

FOSTERING EAST JAVA MSME SUSTAINABILITY THROUGH GREEN ACCOUNTING AND ENVIRONMENTAL MANAGEMENT ACCOUNTING

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ABSTRACT: This study examines the effects of green accounting awareness (GAA) and environmental compliance (EC) on MSME sustainability, with environmental management accounting (EMA) as a mediating variable. Using a quantitative cross-sectional survey, primary data were collected through structured questionnaires from MSME owners and managers in East Java, Indonesia, selected purposively based on their direct involvement in financial or environmental decision-making. Of 300 questionnaires distributed, 262 were complete and usable. The hypotheses were tested using Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS 3. The results show that GAA has no significant direct effect on MSME sustainability, suggesting that environmental knowledge alone is insufficient without effective managerial implementation. In contrast, EC has a significant positive effect on sustainability. GAA and EC both positively influence EMA, and EMA significantly contributes to MSME sustainability. Moreover, EMA mediates the relationships between GAA and sustainability, as well as between EC and sustainability, indicating that environmental knowledge and regulatory compliance are more effective when embedded in systematic accounting practices. These findings highlight EMA as a strategic capability that converts environmental awareness and compliance into sustainable performance. Policymakers and MSME support institutions should strengthen EMA-based capacity building, environmental cost management training, and standardized reporting practices to improve compliance, decision-making, and long-term sustainability.

Keywords: *green accounting awareness, environmental compliance, environmental management accounting, MSME sustainability*

Code JEL : Q56, M41, Q51

INTRODUCTION

The rapid development of the business world has driven companies to compete continuously in meeting increasingly growing consumer demands, while also facing stricter requirements to ensure that their operational activities do not generate negative environmental impacts. Sustainability has long been a major concern for boards of directors in large corporations. However, the situation is different for micro, small, and medium-sized enterprises (MSMEs),

which generally still have relatively limited awareness of and access to information on sustainability practices [1]. At the global level, small and medium-sized enterprises (SMEs) account for approximately 90% of all business entities and play an important role in the economic, social, and environmental structure of nearly every country [2]. Despite their substantial contribution, research on sustainability and sustainability reporting frameworks over the past several decades has remained dominated by large and multinational companies. As a result, SMEs have tended to remain on the periphery of debates on environmental reporting, even though the aggregate ecological pressure they generate cannot be ignored [2]. In line with this, O'Reilly, et al. [3] found that limited managerial resources and the absence of reporting guidance tailored to the characteristics of small businesses make the implementation of environmental sustainability reporting difficult to carry out consistently.

This issue applies on a much larger scale in Indonesia. As the country with the largest population of micro, small, and medium enterprises (MSMEs) in the world, Indonesia has approximately 66 million MSME units, which absorb around 97% of the national workforce [4]. This scale underscores that MSMEs are not merely peripheral economic actors, but the main pillar of the national economy with substantial social and economic weight. Behind this contribution, however, Indonesian MSMEs continue to operate with limited awareness and capability in managing the environmental impacts of their production activities, a gap that becomes increasingly consequential as their aggregate ecological footprint grows in proportion to their economic scale.

East Java is one of the Indonesian provinces with the largest concentration of MSMEs, with more than 1.15 million registered business units, and its contribution to the provincial gross regional domestic product has continued to rise, reaching 59.18% in 2023. MSMEs are also the main source of employment absorption in the province, accommodating around 95–96% of the total labor force [5]. Unfortunately, the rapid growth of MSMEs in East Java has also placed pressure on the environment, particularly through small- and medium-scale production activities in the manufacturing and processing sectors, which generate solid waste, liquid waste, and pollutants that are often not adequately controlled. MSMEs of this scale and density carry an environmental footprint disproportionate to the regulatory attention they receive, positioning East Java as an empirically grounded, yet still largely uncharted, site for examining how MSMEs internalize environmental accountability.

