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Environmental Management Accounting and Green Practices as Drivers of SME Performance: Evidence from an Emerging Economy

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Abstract
This study investigates the impact of environmental management accounting (EMA) on financial performance, with environmental management practices (EMP) and operational performance serving as mediating variables. Using a quantitative survey approach, data were collected from 98 managers or owners of green SMEs in Central Java, Indonesia, using a structured questionnaire and snowball sampling, due to the lack of an official database of green SMEs in the region. Data were analyzed using SEM-PLS via SmartPLS software. The results indicate that while EMA practices significantly enhance EMP, EMP do not significantly influence operational performance. Operational performance, however, has a significant positive influence on financial performance. Additionally, EMP do not mediate the relationship between EMA and operational performance, nor does operational performance (OP) mediate the link between EMP and financial performance (FP). Theoretically, this study contributes to the literature by underscoring the limited mediating role of EMP in green SMEs and the challenges in converting environmental initiatives into operational gains. Practically, the findings suggests that SMEs should better integrate environmental accounting with operational strategies to enhance financial outcomes and recommend that policymakers support SMEs through improved access to environmental management training and resources.
Keywords: environmental management accounting, financial performance, green SMEs, environmental management practices, operational performance.

Introduction

The accelerating climate crisis and ongoing resource depletion have triggered global calls for systemic transitions toward more sustainable economic models. The circular economy has gained international momentum as a promising solution to these challenges (Ellen MacArthur Foundation, 2019; United Nations Environment Programme (UNEP), 2021), promoting resource regeneration and minimizing environmental harm. aiming to regenerate resources and minimize environmental harm. In line with this global movement, the Indonesian government's current development agenda emphasizes advancing a green economy while fulfilling commitments to the Sustainable Development Goals (SDGs). The adoption of circular economy principles has become a central strategy to reduce environmental impact and enhance resource efficiency. By encouraging sustainable waste management and optimizing resource use, this model directly supports SDG goals, especially those related to responsible consumption and production. Furthermore, its implementation targets high-impact sectors—such as food, electronics, plastic packaging, construction, and textiles—which contribute significantly to environmental degradation. The initiative aims to reduce waste by up to 52% and significantly lower carbon emissions by 2030.

Beyond its environmental benefits, the circular economy also creates sustainable economic opportunities, particularly for micro, small, and medium enterprises (SMEs). It encourages environmentally responsible business practices through the development of "green SMEs" that prioritize sustainability in their operations. These green SMEs not only enhance business continuity by adopting eco-friendly strategies but also contribute to Indonesia's broader economic development.

A notable example is the "Central Java Waste-Free 2025" program, initiated by the provincial government, which aims to promote environmental management among SMEs. The initiative addresses pollution in 136 rivers across the province—pollution that poses serious threats to both human health and ecosystems. Environmental experts largely attribute this pollution to domestic waste and industrial activities, including those from SME production processes. These issues are often rooted in limited environmental awareness and the inadequate adoption of modern technologies in environmental health and sustainability (Thenu, 2015; Purnamasari, 2025).

Green SMEs play a dual role by promoting economic growth while also enhancing environmental conditions. For example, textile SMEs that have implemented sustainable practices—such as using recycled materials and minimizing production waste—reported a 15% increase in revenue compared to the previous year. In addition, their operational costs decreased by approximately 10% due to improved resource efficiency (Judith, 2021). Despite these positive developments, many SMEs still face financial difficulties. According to the Asian Development Bank (2021), around 48.6% of SMEs in Indonesia reported a decline in revenue due to pandemic-related disruptions. Likewise, Yoshio (2021) found that during the COVID-19 pandemic, a majority of green SMEs in Indonesia suffered revenue losses, with 27% experiencing a decline of over 60%, highlighting their financial vulnerability.

Enhancing SME financial performance requires effective eco-efficient management. Organizations that deliver high-value products or services while minimizing environmental impact tend to achieve better financial outcomes (Rifai, Ningrum, and Wahyudi, 2024). Environmental Management Accounting (EMA) and Environmental Management Practices (EMP) play a critical role in enabling this eco-efficiency. EMA provides relevant environmental cost information, allowing SMEs to make better-informed resource allocation decisions (Khalid and Salam, 2024), while also facilitating the implementation of environmental management systems that depend on EMP adoption (Alfarizi, Ngatindriatun, and Firmansyah 2024).

Although many studies support the importance of EMA and EMP, recent evidence suggests that their financial benefits are not always direct or consistent. For instance, Deb, Rahman, and Rahman (2022) found that EMA enhances both environmental and financial performance in Bangladeshi manufacturing firms. However, Kong, Javed, Sultan, Hanif, and Khan (2022) argued that EMA's effectiveness may vary depending on external pressures and environmental uncertainty. These mixed findings highlight the need for further investigation into how EMA and EMP affect organizational performance across different settings. Collectively, these practices have the potential to enhance operational management and ultimately improve financial outcomes (Tjahjadi, Soewarno, El Karima, and Sutarso. 2023).

Although interest in green business practices is growing, previous research on Environmental Management Accounting (EMA), Environmental Management Practices (EMP), and firm performance has produced mixed and sometimes contradictory findings. Some scholars have found that EMA enhances innovation and operational strategies, thereby improving organizational outcomes (Chaudhry, Asad, and Hussain 2024). Others, however, report no significant impact of EMA on performance unless supported by institutional factors or organizational readiness (Kong, Javed, Sultan, Hanif, and Khan 2022). Similarly, while EMP has been associated with improved social and environmental outcomes, its financial implications are not always clear-cut. Okafor, Okafor, and Eze (2023) identified a positive link between EMP and sustainability in Nigerian manufacturing firms, but noted that resource

limitations among SMEs may hinder these benefits. Furthermore, Jamil, Ibrahim, Rahman, Senathirajah, Semawi and Rashid. 2023) emphasized that EMP adoption in SMEs is often influenced by external pressures—such as regulatory bodies, customers, and supply chains—yet the resulting business performance outcomes remain inconsistent, largely due to limited resources and internal constraints. These discrepancies underscore a lack of consensus in the literature and indicate the need for a more integrated and context-sensitive investigation, particularly within SME contexts.

