frontiers in Sustainability

TYPE Original Research
PUBLISHED 20 February 2026
DOI 10.3389/frsus.2026.1762537

OPEN ACCESS

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RECEIVED 07 December 2025
REVISED 19 January 2026
ACCEPTED 02 February 2026
PUBLISHED 20 February 2026

CITATION
Zulfiati L, Dahlifah and Pranitasari D (2026) Sustainability reporting and supply chain management for small and medium enterprise perspective of sustainability development goals: evidence from Indonesia.
Front. Sustain. 7:1762537.
doi: 10.3389/frsus.2026.1762537

Sustainability reporting and supply chain management for small and medium enterprise perspective of sustainability development goals: evidence from Indonesia

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Purpose: This study aimed to empirically examine the influence of sustainability reporting (SR) and supply chain management (SCM) practices on the performance of small and medium enterprises (SMEs).
Design, methodology, and approach: A sequential explanatory mixed-methods research design was employed. Quantitative data were collected through a structured questionnaire from 203 SMEs under the Jakpreneur program in Jakarta, Indonesia, and analyzed using partial least squares structural equation modeling (PLS-SEM). Qualitative data were collected through in-depth interviews and observations with SME owners, practitioners, and government regulators to contextualize the quantitative findings.
Findings: The quantitative analysis revealed that key SCM dimensions—namely product development, production processes, and distribution—positively and significantly influence SME performance. In contrast, SR dimensions (economic value, social network and innovation, and eco-efficiency and energy) and the SCM dimensions of supplier relations and customer returns management did not show a statistically significant impact. Qualitative insights explain these results, indicating that SMEs perceive formal SR as complex and costly, while supplier relationships remain largely transactional.
Originality and value: This study provides an integrated, empirically tested model that links specific SR and SCM practices to holistic SME performance. It offers novel evidence from an emerging-market context, demonstrating that operational SCM practices are stronger performance drivers than formal sustainability reporting for micro- and small enterprises. The mixed-methods approach yields nuanced insights valuable for both academia and practice.
Practical implications: The findings suggest that policymakers and business support agencies should develop simplified guidelines and tools for SR adoption tailored to SME capabilities. Concurrently, enhancing SME competency in core supply chain operations—product development, production, and distribution—should be prioritized to improve immediate performance and lay the foundation for long-term sustainability integration.

KEYWORDS
balanced scorecard (BSC), development goals, Indonesia, mixed-methods, SME performance, supply chain management (SCM)

1 Introduction

Small and medium enterprises (SMEs) play a vital role in global economic development, serving as significant job creators and financial contributors. In the European Union, for example, SMEs account for a large share of employment and job creation (Singh et al., 2015), and the accounts play a similar role in developing countries, where their employment role is comparable to that of large firms (Ayyagari et al., 2014). Their substantial contribution to gross domestic product (GDP) is evident across diverse economies; SMEs constitute about 90% of all businesses in Sub-Saharan Africa (Dorasamy and Kikasu, 2024), while in India, they contribute 8% to GDP, 45% to manufacturing output, and 40% to exports (Singh et al., 2015). Similarly, in Indonesia, SMEs' contribution to GDP reached around 60% in the pre-pandemic period, with labor absorption consistently high at 96.99–97.22% across approximately 62 million enterprises, representing about 98% of all national business actors. For this widespread growth to be sustainable, it must be accompanied by strong SME performance in both financial and managerial terms (Oktrivina et al., 2025a). Consequently, supporting SME performance in today's economy fundamentally requires a commitment to sustainable practices and robust supply chain management (SCM) (Niemann et al., 2025; Tran and Le, 2025).

Sustainability practices and reporting have become increasingly prominent research foci over the past decade. This growth in interest is driven by heightened attention from shareholders, institutions, investors, governments, and communities toward environmental, social, and governance (ESG) issues (Le et al., 2025; Oktrivina et al., 2025b). Global environmental challenges are intensifying economic pressures and raising the importance of sustainability. Even though SMEs face challenges such as limited funds and stringent regulations, adopting green practices can improve their sustainability performance (Mashingaidze et al., 2024; Oktrivina et al., 2025b). By using green strategies, such as innovation and new skills, SMEs can become more efficient, lessen their environmental impact, and increase their competitiveness (Wiratmadja et al., 2025). Sustainable manufacturing practices may also help SMEs compete better and remain viable in the long run, especially when they align with environmental laws (Athooli et al., 2023). Hence, despite various obstacles, adopting green practices and sustainable manufacturing offers a clear path for MSMEs to improve performance, competitiveness, and their contribution to the circular economy.

Despite the recognized importance of implementing sustainable practices, significant research gaps remain. First, there is a lack of comprehensive frameworks that holistically integrate sustainability practices and performance criteria across environmental, economic, and social dimensions (Malesios et al., 2021; Muruganantham et al., 2025). Existing models often focus on isolated enablers or barriers without robustly analyzing their interrelationships (Malesios et al., 2021). Second, studies remain geographically limited, with insufficient attention to regions such as Latin America and emerging Asian markets, where social and environmental practices are often underexplored (Das et al., 2020a, 2020b). Broader geographical representation is needed to understand regional variations and to develop context-specific strategies (Ndlovu et al., 2025). Third, research on the long-term impacts of green growth initiatives and the role of resilience in post-pandemic recovery remains scarce (Putri et al., 2025). Future studies should therefore investigate SME sustainability over extended periods and under diverse economic conditions (Putri et al., 2025). These gaps highlight the need for more integrated, geographically inclusive, and longitudinal research to support SMEs in their sustainability transitions effectively.

In the same vein, growing interest in SCM practices is driven by the imperatives of environmental sustainability and resource efficiency. SMEs are increasingly adopting green supply chain management (GSCM), not only to meet these demands but also to gain a competitive edge (Mankar et al., 2025; Zhu et al., 2008) For example, enhancing supply chain resilience through strategic planning and technology adoption has become a priority, enabling SMEs to navigate complex market challenges (Naimat and Davies, 2025). Prior research shows that effective supply chain integration boosts operational performance, enhancing cost efficiency, product quality, and timely delivery—key factors for operational effectiveness. By aligning functions such as logistics and operations, the supply chain resilience fosters stronger partnerships and responsiveness, thereby strengthening competitive advantage (Jama et al., 2025; Kankam and Dza, 2025). Adopting sustainable supply chain practices also contributes to operational performance and long-term growth and profitability, allowing firms to enhance competitiveness while supporting environmental objectives (Israfilov et al., 2020). Combining lean and sustainable initiatives further optimizes performance, enabling SMEs to streamline operations and address ecological concerns simultaneously (Israfilov et al., 2020). Thus, embedding green and resilient practices into the supply chain is essential for SMEs to sustain competitiveness and ensure long-term viability in an evolving business landscape.

