

Environmental Management Accounting and Firm Performance: The Role of Environmental Innovation and Sustainability Pressures in Manufacturing SMEs

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Abstract

This study asks whether environmental management accounting (EMA) lifts performance for manufacturing SMEs in Indonesia and whether that lift travels partly through environmental innovation (EI) while being shaped by top management support (TMS) and institutional pressure (IP). Data from 167 decision-makers at manufacturing firms across five Indonesian regions were analyzed with partial least squares structural equation modeling (PLS-SEM) and a 5,000-resample bootstrap. EMA turned out to be positively tied to firm performance ($\beta = 0.523$, $p < 0.001$) and to EI ($\beta = 0.747$, $p < 0.001$) and EI itself carried a positive link to firm performance ($\beta = 0.224$, $p = 0.001$)—a pattern consistent with EI partially mediating the EMA–performance link. Counter to expectations, TMS ($\beta = -0.149$, $p = 0.002$) and IP ($\beta = -0.122$, $p = 0.028$) both weakened rather than reinforced the EI–performance connection. Taken as a whole, the pattern points to environmental information paying off mainly once it is converted into real innovation, with managerial attention and outside pressure adding little when that innovation stays geared toward compliance instead of strategic integration. Bringing EMA, EI, managerial support, institutional pressure and a dual financial-and-environmental view of performance into one model, the study pushes sustainability accounting research further into resource-limited SME settings.

Keywords: Environmental Innovation, Environmental Management Accounting, Firm Performance, Manufacturing SMEs, Sustainability Accounting.

Introduction

Firms everywhere are pushed to reconcile economic activity with environmental responsibility as climate risk intensifies and resources become scarcer and corporations are expected to protect the environment without sacrificing financial viability (1-3). Indonesia illustrates this tension clearly: small and medium sized enterprises (SMEs) generate a substantial portion of national output and employment and make up most registered businesses in the country (4, 5). Against that backdrop, manufacturing SMEs must stay competitive while confronting wasteful resource use, emissions, tightening regulation and shifting market expectations.

One response to this tension is environmental management accounting (EMA), which pairs monetary data on environmental costs, revenues and liabilities with physical data on material, energy, water, waste and emissions. Together, these data streams can sharpen cost visibility, guide resource allocation, tighten operational

control and inform environmental decisions (6, 7). Studies linking environmental management practices, EMA and organizational performance generally find favorable associations (8-10). Yet the evidence base is uneven. Many measures capture only fragments of the EMA construct and much of this work examines environmental performance in isolation rather than alongside financial outcomes (11-19). A smaller strand of research points to firm value effects transmitted through green or environmental innovation, suggesting that EMA's performance payoff depends on how firms turn environmental information into action (20).

This study addresses that gap by combining environmental innovation (EI), top management support (TMS) and institutional pressure (IP) in a single model. Previous research shows that both managerial commitment and institutional demands influence how EMA is adopted and how much it leads to environmental improvements (21, 22).

In this approach, EMA is seen as a management

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system that generates knowledge by turning environmental costs and resource flows into useful information for planning and control, using established tools such as life-cycle costing and full-cost accounting (23-29). EI is the stage where this information leads to action, such as adopting cleaner technologies, streamlining processes, creating recyclable products and making other changes to reduce environmental harm while maintaining economic value (30-32). TMS refers to the strategic focus and resources that senior leaders dedicate to these efforts (33-37). Institutional theory helps explain how different types of pressure—coercive, normative and mimetic—encourage firms to adopt certain practices to maintain legitimacy (38, 39). In this study, firm performance is viewed as both a financial and environmental result, not just an economic measure (40).

These relationships carry particular weight in Indonesia, where regulations classify SMEs by business capital and manufacturing SMEs face growing demands from domestic and global supply chains, climate change, rising resource costs and stricter environmental rules (41-43). Limited resources, however, mean the same managerial or institutional pressures that push firms toward visible environmental action could produce either real innovation or compliance-focused practices with little performance value.

EMA should improve firm performance because clearer visibility into environmental costs and resource flows supports sharper decisions and stronger environmental outcomes (44-47). That same visibility should extend to EI, since it exposes waste, inefficient resource use and openings for cleaner products and processes, letting EI carry forward part of what EMA contributes to performance (48-50). Management commitment adds another layer, as leaders who supply resources, training, monitoring and strategic direction for environmental initiatives should help a stronger TMS translate into larger performance gains from EI (51-59). Institutional pressure can push firms in the same direction by encouraging environmental practices that align with stakeholder expectations (60-62). Institutional theory nonetheless cautions that this can tip into symbolic compliance once legitimacy pressure outpaces a firm's actual capacity for change, yielding decoupling or greenwashing instead of real innovation, a risk that

looms largest for resource-constrained SMEs (63-68).

The study contributes to the existing body of literature in three ways. Firstly, it places environmental management accounting (EMA) in relation to a combined financial and environmental performance framework within small and medium-sized enterprises in Indonesia, thus extending the evidence to a developing economy that is resource-limited. Secondly, it views environmental innovation (EI) as the mechanism by which the knowledge derived from EMA is turned into actual performance results. Thirdly, it regards top management support (TMS) and institutional pressure (IP) as boundary conditions affecting the relationship between EI and performance, in order to show whether these factors promote innovation or instead lead to compliance-based behaviour. Taken together, these aspects fill a gap in previous research, since earlier work has usually examined EMA, innovation, management support, institutional pressure and environmental performance separately rather than as part of an integrated process. To the authors' knowledge, this is among the first studies to test environmental management accounting, environmental innovation, managerial support and institutional pressure jointly within a single financial- and- environmental performance model for manufacturing SMEs in a developing economy, which constitutes the originality of this study.

Three research questions guide the analysis:

RQ1: Among Indonesian manufacturing SMEs, does EMA improve firm performance and promote environmental innovation?

RQ2: Does environmental innovation act as a mediator linking EMA to firm performance?

RQ3: Do top management support and institutional pressure change the strength or direction of the link between environmental innovation and firm performance?

Five corresponding hypotheses follow: EMA is expected to have a positive effect on firm performance (H1) and on environmental innovation (H2), with environmental innovation in turn expected to mediate the EMA-to-performance relationship (H3). Top management support (H4) and institutional pressure (H5) are each expected to positively moderate how strongly environmental innovation translates into firm performance.