Addressing these challenges requires MSMEs to strengthen their environmental awareness and environmental compliance, thereby enhancing the long-term sustainability of their businesses. Several studies conducted in developing countries, including Yemen, India, and Bangladesh, have demonstrated that green accounting awareness (GAA) is an important predictor of improved organizational performance [6-8]. However, these studies have primarily focused on large companies rather than MSMEs. Moreover, Vagnoni, et al. [9], drawing on 681 European service SMEs across 35 countries, demonstrate that resource-efficiency practices embedded in a circular-economy framework shape SMEs' cost structures and carbon-neutrality strategies findings enabled by an institutional environment in which environmental regulation and reporting expectations are already well established. Such conditions differ markedly from the Indonesian MSME setting,

where environmental reporting obligations under OJK Regulation No. 51/POJK.03/2017 apply to listed issuers and financial institutions rather than to MSMEs, leaving green accounting awareness among Indonesian MSME actors comparatively under-theorized relative to their developed-economy counterparts.

Environmental compliance (EC) research reveals a parallel asymmetry. Sri Wahyuningrum, et al. [10], tracking 767 sustainability reports of Indonesian listed companies between 2016 and 2022, found that the transition from voluntary to mandatory sustainability reporting increased the number of reports published but did not improve the quality of environmental disclosures. The authors attributed this phenomenon to nominal compliance, whereby organizations comply with regulatory requirements primarily as a formality rather than through substantive implementation. Because mandatory sustainability reporting applies only to publicly listed companies, environmental compliance among Indonesian MSMEs remains entirely voluntary, in contrast to several other jurisdictions where environmental compliance obligations have been extended to SMEs. Moreover, the existing empirical evidence on environmental compliance has predominantly been generated from regulatory contexts in which compliance is legally mandated [11, 12]. Consequently, voluntary environmental compliance among MSMEs operating within an evolving regulatory environment such as Indonesia remains relatively underexplored.

A further gap concerns the mechanism connecting awareness and compliance to sustainability outcomes. EMA has been examined primarily as a direct predictor of firm-level environmental or financial performance [13], and a systematic review by Swalih, et al. [14] of the drivers, barriers, and outcomes of EMA for strategic decision-making likewise treats EMA as an antecedent or outcome variable rather than as the mechanism through which upstream constructs such as environmental awareness and compliance are converted into sustainability performance. Mukwarami and van der Poll [15] explicitly note that the theoretical mechanisms linking SMEs' EMA implementation to sustainable outcomes in developing economies remain underdeveloped and call for continued theoretical and empirical attention. To date, no identified study has positioned EMA as a mediating mechanism between green accounting awareness, environmental compliance, and MSME sustainability performance within an Indonesian, or more specifically East Javanese, setting.

This study addresses these gaps by examining how green accounting awareness and environmental compliance influence MSME sustainability performance in East Java, with EMA positioned as the mediating mechanism. The contribution of this study is two-fold. First, it extends the green accounting and environmental compliance literature previously concentrated in developed-economy and listed-company settings to the voluntary-compliance context of Indonesian MSMEs, using East Java's substantial and predominantly micro-scale MSME population as an empirically grounded setting. Second, it responds to the explicit call for further theoretical development of EMA's role in SME sustainability outcomes by testing EMA as a mediating variable, offering evidence on the accounting mechanism through which awareness and compliance are converted into measurable sustainability performance among MSMEs in a developing-economy regulatory environment.

1. THE LITERATURE REVIEW

Resource-Based View (RBV), originally proposed by [16] and subsequently extended by [17] through the VRIN (Valuable, Rare, Inimitable, Non-substitutable) framework, argues that a firm's sustained competitive advantage rests on the internal resources it controls rather than on external market positioning alone. RBV is adopted as the grand theory of this study because it speaks directly to the research problem: explaining why MSMEs exposed to the same regulatory environment nonetheless convert green accounting awareness (GAA) and environmental compliance (EC) into sustainability outcomes to very different degrees. Where institutional or stakeholder-based accounts locate environmentally responsible behavior mainly in external pressure, RBV instead locates the source of that variation inside the firm in resources and capabilities that competitors cannot easily replicate [17]. This internal-capability lens fits a study whose object is not compliance itself but the mechanism, environmental management accounting (EMA), that converts compliance into a durable competitive position.