Pertaining to the relationship between SCM and SME performance within a sustainability context, several critical research gaps persist. First, many existing studies have limited generalizability due to small sample sizes or a narrow focus on specific regions or sectors (Ali et al., 2017; Teoh et al., 2023). More comprehensive, cross-sectoral, and multi-regional research is therefore required to validate findings and develop broadly applicable strategies. Second, there is a lack of robust, integrative models that fully incorporate the triple bottom line—economic, environmental, and social performance—within the specific context of GSCM for SMEs (Kosasih et al., 2023). Future research should develop and test holistic frameworks that address these dimensions simultaneously. Third, the documented relationship between GSCM practices and firm performance remains inconsistent across studies, leaving managers uncertain about which practices are most effective (Qorri et al., 2018). Further investigation is needed to clarify these causal links and provide evidence-based guidance. Finally, the enabling role of technology and innovation in enhancing GSCM effectiveness is underexplored. While studies suggest that advanced technologies like artificial intelligence can improve outcomes, empirical evidence in SME settings remains limited (Kuo, 2023; Liu, 2023). Addressing these gaps is essential to building a coherent, actionable knowledge base that empowers SMEs to adopt sustainable supply chain practices for resilient, competitive performance.

This study aims to develop an integrated framework that combines sustainability reporting (SR) and GSCM to enhance SME performance, thereby addressing key gaps in the literature. The research pursues three specific objectives: to develop and improve SR implementation based on global reporting initiative (GRI) standards alongside effective SCM practices; to provide practical, contextual guidelines for SR preparation and assess the impact of ESG disclosures on SME operations; and to empirically test—both quantitatively and qualitatively—the influence of integrated SR and SCM on holistic SME

performance across economic, environmental, and social dimensions. This study contributes uniquely as one of the first in Indonesia to investigate the convergence of formal SR and green supply chain practices within an SME context. In contrast to prior work focused on large firms, isolated innovations, or singular sustainability aspects, this research proposes and tests a novel integrated model. By adapting GRI standards—typically applied to large corporations—to SMEs and evaluating their synergy with GSCM, it offers a new, actionable framework.

2 Literature review

This section provides a concise overview of the key concepts underpinning this study SR, SCM, and SME performance.

2.1 Small and medium enterprise performance

SME performance is a multifaceted construct influenced by diverse factors, including financial management, digitalization, strategic orientation, and market share. These elements are critical for SMEs to navigate competitive landscapes and achieve sustainable growth (Na-Nan et al., 2017). In Indonesia, where SMEs play a substantial economic role, enhancing their performance is a priority.

Performance measurement for SMEs often extends beyond pure financial metrics. The Balanced Scorecard (BSC) framework is effective in aligning operational activities with strategic objectives by incorporating both financial and non-financial perspectives, specifically the financial, customer, internal business processes, and learning and growth dimensions (Kaplan and Norton, 2001; Muraba et al., 2024; Pineyrua et al., 2021).

2.2 Sustainability reporting and SME performance

SR involves measuring, disclosing, and accounting for an organization's environmental, social, and governance (ESG) impacts. The main goal is to promote sustainable development and enhance long-term firm value by effectively communicating performance to stakeholders (Das et al., 2020a; Bunclark and Barcellos-Paula, 2021). For this study, SR is operationalized using formative constructs based on the GRI standards (2020), grouped into three primary indicators: economic value and financial literacy; social networks and sustainable innovation; and eco-efficiency and energy.

Financial literacy—encompassing both knowledge and application (Huston, 2010)—is crucial for sound financial decision-making and business growth. It enables SMEs to manage finances more effectively, secure better funding, and improve future welfare (Setyaningsih et al., 2024; Al-shami et al., 2024; Putri et al., 2025). Research shows a positive link between financial literacy and enhanced SME performance Furthermore, social networks and sustainable innovation are critical. Continuous innovation is fundamental for creating competitive advantage (Che and Chen, 2024; Dolšak et al., 2024), and social networks, ranging from internal to external ties, are vital catalysts for the diffusion of innovation and new product development (Leick and Gretzinger, 2020; Muafi, 2020). Finally, eco-efficiency involves minimizing environmental impact while significantly maintaining the economic value. Implementing green innovations and energy conservation not only yields environmental benefits but also reduces production costs and enhances brand image, thereby improving economic performance (Thompson et al., 2024; Dolšak et al., 2024). Based on this reasoning, the following hypotheses are proposed:

> *H1*: Economic value (financial literacy) positively affects SME performance.
>
> *H2*: Social networks and sustainable innovation positively affect SME performance.
>
> *H3*: Eco-efficiency and energy practices positively affect SME performance.

2.3 Supply chain management and SME performance

Supply chain management is a holistic approach to efficiently integrate suppliers, manufacturers, distributors, and customers to meet consumer demand. SCM is measured through five key indicators: product development, supplier relations, the production process, distribution, and customer returns management. Within SCM, product development serves as a strategic platform for innovation, enabling SMEs to ensure business continuity and competitiveness (Machado et al., 2020). Effective supplier relations and collaborative procurement are crucial for securing quality inputs and enhancing overall business performance (Chijioke and Vu Minh, 2021). Optimizing the production process enhances operational efficiency, reduces waste, and strengthens competitiveness (Simona et al., 2023). Furthermore, efficient distribution logistics directly improve market accessibility and operational outcomes (Nupus and Ichwanudin, 2020). Lastly, an effective system for managing customer returns is critical for maintaining satisfaction, loyalty, and operational efficiency (Rufina, 2022); (Lu et al., 2021). Consequently, the following hypotheses are advanced (Figure 1):

> *H4*: Product development positively affects SME performance.
>
> *H5*: Supplier relations positively affect SME performance.
>
> *H6*: The production process positively affects SME performance.
>
> *H7*: Distribution positively affects SME performance.
>
> *H8*: Customer returns management positively affects SME performance.