Figure 1 lays out these proposed direct, mediating and moderating links.

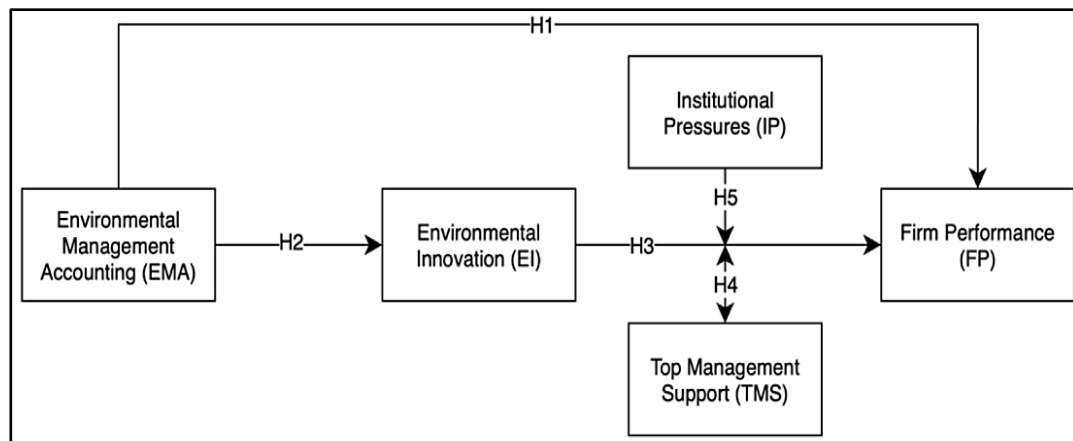


Figure 1: Conceptual Framework

Methodology

This quantitative, cross-sectional study investigated the relationships among EMA, EI, TMS, IP and firm performance in Indonesian manufacturing SMEs. The target population comprised manufacturing SMEs located in West Java, Central Java, East Java, Jakarta and North Sumatra. Purposive sampling was used to identify firms that met three study criteria: 5-99 employees, preparation of financial reports and active engagement in environmental innovation practices. Eligible respondents were organizational decision-makers with sufficient knowledge of environmental and financial practices, including chief executive officers and managers responsible for finance or operations. The final dataset comprised 167 valid responses. Medium-sized firms represented 57% of the sample and small firms 43%. Geographically, 41% of respondents were from Jakarta and 32% from West Java; the remaining respondents were distributed across Central Java, East Java and North Sumatra. The largest sector groups were culinary businesses (27%), clothing (20%) and food and beverages (19%), with the balance distributed among other manufacturing subsectors. The respondents' business locations ranged from approximately 3.61°N to 8.17°S latitude and 97.62°E to 113.82°E longitude. The main sampling clusters were Jakarta (6.20°S, 106.82°E), Bandung (6.92°S, 107.62°E), Bekasi (6.24°S, 106.98°E) and Bogor (6.60°S, 106.81°E) in West Java, Surabaya (7.26°S, 112.75°E) in East Java, Semarang (6.99°S, 110.41°E) in Central Java and Medan (3.61°N, 98.67°E) in North Sumatra.

Data collection ran from April to mid-June 2025, with every construct rated on a seven-point Likert scale. Seven EMA items tracked how firms record and analyze physical environmental data, identify and allocate environmental costs, build environmental performance indicators and channel that information—through accounting systems or dedicated software—into operational and strategic choices (6, 7, 9, 10, 15, 21). Five EI items covered sustainability-driven changes to products and processes, from leaner packaging and sustainable product design to recyclable products and cleaner production, plus firms' visible push toward such innovation (9, 64). TMS relied on two indicators capturing management's commitment to EMA and how far environmental impact feeds into business evaluation and strategic choices (21). IP drew on two items covering regulatory or standards-driven pressure alongside stakeholder expectations on environmental issues (7, 21). Firm performance combined nine items spanning financial indicators—revenue, profit margin, market share, operating cost efficiency, waste-related cost management—with environmental ones such as waste reduction, resource efficiency, a smaller footprint and recycling (6, 7, 9, 10, 14, 15, 21, 68). Two firm-performance items (FP1 and FP9) were removed because their outer loadings fell below the 0.70 threshold, leaving seven items in the final model.

Because the model combines direct, mediating and moderating relationships at once, SmartPLS 4.0 was used to run partial least squares structural equation modeling (PLS-SEM)—a technique that fits prediction-oriented models built on modest

samples and does not depend on multivariate normality (69, 70). The work unfolded in two stages: first, indicator loadings, Cronbach's alpha, composite reliability, AVE, HTMT, the Fornell-Larcker criterion and cross-loadings were used to check the measurement model; then 5,000 bootstrap resamples were drawn to estimate the structural model's path coefficients and test the hypothesized direct, indirect and interaction effects. Effect size (f^2), explained variance (R^2), predictive relevance (Q^2) and SRMR rounded out the assessment, with the full workflow

summarized in Figure 2. Ethical clearance for the study came from the Ethics Commission for Data Research, Institution of Research and Community Service (LPPM), Universitas Kristen Maranatha (No. 108- 1/LPPM/UKM/IV/2025). Before answering, respondents were informed of the study's purpose and assured that their responses would be kept confidential and used solely for research purposes; respondents provided informed consent by proceeding with and submitting the online questionnaire.

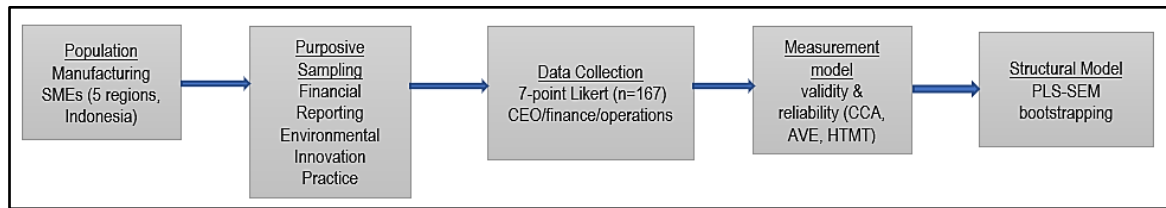


Figure 2: Research Design and Analytical Workflow

Results

Table 1 sets out the descriptive statistics for the 167 observations, none of which had missing data. Every construct averaged above the midpoint of the seven-point scale, pointing to generally favorable perceptions of the practices and

outcomes captured. Firm performance carried the highest mean (5.96) and environmental innovation the lowest (4.41); firm performance was also the most tightly clustered (SD = 0.84), whereas institutional pressure varied the most (SD = 1.20).