RBV's relevance to environmental and accounting-based capabilities specifically is reinforced by its natural-resource-based extension, which frames a firm's relationship with the natural environment as itself a source of competitive advantage through capabilities such as pollution prevention and proactive environmental strategy [18]. Recent empirical work in environmental accounting continues to use RBV as the theoretical anchor for treating EMA as a strategic, VRIN-consistent capability rather than a compliance cost: EMA has been shown to translate into corporate environmental performance through green process innovation [19], to function as the internal accounting infrastructure behind strategic environmental decision-making [14], and green environmental capabilities more broadly have been shown to generate innovation performance through the same resource-based logic [20]. Positioning GAA, EC, and EMA within this stream of research, the present study treats green accounting awareness, environmental compliance, and environmental management accounting as internal, hard-to-imitate resources through which MSMEs build the environmental capabilities needed for long-term sustainability consistent with RBV's central proposition and directly tied to this study's title and constructs.

GAA is an intangible strategic resource that has the VRIN characteristics of valuable, rare, inimitable, and non-substitutable as conceptualized by the Resource-Based View (RBV). SMEs with a high environmental awareness are in a better position to exploit this knowledge-based resource as a source of sustained competitive advantage in markets that are increasingly sustainability-oriented. [21] in Europe and [22] in South Korea, provide empirical evidence that green accounting awareness positively influences various aspects of SME sustainability, including revenue growth, employee retention, and customer satisfaction. Moreover, in the case of emerging markets, [23] asserts that knowledge of green accounting is a more valuable strategic asset because of the relative shortage of firms that have such knowledge, thus further supporting its role as a unique source of sustainable competitive advantage.

The Resource-Based View (RBV) posits that the ability to comply with environmental rules is a regulatory compliance capability which protects firms from legal consequences and financial punishment, whilst improving stakeholder trust and providing access to the burgeoning green

market. Environmental compliance in Indian firms enhances firm performance mainly through practices such as emission reduction, waste management and resource efficiency. Compliance initiates these practices, which in turn improve the financial, customer, process and growth performance [24]. Furthermore, SMEs in Central Europe that properly understand and implement CSR show improved sustainability, in terms of increased innovation, higher customer retention and lower risk of failure [25, 26]. The findings align with the Resource-Based View (RBV), which posits that expenditures in regulatory skills exceeding the minimum compliance threshold confer a first-mover advantage that is difficult for competitors to replicate in the short term.

In theory, the recognition of green accounting creates the cognitive prerequisites for the implementation of EMA via three primary mechanisms. Initially, managers' recognition of concealed environmental costs prompts them to seek more comprehensive accounting methods to accurately reflect environmental consequences. Secondly, the perceived utility of EMA escalates when managers comprehend the strategic significance of environmental information in decision-making processes. Third, a dedication to responsible environmental stewardship fosters an organizational culture that endorses the ongoing utilization of EMA. In the Vietnamese manufacturing sector, the perspective of senior management toward the environment significantly and directly influences the selection of green production strategies and the application of EMA, which subsequently enhances green competitive advantage [27]. In Indonesian SMEs, data indicates that benefit expectation, influenced by cognitive awareness, pertains to managers' recognition of the value of environmental accounting, significantly and positively affecting EMA adoption, in addition to regulatory pressure [28].

Within the RBV framework, the capacity to adhere to environmental regulations represents a valued and rare regulatory competency, especially given the growing complexity of environmental legislation in Indonesia. [29] contend that environmental compliance pushes companies to establish more advanced environmental information management systems to meet regulatory reporting obligations. In Indian companies, environmental compliance positively influences company performance; however, this influence is entirely mediated by environmental practices, suggesting that compliance initiates environmental practices, which subsequently enhance performance [24]. In Vietnamese building materials companies, government enforcement is one of six factors that positively affects the adoption of EMA, demonstrating the most significant positive correlation with EMA implementation [30].

EMA is a dynamic capability enabling micro, small, and medium-sized organizations (MSMEs) to transform environmental information into strategic decision-making processes for enduring sustainability. The EMA contributes to organizational sustainability via four primary mechanisms: (1) minimizing environmental costs by identifying and eliminating inefficiencies in material and energy usage; (2) enhancing revenue generation through environmentally differentiated products that confer a competitive advantage; (3) mitigating regulatory and reputational risks associated with environmental performance; and (4) augmenting organizational innovation capabilities through systematic management and utilization of environmental information. These theoretical principles are empirically validated. A longitudinal research of 998

US enterprises demonstrates that superior environmental performance, driven by environmental orientation and innovation, significantly improves return on assets and return on equity, hence bolstering firms' long-term economic sustainability [31]. A thorough examination of the SME literature indicates that environmental management practices and accounting instruments, including environmental scorecards and risk management techniques, enable firms to systematically assess the financial impacts of environmental initiatives while facilitating the execution of sustainability-focused business strategies [32].