Despite the substantial body of research on environmental management, only a limited number of studies have examined Environmental Management Accounting (EMA), Environmental Management Practices (EMP), and operational performance (OP) within a unified framework. Most existing research has focused on large corporations or has explored only partial mediating relationships. For example, Fuzi, Habidin, Janudin and Ong. (2019) investigated the mediating role of environmental management systems (EMS) between EMP and performance but did not consider the influence of EMA. Similarly, Solovida and Latan (2017, 2021) emphasized the role of EMA in sustainability but did not explore its indirect effects through EMP and OP. More recent studies, such as that of Chaudhry, Asad, and Hussain (2024), have begun to investigate how environmental strategies mediate the relationship between EMA and performance; however, operational mechanisms remain underdeveloped. Consequently, our understanding of how these tools interact in practice—particularly in resource-constrained SMEs—remains limited.

Although previous research has acknowledged the value of EMA and EMP, few studies have examined the full mechanism through which environmental accounting capabilities translate into financial performance. While EMA may provide the necessary data and EMP the corresponding actions, their impact is likely transmitted through improvements in operational performance—yet this pathway remains underexplored. Both, Kong, Javed, Sultan, Hanif, and Khan (2022) and Chaudhry, Asad, and Hussain (2024) suggest that strategic and contextual factors moderate these relationships, but neither study explicitly investigates operational performance as a mediating factor. This gap is particularly relevant in developing country contexts, where SMEs often face resource constraints. A more comprehensive model that includes EMA, EMP, and OP could help clarify the conditions under which environmental initiatives lead to improved financial outcomes. Therefore, a significant gap remains in understanding how environmental accounting capabilities are converted into financial performance through operational mechanisms within SMEs that operate under limited resources.

This study offers a novel contribution by integrating EMA, EMP, OP, and FP into a comprehensive mediation model, which, to our knowledge, has not been empirically tested in the context of green SMEs in Indonesia. By simultaneously examining the dual mediating roles of EMP and OP, this research extends prior models that have focused solely on direct or partially mediated relationships. Furthermore, by adopting both the RBV and NRBV, this study provides a theoretically grounded explanation of how environmental capabilities are transformed into performance outcomes— an approach that has rarely been applied in SME-focused research.

Aligned with this objective, the study investigates the influence of EMA and EMP on financial performance, with OP and EMP serving as mediating variables. This research is significant because it addresses the practical need among green SMEs to understand how environmental strategies can enhance business outcomes. In the Indonesian context, where many SMEs operate under resource constraints, identifying effective pathways to improve performance through sustainable practices is both timely and valuable. The findings are expected to provide practical insights for managers and policymakers striving to promote more environmentally responsible business models.

Literature review

Resource-based view (RBV) theory

The resource-based view (RBV) of the firm emerged as a response to the limitations of the industrial organization (I/O) perspective, which largely emphasized external market conditions as the main determinants of firm performance. Over time, this externally focused view came to be seen as insufficient for explaining differences in performance among firms operating within the same industry. In contrast, the RBV brought attention to the strategic importance of internal resources and capabilities as the basis for achieving sustainable competitive advantage (Wernerfelt, 1984). Recent developments in strategic management research continue to support the idea that firms gain and maintain superior performance by leveraging resources that are valuable, rare, inimitable, and non-substitutable (Barney, Ketchen, and Wright 2021). These capabilities, when aligned with external opportunities, enable firms to build resilient and adaptive strategies in dynamic environments (Pitelis and Wagner 2020). Furthermore, the ways in which firms acquire, integrate, and deploy their resources play a critical role in shaping strategic decisions and outcomes—ranging from improved efficiency and cost savings to enhanced product quality, market share, and profitability (Dasuki 2021). In today's competitive landscape, the effective orchestration of resources remains central to long-term organizational success.

Natural resource-based view (NRBV) theory

A company's efforts to implement sustainable environmental management through environmentally related activities can improve financial performance, particularly in terms of profitability and increased market responsiveness. However, this relationship has not been clearly explained in terms of how environmental activities function as mediators within the environmental management system (Klassen and McLaughlin , 1996).

This study refers to the theoretical frameworks of the RBV and the Natural-Resource-Based View (NRBV). The theory proposed by Hart and Dowell (2011) emphasizes that "corporate strategy (environmental strategy) and competitive advantage (corporate environmental performance) must be rooted in capabilities that facilitate eco-friendly economic activities," in line with the firm's natural resource-based view. As proposed by Hart (1995), NRBV comprises three interrelated strategies: pollution prevention, product stewardship, and sustainable development. The NRBV provides a framework for companies to understand and address environmental challenges by adopting environmental strategies and implementing environmental management practices.

Financial performance

Financial performance refers to the ability of an organization to generate profits and manage its resources effectively and efficiently over a specific period. It reflects the financial health of a company and is commonly measured using indicators such as profitability, return on assets (ROA), return on equity (ROE), and net profit margin (Brigham and Houston 2019).

In the context of small and medium enterprises (SMEs), financial performance is not only influenced by internal operational efficiency but also by the adoption of sustainable and environmentally responsible practices. According to recent studies, integrating environmental considerations into business operations—such as through environmental management accounting (EMA) and green innovation—can enhance financial performance by improving resource efficiency and reducing operational costs (Rifai, Ningrum, and Wahyudi, 2024 ;Tjahjadi, Sowarno, Karima, and Sutarsa 2023). Studies have shown that SMEs adopting green practices—such as eco-design, energy-efficient technologies, waste minimization, and sustainable sourcing—can achieve superior financial outcomes by reducing operational costs,

mitigating environmental risks, and enhancing productivity (Chen, Lin, and Chang, 2021;Weng and Lin 2022).