Table 1: Descriptive Statistics

Variable	N	Minimum	Maximum	Mean	Standard Deviation
Environmental Management Accounting (EMA)	167	1.57	7.00	4.52	1.18
Environmental Innovation (EI)	167	1.80	6.60	4.41	0.99
Top Management Support (TMS)	167	1.50	7.00	4.59	1.18
Institutional Pressure (IP)	167	2.00	7.00	4.56	1.20
Firm Performance (FP)	167	3.78	7.00	5.96	0.84

Reliability and convergent validity both came out well for the measurement model. Table 2 shows every construct clearing 0.70 on Cronbach's alpha and composite reliability and 0.50 on AVE and the indicator loadings in Table 3 stayed above the recommended cutoff (71). Three checks spoke to discriminant validity. HTMT figures in Table 4 sat under the 0.90 ceiling (72). Table 5's Fornell-Larcker comparison put each construct's AVE square root ahead of its correlations with the

others and Table 3's cross-loadings confirmed that every indicator loaded highest on its own construct." (Cross-loadings are reported in Table 3; Table 5 is the Fornell-Larcker criterion). Together, these checks confirm the measurement model's reliability and validity. Figure 3 then presents the estimated structural model, including the standardized path coefficient s , outer loadings and R^2 values.

Table 2: Construct Reliability and Validity

Construct	Cronbach's Alpha	Composite Reliability (ρ_a)	Composite Reliability (ρ_c)	Average Variance Extracted (AVE)
Top Management Support (TMS)	0.921	0.925	0.962	0.926
Institutional Pressure (IP)	0.915	0.922	0.959	0.922
Environmental Management Accounting (EMA)	0.875	0.877	0.903	0.570

Firm Performance (FP)	0.950	0.951	0.959	0.768
Environmental Innovation (EI)	0.787	0.787	0.855	0.540

Table 3: Discriminant Validity: Cross-loadings

Indicator	TMS	IP	EMA	FP	EI	TMS × EI	IP × EI
TMS1	0.965	-0.086	0.095	0.259	0.120	0.021	0.055
TMS2	0.960	-0.100	0.034	0.240	0.079	0.023	-0.057
IP1	-0.087	0.956	0.088	0.260	0.136	-0.011	0.056
IP2	-0.098	0.964	0.061	0.287	0.107	0.012	0.029
EMA1	0.071	0.003	0.747	0.528	0.550	0.094	0.157
EMA2	0.057	0.039	0.786	0.563	0.611	0.121	0.020
EMA3	0.017	0.150	0.749	0.554	0.580	0.080	0.073
EMA4	0.101	0.035	0.763	0.510	0.577	0.083	0.072
EMA5	0.096	-0.029	0.720	0.406	0.479	0.059	0.066
EMA6	-0.032	0.136	0.745	0.571	0.614	-0.033	0.100
EMA7	0.068	0.046	0.777	0.528	0.515	0.059	0.110
FP2	0.157	0.284	0.598	0.892	0.588	0.021	-0.076
FP3	0.260	0.250	0.602	0.872	0.568	-0.085	-0.008
FP4	0.209	0.262	0.597	0.857	0.564	-0.093	0.017
FP5	0.268	0.191	0.618	0.881	0.587	-0.133	0.010
FP6	0.146	0.311	0.601	0.875	0.503	-0.027	0.006
FP7	0.293	0.267	0.661	0.896	0.587	-0.055	0.001
FP8	0.250	0.187	0.599	0.863	0.592	-0.106	-0.027
EI1	0.052	0.118	0.532	0.487	0.710	0.011	0.063
EI2	0.088	0.078	0.557	0.461	0.749	0.122	0.052
EI3	0.084	0.115	0.541	0.474	0.755	-0.027	0.177
EI4	0.071	0.063	0.572	0.469	0.737	0.056	0.048
EI5	0.088	0.089	0.542	0.499	0.724	0.023	-0.007
IP × EI	0.001	0.043	0.112	-0.012	0.090	-0.118	1.000
TMS × EI	0.023	0.001	0.087	-0.078	0.051	1.000	-0.118

Note: TMS = Top Management Support, IP = Institutional Pressure, EMA = Environmental Management Accounting, FP = Firm Performance, EI = Environmental Innovation.

Table 4: Discriminant Validity: Heterotrait-monotrait Ratios (HTMT)

Construct	TMS	IP	EMA	FP	EI
Top Management Support (TMS)	—				
Institutional Pressure (IP)	0.105	—			
Environmental Management Accounting (EMA)	0.093	0.093	—		
Firm Performance (FP)	0.275	0.306	0.759	—	
Environmental Innovation (EI)	0.121	0.149	0.894	0.752	—
TMS × EI	0.024	0.013	0.107	0.087	0.073
IP × EI	0.061	0.046	0.121	0.024	0.107

Table 5: Discriminant Validity: Fornell-larcker Criterion

Construct	TMS	IP	EMA	FP	EI
Top Management Support (TMS)	0.962				
Institutional Pressure (IP)	-0.096	0.960			
Environmental Management Accounting (EMA)	0.068	0.077	0.755		
Firm Performance (FP)	0.260	0.285	0.697	0.877	
Environmental Innovation (EI)	0.104	0.126	0.747	0.650	0.735