3 Methods

This study aims to develop an instrument to model the relationships among sustainability perspectives, SCM and SME performance. The mixed-methods research approach is employed. This approach integrates quantitative and qualitative data collection and analysis techniques in sequential phases to provide a comprehensive understanding of the research phenomena. Specifically, the study adopts a sequential explanatory strategy (Creswell, 2015). This design involves

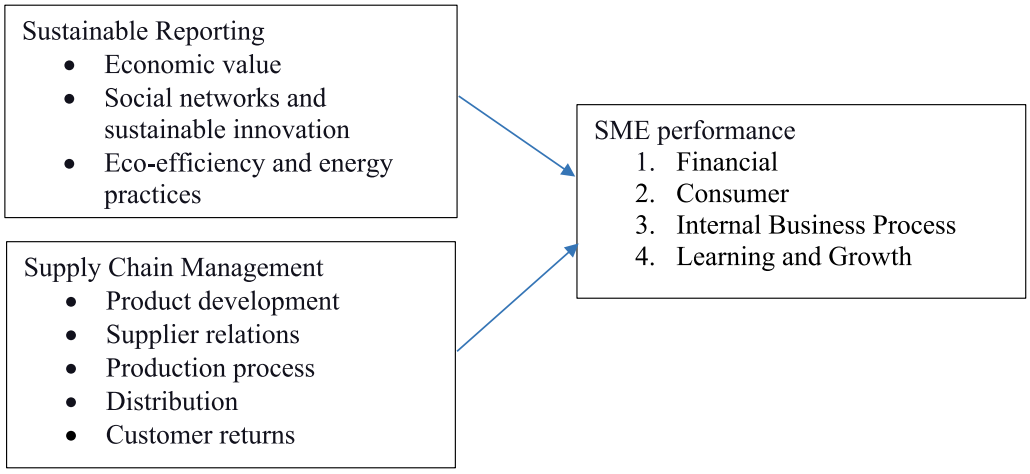

FIGURE 1
Research model.

first collecting and analyzing quantitative data, followed by a subsequent qualitative phase to elaborate on and contextualize the initial results.

3.1 Sample and procedures

The study sample consists of SMEs enrolled in the Jakpreneur program, coordinated by the Provincial Government of Jakarta, Indonesia. This program was selected as the sampling frame because it provides participating SMEs with structured support—including mentoring, training, access to capital, marketing assistance, and business licensing—resulting in a relatively homogeneous population of over 300,000 active members. As an initial study, convenience sampling was employed for several reasons. First, this initial research examines how sustainability, SCM, and the performance of SMEs are interconnected. The goal is to better understand these relationships before carrying out more in-depth studies. In early-stage research like this, speed and flexibility are more important than making broad generalizations (Etikan, 2016; Saunders et al., 2023). Second, due to time constraints, data collection needed to be efficient to reduce the logistical burden associated with more complex sampling designs (Memon et al., 2025; Sunarsih et al., 2026). Third, a total of 203 SMEs voluntarily participated, which meets the minimum sample size recommended by the inverse square root method (Kock and Hadaya, 2016; Legate et al., 2023) based on predictive R^2 criteria. According to the minimum R-squared guideline (Kock and Hadaya, 2016), for a model where $R^2 > 0.10$ and the maximum number of arrows pointing at a construct exceeds 10, the required sample size is 189. Therefore, the sample of 203 satisfies the minimum threshold for robust partial least squares structural equation modeling (PLS-SEM).

Table 1 shows that the sample is composed of micro-enterprises, with 91.63% having fewer than five employees. This strongly reflects the typical structure of the SME sector, where very small, often owner-operated, businesses are the norm. In terms of business focus, the majority (74.38%) operate in the Food and Beverage sector, indicating that this is a primary industry for local SMEs. The retail sector denotes a significant minority (20.69%), while other services form a much smaller segment (4.93%). Regarding the respondents' demographics, the largest group (45.81%) falls within the 25–45 years age bracket, representing the core working-age and entrepreneurial population. A substantial portion (32.51%) is also represented by younger entrepreneurs (18–25 years), suggesting active participation from a new generation of business owners. Respondents over 45 years contain 21.67% of the sample.

TABLE 1 Sample characteristics.

	Count	Percentage (%)
Business sector		
Food and beverage	151	74.38%
Retail	42	20.69%
Other services	10	4.93%
Number of employees		
Micro (<5 employees)	186	91.63%
Small (5–10 employees)	8	3.94%
Medium (>10 employees)	9	4.43%
Age of respondent		
18–25 years	66	33%
25–45 years	93	46%
>45 years	44	22%

3.2 Measurement

The measurement instruments for this study were developed by adapting and integrating well-established constructs from the literature to fit the specific context of SMEs in Indonesia. All items were measured using a five-point Likert scale (1 = Strongly disagree to 5 = Strongly agree). A detailed overview of the constructs, dimensions, and sources is provided in Table 2. The initial scale development involved content validity assessment by five experts in management and finance to ensure the relevance and clarity of the proposed items.

R was modeled as a formative higher-order construct comprising three key dimensions, with items adapted from academic frameworks and the global reporting initiative (GRI) standards.

TABLE 2 Research measurement instrument and psychometric properties.

Construct and dimension	Number of items	Reliability
Sustainability reporting (SR)		
Economic value and financial literacy	3 Items	0.869
Social network and sustainable innovation	3 Items	0.796
Eco-efficiency and energy	3 Items	0.813
Supply chain management (SCM)		
Product/Business development	3 Items	0.866
Procurement process (Supplier Relations)	6 Items	0.897
Production process	6 Items	0.912
Shipping and distribution	3 Items	0.889
Customer returns management	4 Items	0.893
SME performance		
Financial perspective	3 Items	0.879
Customer perspective	4 Items	0.895
Internal business process perspective	4 Items	0.870
Learning and growth perspective	7 Items	0.925

All constructs demonstrate strong internal consistency, with Cronbach's alpha (α).

Economic value and financial literacy were measured using three items that assess the understanding and application of accounting principles, bookkeeping, and financial planning, drawing on (Bunclark and Barcellos-Paula, 2021; Al-shami et al., 2024), and aligned with relevant GRI standards (e.g., GRI 102, 201). *Social Network and Sustainable Innovation* was measured with three items evaluating community involvement and stakeholder relations, informed by the same sources and GRI standards on local communities (e.g., GRI 413). *Eco-Efficiency and Energy* were measured using three items covering environmental management practices related to resource use and materials, based on Bunclark and Barcellos-Paula (2021) and Al-shami et al. (2024), and corresponding GRI categories (e.g., GRI 301, 302).

Supply chain management was also modeled as a higher-order formative construct, comprising five dimensions derived from an integrated SCM framework. Product/business development (three items), procurement process (six items), production process (six items), shipping and distribution (three items), and customer returns management (four items) were established by adapting scales from Machado et al. (2020) and Oliveira et al. (2022). These items measure core SCM capabilities, including innovation, supplier relations, operational efficiency, logistics, and post-sales service.