Government policies and regulatory pressures have also played a critical role in encouraging SMEs to transition towards sustainability. Support mechanisms—such as green financing, tax incentives, and eco-certification programs—have contributed to improved financial performance among SMEs that proactively implement sustainability initiatives (Zameer, Wang, and Yasmeen. 2020; Zhang, Chen, and Liu 2023). Overall, there is growing empirical evidence that environmental commitment in SMEs is not merely a cost burden but a strategic lever for enhancing financial performance and achieving competitive advantage in the green economy.

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Environmental management accounting practices

Environmental Management Accounting (EMA) integrates environmental considerations into conventional management accounting. It provides essential tools that support sustainable development goals and enhance the oversight of environmental activities.. EMA adoption is influenced by factors such as organizational culture, structure, disclosure quality, and performance, offering strategic insight into both financial and environmental outcomes (Aman and Lucianetti 2025). The adoption of EMA in companies is also influenced by corporate environmental strategies, which are integrated into their broader business strategies. EMA assists companies in fulfilling environmental responsibilities while identifying economic benefits to improve both environmental and financial performance (Sari, Said, and Ediaty 2020).

Moreover, EMA adoption is shaped by external pressures, including environmental regulations, stakeholder demands, and increasing public awareness of sustainability issues. These factors push companies to enhance transparency and accountability in managing environmental impacts. EMA supports strategic decision-making by providing relevant information for evaluating green investments and improving resource efficiency. Recent studies highlight that regulatory frameworks and stakeholder engagement significantly influence the integration of EMA into corporate practices, reinforcing its role in achieving both economic and environmental objectives (Khan, Muttakin, and Siddiqui, 2021).

Environmental management practices

Environmental Management Practices (EMP) encompass production-related activities carried out by management, including eco-friendly production processes and sustainable value chains (Pratiwi, D., R. Dani Putyri, and D. Suryadi 2024). Companies must implement effective environmental management to enhance green supply chain practices, such as fostering interdepartmental collaboration for environmental improvement, training employees in green practices, and adopting a green management system (Alvin and Santosa 2023).

Effective implementation of EMP is also driven by organizational commitment and leadership support, which play a pivotal role in embedding sustainability into core business operations. EMP contributes to long-term organizational performance by fostering innovation, enhancing operational efficiency, and strengthening environmental compliance. Recent studies indicate that when environmental practices are integrated into strategic planning, companies are more likely to achieve both competitive advantage and sustainability goals (Mustafi, Dong, Hosain, Amin, Rahaman, and Abdullah. 2024;Hermawan, Yuliana, and Putri, 2022).

Operational performance

Operational performance is commonly categorized into four dimensions: quality, cost, delivery, and flexibility (Siefan, Antony, Mayas, Omar, Prashar, Tortorella, Foster and Maalouf, 2024). Operational performance measures improvements in product quality, reductions in

production costs, the speedy delivery of end-products, and rapid restructuring of production systems and enhancements in operational dependability and flexibility (Opoku and Li 2025)

In addition to these dimensions, recent research emphasizes the significant role of sustainability-oriented practices in enhancing organizational performance. The integration of green initiatives into daily operations—such as improving energy efficiency, minimizing waste, adopting renewable resources, and utilizing eco-friendly materials—not only supports environmental protection but also improves cost efficiency, product quality, and customer satisfaction. These sustainable practices contribute to long-term business value by increasing process agility, enhancing supply chain resilience, and enabling firms to better respond to dynamic market demands. This comprehensive approach aligns environmental responsibility with strategic performance objectives (Rothenberg, Pil, and Maxwell 2001;Nasir, Abdul-Rahman, and Malik, 2021)

Hypothesis Development

Based on the RBV, organizations gain competitive advantage through valuable, rare, and inimitable internal resources, including environmental capabilities (Barney, 1991). The NRBV extends this perspective by emphasizing environmental sustainability as a strategic resource (Hart, 1995a). EMA practices serve as tools to generate relevant environmental information, while EMP reflects the firm's capability to implement sustainable strategies. Thus, both EMA and EMP are considered strategic resources that align with the RBV and NRBV frameworks in achieving superior environmental performance (Schaltegger and Burritt 2005).

EMA and EMP are closely linked to environmental concerns as both aim to enhance the implementation of environmental management. Albelda (2011) demonstrated that EMA implementation is associated with the development of environmental management systems. EMP supports EMA by offering financial information related to environmental aspects and aligning with corporate goals. An effective environmental management system helps organizations manage EMA more efficiently. EMP plays a crucial role in enhancing EMA through the refinement of procedures, regulations, and structures within corporate environmental management. Ismail, Ramli, and Darus (2014), Prajogo, Tang, and Lai (2014), and Campos, Heizen, Verdinelli, Miguel and Chick (2015) found that EMA positively influences environmental management systems, signifying alignment with EMP adoption. Based on these findings, the following hypothesis is proposed:

H1: Environmental Management Accounting Practices have a positive effect on Environmental Management Practices.

The NRBV theory explains that resources owned by organizations which cannot be easily imitated by competitors can create competitive advantages, including environmental strategies that lead to sustainable competitive advantages (Hart ,1995; Hart and Dowell, 2011; Klassen and Whybark (1999). Famiyeh, Adaku, Amoako-Gyampah,Asante-Darko, and Amoatey (2018) classified operational performance into four aspects: cost, quality, delivery, and flexibility. Their study found that EMP positively impacts cost reduction and contributes to cost advantages (Chrismann, 2000).

Organizations that have adopted EMP focus on eco-friendly product quality, including the use of green raw materials, which supports the findings of Famiyeh, Adaku, Amoako-Gyampah, Asante-Darko, and Amoatey (2018) and Melynk, Sroufe, and Calantone (2003) that EMP positively correlates with quality improvement. EMP also positively influences delivery performance, as noted by Lambert and Cooper (2000), by promoting corporate activities aimed at environmental improvement, including more efficient delivery systems. Optimizing delivery routes for efficiency and fuel consumption reduction further supports these efforts. Based on these findings, the following hypothesis is proposed:

H2: Environmental Management Practices have a positive effect on Operational Performance.