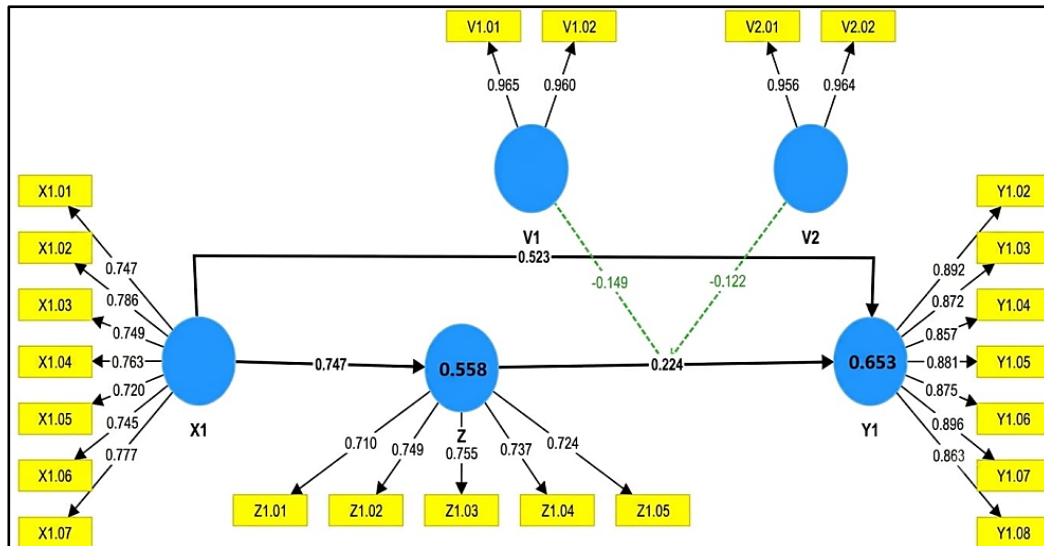


Figure 3: PLS-SEM Structural Model Results (Standardized Path Coefficients, Outer Loadings and R^2 Values)

The structural model was evaluated using 5,000 bootstrap resamples. As shown in Table 6 and Figure 3, EMA had a positive effect on firm performance ($\beta = 0.523$, $p < 0.001$), supporting H1 and a positive effect on environmental innovation ($\beta = 0.747$, $p < 0.001$), supporting H2. Environmental innovation also had a positive effect on firm performance ($\beta = 0.224$, $p = 0.001$). The mediation analysis indicated that EMA affected firm performance both directly and through environmental innovation; with the direct path remaining significant, the pattern was consistent with partial mediation and supported H3.

The moderation results differed from the predicted direction. The TMS $\times$ EI interaction was negative and significant ($\beta = -0.149$, $p = 0.002$) and

the IP $\times$ EI interaction was likewise negative and significant ($\beta = -0.122$, $p = 0.028$). Thus, higher levels of TMS and IP were associated with a weaker positive relationship between EI and firm performance. Because H4 and H5 predicted positive moderation, neither hypothesis was supported. The significant direct paths from TMS to firm performance ($\beta = 0.228$, $p < 0.001$) and from IP to firm performance ($\beta = 0.244$, $p < 0.001$) were retained in the moderation model as constituent main effects and should not be interpreted as reversing the negative interaction effects. Table 6 reports the full set of path coefficients and Table 7 reports the corresponding effect sizes.

Table 6: Structural Path Coefficients

Relationship	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	p-value
TMS $\rightarrow$ FP	0.228	0.234	0.051	4.502	<0.001
IP $\rightarrow$ FP	0.244	0.245	0.048	5.066	<0.001
EMA $\rightarrow$ FP	0.523	0.520	0.066	7.968	<0.001
EMA $\rightarrow$ EI	0.747	0.749	0.036	20.903	<0.001
EI $\rightarrow$ FP	0.224	0.227	0.069	3.266	0.001
TMS $\times$ EI $\rightarrow$ FP	-0.149	-0.143	0.048	3.090	0.002
IP $\times$ EI $\rightarrow$ FP	-0.122	-0.121	0.055	2.215	0.028

Note: TMS = Top Management Support, IP = Institutional Pressure, EMA = Environmental Management Accounting, FP = Firm Performance, EI = Environmental Innovation.

Table 7: Effect-size Matrix (f^2)

Construct	TMS	IP	EMA	FP	EI	TMS $\times$ EI	IP $\times$ EI
Top Management Support (TMS)				0.146			
Institutional Pressure (IP)				0.167			
Environmental Management Accounting (EMA)				0.344	1.261		
Firm Performance (FP)							

Environmental Innovation (EI)	0.063
TMS × EI	0.067
IP × EI	0.040

Note: TMS = Top Management Support, IP = Institutional Pressure, EMA = Environmental Management Accounting, FP = Firm Performance, EI = Environmental Innovation.

Effect sizes, listed in Table 7, place EMA's effect on EI in the large range ($f^2 = 1.261$) and its effect on firm performance just below that, at the top of the medium band ($f^2 = 0.344$). IP's effect on firm performance was medium ($f^2 = 0.167$), while TMS ($f^2 = 0.146$), EI ($f^2 = 0.063$) and both interaction terms—TMS × EI ($f^2 = 0.067$) and IP × EI ($f^2 = 0.040$)—landed in the small range against the usual 0.02/0.15/0.35 cutoffs (73). The model

accounted for 55.8% of the variance in EI and 65.3% in firm performance ($R^2 = 0.558$ and 0.653), a moderate level of explanatory power and positive Q^2 values across all endogenous constructs point to adequate predictive relevance. SRMR for the estimated model was 0.052, comfortably under the 0.08 benchmark; the remaining fit statistics appear in Table 8.

Table 8: Model Fit

Fit Index	Saturated Model	Estimated Model
SRMR	0.051	0.052
d_ULS	0.709	0.746
d_G	0.372	0.373
Chi-square	363.635	359.932
NFI	0.861	0.863

Discussion

Together, these results help explain how EMA shapes both the financial and environmental sides of performance in Indonesian manufacturing SMEs. That EMA is positively linked to performance fits the view of environmental information as a strategic resource rather than a mere reporting obligation: once costs, material use, waste and operational slack become visible, firms can allocate resources and tighten control in ways that also serve environmental goals (9, 10, 15). This dual payoff matters in a resource-constrained SME setting, where sustainability efforts tend to persist only when they also pay for themselves.

EMA also showed a strong positive relationship with environmental innovation, echoing the broader idea that environmental accounting data grows more useful once managers use it to spot openings for cleaner technologies, leaner processes, recyclable products, or less waste (9, 11, 50). The mediation result further indicates that environmental innovation is one pathway through which EMA is translated into organizational outcomes. From a knowledge-based perspective, EMA generates structured environmental knowledge, while innovation converts that knowledge into changes in products and processes. The remaining significant direct EMA-performance relationship indicates that other mechanisms, such

as cost visibility, resource control and risk reduction, may operate alongside innovation.