SME Performance was measured formatively according to the four perspectives of the Balanced Scorecard (BSC), as defined by Kaplan and Norton (2001). The financial perspective used three items focusing on revenue and profit stability. The customer perspective included four items related to customer growth and satisfaction. The internal business process perspective comprised four items assessing product diversity and quality control. The learning and growth perspective was measured with seven items covering employee skills, training, and organizational effectiveness.

The pilot test results confirm the measurement model's internal consistency (see Table 2). All constructs demonstrated strong internal consistency, with Cronbach's Alpha values exceeding the accepted threshold of 0.70. These results, detailed in Table 2, indicate that the adapted scales are reliable and valid for measuring SR, Supply Chain Management, and SME Performance in the context of this study.

3.3 Data analysis procedures

This study employs a two-stage PLS-SEM analytical procedure. The analysis was conducted using SmartPLS software, well-suited for this research due to its predictive orientation, the use of formative constructs, and the relatively small sample size. In the first stage, a higher-order construct evaluation was executed for SME performance. Since performance was conceptualized as a formative second-order construct comprising the four BSC perspectives (financial, customer, internal business process, and learning and growth), latent variable scores were generated. These scores were produced by creating composite indices from the first-order dimensions, resulting in a single, robust composite score for overall SME Performance to be used in the subsequent path analysis. The second stage involved the primary PLS-SEM analysis. The structural (inner) model was evaluated to test the hypothesized relationships among all eight specific dimensions of SR, SCM, and SME performance. This analysis assessed the individual influence of each dimension—economic value, social network and innovation, eco-efficiency, product development, supplier relations, production process, distribution, and customer returns management—on the performance outcome, in line with hypotheses H1–H8.

4 Results and discussion

4.1 Outer model evaluation

The measurement model demonstrated strong psychometric properties, confirming the reliability and validity of the scales employed in this study. First, indicator reliability was established, as all factor loadings exceeded the recommended threshold of 0.70, confirming that each item is a reliable measure of its corresponding latent construct. Second, internal consistency and convergent validity were confirmed. All constructs exhibited excellent internal consistency, with Cronbach's alpha (α) and composite reliability (CR) values surpassing the accepted level of 0.70. Convergent validity was established, as the average variance extracted (AVE) for every construct exceeded the benchmark of 0.50. Collectively, these results confirm the robustness of the measurement model, providing a solid foundation for proceeding with the structural model analysis. Thirdly, the discriminant validity was verified using the heterotrait–monotrait ratio (HTMT) analysis, where all values stayed below the conservative cutoff of 0.90 (highest HTMT = 0.72) (Franke and Sarstedt, 2019; Legate et al.,

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TABLE 3 Outer model evaluation.

Construct and indicators	Factor loading	CA	CR	AVE
Economic value		0.869	0.873	0.718
EV3	0.85			
EV5	0.85			
EV7	0.82			
EV9	0.86			
Networking innovation		0.796	0.798	0.711
NET_INNOV5	0.82			
NET_INNOV7	0.87			
NET_INNOV9	0.83			
Eco energy		0.813	0.827	0.729
ECO_EN7	0.79			
ECO_EN8	0.90			
ECO_EN9	0.87			
Product development		0.889	0.892	0.817
PROD_DEV3	0.86			
PROD_DEV5	0.87			
PROD_DEV8	0.84			
Production process		0.899	0.914	0.769
PROD_PROC1	0.81			
PROD_PROC10	0.79			
PROD_PROC3	0.82			
PROD_PROC7	0.81			
PROD_PROC8	0.79			
PROD_PROC9	0.82			
Distribution		0.889	0.892	0.817
DIST2	0.92			
DIST3	0.90			
DIST4	0.89			
Supplier relation		0.897	0.902	0.662
SUPP1	0.81			
SUPP2	0.88			
SUPP3	0.82			
SUPP4	0.79			
SUPP8	0.74			
SUPP9	0.84			
Product return		0.893	0.898	0.756
CUST_RET1	0.87			
CUST_RET3	0.85			
CUST_RET4	0.90			
CUST_RET6	0.86			
SME performance		0.899	0.914	0.769
Customer	0.92			
Financial	0.77			
Internal business	0.91			
Learning	0.90			

HTMT values = 0.42–0.72.

2023). These findings validate the reliability and justify the measurement model for the following structural analysis (Table 3).

4.2 Inner model evaluation and hypothesis testing

This study investigates the direct relationships among the eight key dimensions of SR, SCM, and SME performance. The structural model was assessed by examining the significance of the standardized path coefficients (using a bootstrapping procedure with 5,000 subsamples), the model's explanatory power (R^2), the effect sizes (f^2) of the predictor variables, and its predictive relevance through the Stone-Geisser Q^2 test.

The analysis results are depicted in Table 4. Diagnostic checks confirmed the absence of multicollinearity, with all variance inflation factor (VIF) values below the threshold of 5. The model demonstrates exceptionally strong explanatory power, explaining 82.4% of the variance in SME performance ($R^2 = 0.824$). Predictive relevance was confirmed, as the blindfolding procedure (omission distance $D = 7$) yielded a Q^2 value of 0.492 for SME performance [calculated as $Q^2 = 1\text{-}(1\text{-}R_1^2)$], which is significantly above zero.

Six of the eight proposed hypotheses were statistically significant. The dimensions of production process ($\beta = 0.268$, $p < 0.01$), distribution ($\beta = 0.195$, $p < 0.05$), and product return management ($\beta = 0.177$, $p < 0.05$) demonstrated the most potent positive effects on SME performance, with small to medium effect sizes. Networking innovation ($\beta = 0.128$, $p < 0.05$), product development ($\beta = 0.164$, $p < 0.05$), and economic value ($\beta = 0.083$, $p < 0.05$) were also significant, supporting hypotheses H2, H4, and H1, respectively. In contrast, the paths from eco-energy ($\beta = -0.083$, $p > 0.05$) and supplier relation ($\beta = 0.119$, $p > 0.05$) to SME performance were not statistically significant; therefore, hypotheses H3 and H5 were not supported.