This mediation hypothesis is based on the RBV argument, supported by Dynamic Capabilities Theory [33]. EMA is a transformative process that transforms cognitive resources (awareness of green accounting) and regulatory capabilities (environmental compliance) into organizational capabilities that directly improve the sustainability of MSMEs. The mediation of EMA can be explained by the following sequential logic: green accounting awareness and environmental compliance create the motivation and need for a more complete environmental information system. EMA provides the informational infrastructure necessary to turn this motivation into concrete managerial action. Ultimately, managerial action informed by EMA leads to measurable improvements in sustainability performance. [34] explicitly identifies EMA as a mediator between environmental pressures from external environment and firms' sustainability performance. [35] confirms that EMA is a mediator in the environmental awareness- sustainability performance relationship in the context of manufacturing firms. The mediating role of EMA becomes more critical in the MSME context as the MSME resource constraints require a more systematic, information-based mechanism for resource allocation. EMA does this by incorporating environmental components into the daily management decision making process, thereby ensuring that investments in green accounting awareness and environmental compliance produce optimal sustainability outcomes.

Based on the explanation above, the following hypotheses can be formulated:

- H1. GAA has a positive and significant effect on MSME Sustainability
- H2. EC has a positive and significant effect on MSME Sustainability
- H3. GAA has a positive and significant effect on EMA
- H4. EC has a positive and significant effect on EMA
- H5. EMA has a positive and significant effect on MSME Sustainability
- H6. EMA mediates the relationship between GAA and MSME sustainability.
- H7. EMA mediates the relationship between EC and MSME sustainability.

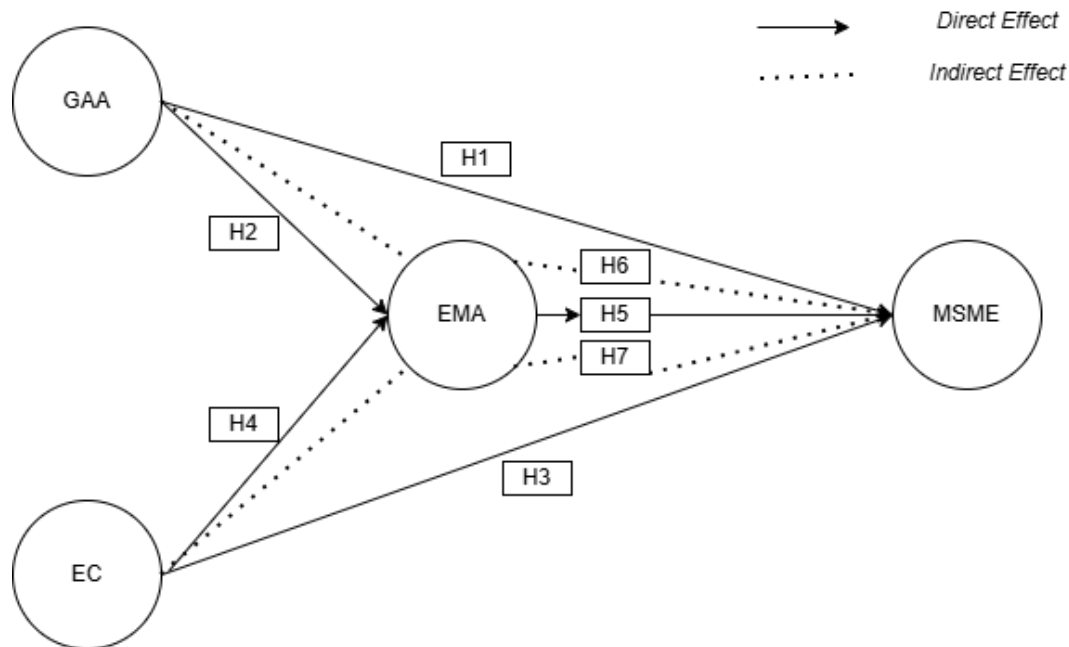


Figure 1. Framework Research

2. METHODS

The present study used a cross-sectional survey design, with data collected at one point in time. This approach was chosen for the efficiency of reaching the geographically dispersed population of MSMEs and limited time resources available for the research. The nature of data collected determined the type of data used in this study which was primary data obtained through a structured Likert-scale questionnaire instrument. The underlying research paradigm is positivism with the emphasis on objectivity of measurement, replicability of procedures and hypothesis testing by means of statistical analysis [36].