The negative TMS interaction requires more careful interpretation. It does not mean that managerial support is inherently detrimental: TMS had a positive direct association with firm performance. Rather, in this sample, increasing TMS was associated with a weaker marginal performance return from environmental innovation. This pattern differs from studies in which managerial commitment strengthens environmental initiatives (21, 52, 54). One plausible explanation, consistent with institutional theory, is decoupling: visible managerial support may sometimes emphasize compliance, reputation, or formal endorsement without the complementary capabilities needed to turn environmental innovation into economic and environmental value (63, 67). The finding therefore points to the quality and strategic content of managerial support, not merely its presence.

A parallel story fits institutional pressure. IP was positively tied to firm performance directly, yet its interaction with EI came out negative—suggesting that while outside demands can nudge firms toward environmental practices, heavier regulatory or stakeholder pressure may pull scarce managerial attention and resources toward

paperwork and compliance rather than experimentation and capability-building (7, 21, 60). For SMEs already stretched thin on finance and technical capacity, that trade-off could well erode the extra performance environmental innovation would otherwise deliver, echoing earlier work showing that legitimacy pressure can push firms toward symbolic rather than substantive environmental responses when practices never become fully internalized (63, 67). Given the cross-sectional design, though, this remains an interpretation worth testing further rather than direct proof of symbolic compliance.

Practical Implications

Managers should connect EMA directly to operational and innovation decisions rather than treating it as an environmental reporting exercise. A practical sequence is to identify high-cost or high-impact material and energy flows, translate them into a short list of innovation priorities, assign cross-functional responsibility and track both environmental and financial outcomes. Top management support should therefore include capability building—such as staff training, pilot budgets, access to technical expertise and performance indicators linked to resource savings and waste reduction—rather than only formal endorsement or compliance targets. Policymakers and industry associations can reinforce this approach by providing simplified EMA tools, technical assistance, training, environmental audits and outcome-based incentives that help SMEs convert regulatory demands into implementable innovations. These recommendations are especially relevant because the moderation results suggest that pressure or leadership attention alone is insufficient when organizational capabilities are weak.

The study contributes theoretically by integrating EMA, environmental innovation, managerial support, institutional pressure and a dual financial-environmental performance construct in one model. It also shows that variables usually assumed to strengthen sustainability initiatives can have more complex interaction effects in resource-constrained firms. This finding extends the knowledge-based view by emphasizing the conversion of environmental information into innovation and extends institutional theory by showing that legitimacy-related forces may condition the value created by that innovation.

Conclusion

Taken as a whole, the evidence indicates that environmental management accounting is positively associated with firm performance and environmental innovation among Indonesian manufacturing SMEs. Environmental innovation channels part of EMA's influence into performance outcomes, alongside a direct EMA-performance relationship. Contrary to expectations, top management support and institutional pressure both weakened the positive environmental innovation-performance relationship, despite each having a positive direct association with firm performance. Read together, these patterns suggest that environmental information, managerial attention and external pressure are most beneficial when supported by the capabilities needed to translate environmental goals into substantive operational innovation. The originality of this study lies in its joint treatment of EMA, environmental innovation, managerial support and institutional pressure within one dual financial-and-environmental performance model, a combination that prior research in manufacturing SMEs has not examined as an integrated process. Several limitations should be considered when interpreting these conclusions. Respondents were concentrated in two regions—41% from Jakarta and 32% from West Java, or 73% of the sample—so the findings should not be treated as automatically representative of manufacturing SMEs elsewhere in Indonesia. The cross-sectional design also limits causal and temporal inference and the reliance on respondents' perceptions may not fully reflect firms' actual environmental and financial practices. Finally, the quantitative design cannot on its own explain why the moderation effects were negative. Future research would benefit from broader regional samples, longitudinal or multi-wave designs, objective environmental and financial indicators and qualitative case studies or interviews examining whether capability constraints, compliance behavior, or decoupling explain the moderation pattern.

Abbreviations

EMA: Environmental Management Accounting, EI: Environmental Innovation, FP: Firm Performance, IP: Institutional Pressure, KBV: Knowledge-Based View, PLS-SEM: Partial Least Squares Structural

Equation Modeling, SMEs: Small and Medium-sized Enterprises, TMS: Top Management Support.

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Author Contributions

Stella Maretia: Conceptualization, Data Collection, Data Analysis, Writing - Original Manuscript Draft, Rapina Rapina: Research Supervision, Methodology Development, Theoretical Framework Refinement, Manuscript Review, Meythi Meythi: Literature Review, Data Interpretation, Revision of the Discussion Section, Riki Martusa: Statistical Analysis, Validation of Research Findings, Editing of the Manuscript, Puji Astuti: Review of Conclusions, Language Refinement, Final Manuscript Evaluation. All authors reviewed and approved the final manuscript.

Conflict of Interest

The authors have no financial or personal conflicts of interest to declare in relation to the conduct, analysis, or reporting of this research.

Data Availability

The dataset underlying this study can be obtained from the corresponding author on reasonable request; it is not posted publicly in order to protect participants' confidentiality and privacy.

Declaration of Artificial Intelligence (AI) Assistance

The authors used ChatGPT (OpenAI) and Grammarly solely for language editing and clarity improvement. The authors prepared Figures 1 and 2 without AI tools. Figure 3 was generated in SmartPLS 4.0 and ChatGPT was used only to sharpen its colors and text; the authors did not alter its content and verified it against the original output. AI tools were not used for data collection, analysis, generation of findings, or figure creation. The authors reviewed the final manuscript and take full responsibility for its content.

Ethics Approval

The Ethics Commission for Data Research at the Institution of Research and Community Service (LPPM), Universitas Kristen Maranatha, approved

this study (approval No. 108-1/LPPM/UKM/IV/2025), which was carried out in line with applicable institutional and national ethical standards. Respondents were given information about the study at the start of the online questionnaire and their completion and submission of the questionnaire was taken as implied informed consent.