According to the RBV, operational capabilities are strategic resources that can lead to sustained competitive advantage (Barney 1991). The NRBV (Hart, 1995) extends this by emphasizing environmental responsiveness as a pathway to superior performance. Environmental management practices that enhance operational performance—such as cost efficiency, quality, and flexibility—reflect valuable internal capabilities that improve financial outcomes (Klassen and McLaughlin 1996; Tibor and Feldman 1996). Thus, improved operations serve as a strategic bridge to financial performance.

Famiyeh, Adaku, Amoako-Gyampah, Asante-Darko, and Amoatey (2018) demonstrated that EMP enhances operational performance by reducing costs, improving quality, and increasing delivery efficiency and flexibility over time. Operational performance resulting from environmental management practices helps minimize adverse environmental impacts (Klassen and McLaughlin, 1996; Tibor and Feldman, 1996; Rothenberg, Pil, and Maxwell 2001). Resource savings in operational performance contribute to cost reductions, thereby improving financial performance. Several studies have confirmed a significant relationship between competitive costs and environmental performance (Tibor and Feldman, 1996). Consumption reductions also contribute to cost efficiency, as evidenced in the study by Kumar, Teichman, and Timpernagel (2012). The use of eco-friendly raw materials helps reduce environmental impact, while lower operational costs contribute to improved financial performance. Enhancing product quality reduces rework costs. Evaluating supply chains and improving raw material quality strengthen consumer trust, thereby enhancing financial performance. Delivery efficiency further signals minimal resource usage, reducing costs and significantly impacting financial performance (Rao, Rao, and Muniswamy 2011). Increased operational flexibility enables companies to respond effectively to high-volume orders and product development changes, ultimately driving sales growth and financial performance. Based on these findings, the following hypothesis is proposed:

H3: Operational Performance has a positive effect on Financial Performance.

From the RBV perspective, internal capabilities such as environmental management and accounting systems are strategic assets that enhance performance (Barney 1991). The NRBV further emphasizes environmental practices as vital for achieving long-term competitive advantage (Hart 1995). EMA provides accurate and relevant environmental cost information, while EMP translates this information into actionable practices. Together, they function as organizational capabilities that enhance operational outcomes such as efficiency, quality, and resource utilization (Fuzi, Habidin, Janudin dan Eng 2019), thereby reinforcing the strategic alignment between EMA, EMP, and operational performance.

EMP mediates the relationship between EMA and operational performance. EMP serves as a crucial tool in environmental management within an organization (Fuzi, Habidin, Janudin and Ong, 2019). Prajogo, Tang, and Lai (2014) indicated that EMP strengthens the relationship between EMA and operational performance. In other words, EMP supports the development and sustainability of EMA within organizations. Studies by Feng, Zhao, and Su (2014), Jalil, Abar, Dadashian (2016), and Neves, Salgado, and Beijo (2017) provide empirical evidence that EMA and EMP significantly enhance operational performance. The implementation of EMP encourages organizations to adopt EMA and enhance operational performance through cost reduction, improved quality of environmental management, reduced consumption of raw materials and energy, and systematic evaluations of environmental impacts. Based on these findings, the following hypothesis is proposed:

H4: Environmental Management Accounting Practices have a positive effect on Operational Performance through Environmental Management Practices.

The RBV suggests that superior performance stems from internal capabilities that are valuable, rare, and well-organized (Barney 1991). When effectively embedded into operations, EMP functions as a strategic capability that drives process improvements, resource efficiency, and cost control—key components of operational performance (Klassen and McLaughlin 1996). According to the NRBV, environmental responsiveness and sustainability initiatives are essential resources for achieving long-term competitiveness (Hart 1995; (Tibor and Feldman 1996). EMP not only strengthens a firm's ability to reduce its environmental footprint but also enhances operational outcomes such as delivery efficiency, quality, and flexibility (Mantabon, Sroufe, and Narasimhan 2007; Hanna, Rocky Newman, and Johnson 2000). These operational improvements translate into financial benefits—such as cost savings and revenue growth—as organizations become more agile and environmentally responsible, attracting positive stakeholder responses (Djuitaningsih and Ristiawati 2011).

The adoption of EMP minimizes environmental impact across all aspects of operational performance, thereby influencing financial performance by providing relevant environmental information for each operational activity (Hanna, Newman, and Johnson, 2000; Klassen and McLaughlin, 1996; Rothenberg, Pil, Maxwell, 2001; Mantabon, Sroufe, and Narasimhan 2007; Tibor and Feldman, 1996). Furthermore, Djuitaningsih and Ristiawati (2011) found that environmental performance positively impacts financial performance, as stakeholders respond favorably to corporate environmental efforts, leading to long-term revenue growth. Operational performance supported by EMP indirectly enhances financial performance. Thus, the following hypothesis is proposed:

H5: Environmental Management Practices have a positive effect on Financial Performance through Operational Performance.