The population of this research comprised all micro, small, and medium enterprise (MSME) actors operating actively in East Java that held legal business licenses. A purposive sampling technique with predetermined inclusion criteria was employed: respondents' businesses had to have been operating for at least two years, and owners/managers had to demonstrate basic awareness of environmental regulatory aspects relevant to their business sector. This approach was chosen because the constructs under investigation green accounting awareness (GAA), environmental cost (EC), and environmental management accounting (EMA) require respondents with sufficient operational experience and environmental knowledge to provide meaningful and reliable responses. Criterion-based purposive sampling allows researchers to deliberately target information-rich cases whose characteristics align directly with the study's objectives, which strengthens the relevance and validity of the resulting data compared to random selection from an undifferentiated population [37]. Respondents in this study volunteered to participate, and the confidentiality of all respondents' business data was maintained throughout the research process. Data collection was carried out through a door-to-door approach, in which the researchers met

MSME actors directly at their business premises in East Java; this direct engagement was intended to reduce non-response bias, ensure respondents' correct understanding of the questionnaire items, and protect data reliability. Of the 285 questionnaires distributed, 262 were returned complete and usable for analysis, corresponding to a response rate of 91.9 percent.

Data analysis was performed using Partial Least Squares Structural Equation Modeling (PLS-SEM), operationalized through SmartPLS software. PLS-SEM was selected as the appropriate analytical technique for three main reasons. First, the research model involves multiple latent constructs (GAA, EC, and EMA) linked through both direct and mediating relationships, a structure for which PLS-SEM is particularly well suited given its capacity to estimate complex path models without requiring a strictly specified theoretical model as in covariance-based SEM. Second, PLS-SEM does not assume multivariate normal distribution, making it appropriate for the ordinal, Likert-scale survey data collected in this study. Third, PLS-SEM performs reliably with moderate sample sizes, and the study's sample of 262 respondents exceeds the minimum threshold recommended for models of this complexity, supporting stable and reliable parameter estimation [38]. The analysis was conducted in two stages: evaluation of the measurement model (indicator reliability, internal consistency, convergent validity, and discriminant validity), followed by evaluation of the structural model through path coefficient estimation, bootstrapping-based significance testing, and mediation analysis to examine the indirect effects of EMA.

Table 1. Measurement Variables and indicators

Variables	Indicators
Green Accounting Awareness [39], [40]	Environmental Knowledge, Environmental Awareness, Environmental Concern, Implementation Commitment
Environmental Compliance [41], [42], [43]	Regulatory Compliance, Environmental Reporting, Compliance Management System, Compliance Monitoring
MSME Sustainability [44], [45], [46]	Eco-efficiency, Community, Mitigation, Integration
Environmental Management Accounting [47], [48], [49]	Identification, Allocation, Measurement, Decision-making

Resource: Literature Review (owned)

Regression Math

Model 1 :

$$EMA = \beta_0 + \beta_1 GAA + \beta_2 EC + \varepsilon \dots \dots \dots (1)$$

Model 2 :

$$MSME = \beta_0 + \beta_1 GAA + \beta_2 EC + \beta_3 EMA + \varepsilon \dots \dots \dots (2)$$

With the following information:

β_0	= Intercept for category
GAA	= Green Accounting Awareness
EC	= Environmental Compliance
EMA	= Environmental Management Accounting
MSME	= MSME Sustainability
$\beta_0 \dots \beta_0$	= Coefficients of predictor for category
ε	= other factors outside the research model

3. RESULT AND DISCUSSION

The measuring model assessment will include several indicators such as reliability, discriminant validity and convergent validity. The test results for reliability and convergent validity are presented in Table 2.