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References

1. Intergovernmental Panel on Climate Change. Climate change 2023: synthesis report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Geneva, IPCC. 2023;1-34. doi:10.59327/IPCC/AR6-9789291691647.001
2. Haque F, Ntim CG. Executive Compensation, Sustainable Compensation Policy, Carbon Performance and Market Value. *Br J Manag.* 2020;31(3):525-546. <https://doi.org/10.1111/1467-8551.12395>
3. Latif B, Mahmood Z, San OT, Said RM, Bakhsh A. Coercive, normative and mimetic pressures as drivers of environmental management accounting adoption. *Sustainability (Basel).* 2020;12(11):4506. <https://doi.org/10.3390/su12114506>
4. Sinha KJ, Sinha S, Sinha BJ. Micro, Small and Medium-Sized Enterprises (MSMEs): The Significant Role and Challenges in Indonesia's Economy. *Int J Multidiscip Res.* 2024;6(3):1-10. <https://doi.org/10.36948/ijfmr.2024.v06i03.20824>
5. Maksum IR, Sri Rahayu AY, Kusumawardhani D. A social enterprise approach to empowering micro, small and medium enterprises (SMEs) in Indonesia. *J Open Innov Technol Mark Complex.* 2020;6(3):50. <https://doi.org/10.3390/JOITMC6030050>
6. Chaudhry NI, Amir M. From institutional pressure to the sustainable development of firm: Role of environmental management accounting implementation and environmental proactivity. *Bus Strateg Environ.* 2020;29(8):3542-3554. <https://doi.org/10.1002/bse.2595>
7. Gunarathne ADN, Lee KH, Hitigala Kaluarachchilage PK. Institutional pressures, environmental management strategy and organizational performance: The role of environmental management accounting. *Bus Strateg Environ.* 2021;30(2):825-839. <https://doi.org/10.1002/bse.2656>
8. Aslam S, Elmagrhi MH, Rehman RU, Ntim CG. Environmental management practices and financial performance using data envelopment analysis in Japan: The mediating role of environmental performance. *Bus Strateg Environ.* 2021;30(4):1655-1673. <https://doi.org/10.1002/bse.2700>
9. Gerged AM, Zahoor N, Cowton CJ. Understanding the relationship between environmental management accounting and firm performance: The role of

- environmental innovation and stakeholder integration – Evidence from a developing country. *Manag Account Res.* 2024;62.
<https://doi.org/10.1016/j.mar.2023.100865>
10. Le TT, Nguyen TMA, Phan TTH. Environmental management, accounting and performance efficiency in the Vietnamese construction material industry: A managerial implication for sustainable development. *Sustainability (Basel)*. 2019;11(19):5152.
<https://doi.org/10.3390/su11195152>
 11. da Rosa FS, Lunkes RJ, Mendes AC. Environmental management accounting and innovation in water and energy reduction. *Environ Monit Assess.* 2020;192(10):621.
<https://doi.org/10.1007/s10661-020-08586-7>
 12. Fuzi NM, Habidin NF, Janudin SE, Ong SY. Environmental management accounting practices, environmental management system and environmental performance for the Malaysian manufacturing industry. *Int J Bus Excell.* 2019;18(1):120.
<https://doi.org/10.1504/ijbex.2019.10020908>
 13. Tashakor S, Appuhami R, Munir R. Environmental management accounting practices in Australian cotton farming: The use of the theory of planned behaviour. *Account Audit Account J.* 2019;32(4):1175-1202.
<https://doi.org/10.1108/AAAJ-04-2018-3465>
 14. Asa'd M, Ahmad WNW, Ayoup H. Environmental Management Accounting Information and Environmental Performance, the Mediating Effect of Environmental Decision Quality. *Int J Energy Econ Policy.* 2024;14(2):562-573.
<https://doi.org/10.32479/ijeep.15487>
 15. Asiaei K, Bontis N, Alizadeh R, Yaghoubi M. Green intellectual capital and environmental management accounting: Natural resource orchestration in favor of environmental performance. *Bus Strateg Environ.* 2022;31(1):76-93.
<https://doi.org/10.1002/bse.2875>
 16. Rehman SU, Kraus S, Shah SA, Khanin D, Mahto RV. Analyzing the relationship between green innovation and environmental performance in large manufacturing firms. *Technol Forecast Soc Change.* 2021;163.
<https://doi.org/10.1016/j.techfore.2020.120481>
 17. Nkundabanyanga SK, Muramuzi B, Alinda K. Environmental management accounting, board role performance, company characteristics and environmental performance disclosure. *J Account Organ Change.* 2021;17(5):633-659.
<https://doi.org/10.1108/JAOC-03-2020-0035>
 18. Bresciani S, Rehman SU, Giovando G, Alam GM. The role of environmental management accounting and environmental knowledge management practices influence on environmental performance: mediated-moderated model. *J Knowl Manag.* 2023;27(4):896-918.
<https://doi.org/10.1108/JKM-12-2021-0953>
 19. Susanto A, Meiryani M. Antecedents of environmental management accounting and environmental performance: Evidence from Indonesian small and medium enterprises. *Int J Energy Econ Policy.* 2019;9(6):401-407.
<https://doi.org/10.32479/ijeep.8366>
 20. Agustia D, Sawarjuwono T, Dianawati W. The mediating effect of environmental management accounting on green innovation: Firm value relation ship. *Int J Energy Econ Policy.* 2019;9(2):299-306.
<https://doi.org/10.32479/ijeep.7438>
 21. Hasan SAS, Waghule SN, Hasan MB. Linking environmental management accounting to environmental performance: the role of top management support and institutional pressures. *Cogent Bus Manag.* 2024;11(1):2296700.
<https://doi.org/10.1080/23311975.2023.2296700>
 22. Iredele OO, Tankiso M, Adelowotan MO. The influence of institutional isomorphism and organisational factors on environmental management accounting practices of listed Nigerian and South African firms. *S Afr J Account Res.* 2020;34(3):183-204.
<https://doi.org/10.1080/10291954.2019.1675254>
 23. Wilmschurst TD, Frost GR. The role of accounting and the accountant in the environmental management system. *Bus Strateg Environ.* 2001;10(3):135-147.
<https://doi.org/10.1002/bse.283>
 24. Boyd J. The benefits of improved environmental accounting: an economic framework to identify priorities. Washington (DC): Resources for the Future. 1998.
<https://doi.org/10.22004/ag.econ.10609>
 25. International Federation of Accountants. International guidance document: environmental management accounting. New York (NY): IFAC. 2005. ISBN: 1-931949-46-8.
<https://search.worldcat.org/search?q=bn:1931949468>
 26. Burritt RL, Hahn T, Schaltegger S. Towards a comprehensive framework for environmental management accounting—Links between business actors and environmental management accounting tools. *Aust Account Rev.* 2002;12(27):39-50.
<https://doi.org/10.1111/j.1835-2561.2002.tb00202.x>
 27. Christ KL, Burritt RL. Environmental management accounting: The significance of contingent variables for adoption. *J Clean Prod.* 2013;41:163-173.
<https://doi.org/10.1016/j.jclepro.2012.10.007>
 28. Johnstone L. Environmental management decisions in CSR-based accounting research. *Corp Soc Responsib Environ Manag.* 2018;25(6):1212-1222.
<https://doi.org/10.1002/csr.1632>
 29. Jasch C. The use of environmental management accounting (EMA) for identifying environmental costs. *J Clean Prod.* 2003;11(6):667-676.
[https://doi.org/10.1016/S0959-6526\(02\)00107-5](https://doi.org/10.1016/S0959-6526(02)00107-5)
 30. Rennings K, Rammer C. Increasing energy and resource efficiency through innovation – an explorative analysis using innovation survey data. *Czech Journal of Economics and Finance (Finance a úvér).* 2009;59(5):442-459.
<https://doi.org/10.2139/ssrn.1495761>
 31. Murat Ar I. The Impact of Green Product Innovation on Firm Performance and Competitive Capability: The Moderating Role of Managerial Environmental Concern. *Procedia Soc Behav Sci.* 2012;62:854-864.
<https://doi.org/10.1016/j.sbspro.2012.09.144>
 32. Küçüköğlu MT, Pınar Rİ. Positive Influences of Green Innovation on Company Performance. *Procedia Soc*

