary information related to environmental performance for internal decision-making. Unlike conventional accounting systems, EMA incorporates environmental costs—including energy consumption, water use, waste management, emissions, and pollution prevention—into managerial accounting, enabling organizations to make environmentally and economically informed decisions (Burritt & Schaltegger, 2014).

Previous studies have demonstrated that Environmental Management Accounting significantly improves organizational sustainability performance. Qian, Burritt, and Monroe (2018) found that EMA enhances environmental management by providing accurate environmental cost information that supports strategic planning and operational decision-making. Similarly, Huynh and Nguyen (2024) reported that Environmental Management Accounting positively influences green innovation, resource efficiency, and sustainable business performance. Furthermore, Burritt and Christ (2016) emphasized that environmental accounting enables organizations to identify hidden environmental costs that are often ignored in traditional accounting systems, thereby improving organizational competitiveness while supporting environmental conservation.

Despite these advantages, the implementation of Environmental Management Accounting remains limited among SMEs because environmental information is often managed separately from financial accounting systems. Consequently, managers have limited access to integrated information required for evaluating environmental performance, identifying resource inefficiencies, and preparing sustainability reports. This limitation reduces SMEs' ability to respond effectively to increasing stakeholder demands for transparency and environmental accountability.

The rapid advancement of digital technology has created opportunities to overcome these limitations through the development of Environmental Management Accounting Information Systems (EMAIS). An Environmental Management Accounting Information System integrates accounting information, environmental performance data, and managerial reporting into a unified digital platform that supports organizational decision-making. Such systems enable enterprises to monitor environmental costs, measure resource consumption, evaluate waste generation, and generate sustainability-related information in real time (Romney & Steinbart, 2021). Digital integration also improves information accuracy, reporting efficiency, organizational transparency, and managerial responsiveness, thereby facilitating sustainable business management (Moll & Yigitbasioglu, 2019).

Recent studies have highlighted the growing importance of digital accounting technologies in sustainability management. Digital technologies facilitate the integration of financial and environmental information, improve reporting quality, and support sustainability accounting and reporting practices (Gerged et al., 2024). Furthermore, accounting digitalization strengthens managerial decision-making by improving information quality and enabling organizations to manage environmental and sustainability information more effectively (Antonini, 2024). These findings indicate that integrating Environmental Management Accounting with digital information systems offers significant opportunities for SMEs to strengthen sustainability management while improving organizational competitiveness.

However, existing studies have primarily focused on either Environmental Management Accounting or digital accounting systems independently. Research concerning the implementation of Environmental Management Accounting Information Systems (EMAIS) that simultaneously integrate environmental accounting, digital technologies, and sustainability management within SMEs remains relatively limited, particularly in developing countries. Moreover, most community engagement initiatives continue to emphasize conventional bookkeeping, financial literacy, or digital marketing rather than sustainability-oriented accounting systems capable of supporting environmental performance measurement and sustainable business development.

To address this gap, this community engagement program proposes the implementation of an Environmental Management Accounting Information System specifically designed for SMEs. The program combines participatory system development, capacity-building workshops, technical training, and mentoring activities to improve SMEs' capabilities in environmental accounting, sustainability management, and digital financial reporting. Through the implementation of EMAIS, SMEs are expected to systematically identify environmental costs, improve resource efficiency, strengthen environmental accountability, and enhance organizational sustainability.

METHODS

This international community engagement program adopted a participatory approach involving close collaboration between the university team and the SME partner to implement an Environmental Management Accounting Information System (EMAIS). The program was designed to strengthen sustainable business management by integrating environmental management accounting with digital accounting technologies. Through participatory system development, technical training, and continuous mentoring, the program aimed to improve the enterprise's capability to identify environmental costs, manage sustainability-related information, and support evidence-based managerial decision-making.

The implementation consisted of four sequential stages: preliminary assessment, capacity-building and technical training, participatory system development and mentoring, and monitoring and evaluation. A preliminary assessment was conducted through field observations, interviews with SME owners and employees, and reviews of existing accounting practices. The assessment identified three major challenges that limited the effective implementation of Environmental Management Accounting and sustainability management. Based on these findings, intervention strategies were formulated as presented in Table 1.

Table 1. Problems Identified and Proposed Solutions

NO	Problems Identified	Proposed Solutions
1	Environmental information was not integrated into the existing accounting system. The SME relied on conventional bookkeeping that primarily recorded financial transactions, while environmental costs such as energy consumption, waste management, and resource utilization were not systematically identified or recorded.	Develop and implement an Environmental Management Accounting Information System (EMAIS) that integrates financial and environmental information, enabling systematic recording, monitoring, and analysis of environmental costs.