Table 2. Outer Model, Construct Reliability and Validity Test

Variable and Item	Loading Factor	AVE	CR
Green Accounting Awareness		0.693	0.900
GAA1	0.820		
GAA2	0.873		
GAA3	0.785		
GAA4	0.851		
Environmental Compliance		0.733	0.916
EC1	0.913		
EC2	0.842		
EC3	0.867		
EC4	0.800		
Environmental Management Accounting		0.604	0.859
EMA1	0.776		
EMA2	0.722		
EMA3	0.737		
EMA4	0.865		
MSME Sustainability		0.858	0.960
MSME1	0.923		
MSME2	0.950		
MSME3	0.938		
MSME4	0.894		

Source: SmartPLS.4

Convergent validity was assessed by outer loadings and Average Variance Extracted (AVE). Table 2 demonstrates that the outer loadings of all indicators were positive and above 0.70, signifying that each indicator sufficiently elucidated its latent construct. The AVE values for all variables varied from 0.604 to 0.858, exceeding the minimum threshold of 0.50, hence confirming the fulfillment of convergent validity requirements. Reliability was assessed using Composite Reliability (CR), which ranged from 0.859 to 0.960. All constructs exhibited CR values over the 0.70 threshold, signifying an adequate level of internal consistency reliability.

Discriminant validity. Table 3 illustrates the Fornell–Larcker criterion for evaluating the discriminant validity of the notions. The square root of the Average Variance Extracted (AVE) for each construct is displayed in bold on the diagonal and was compared with the inter-construct correlations. In every instance, the square root of the AVE exceeded the corresponding correlation coefficients, indicating that each concept was empirically unique from the others. Consequently, the discriminant validity of all constructs in the model was confirmed.

Table 3. Fornell-Larcker Criteria Test

	EC	EMA	GAA	MSME
EC	0.951			
EMA	0.892	0.899		
GAA	0.856	0.887	0.910	
MSME	0.812	0.777	0.833	0.927

Source: SmartPLS.4

The structural model was evaluated by examining the coefficient of determination (R^2) that measures the extent to which the variation of endogenous constructs is predicted by the exogenous constructs that affect them [36]. The higher the value of R^2 , the greater is the ability of exogenous constructs to explain the variability of the endogenous construct. The coefficient of determination (R^2) from the full test results are shown in Table 4.

Table 4. R-Square Testing

Dependent	R-Square	Adjusted R-Square	Status
Environmental Management Accounting	0.798	0.796	Strong
MSME Sustainability	0.885	0.884	Strong

Table 4 indicates that the coefficient of determination (R^2) for the MSME Sustainability variable is 0.885, meaning that the exogenous constructs of the study model account for 88.5% of the variation in this variable. This value demonstrates strong predictive capability, as it exceeds the R^2 threshold requirement of 0.75. The EMA variable exhibited a R^2 value of 0.798, signifying that 79.8 percent of the variance in the exogenous constructs was elucidated. The model's predictive capability regarding the EMA variable is similarly robust, with a value surpassing the 0.75 threshold. Table 5 presents data applicable for assessing the significance level and doing hypothesis testing.

Table 5. Hypothesis Testing Results

	Original Sample	T-Statistic (IO/STDEVI)	P Values	Decision
GAA → MSME	0.046	0.427	0.669	Rejected (H1)
EC → MSME	0.445	4.601	0.000	Accepted (H2)
GAA→EMA	1.204	13.798	0.000	Accepted (H3)
EC → EMA	0.333	3.614	0.000	Accepted (H4)
EMA → MSME	0.497	16.405	0.000	Accepted (H5)
GAA → EMA → MSME	0.598	9.918	0.000	Accepted (H6)
EC → EMA → MSME	0.166	3.435	0.001	Accepted (H7)

The results of hypothesis testing reveal the intricacies of both direct and mediated effects on the sustainability of MSMEs. The direct impact of GAA on MSME was not statistically significant ($\beta = 0.046$, $t = 0.427$, $p = 0.669$). Awareness alone does not result in concrete sustainability outcomes. This aligns with the assertion that accounting-based knowledge requires institutional channels to influence the organization. The direct impact of EC on MSME sustainability ($\beta = 0.445$, $t = 4.601$, $p < 0.001$) was significant, corroborating the notion that regulatory compliance serves as a fundamental catalyst for sustainable performance [6]. Significantly, EMA served as the predominant mediating mechanism. GAA was a substantial predictor of EMA adoption ($\beta = 1.204$, $t = 13.798$, $p < .001$). EC was a notable predictor of EMA adoption ($\beta=0.333$, $t=3.614$, $p<0.001$). The EMA exerts a substantial direct influence on the sustainability of MSMEs ($\beta = 0.497$, $t = 16.405$, $p < 0.001$), corroborating the findings of [50] and [51]. The findings validated complete mediation in the indirect pathways GAA→EMA→MSME sustainability ($\beta = 0.598$, $t = 9.918$, $p<0.001$) and EC→EMA→MSME sustainability ($\beta = 0.166$, $t = 3.435$, $p = 0.001$). This underscores the function of EMA as a transformative intermediary in systematically converting environmental knowledge and compliance requirements into sustainable corporate practices [52, 53].