- Behav Sci. 2015;195:1232-1237.
<https://doi.org/10.1016/j.sbspro.2015.06.261>
33. Sheikh AA, Rana NA, Inam A, Shahzad A, Awan HM. Is e-marketing a source of sustainable business performance? Predicting the role of top management support with various interaction factors. *Cogent Bus Manag.* 2018;5(1):1-22.
<https://doi.org/10.1080/23311975.2018.1516487>
 34. Liu J, Liu Y, Yang L. Uncovering the influence mechanism between top management support and green procurement: The effect of green training. *J Clean Prod.* 2020;251:119674.
<https://doi.org/10.1016/j.jclepro.2019.119674>
 35. Lin HF. An investigation into the effects of IS quality and top management support on ERP system usage. *Total Qual Manag Bus Excell.* 2010;21(3):335-349.
<https://doi.org/10.1080/14783360903561761>
 36. Blass V, Corbett CJ, Delmas MA, Muthulingam S. Top management and the adoption of energy efficiency practices: Evidence from small and medium-sized manufacturing firms in the US. *Energy.* 2014;65:560-571.
<https://doi.org/10.1016/j.energy.2013.11.030>
 37. Pérez EA, Ruiz CC, Fenech FC. Environmental management systems as an embedding mechanism: A research note. *Account Audit Account J.* 2007;20(3):403-422.
<https://doi.org/10.1108/09513570710748562>
 38. Wang S, Wang H, Wang J. Exploring the effects of institutional pressures on the implementation of environmental management accounting: Do top management support and perceived benefit work? *Bus Strateg Environ.* 2019;28(1):233-243.
<https://doi.org/10.1002/bse.2252>
 39. DiMaggio PJ, Powell WW. The Iron Cage Revisited: Institutional Isomorphism in Organizational Fields. *Am Sociol Rev.* 1983;48(2):147-160.
<https://doi.org/10.2307/2095101>
 40. Prasetya SG, Safitri J. The Effect of Environmental Management Accounting (EMA) on Financial Performance and Working Capital Management (WCM) as Mediating Variables. *Jurnal Manajemen.* 2023;14(1):14-29.
<https://doi.org/10.32832/jm-uika.v14i1.9778>
 41. Henryanto AG, Hanifah H, Cahyadin M, Kaihatu TS. Causal threads: SMEs and macroeconomic indicators in Indonesia. *Journal of Small Business Strategy.* 2025;35(2):82-95.
<https://doi.org/10.53703/001c.129670>
 42. Asian Development Bank. Asia small and medium-sized enterprise monitor 2020: volume I - country and regional reviews. Manila: Asian Development Bank. 2020.
<https://doi.org/10.22617/TCS200290-2>
 43. World Bank Group. Indonesia country climate and development report [Internet]. Washington (DC): World Bank. 2023.
<https://doi.org/10.1596/39750>
 44. Zhou Z, Zhao W, Chen X, Zeng H. MFCA extension from a circular economy perspective: Model modifications and case study. *J Clean Prod.* 2017;149:110-125.
<https://doi.org/10.1016/j.jclepro.2017.02.049>
 45. Qian W, Burritt RL, Monroe GS. Environmental management accounting in local government: Functional and institutional imperatives. *Financ Account Manag.* 2018;34(2):148-165.
<https://doi.org/10.1111/faam.12151>
 46. Sari RN, Pratadina A, Anugerah R, Kamaliah K, Sanusi ZM. Effect of environmental management accounting practices on organizational performance: role of process innovation as a mediating variable. *Bus Process Manag J.* 2021;27(4):1296-1314.
<https://doi.org/10.1108/BPMJ-06-2020-0264>
 47. Zandi GR, Khalid N, Islam DMZ. Nexus of knowledge transfer, green innovation and environmental performance: impact of environmental management accounting. *Int J Energy Econ Policy.* 2019;9(5):387-393.
<https://doi.org/10.32479/ijeep.8285>
 48. Danso A, Adomako S, Lartey T, Amankwah-Amoah J, Owusu-Yirenkyi D. Stakeholder integration, environmental sustainability orientation and financial performance. *J Bus Res.* 2020;119:652-662.
<https://doi.org/10.1016/j.jbusres.2019.02.038>
 49. Papagiannakis G, Voudouris I, Lioukas S, Kassinis G. Environmental management systems and environmental product innovation: The role of stakeholder engagement. *Bus Strateg Environ.* 2019;28(6):939-950.
<https://doi.org/10.1002/bse.2293>
 50. Ferreira A, Moulang C, Hendro B. Environmental management accounting and innovation: An exploratory analysis. *Account Audit Account J.* 2010;23(7):920-948.
<https://doi.org/10.1108/09513571011080180>
 51. Christ KL, Burritt RL. Material flow cost accounting: A review and agenda for future research. *J Clean Prod.* 2015;108:1378-1389.
<https://doi.org/10.1016/j.jclepro.2014.09.005>
 52. Latan H, Chiappetta Jabbour CJ, Lopes de Sousa Jabbour AB, Wamba SF, Shahbaz M. Effects of environmental strategy, environmental uncertainty and top management's commitment on corporate environmental performance: The role of environmental management accounting. *J Clean Prod.* 2018;180:297-306.
<https://doi.org/10.1016/j.jclepro.2018.01.106>
 53. Dixon-Fowler HR, Ellstrand AE, Johnson JL. The Role of Board Environmental Committees in Corporate Environmental Performance. *J Bus Ethics.* 2017;140(3):423-438.
<https://doi.org/10.1007/s10551-015-2664-7>
 54. Ilyas S, Hu Z, Wiwattanakornwong K. Unleashing the role of top management and government support in green supply chain management and sustainable development goals. *Environ Sci Pollut Res Int.* 2020;27(8):8210-8223.
<https://doi.org/10.1007/s11356-019-07268-3>
 55. Sarkis J, Gonzalez-Torre P, Adenso-Diaz B. Stakeholder pressure and the adoption of environmental practices: The mediating effect of training. *J Oper Manag.* 2010;28(2):163-176.
<https://doi.org/10.1016/j.jom.2009.10.001>
 56. Burritt RL, Saka C. Environmental management accounting applications and eco-efficiency: case studies from Japan. *J Clean Prod.* 2006;14(14):1262-1275.
<https://doi.org/10.1016/j.jclepro.2005.08.012>
 57. Henri JF, Journeault M. Eco-control: The influence of management control systems on environmental and