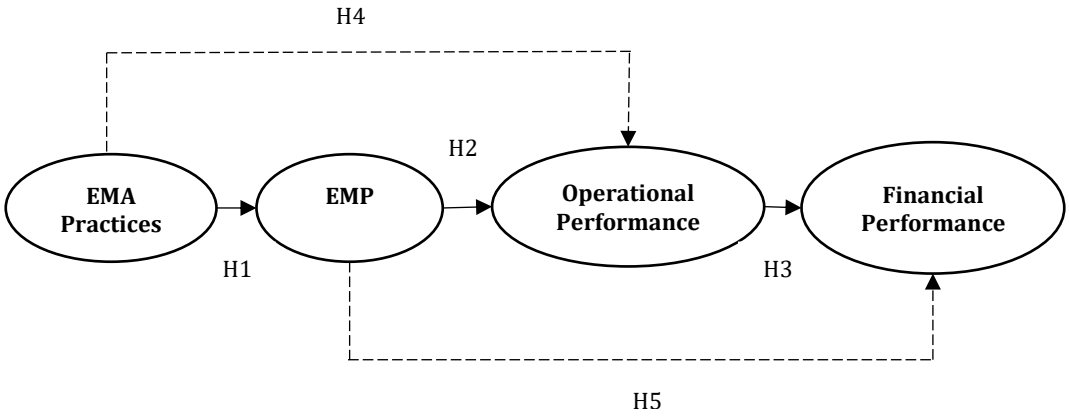

Figure 1 research framework

Method

This study adopts a quantitative research approach aimed at examining the relationships among environmental management accounting (EMA), environmental management practices (EMP), operational performance (OP), and financial performance (FP). The study population consists of small and medium-sized enterprises (SMEs) operating in Central Java, Indonesia, particularly those that implement environmentally oriented operations using green or recycled raw materials. Due to the absence of a centralized database, the exact number of such SMEs is unknown. Given the niche characteristics of the target population and the lack of a centralized registry, a non-probability sampling method—specifically snowball sampling—was adopted. Although snowball sampling is more commonly associated with qualitative research, it is deemed appropriate in this context for reaching hard-to-identify

respondents who meet the specific criteria of environmentally oriented SMEs (Sarstedt, Bengart, Shaltoni, and Lehmann. 2017).

Due to these constraints, the sample size was determined based on the minimum requirement for multivariate analysis, which is at least 30 respondents to meet the assumption of normality (Wahyuni 2020). A total of 107 SMEs participated in the study; however, only 98 respondents were included in the final sample and analyzed, while 9 responses were excluded because the SMEs did not meet the green criteria. Primary data were collected through a structured questionnaire distributed directly to business owners or managers. The questionnaire includes items adapted from previously validated studies and employs a Likert scale to measure the constructs. Data collection was conducted over a period of three months, ensuring both confidentiality and voluntary participation.

For data analysis, this study employs Partial Least Squares Structural Equation Modeling (PLS-SEM) using the SmartPLS software. PLS-SEM is chosen for its ability to estimate complex models with relatively small sample sizes and to address issues such as inadmissible solutions and factor indeterminacy (Tenenhaus, Vinzi, and Catheline 2005). The analysis includes both measurement model assessment (validity and reliability of indicators) and structural model evaluation (hypothesis testing), aligning with recommendations for variance-based SEM approaches (Ghozali, 2021). Table 2 outlines the operationalization of the variables, including the indicators and measurement scales used in the study.

Results and discussion

Table 2 profile of respondent

Demographic	Category	Frequency (n)	Percentage (%)
Gender	female	58	59%
	male	40	41%
Age	< 20 y.o	2	2%
	20-40 y.o	58	59%
	Over 40 y.o	38	39%
Length of time in Business	0-10 y	79	81%
	11-20 y	10	10%
	Over 21 y	9	9%
Employees	1 – 5	89	91%
	6 -20	8	8%
	Over 20	1	1%
Income	1-12 million	62	64%
	13-24 million	22	22%
	25 million -	14	14%

Source: primary data (processed, 2025)

Table 2 presents the demographic profile of the respondents, including variables such as gender, age, education level, and business characteristics. The subjects of this study are the managers of green SMEs in Central Java. The total number of respondents was 98 SMEs. Based on the research results, the gender distribution of green SME managers is as follows: 59% are female and 41% are male.Therefore, the respondents in this study are predominantly female.

In terms of age, most respondents are between 20 and 40 years old, followed by those over 40 years old. This indicates that the owners of green SMEs are generally in the mature and experienced age group. The smallest group is under 20 years old. The majority of respondents employ 1 to 5 employees, followed by 8 respondents who employ 6 to 20 employees, and only one respondent employs more than 21 employees.

In terms of turnover, 63% of the green SMEs generate revenue in the range of 1 to 12 million rupiahs. 22% have a turnover between 13 and 24 million rupiahs, and 14% have a turnover of more than 25 million rupiahs. Therefore, it can be concluded that the respondents are predominantly green SMEs with a turnover of 1 to 12 million rupiahs. Regarding business duration, 81% of the respondents have been operating for 0 to 10 years, 10% for 11 to 20 years, and 9% for more than 21 years. *Hence, the respondents are predominantly green SMEs that have been operating for 0 to 10 years.*

Validity and reliability testing

Table 3 presents the results of the validity and reliability testing for all constructs in this study. Convergent validity was assessed using the Average Variance Extracted (AVE) and item loading values. The results show that all AVE values exceeded the recommended threshold of 0.50, and all item loadings were above 0.70, indicating that the indicators are well-correlated with their respective constructs.

Discriminant validity was evaluated through cross-loading analysis. Each item showed a higher loading on its associated construct than on other constructs, confirming adequate discriminant validity . Reliability was tested using Cronbach's Alpha and Composite Reliability. All constructs demonstrated Cronbach's Alpha values above 0.70 and Composite Reliability values exceeding 0.80, confirming that the measurement model is internally consistent and reliable.

Table 3 validity and reliability testing

Variables	Indicators	Outer loadings	Cronbach's alpha	Composite reliability	AVE
Financial performance	FP1	0.824	0,856	0,913	0,777
	FP2	0.911			
	FP3	0.907			
EMA practices	EMAP1	0.944	0,962	0,970	0,868
	EMAP2	0.935			
	EMAP3	0.930			
	EMAP4	0.949			
	EMAP5	0.899			
Environmental management practices	EMP1	0.863	0,939	0,953	0,804
	EMP2	0.907			
	EMP3	0.908			
	EMP4	0.898			
	EMP5	0.906			
Operasional performance	OPC.1	0.724	0,940	0,948	0,605
	OPC.2	0.753			
	OPD.1	0.798			
	OPD.2	0.783			
	OPD.3	0.769			
	OPD.4	0.791			
	OPF.1	0.750			
	OPF.2	0.803			
	OPQ.1	0.722			
	OPQ.2	0.823			
	OPQ.3	0.769			
	OPQ.4	0.838			