This study evaluated the out-of-sample predictive validity of the proposed model using the PLSpredict procedure (Hair et al., 2020; Legate et al., 2023). The results, presented in Table 5, demonstrate strong overall predictive performance. All indicators of the SME performance construct yielded positive Q^2predict values, confirming the model's predictive relevance. Furthermore, the PLS-SEM model consistently yielded lower root mean square errors (RMSEs) than the linear model (LM) benchmark for each indicator, as indicated by the negative ΔRMSE values. This pattern confirms that the specified structural relationships enhance prediction accuracy. A nuanced observation is made for the Financial Perspective indicator, which shows the smallest Q^2predict value (0.359) and the most modest improvement in RMSE (ΔRMSE = −0.024). This proposes that while the model retains predictive power, its capacity to forecast this specific financial dimension is relatively constrained compared with other performance aspects, such as learning and growth, which showed the most significant gain in accuracy (ΔRMSE = −0.070).

These findings are further substantiated by the cross-validated augmentation test (CVAT). As shown in Table 5, the prediction error for the SME performance construct is substantially lower in the PLS-SEM model, with a PLS loss value (0.404) significantly less than the IA loss benchmark (1.013). This difference is statistically significant ($t = 4.384$, $p < 0.001$), confirming that the specified structural relationships meaningfully enhance the model's predictive ability (Sharma et al., 2023). In sum, these results affirm that the integrated framework of SR and SCM dimensions offers a robust and valid model not only for explaining but also for reliably predicting SME performance.

4.2.1 Robustness check: Gaussian copula analysis

To examine potential endogeneity bias in the proposed model, a Gaussian Copula (GC) analysis was conducted. The results indicate that there is no statistically significant endogeneity concerns for the primary structural relationships. As presented in the output, all GC terms—which test for latent confounding between the predictor constructs and SME performance—yielded statistically insignificant

TABLE 4 Structural model assessment (direct effects).

Hypothesis	Path	Coeff.	SD	*t*-values	*p*-values	f^2	Supported/ Unsupported
H1	Economic value → SME performance	0.083	0.039	2.136	0.033	0.028	Supported
H2	Networking innovation → SME performance	0.128	0.050	2.551	0.011	0.047	Supported
H3	Eco energy → SME performance	−0.083	0.057	1.442	0.149	0.017	Unsupported
H4	Product development → SME performance	0.164	0.079	2.083	0.037	0.042	Supported
H5	Supplier relation → SME Performance	0.119	0.083	1.439	0.150	0.019	Unsupported
H6	Production process → SME performance	0.268	0.083	3.228	0.001	0.097	Supported
H7	Distribution → SME performance	0.195	0.077	2.541	0.011	0.057	Supported
H8	Product return → SME performance	0.177	0.079	2.252	0.024	0.045	Supported

R^2 value of 0.824. VIF values = 2.17–2.97.

TABLE 5 Out-of-sample predictive ability evaluation using PLSpredict.

Construct: SME performance	Q^2 predict	PLS-SEM RMSE	Linear model (LM) RMSE	ΔRMSE
Customer perspective	0.737	0.517	0.552	−0.035
Financial perspective	0.359	0.805	0.829	−0.024
Internal process perspective	0.704	0.547	0.576	−0.029
Learning and growth perspective	0.603	0.634	0.704	−0.070

CVAT	PLS loss	IA loss	*t*-value	*p*-value
SME performance	0.404	1.013	4.384	0.000
Overall model	0.404	1.013	4.384	0.000

Q^2 predict: Values above zero indicate the model has predictive relevance for that indicator.

coefficients (p-values > 0.05). For instance, the GC terms for key paths such as production process → SME performance ($\beta = 0.076$, $p = 0.461$), product return → SME performance ($\beta = -0.056$, $p = 0.520$), and eco-energy → SME performance ($\beta = 0.181$, $p = 0.085$) were not significant. This pattern holds across all eight hypothesized relationships. Therefore, the non-significant GC terms suggest that the estimated path coefficients from the primary PLS-SEM analysis are robust and unlikely to be substantially biased by omitted variables or reverse causality. This finding reinforces the validity of the original model conclusions, confirming that the significant relationships identified (e.g., the positive effects of production process, distribution, and networking innovation) are reliable. The robustness check complements the earlier evidence of strong predictive validity, providing greater confidence in the integrated framework linking SR and SCM to SME performance (see Appendix 1).

4.3 Discussion

This study examined the influence of SR and GSCM practices on the performance of SMEs. Based on data from 203 SMEs within Jakarta's Jakpreneur program, the PLS-SEM analysis revealed that six of the eight hypothesized dimensions significantly enhanced SME performance. These positive drivers are Production process, distribution, product return management, networking innovation, product development, and economic value (financial literacy). In contrast, eco-energy and supplier relations did not show a statistically significant impact. The integrated model demonstrated strong explanatory power, accounting for approximately 82.4% of the variance in SME performance.

These findings are contextualized and enriched by qualitative insights, revealing a gap between formal concepts and on-the-ground practice. Notably, while economic value was a significant driver, interviews showed SME owners' unfamiliarity with formal SR terminology, aligning with observations by Chen et al. (2024) regarding limited reporting capacity of SMEs. This suggests that the measured relationship stems from a foundational understanding of finance rather than advanced reporting. Similarly, the non-significant result for eco-nergy is clarified by qualitative data showing that SMEs prioritize basic environmental actions over complex energy efficiency, reflecting the "green cost dilemma" for resource-constrained firms discussed by Das and Rangarajan (2020). The lack of support for supplier relations aligns with descriptions of transactional, cost-focused supply chains, a gap between partnership theory and SME reality noted by Chijioke and Vu Minh (2021).

4.3.1 Theoretical implications

This study provides several key theoretical contributions that both align with and extend existing literature. First, it advances the integration of sustainability and operational management frameworks within the SME context. The significant positive effects of production process, distribution, and product return management empirically validate that core operational excellence is a fundamental performance driver. This finding extends established supply chain theory (Machado et al., 2020; Lu et al., 2021) into the SME domain and supports recent arguments that operational resilience is a prerequisite for sustainable transitions (Muruganantham et al., 2025).

Second, the significant influence of networking innovation and economic value through financial literacy bridges critical theoretical gaps. The support for networking innovation underscores the value of social capital, corroborating recent studies on network-driven growth in emerging markets (Putri et al., 2025). The confirmation of economic value through financial literacy solidifies the argument that such intangible capabilities are critical strategic resources, supporting the adaptation of formal frameworks, such as the GRI standards, into practical tools (Al-shami et al., 2024; Ndlovu et al., 2025). However, the qualitative discovery of a significant knowledge gap calls for more nuanced theoretical models that differentiate between basic financial practice and advanced reporting capability.