Based on the hypothesis testing results, GAA does not have a significant effect on MSME sustainability; therefore, H1 is rejected. GAA appears insufficient on its own because MSMEs often recognize the importance of sustainability but still lack the knowledge, tools, time, data systems, and human resource capacity required to translate that awareness into measurable sustainability practices [3, 54, 55]. Furthermore, cost constraints and short-term financial pressures diminish the effectiveness of green accounting awareness, as MSMEs tend to prioritize low-cost operational practices and frequently avoid investing in environmental accounting initiatives when the expected benefits are not immediately observable [54]. Taken together, these findings suggest that green accounting awareness has not yet emerged as a critical predictor of MSME sustainability, primarily due to limited organizational resources, shortages of skilled personnel, and inadequate government support.

Based on the hypothesis testing results above, EC has a positive and significant effect on MSME sustainability; therefore, H2 is accepted. Compliance-related environmental action often improves not only environmental outcomes but also business survival and efficiency. Ghanaian MSMEs reported that sustainable business practices help ensure business continuity, reduce costs, and enhance productivity and operational efficiency [56]. Several studies connect compliance-oriented green action to broader firm performance [57, 58]. The RBV is particularly relevant because it identifies three key sustainability capabilities: pollution prevention, product stewardship, and sustainable development. That framework matches the empirical mechanisms in these studies, where compliance pushes MSMEs to prevent waste and pollution, improve processes, and embed environmental stewardship into strategy and culture [54, 56, 59].

Based on the hypothesis testing results above, GAA has a positive and significant effect on EMA; therefore, H3 is accepted. Green accounting awareness may promote environmental management accounting (EMA) by integrating environmental concerns into standard accounting

activities and organizational decision-making. RBV integrates these findings by viewing green accounting awareness as an intangible asset that strengthens a firm's ability to develop valuable environmental information capabilities [14, 60]. The present finding aligns with Swalih, et al. [14] and Nguyen [61], both of whom indicate that GAA significantly and positively affects EMA. Greater awareness of green accounting helps owners and managers integrate environmental costs, risks, and opportunities into their business decisions, rather than treating them as matters of compliance alone. Consequently, GAA repositions EMA from a mere reporting mechanism into a practical decision-support system. EMA enables firms to identify, collect, and assess environmental information, both financial and non-financial, so they can make decisions that are more sustainable, efficient, and competitively oriented [62, 63].

Based on the hypothesis testing results above, EC has a positive and significant effect on EMA; therefore, H4 is accepted. Environmental compliance awareness has a positive and significant effect on EMA because it heightens managers' attention to legal obligations, environmental costs, and the need to monitor operational activities more closely. RBV helps explain this finding by framing compliance awareness not merely as an external pressure, but as a driver of internal capability development [53, 64]. This result is consistent with studies from other developing economies: in Pakistan, environmental compliance plays a critical role in pollution prevention and encourages MSMEs to adopt EMA [59]; in India, environmental strategies strengthen EMA adoption [7]; and in Ghana, even where legal requirements are still limited, environmentally aware MSMEs view responsibility as obligatory and integrate sustainable practices into their business strategies [56].

Based on the hypothesis testing results above, EMA has a positive and significant effect on MSME Sustainability; therefore, H5 is accepted. EMA has a positive effect because it makes the costs, material flows, energy use, water consumption, waste, and emissions more visible in operational decision-making, enabling MSMEs to better control waste and pollution [6, 62]. The RBV helps explain this finding by positioning EMA not merely as an accounting technique, but as a valuable organizational capability and intangible asset that generates environmental information that is difficult to replace and can be leveraged into stronger performance [63]. This result is consistent with prior studies showing that EMA plays a vital role in waste reduction, energy conservation, resource optimization, reporting transparency, and improved corporate image, although its adoption is often constrained by cost, limited knowledge, and inadequate data-recording tools [3, 59, 65].