Source: primary data (processed, 2025)

Table 1 Constructs and Their Measurement Items

Variables	Indicator	Questionnaire Statements	Reference	Scale
Financial performance	1. The organization's ability to increase profits,	The SME I manage demonstrates consistent profit growth.	Wijayanti (2016)	1-5 1 = "very poor" 5 = "very good."
	2. its ability to maintain financial stability,	The SME I manage practices effective financial management.		
	3. its ability to meet its obligations.	The SME I manage is financially capable of meeting its obligations.		
EMA Practices	4. Identification of environmental costs,	The SME I manage consistently identifies environmental costs.	Solovida and Latan (2017) Fuzi, Habidin, Janudin and Ong, (2019)	1-5 1 = "not done at all" 5 ="significantly done."
	5. Classification of environmental costs,	The SME I manage consistently classifies environmental costs.		
	6. Allocation of environmental costs for the production process,	The SME I manage allocates environmental costs to the production process.		
	7. Improvement of environmental management costs,	The SME I manage has improved its environmental cost management.		
	8. Use of environmental cost accounts.	The SME I manage has implemented environmental cost accounts.		
Environmental Management Practices	9. Raw material consumption,	The SME I manage has reduced the use of raw materials.	Famiyeh, Adaku, Amoako-Gyampah, Asante-Darko, and Amoatey (2018)	1-5 1 = "not done at all" 5 ="significantly done."
	10. Energy consumption,	The SME I manage has reduced energy consumption.		
	11. Water consumption,	The SME I manage has reduced water consumption.		
	12. Conservation of natural resources,	The SME I manage has contributed to managing the surrounding environment.		
	13. Pollution prevention	The SME I manage has taken actions to prevent pollution in its operations.		
Operational performance	***Operational cost reduction***		Famiyeh, Adaku, Amoako-Gyampah, Asante-Darko, and Amoatey (2018)	1-5 1 = "strongly disagree" 5 = "strongly agree."
	14. increased capacity utilization,	The SME I manage has utilized its production capacity to the fullest in manufacturing products.		
	15. reduced transportation costs	The SME I manage applies delivery standards to minimize delivery delays.		
	Competitive operational delivery performance			
	16. delivery reliability,	The SME I manage apply clear standards to minimize shipping delays		
	17. faster delivery speed,	The SME I manage always deliver products on time as requested by customers		
	18. increased production time, improved on-time shipment quantity	The SME I manage produce products quickly to meet customer demand without compromising quality.		
	19. Timely and Accurate Delivery	The SME I manage ensure the right quantity of products is delivered on time.		
	Flexibility performance			
	20. rapid changes in design,	The SME I manage frequently makes rapid changes or improvements to its products.		
	21. reduced transition or setup time	The SME I manage easily adapts to changes in market demand.		
	Quality improvement performance			
	22. reduction of organizational imperfections,	The SME I manage has minimized the number of defective products.		
	23. product reliability,	The SME I manage has minimized product failures.		
	24. reduction of customer complaints,	The SME I manage has minimized customer complaints.		
	25. implementation of quality management systems.	The SME I manage has implemented standard practices to ensure product quality.		

Hypothesis Test

Table 4 direct and indirect effect

Hypothesis	Original Sample	T statistics	P Values	Results
H1: EMAP → EMP	0.801	19.205	0.000	Accepted
H2: EMP → OP	0.237	1.582	0.114	Not supported
H3: OP → FP	0.520	6.444	0.000	Accepted
H4: EMAP → EMP → OP	0,189	1.571	0,116	Not supported
H5: EMP → OP → FP	0.123	1.473	0,141	Not supported

Source : Primary data (processed, 2025)

The results of hypothesis testing using the SEM-PLS approach are summarized in Table 4. The findings provide empirical support for several proposed relationships. Hypothesis 1, which posits that environmental management accounting practices (EMAP) positively influence environmental management practices (EMP), is supported. The path coefficient is 0.801 with a t-statistic of 19.205 and a p-value of 0.000, indicating a strong and statistically significant relationship. Hypothesis 2, which proposes that environmental management practices have a positive effect on operational performance (OP), is not supported. The path coefficient is 0.237 with a t-statistic of 1.582 and a p-value of 0.114, which does not meet the threshold for significance. Hypothesis 3 is supported, showing that operational performance positively affects financial performance (FP), with a path coefficient of 0.520, a t-statistic of 6.444, and a p-value of 0.000.

Hypothesis 4, which examines the mediating effect of EMP on the relationship between EMAP and OP, is rejected. The indirect effect has a coefficient of 0.189 with a t-statistic of 1.571 and a p-value of 0.116, suggesting that the mediation is not statistically significant. Similarly, Hypothesis 5, which suggests that operational performance mediates the relationship between EMP and financial performance, is also not supported. The coefficient is 0.123 with a t-statistic of 1.473 and a p-value of 0.141. These findings indicate that while EMAP has a direct and strong influence on EMP, and operational performance contributes significantly to financial performance, the expected mediating effects do not hold in this study's context. Based on Table 4, Hypotheses 4 and 5 are not supported, indicating that the mediating variables do not significantly mediate the relationship between the independent and dependent variables, and therefore, mediation testing using VAF is unnecessary.

Environmental management accounting practices and environmental management practices

These results provide robust support for the acceptance of Hypothesis 1, confirming that the implementation of EMA practices substantially enhances the environmental management practices adopted by green SMEs. These empirical findings align with the NRBV theory outlined in this study and are consistent with the foundational principles of the RBV as articulated in Barney (1991) work, which posits that competitive advantage is derived from valuable company resources and capabilities. The NRBV emphasizes strategic capabilities for environmental stewardship, such as stewardship product strategies. One such strategy encourages companies to be environmentally productive, beginning with the selection of raw materials and components from suppliers, with the aim of minimizing environmental impacts throughout the entire supply chain. Hart (1995) similarly argues that firms within growing markets are inclined to advance their environmental strategies to achieve reductions in product system life-cycle costs. By engaging in strategic product procurement, firms can disengage from environmentally damaging operations, restructure current product systems to minimize environmental liabilities, and innovate new offerings that incur lower costs throughout their life cycles.