Third, the non-significant findings for eco-energy and supplier relations provide important theoretical nuance. The result for eco-energy suggests a decoupling between advanced environmental practices and immediate performance perceptions, supporting recent observations of the "green cost dilemma," in which SMEs view deep-green practices as burdensome without clear short-term returns (Das and Rangarajan, 2020; Muruganantham et al., 2025). The non-significant result for supplier relation indicates that relationships often remain transactional, highlighting a persistent gap between collaborative SCM theory and the price-driven reality of micro-enterprise supply chains (Nwachukwu and Hieu, 2021). These findings collectively call for more contextualized theories of sustainability adoption that account for the hierarchical and resource-conscious prioritization of SMEs.

4.3.2 Practical implications

The findings yield actionable insights for SME owners, policymakers, and business development programs. SME managers should prioritize strengthening their internal operational foundations, such as production quality, reliable distribution, and efficient returns, as these provide the most substantial direct performance benefits, a focus supported by the operations management literature. Fostering social

networks and building practical financial literacy are also essential; participating in business communities may spur innovation, while training in basic financial management is crucial for stability. Sustainability adoption requires custom-made support; to make practices such as eco-efficiency more attractive, mechanisms must demonstrate clear cost savings, as overcoming the perceived cost barrier is critical for adoption. The validated model may serve as a diagnostic tool for mentors to assess SME strengths and weaknesses.

To directly and effectively support SR adoption, targeted training modules and accessible digital tools are recommended. Specifically, practical training should focus on simplifying sustainability concepts into SME-friendly workshops that translate reporting standards into actionable steps, coupled with financial literacy programs that highlight the cost–benefit analysis of green initiatives. Furthermore, accessible digital tools are crucial, such as simplified, integrated accounting and sustainability dashboards that automate basic ESG metric tracking, as well as digital platforms that connect SMEs to networks of green suppliers and service providers. The creation of mobile-friendly e-learning repositories featuring case studies from peer SMEs can also provide relatable guidance. These structured resources are designed to lower the perceived complexity and resource burden of SR, transforming it from a compliance exercise into a tangible tool for operational improvement and market resilience. Collectively, these actions advance SDG 8 (decent work and economic growth) through enhanced SME performance, SDG 9 (industry, innovation, and infrastructure) through improved production and innovation, and SDG 12 (responsible consumption and production) through the promotion of sustainable practices.

4.3.3 Limitations and future research

This study has several methodological limitations that should be considered when interpreting the findings. The cross-sectional design restricts the ability to establish causal relationships among SR, SCM, and SME performance, highlighting the need for longitudinal research to trace developmental pathways. The reliance on a convenience sample drawn solely from SMEs in Jakarta, Indonesia, also limits the generalizability of the results; future studies should validate the model across more diverse geographical and institutional settings. A particularly valuable direction would be comparative studies across ASEAN countries, examining how differing national policies, regulatory environments, cultural contexts, and levels of economic development influence the adoption and effectiveness of SR and SCM practices in SMEs. Furthermore, while self-reported data are practical, they may introduce perceptual bias, suggesting that future work would benefit from triangulating survey data with objective performance metrics. The qualitative component, though insightful, was limited in scope, and the use of formative measurement for constructs such as SR and SCM, while theoretically sound, requires careful interpretation. Expanding the model to include the role of digital technologies as potential moderators or mediators is also recommended.

5 Conclusion

This study aimed to investigate the impact of SR GSCM practices on the performance of SMEs. Utilizing a sequential mixed-methods approach involving 203 SMEs in Indonesia, this research provides a comprehensive analysis of how specific sustainability and operational dimensions drive business outcomes. The findings confirmed that a core set of integrated practices significantly enhances SME performance. Production process, distribution, product return management, networking innovation, product development, and economic value were identified as positive and significant drivers. This underscores that performance in this context is rooted in operational excellence, innovation through social networks, and fundamental financial management capabilities. In contrast, the hypothesized positive effects of eco-energy and supplier relations on performance were not supported.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

LZ: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Resources, Validation, Writing – original draft, Writing – review & editing, Software. Dahlifah: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. DP: Conceptualization, Data curation, Formal analysis, Writing – review & editing.

Funding

The author(s) declared that financial support was received for this work and/or its publication. This research was supported by Kementerian Pendidikan, Kebudayaan, Riset dan Teknologi Republik Indonesia, Fundamental Research Grant, No. 766/LL3/AL.04/2024.

Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

Ali, A., Bentley, Y., Cao, G., and Habib, F. (2017). Green supply chain management–food for thought? *Int J Log Res Appl* 20, 22–38. doi: 10.1080/13675567.2016.1226788

Al-shami, S. A., Damayanti, R., Adil, H., Farhi, F., and Al mamun, A. (2024). Financial and digital financial literacy through social media use towards financial inclusion among batik small enterprises in Indonesia. *Heliyon* 10:e34902. doi: 10.1016/j.heliyon.2024.e34902

Athooli, J., Dayanandan, R., and Elsaman, H. (2023). Study on the impact of strategic management through sustainable operations for industry 4.0 from the perspective of SMEs in the UAE. *Int. J. Advanc. Appl. Sci.* 10, 165–173. doi: 10.21833/IJAAS.2023.09.019

Ayyagari, M., Demirguc-Kunt, A., and Maksimovic, V. (2014). Who creates jobs in developing countries? *Small Bus. Econ.* 43, 75–99. doi: 10.1007/s11187-014-9549-5

Bunclark, L., and Barcellos-Paula, L. (2021). Sustainability reporting for sustainable supply chain management in Peru. *Sustain. Product. Consum.* 27, 1458–1472. doi: 10.1016/j.spc.2021.03.013

Che, J., and Chen, J. (2024). Empirical study on marketing investment and business innovation—A case analysis based on small and medium enterprises. *Financ. Res. Lett.* 69:106023. doi: 10.1016/j.frl.2024.106023

Chen, J., Calabrese, R., and Cowling, M. (2024). Does energy efficiency of UK SMEs affect their access to finance? *Energy Econ.* 129:107251. doi: 10.1016/j.eneco.2023.107251

Chijioke, N., and Vu Minh, H. (2021). *Assessing supplier-customer relationship management practice and business performance.* doi: 10.4108/EAI.7-6-2021.2308605

Creswell, J. W. (2015). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. London: SAGE Publications.