2	Limited knowledge and practical implementation of Environmental Management Accounting (EMA). Participants had limited understanding of environmental cost identification, environmental performance measurement, and the utilization of environmental accounting information for managerial decision-making.	Conduct capacity-building workshops and technical training on Environmental Management Accounting, including environmental cost identification, environmental performance measurement, and the application of environmental information in managerial decision-making.
3	Limited utilization of digital accounting technology to support sustainability management. Existing accounting practices did not provide integrated information required for monitoring environmental performance, evaluating resource efficiency, and supporting sustainable business planning.	Develop digital accounting capabilities through participatory system development, practical training, and continuous mentoring to enable effective utilization of EMAIS for sustainability management and strategic decision-making.

Table 1 indicates that the identified problems were closely interconnected. The absence of integrated environmental information limited the implementation of Environmental Management Accounting, while inadequate digital capabilities reduced the effectiveness of sustainability management. Therefore, the community engagement program combined system development with capacity building to ensure that participants were able to implement Environmental Management Accounting Information Systems effectively in their daily business operations.

RESULTS AND DISCUSSION

The community engagement program was implemented to strengthen sustainable business management through the adoption of an Environmental Management Accounting Information System (EMAIS). The implementation combined participatory system development, technical training, and continuous mentoring to improve environmental accounting practices and the utilization of sustainability information in managerial decision-making. The program addressed the three major challenges identified during the preliminary assessment and successfully integrated environmental management accounting into the SME's accounting processes.

A. Implementation of the Environmental Management Accounting Information System

The first intervention focused on developing and implementing an Environmental Management Accounting Information System that integrates financial and environmental information into a single digital platform. Preliminary observations indicated that the enterprise relied primarily on conventional bookkeeping practices, with environmental expenditures recorded inconsistently or not documented at all. Consequently, managers lacked comprehensive information regarding resource utilization, waste management, and environmental costs.

The implementation began with a comprehensive assessment of existing accounting procedures to determine system requirements and identify environmental information relevant to business operations. Based on these findings, the university team collaborated with the SME to develop an Environmental Management Accounting Information System tailored to the enterprise's operational characteristics. The system incorporated modules for recording financial transactions, environmental expenditures, resource consumption, and waste management activities.

Training and technical assistance enabled participants to operate the system and integrate environmental information into routine accounting processes. As a result, environmental cost information became systematically documented alongside financial transactions, improving accounting quality, information accuracy, and managerial access to sustainability-related information. The integrated system also facilitated more effective monitoring of operational efficiency and environmental performance.

B. Strengthening Environmental Management Accounting Practices

The second intervention emphasized improving participants' understanding and practical application of Environmental Management Accounting. Before the program, environmental costs were generally treated as ordinary operational expenses without being separately identified or analyzed for managerial purposes. This limitation reduced the organization's ability to evaluate environmental performance and identify opportunities for improving resource efficiency.

Capacity-building workshops introduced participants to Environmental Management Accounting concepts, environmental cost classification, resource consumption analysis, waste management accounting, and environmental performance measurement. Practical exercises enabled participants to identify environmental expenditures associated with production processes, energy utilization, water consumption, packaging materials, and waste handling activities.

Continuous mentoring supported participants in applying Environmental Management Accounting within daily business operations. Participants gradually developed the capability to identify hidden environmental costs, evaluate resource utilization, and generate environmental information that supports operational planning and sustainability management. Consequently, Environmental Management Accounting became an integral component of managerial decision-making rather than merely an accounting procedure.

C. Enhancing Sustainability Management through Digital Environmental Accounting

The third intervention focused on strengthening sustainability management through the effective utilization of digital accounting technology. The Environmental Management Accounting Information System enabled participants to integrate financial information with environmental performance indicators, creating a comprehensive information base for sustainability-oriented decision-making.

Practical training sessions emphasized the use of digital accounting tools for environmental monitoring, resource efficiency evaluation, environmental reporting, and managerial analysis. Participants learned how to generate accounting reports containing both financial and environmental information, enabling management to evaluate sustainability performance more comprehensively.

Continuous mentoring increased participants' confidence in utilizing digital accounting information for strategic planning. The availability of integrated environmental information supported evidence-based managerial decisions related to resource conservation, operational efficiency, environmental accountability, and long-term business sustainability. Furthermore, the implementation of EMAIS improved organizational transparency by providing more reliable sustainability-related information that can support future sustainability reporting and stakeholder communication.