From an accounting perspective, this relationship also emphasizes the strategic role of EMA as a management accounting system specifically designed to capture, measure, and

communicate environmental costs and performance. EMA enables green SMEs to systematically integrate environmental considerations into their accounting processes, such as budgeting, performance evaluation, and cost control. This integration reflects the essence of strategic management accounting, where environmental data becomes an integral part of business decision-making and resource allocation.

All EMA practices contribute to improving EMP, including energy savings (electricity, fuel, or gas), the selection of production sites that do not negatively impact the environment, safe waste disposal, and appropriate water usage. As a result, both the operational and financial performance of the company are expected to improve.

This result aligns with prior studies that demonstrate a strong positive association between the implementation of EMA and improvements in corporate sustainability performance. By adopting EMA, companies can improve their environmental performance (Frost and Toh 2021). Furthermore, the adoption of EMA can enhance environmental management practices (Christ and Burritt 2013) and serve as an important tool for achieving corporate sustainability goals (A. Jamil and Haniffa 2023). Research also demonstrates improvements in environmental performance through EMA implementation (Gunarathne, Lee, and Herath 2022). This study also aligns with Solovida and Latan (2021), who explored the relationship between sustainable supply chain management and EMA and proposed directions for future research in this field. It can be concluded that this study is relevant to previous research and signifies the benefits of EMA practices in enhancing EMP across sectors and countries.

The results suggest that adopting EMA can serve as a practical step for green SMEs aiming to strengthen their environmental management practices. This implies a need for greater support from policymakers and industry stakeholders in encouraging the use of EMA as a means to improve environmental performance and sustain business competitiveness.

Environmental management practices and operational performance

In this study, Hypothesis 2, which posits that EMP positively influence OP, is not supported. Although green SMEs have adopted environmental management practices, these practices have not yet contributed to improvements in their operational performance. While these environmentally conscious SMEs care about the environment, they have not been able to effectively reduce their operational costs. The reduction in operational costs has not led to increased profits for these green SMEs, even though many strive to cut costs to achieve profitability. Adopting environmental management practices could be a solution for reducing operational costs, such as minimizing potential liability costs, legal expenses, and insurance costs resulting from their business activities. Moreover, implementing environmental management practices may help save resources, which in turn can reduce the operational costs of green SMEs.

From a theoretical perspective, the insignificant findings can be interpreted using the RBV and its extension, the NRBV. RBV suggests that a firm's sustainable competitive advantage derives from the possession and deployment of valuable, rare, inimitable, and non-substitutable (VRIN) resources. EMPs, when deeply embedded into a firm's operations and culture, may qualify as such resources. However, in the context of green SMEs, these practices may still be in a nascent stage and not yet sufficiently developed or integrated to influence operational outcomes. NRBV builds upon RBV by emphasizing the strategic potential of capabilities that address environmental concerns, particularly when they foster innovation, efficiency, and regulatory compliance. The findings of this study suggest that while EMP hold promise from a strategic standpoint, their operational impact may be contingent upon the maturity of implementation, organizational learning, and the availability of complementary resources—factors that may still be evolving among SMEs.

This study contrasts with the research conducted by Liu, Yue, Ijaz, Lutfi and Mao. (2023), which investigated how green innovation practices, responsible leadership, and green human resource management (Green HRM) contribute to sustainable business performance. That study demonstrated that such practices positively impact operational performance. Evidence also showed that green innovation and responsible leadership significantly contributed to sustainable operational performance through the mediation of pro-environmental behavior. Another study found that green supply chain management practices, such as waste reduction and the use of renewable energy, significantly improved companies' operational performance through increased efficiency and reduced operational costs (Abdallah and Al-ghwayeen 2020). Additionally, the implementation of environmental management and green innovation was found to have a positive correlation with operational performance, emphasizing the importance of such innovations in improving operational efficiency and reducing environmental costs.

Previous studies have shown that EMP not only benefit environmental sustainability but also provide operational advantages for companies by improving efficiency, reducing costs, and ensuring compliance with environmental regulations. However, this study does not yet provide significant evidence that EMP affect OP.

The findings indicate that while environmental management practices are being adopted, they may not yet be fully integrated or optimized to yield operational benefits for green SMEs. This highlights the need for practical guidance, training, and stronger institutional support to help SMEs realize the operational value of their environmental efforts.

Operational performance and financial performance

Hypothesis 3, which states that operational performance positively affects financial performance, is supported. Competitive operational performance—reflected in cost efficiency, quality improvement, timely delivery, and operational flexibility—positively influences financial outcomes. In this study, many green SMEs have adopted operational cost-reduction strategies, such as utilizing natural raw materials, producing environmentally friendly quality products, meeting delivery standards, and improving adaptability in their operations. These practices have helped improve overall operational performance, which in turn has contributed to stronger financial results.

This finding aligns with previous studies by Famiyeh, Adaku, Amoako-Gyampah, Asante-Darko, and Amoatey (2018) and Kumar, Teichman, and Timpernagel (2012), which highlight that operational efficiency can generate resource savings and lower costs, leading to better financial performance. From a theoretical perspective, this result is consistent with the RBV, which emphasizes that firms gain competitive advantage when they develop and utilize internal resources and capabilities that are VRIN. Operational performance, when developed through continuous improvement and embedded in routines, can become a strategic resource that enhances a firm's financial strength. The NRBV further extends this by recognizing that environmentally oriented capabilities—such as eco-efficient operations or sustainable sourcing—can contribute to both environmental and financial performance when aligned with the firm's long-term strategy. In this context, green SMEs that effectively integrate environmental considerations into their operations are not only reducing costs but also creating value in a way that is difficult for competitors to replicate, thus strengthening their financial position.