Das, M., and Rangarajan, K. (2020). Impact of policy initiatives and collaborative synergy on sustainability and business growth of Indian SMEs. *Indian Growth Develop. Rev.* 13, 607–627. doi: 10.1108/IGDR-09-2019-0095

Das, M., Rangarajan, K., and Dutta, G. (2020a). Corporate sustainability in small and medium-sized enterprises: a literature analysis and road ahead. *J. Indian Bus. Res.* 12, 271–300. doi: 10.1108/JIBR-09-2017-0166

Das, M., Rangarajan, K., and Dutta, G. (2020b). Corporate sustainability in SMEs: an Asian perspective. *J Asia Bus Stud* 14, 109–138. doi: 10.1108/JABS-10-2017-0176

Dolšak, J., Hrovatin, N., and Zorić, J. (2024). What impacts the strength of perceived barriers to and drivers of energy efficiency in manufacturing SMEs? *Heliyon* 10:e24020. doi: 10.1016/j.heliyon.2024.e24020

Dorasamy, N., and Kikasu, E. T. (2024). "SMEs and job creation" in SMEs perspective in Africa: Creating sustainable and resilient economies. (eds.) G. Mugano and N. Dorasamy Switzerland: Springer Nature, 57–88. doi: 10.1007/978-3-031-69103-4_4

Etikan, I. (2016). Comparison of convenience sampling and purposive sampling. *Am. J. Theor. Appl. Stat.* 5:1. doi: 10.11648/j.ajtas.20160501.11

Franke, G. R., and Sarstedt, M. (2019). Heuristics versus statistics in discriminant validity testing: a comparison of four procedures. *Int. Res.* 29, 430–447. doi: 10.1108/IntR-12-2017-0515

Hair, J. F., Howard, M. C., and Nitzl, C. (2020). Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. *J. Bus. Res.* 109, 101–110. doi: 10.1016/j.jbusres.2019.11.069

Huston, S. J. (2010). Measuring financial literacy. Second Special Issue on Financial Literacy. 44, 296–316. doi: 10.1111/j.1745-6606.2010.01170.x

Israfilov, N., Ablaev, I., Seisinbinova, A., and Sakulyeva, T. (2020). Impact of supply chain management strategies on the performance indicators of small and medium-sized businesses. *Int. J. Supply Chain Manage.* 9, 544–552. doi: 10.59160/ijscm.v9i4.5179

Jama, L. A., Mohamud, I. H., and Hassan, M. A. (2025). Optimizing supply chain performance in Somali SMEs: the role of internal and external integration. *Int. J. Advanc. Appl. Sci.* 12, 78–86. doi: 10.21833/ijaas.2025.01.007

Kankam, G., and Dza, M. (2025). Navigating the supply chain frontier: insights from SMEs on the effects of inter-organizational collaboration and inter-organizational trust on supply chain performance. *J. Open Innov.: Technol. Mark. Complex.* 11, 1–9. doi: 10.1016/j.joitmc.2025.100560

Kaplan, R. S., and Norton, D. P. (2001). Transforming the balanced scorecard from performance measurement to strategic.

Kock, N., and Hadaya, P. (2016). Minimum sample size estimation in PLS-SEM: The inverse square root and gamma-exponential methods. *Inf. Syst. J.* doi: 10.1111/isj.12131

Kosasih, W., Pujawan, I. N., and Karningsih, P. D. (2023). Integrated lean-green practices and supply chain sustainability for manufacturing SMEs: A systematic literature review and research agenda. *Sustainability (Switzerland)* 15, 2–28. doi: 10.3390/su151612192

Kuo, T. C. (2023). "Sustainability outlook: green design, consumption, and innovative business model" in Microconstituents in the environment: Occurrence, fate, removal, and management, 545–563.

Le, H. T., Pappa, G., and Lattanzi, N. (2025). Integrating the SDGs into SMEs: A systematic review of approaches, barriers, and assessment methods. *Clean. Product. Lett.* 9, 1–24. doi: 10.1016/j.clpl.2025.100119

Leick, B., and Gretzinger, S., (2020). Knowledge sharing for business cluster and business network contexts. *J. Innov. Econ. De Boeck Université*, 1–8.

Legate, A. E., Hair, J. F., Chretien, J. L., and Risher, J. J. (2023). PLS-SEM: prediction-oriented solutions for HRD researchers. *Hum. Resour. Dev. Q.* 34, 91–109. doi: 10.1002/hrdq.21466

Liu, B. (2023). Integration of novel uncertainty model construction of green supply chain management for small and medium-sized enterprises using artificial intelligence. *Optik* 273, 170–195. doi: 10.1016/j.ijleo.2022.170411

Lu, Y., Liu, Z., and Min, Q. (2021). A digital twin-enabled value stream mapping approach for production process reengineering in SMEs. *Int. J. Comput. Integr. Manuf.* 34, 764–782. doi: 10.1080/0951192X.2021.1872099

Machado, M. C. V., Oliveira, O., and de Oliveira, O. J. (2020). Production and supply-chain as the basis for SMEs' environmental management development: A systematic literature review. *J. Clean. Prod.* 273, 1–13. doi: 10.1016/j.jclepro.2020.123141

Malesios, C., De, D., Moursellas, A., Dey, P. K., and Evangelinos, K. (2021). Sustainability performance analysis of small and medium sized enterprises: criteria, methods and framework. *Socio Econ. Plan. Sci.* 75, 100–129. doi: 10.1016/j.seps.2020.100993

Mankar, V. A., Katare, V., Lodhi, L., and Kaushik, T. K. (2025). "A study of drivers and barriers of green supply chain management practices in the context of developing framework for SMEs" in Leveraging AI for innovative sustainable energy: Solar, wind and green hydrogen, 1–14.

Mashingaidze, M., Bunu, S. V, Mashoko, D., Njanji, R., and Madyise, T. (2024). Adoption of green practices in small and medium Enterprises in Developing Countries. In Examining green human resources management and nascent entrepreneurship (pp. 25–50)

Memon, M. A., Thurasamy, R., Ting, H., and Cheah, J.-H. (2025). Convenience sampling: A review and guidelines for quantitative research. *Journal of Applied Structural Equation Modeling* 9, 1–15. doi: 10.47263/JASEM.9(2)01

Muafi, U. (2020). A Nexus among Strategic Orientation, Social Network, Knowledge Sharing, Organizational Innovation, and MSMEs Performance. *J. Asian Finance Econ. Bus.* 7, 327 – 338. doi: 10.13106/jafeb.2020.vol7.no6.327

Muraba, J., Mamogobo, M., and Thango, B. (2024). The balanced scorecard methodology: Performance metrics and strategy execution in SMEs: A systematic review the balanced scorecard methodology: Performance.