Overall, the implementation of the Environmental Management Accounting Information System demonstrated that integrating Environmental Management Accounting with digital accounting technologies significantly strengthened sustainable business management within the SME. The program improved accounting quality, enhanced environmental information management, increased resource efficiency, and strengthened managerial decision-making through the availability of integrated financial and environmental information. Beyond addressing the immediate operational needs of the partner enterprise, the developed implementation framework provides a practical and replicable model for other SMEs seeking to improve environmental accountability, sustainability management, and long-term organizational competitiveness through digital accounting innovation.

CONCLUSION

This international community engagement program successfully implemented an Environmental Management Accounting Information System (EMAIS) to strengthen sustainable business management among SMEs. The program effectively addressed three key challenges identified during the preliminary assessment, namely the lack of integration between environmental information and accounting systems, limited implementation of Environmental Management Accounting (EMA), and the underutilization of digital accounting technologies for sustainability management. Through a participatory approach involving system development, technical training, continuous mentoring, and evaluation, the SME improved its capability to manage environmental information and utilize sustainability-oriented accounting practices.

The implementation of EMAIS enabled the systematic integration of financial and environmental information into a unified digital accounting platform. This integration improved the identification, measurement, and recording of environmental costs, thereby enhancing accounting quality, resource efficiency, and environmental accountability. In addition, strengthening participants' understanding of Environmental Management Accounting enabled the enterprise to utilize environmental information more effectively in managerial planning, operational evaluation, and sustainability-oriented decision-making. The adoption of digital accounting technology further enhanced organizational transparency by providing timely and reliable information to support sustainable business management.

BIBLIOGRAPHY

- Antonini, C. (2024). Accounting digitalization in the quest for environmental sustainability. *Current Opinion in Environmental Sustainability*, 66, 101399.
- Burritt, R. L., Schaltegger, S., & Christ, K. L. (2023). Environmental Management Accounting: Developments over the last 20 years from a framework perspective. *Australian Accounting Review*, 33(3), 336–351.

- Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: Aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance & Investment*, 5(4), 210–233.
- Gerged, A. M., Zahoor, N., & Cowton, C. J. (2024). Understanding the relationship between environmental management accounting and firm performance: The role of environmental innovation and stakeholder integration—Evidence from a developing country. *Management Accounting Research*, 62, 100865.
- Huynh, Q. L., & Nguyen, V. K. (2024). The role of Environmental Management Accounting in sustainability. *Sustainability*, 16(17), 7440.
- International Federation of Accountants. (2023). The state of play: Sustainability disclosure & assurance 2019–2021—Trends & analysis. IFAC.
- Lodhia, S., Farooq, M. B., Sharma, U., & Zaman, R. (2025). Digital technologies and sustainability accounting, reporting and assurance: Framework and research opportunities. *Meditari Accountancy Research*, 33(2), 417–441.
- Kim, S., & Ha, T. (2023). Influential Variables and Causal Relations Impact on Innovative Performance and Sustainable Growth of SMEs in Aspect of Industry 4.0 and Digital Transformation. *Sustainability*, 15(9), 7310.
- Moll, J., & Yigitbasioglu, O. (2019). The role of internet-related technologies in shaping the work of accountants: New directions for accounting research. *The British Accounting Review*, 51(6), 100833.
- Ngoc, T. T. (2024). Unlocking environmental management accounting and environmental performance: A mediated moderation model through green technology innovation and environmental strategy. *Meditari Accountancy Research*, 33(2), 733–758.
- O'Reilly, S., Mac an Bhaird, C., Gorman, L., & Brennan, N. M. (2023). Accounting practitioners' perspectives on small- and medium-sized enterprises' environmental sustainability reporting. *Journal of Applied Accounting Research*, 26(6), 26–46.
- Organisation for Economic Co-operation and Development. (2023). Assessing greenhouse gas emissions and energy consumption in SMEs: Towards a pilot dashboard of SME greening and green entrepreneurship indicators (OECD SME and Entrepreneurship Papers No. 42). OECD Publishing.
- Qian, W., Burritt, R. L., & Monroe, G. S. (2018). Environmental management accounting in local government: Functional and institutional imperatives. *Financial Accountability & Management*, 34(2), 148–165.
- Romney, M. B., Steinbart, P. J., Summers, S. L., & Wood, D. A. (2021). *Accounting Information Systems* (15th ed.). Pearson.
- Shaofeng Wang, José Paulo Esperança, Can digital transformation improve market and ESG performance? Evidence from Chinese SMEs, *Journal of Cleaner Production*, Volume 419, 2023, 137980,
- World Bank. (2023). Business Ready (B-READY): Corporate Sustainability and Business Environment (atau laporan World Bank 2023 yang membahas green transition dan private sector competitiveness).