Improving operational performance through sustainable practices appears to be a practical strategy for green SMEs aiming to strengthen their financial outcomes. When efficiency, quality, and flexibility are embedded into day-to-day operations, businesses are better positioned to reduce costs and enhance value creation. This underlines the strategic importance of investing in eco-efficient capabilities.

The mediating role of environmental management practices in the relationship between EMA practices and operational performance

Hypothesis 4, which proposes that environmental management practices (EMP) mediate the relationship between environmental management accounting (EMA) practices and operational performance, is not supported.

Theoretically, EMA practices are expected to enhance operational performance through the strategic implementation of EMP. EMA provides relevant and accurate information regarding environmental costs and impacts, which should enable firms to develop and implement environmentally sound practices—such as waste minimization, energy efficiency, and resource optimization (Burritt & Schaltegger,2010; Christ & Burritt 2013). However, the absence of a significant mediating effect in this study suggests that the translation from EMA insights into tangible EMP actions may not be effectively occurring. In particular, for smaller enterprises such as SMEs, EMP implementation may remain symbolic or superficial due to resource limitations, managerial capacity, or lack of environmental expertise (Christ and Burritt 2013).

This finding can be interpreted through the lens of the Resource-Based View (RBV) and the Natural Resource-Based View (NRBV). According to RBV, information systems like EMA can serve as strategic resources only when they are actively leveraged to develop capabilities that are valuable, rare, inimitable, and non-substitutable. However, if the environmental data generated by EMA is not operationalized into effective practices, its strategic value remains latent. NRBV further extends this view by emphasizing that the ability to convert environmental knowledge into operational benefits depends on the firm's capacity to integrate sustainability into its core processes and routines. In the context of this study, the weak mediation effect implies that while EMA may provide a foundation for EMP, the lack of integration, institutional support, or strategic alignment may inhibit these practices from delivering improved operational outcomes.

Moreover, this result reinforces the idea that information availability alone is insufficient to drive performance improvements. As recent research suggests, the performance impact of EMA depends on an organization's readiness and commitment to implementing environmental strategies (Gerged et al. 2024). Thus, achieving operational benefits from EMA requires not only accurate environmental information but also the existence of complementary resources, organizational capabilities, and a culture that supports proactive environmental management.

The lack of a mediating effect highlights the need for stronger integration between environmental accounting and management practices. For green SMEs, it is crucial to move beyond data collection toward actionable strategies. Strengthening internal capabilities and aligning environmental goals with daily operations may help unlock the full potential of EMA.

The mediating role of operational performance in the relationship between environmental management practices and financial performance

Although environmental management accounting (EMA) provides accurate information regarding environmental costs and impacts, the empirical findings do not support Hypothesis 5, which proposes that operational performance mediates the relationship between environmental management practices (EMP) and financial performance. The indirect effect is not supported. Based on RBV, the absence of a mediating effect suggests that EMP have not yet evolved into strategic capabilities that can enhance operational performance. Without the transformation of practices into embedded routines and efficiencies, the pathway from EMP to financial performance via operational outcomes remains limited for green SMEs.

This may reflect a misalignment between the formulation and execution of environmental strategies, where firms are unable to translate EMA data into effective EMP that improve operations. From the RBV, this suggests that although EMP could be considered a valuable

internal capability, it must be fully integrated into operational routines to generate performance outcomes. Meanwhile, the NRBV posits that environmental capabilities only yield competitive advantage when supported by complementary organizational factors such as culture, leadership, and innovation. In many SMEs or less regulated sectors, EMP implementation may still be symbolic or constrained by limited resources.

Additionally, as noted by Khan and Yu (2021), environmental initiatives often deliver benefits over a longer time horizon. Hence, short-term empirical studies may underestimate the mediating role of EMP in enhancing performance. External pressures such as regulatory demands, stakeholder expectations, or economic uncertainty may also exert a more direct influence on operational performance, overshadowing the gradual internal impact of EMP. These findings reinforce the idea that strategic environmental practices need to be deeply embedded, adequately supported, and sustained over time before they can significantly contribute to financial outcomes through improved operations.

Conclusions

This study highlights the important role of environmental management accounting (EMA) in encouraging green SMEs in Indonesia to adopt improved environmental management practices (EMP). However, despite the adoption of these practices, the expected improvements in operational performance were not clearly evident. This suggests that achieving operational gains from environmental initiatives may take time or require better alignment with the firm's internal strategies and resources.

Interestingly, operational performance remains a key driver of financial outcomes, reinforcing the idea that operational excellence is essential for financial sustainability. These findings suggest that while environmental practices are crucial, their benefits may not be immediately observable, and their success may depend on broader organizational or contextual factors.

The findings enrich the current body of knowledge by confirming that EMA functions not only as an accounting tool but also as a strategic lever to drive environmental initiatives within small and medium-sized enterprises. While prior studies suggest a linear link between environmental practices and performance, this research indicates that the pathway may be more complex and indirect—particularly in the context of SMEs operating in emerging markets like Indonesia, where formal systems and environmental infrastructure are still evolving. This calls for a reconsideration of how the role of environmental practices is conceptualized within performance models.

For SME owners and managers—especially those aiming to operate more sustainably—this study offers a clear message: adopting environmental management accounting can significantly improve environmental practices, which, over time, may lead to better financial outcomes. Although the link to operational performance is not immediate, it is still important to invest in environmental strategies and align them with long-term business goals. Policymakers and SME support agencies should also consider providing technical assistance and practical tools to help SMEs better translate their environmental efforts into operational improvements.

This research was conducted with certain limitations. Due to the lack of a formal registry for green SMEs in Indonesia, respondents were identified through a snowballing method, which may introduce bias. Furthermore, the study relied on a structured questionnaire, which may not fully capture the scope and diversity of EMA and EMP across different industries. Future research could explore these dynamics further—perhaps over a longer time horizon or across different sectors—to better understand how environmental efforts contribute to long-term performance. A case study or interview-based approach could also be adopted to explore the underlying mechanisms and contextual factors that influence how environmental strategies are implemented and their eventual impact on business performance.

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