- economic performance. *Account Organ Soc.* 2010;35(1):63-80.
<https://doi.org/10.1016/j.aos.2009.02.001>
58. Phan TN, Baird K, Su S. The use and effectiveness of environmental management accounting. *Australas J Environ Manag.* 2017;24(4):355-374.
<https://doi.org/10.1080/14486563.2017.1354235>
 59. Tung A, Baird K, Schoch H. The relationship between organisational factors and the effectiveness of environmental management. *J Environ Manage.* 2014;144:186-196.
<https://doi.org/10.1016/j.jenvman.2014.05.025>
 60. Kalyar MN, Shoukat A, Shafique I. Enhancing firms' environmental performance and financial performance through green supply chain management practices and institutional pressures. *Sustain Account Manag Policy J.* 2020;11(2):451-476.
<https://doi.org/10.1108/SAMPJ-02-2019-0047>
 61. Dubey R, Gunasekaran A, Ali SS. Exploring the relationship between leadership, operational practices, institutional pressures and environmental performance: a framework for green supply chain. *Int J Prod Econ.* 2015;160:120-132.
<https://doi.org/10.1016/j.ijpe.2014.10.001>
 62. Gunarathne ADN, Lee KH. Environmental and managerial information for cleaner production strategies: An environmental management development perspective. *J Clean Prod.* 2019;237:117849.
<https://doi.org/10.1016/j.jclepro.2019.117849>
 63. Hyatt DG, Berente N. Substantive or Symbolic Environmental Strategies? Effects of External and Internal Normative Stakeholder Pressures. *Bus Strateg Environ.* 2017;26(8):1212-1234.
<https://doi.org/10.1002/bse.1979>
 64. Windolph SE, Schaltegger S, Herzig C. Implementing corporate sustainability: What drives the application of sustainability management tools in Germany? *Sustain Account Manag Policy J.* 2014;5(4):374-404.
<https://doi.org/10.1108/SAMPJ-01-2014-0002>
 65. Zhu Q, Cordeiro J, Sarkis J. Institutional pressures, dynamic capabilities and environmental management systems: Investigating the ISO 9000: Environmental management system implementation linkage. *J Environ Manage.* 2013;114:232-242.
<https://doi.org/10.1016/j.jenvman.2012.10.006>
 66. Abrahamson E. Managerial fads and fashions: the diffusion and rejection of innovations. *Acad Manage Rev.* 1991;16(3):586-612.
<https://doi.org/10.5465/amr.1991.4279484>
 67. Testa F, Boiral O, Iraldo F. Internalization of environmental practices and institutional complexity: Can stakeholder pressures encourage greenwashing? *J Bus Ethics.* 2018;147(2):287-307.
<https://doi.org/10.1007/s10551-015-2960-2>
 68. Shashi, Centobelli P, Cerchione R, Singh R. The impact of leanness and innovativeness on environmental and financial performance: Insights from Indian SMEs. *Int J Prod Econ.* 2019;212:111-124.
<https://doi.org/10.1016/j.ijpe.2019.02.011>
 69. Sarstedt M, Hair JF, Nitzl C, Ringle CM, Howard MC. Beyond a tandem analysis of SEM and PROCESS: Use of PLS-SEM for mediation analyses! *Int J Mark Res.* 2020;62(3):288-299.
<https://doi.org/10.1177/1470785320915686>
 70. Hair JF, Risher JJ, Sarstedt M, Ringle CM. When to use and how to report the results of PLS-SEM. *Eur Bus Rev.* 2019;31(1):2-24.
<https://doi.org/10.1108/EBR-11-2018-0203>
 71. Nunnally JC, Bernstein IH. *Psychometric theory.* 3rd ed. New York: McGraw Hill; 1994. ISBN:0071070885
https://books.google.co.in/books/about/Psychometric_Theory_3E.html?id=_6R_f3G58JsC&redir_esc=y
 72. Henseler J, Ringle CM, Sarstedt M. A new criterion for assessing discriminant validity in variance-based structural equation modeling. *J Acad Mark Sci.* 2015;43(1):115-135.
<https://doi.org/10.1007/s11747-014-0403-8>
 73. Cohen J. *Statistical power analysis for the behavioral sciences.* 2nd ed. Hillsdale (NJ): Lawrence Erlbaum Associates. 1988. ISBN: 9780203771587.
<https://utstat.toronto.edu/~brunner/oldclass/378f16/readings/CohenPower.pdf>

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