The findings from the hypothesis test show that EMA plays a positive mediating role in the relationship between GAA and MSME sustainability, which means H6 is accepted. This suggests that GAA by itself is not enough to drive sustainability. Its influence is more likely to appear when green awareness is operationalized through environmental management accounting (EMA), where information on environmental costs, materials, energy, and ecological impacts is collected, analyzed, and used in managerial decisions [7, 62]. RBV offers a useful explanation by treating EMA as a strategic internal capability that converts environmental awareness into sustainable performance [7, 64]. The result aligns with earlier research showing that EMA

functions as a bridge between green awareness and real sustainability outcomes, such as more efficient resource use, reduced waste, better environmental performance, and, in some studies, stronger financial performance as well [52, 62, 66].

Lastly, EMA has been proven to positively mediate the relationship between environmental compliance and MSME sustainability, which means H7 is accepted. EMA works by turning external compliance obligations into internal information that managers can use to evaluate environmental costs, resource use efficiency, and the operational consequences of their actions. In the RBV lens, EMA fits naturally as a valuable organizational capability, since it supports the orchestration of green resources, the interpretation of regulatory pressure, and the implementation of responses that competitors cannot easily imitate. Several studies likewise argue that RBV explain how proactive strategies, managerial commitment, green intellectual capital, and EMA practices interact to shape competitive advantage and sustainability performance [14, 53]. The broader literature also shows that compliance, regulatory pressure, and environmental strategy seldom operate through direct effects alone; their influence is more often channeled through environmental cost information, emissions and waste tracking, and the decision-support systems built through EMA [7, 50, 66].

4. CONCLUSION

This study provides empirical clarity regarding the structural pathways underlying MSME sustainability by examining the interrelationships among green accounting awareness, environmental compliance, and environmental management accounting. The empirical findings indicate that green accounting awareness does not have a statistically significant direct effect on MSME sustainability. This result underscores the persistence of an attitude–behavior gap in the MSME sector, where rudimentary environmental knowledge is insufficient to generate tangible outcomes without structural intervention. In contrast, environmental compliance is proven to exert a strong direct effect on sustainability performance, suggesting that regulatory compliance functions not only as a legal obligation but also as an institutional catalyst that strategically drives business operations. More importantly, environmental management accounting emerges as a full mediation mechanism and a pivotal factor in both relationship paths. This key finding confirms that external compliance pressures and internal environmental awareness must be systematically institutionalized through a formal environmental accounting framework in order to transform cognitive intentions and regulatory demands into measurable and long-term sustainable business practices.

This study has several limitations. First, the cross-sectional design only captures a snapshot of MSME behavior and is unable to assess the long-term effects of EMA implementation on MSME sustainability. Second, due to time and cost constraints, the study was unable to cover the entire East Java region. This condition may limit the generalizability of the findings to other developing regions with different institutional characteristics, infrastructure support, and levels of regulatory strictness. Third, most of the empirical data in this study were obtained from self-reported survey responses provided by MSME owners and managers. This approach is vulnerable

to perceptual subjectivity and social desirability bias, which may lead to an overestimation of actual levels of compliance and environmental performance.

Future research is recommended to adopt a longitudinal approach or trend analysis to evaluate changes over time, identify barriers in the adaptation process, and assess the sustainability of MSMEs. In addition, researchers are encouraged to consider various contingent boundary conditions that may influence the relationships among constructs. For instance, incorporating moderating variables such as the consistency of local regulations, government financial subsidies, or managerial green commitment may provide a more comprehensive explanation of variations in the readiness to adopt environmental accounting practices.

Author contribution

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Analysis: P.P.A

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Visualization: A.H; P.P.A; D.A.P

Supervision: A.H; P.P.A.

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Conflicts of interest

The third authors do not have any conflicts of interest.

Declaration of AI-Assisted Technology

During the preparation of this work, the author used [Grammarly] to draft the initial text and generate ideas for paragraph structure. The author reviewed the entire generated text, corrected data interpretations, and assumes responsibility for the integrity of this scholarly work.

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