Muruganantham, G., Sridar, S., Dinesh Kumar, B., Aswanth, R. S., and Sankar Patro, U. (2025). Integrating sustainable practices in Indian manufacturing small medium Enterprises: A BASLR approach. *Electron. Green J.* 1, 1–29. doi: 10.5070/G3.40099

Naimat, A. A. A., and Davies, L. (2025). A systematic literature review of supply chain management strategies and SME performance: A retrospective analysis, current trends and future opportunities. *Eng. Econ.* 36, 192–211. doi: 10.5755/j01.ee.36.2.39372

Na-Nan, K., Chaiprasit, K., and Pukkeeree, P. (2017). Performance management in SME high-growth sectors and high-impact sectors in Thailand: mixed method research. *Int. J. Engin. Bus. Manage.* 9:1847979017718451. doi: 10.1177/1847979017718451

Ndlovu, M. N., Ndlovu, E. N., and Ebewo, P. E. (2025). The intersection of business models and SME performance: A bibliometric analysis of research trends. *Admin. Sci.* 15, 143–167. doi: 10.3390/admsci15040143

Niemann, L., Morssinkhof, S., van der Linden, M. J., and de Vries, K. (2025). Data requests in value chains: the effects of corporate sustainability reporting on SMEs in the Netherlands. *Sustainability (Switzerland)* 17, 2–18. doi: 10.3390/su17178029

Nupus, H., and Ichwanudin, W. (2020). Integrated paradigm of lean supply chain of SMEs by utilizing customer relationship management capabilities and family distribution networks. 9, 93–103.

Nwachukwu, C., and Hieu, V. M. (2021). Assessing supplier-customer relationship management practice and business performance.

Oktrivina, A., Effendi, S., and Hendryadi (2025a). How and when circular economy practices drive financial performance: the role of organizational agility, operational efficiency, and digital technology adoption. *J. Open Innov.: Technol. Mark. Complex.* 11:100613. doi: 10.1016/j.joitmc.2025.100613

Oktrivina, A., Sumail, L. O., and Hendryadi, H. (2025b). Green transformational leadership and financial performance in micro and small enterprises: the interplay of circular economy practices and environmental uncertainty. *Front. Sustain.* 12, 1–12. doi: 10.3389/frsus.2025.1684185

Oliveira, G. A., Piovesan, G. T., Setti, D., Takechi, S., Tan, K. H., and Tortorella, G. L. (2022). Lean and green product development in SMEs: A comparative study between small- and medium-sized Brazilian and Japanese Enterprises. *J. Open Innov. Technol. Mark. Complex.* 8:123. doi: 10.3390/joitmc8030123

Pineyrua, D. G. F., Redondo, A., and Pascual, J. A. (2021). Knowledge management and sustainable balanced scorecard: Practical application to a service SME.

Putri, A. N. A., Hermawan, P., Mirzanti, I. R., Meadows, M., and Sadraei, R. (2025). Exploring green growth in SMEs: global trends, challenges, and future directions. *Foresight STI Governance* 19, 16–31. doi: 10.17323/fstig.2025.23708

Qorri, A., Mujkić, Z., Gashi, S., and Kraslawski, A. (2018). Green supply chain management practices and company performance: A Meta-analysis approach. *Procedia Manufact.* 17, 317–325. doi: 10.1016/j.promfg.2018.10.052

Rufina (2022). Small and medium scale enterprises: Content analysis and Partial Least Square Approach, vol. 5, 64–96.

Saunders, M. N. K., Lewis, P., and Thornhill, A. (eds.). (2023). *Research methods for business students*. 9th Edn. United Kingdom: Pearson Education Limited.

Setyaningsih, S., Widjojo, R., and Kelle, P. (2024). Challenges and opportunities in sustainability reporting: a focus on small and medium enterprises (SMEs). *Cogent Bus. Manage.* 11, 1–17. doi: 10.1080/23311975.2023.2298215

Sharma, P. N., Liengaard, B. D., Hair, J. F., Sarstedt, M., and Ringle, C. M. (2023). Predictive model assessment and selection in composite-based modeling using PLS-SEM: extensions and guidelines for using CVPAT. *Eur. J. Mark.* 57, 1662–1677. doi: 10.1108/EJM-08-2020-0636

Simona, S., Ausra, Z., Juzėnas, K., and Stasė, P. (2023). Optimization Experiment of Production Processes Using a Dynamic Decision Support Method: A Solution to Complex Problems in Industrial Manufacturing for Small and Medium-Sized Enterprises. *Sensors.* 23:4498. doi: 10.3390/s23094498

Singh, D., Khamba, J. S., and Nanda, T. (2015). Exploring the determinants of technology innovation in MSMEs. *Int. J. Eng. Res. Afr.* 13, 103–115. doi: 10.4028/www.scientific.net/JERA.13.103

Sunarsih, U., Hendryadi, Tricahyadinata, I., Effendi, S., Faruqi, F., Budiantoro, H., et al. (2026). Dataset on the exploratory factor structure of organizational health performance for micro and small enterprises: the initial research stage. *Data Brief* 64:112317. doi: 10.1016/j.dib.2025.112317

Teoh, B. A., Mohd Arzaman, A. F., Chew, B. C., Abd Aziz, M. S., Kamalrudin, M., and Germaine Chee, J. L. (2023). The impact of green supply chain practices towards operational performances among SMEs in Penang, Malaysia. *Int. J. Sustain. Dev. Plan.* 18, 3381–3387. doi: 10.18280/ijsdp.181104

Thompson, J., Ramazani, R. B., Sinai, C. S., Bindu, K. K., and Jagger, P. (2024). Do decentralized solar mini grids improve energy access for small enterprises in Goma, Democratic Republic of the Congo? *Energy Sustain. Dev.* 81:101464. doi: 10.1016/j.esd.2024.101464

Tran, P. Q., and Le, T. T. (2025). Do corporate social responsibility drive sustainable corporate performance in emerging economy? Mediation roles of green innovation and corporate image. *Asia Pac J Bus Admin.* 13, 1–29. doi: 10.1108/APJBA-12-2024-0707

Wiratmadja, I. I., Achmad, F., and Rizana, A. F. (2025). Green strategy implementation and innovativeness in SMEs: A pathway towards sustainable development goals. *Lecture Mech. Engin.* 2, 305–314. doi: 10.1007/978-981-96-5690-5_29

Zhu, Q., Sarkis, J., Lai, K.-H., and Geng, Y. (2008). The role of organizational size in the adoption of green supply chain management practices in China. *Corp. Soc. Responsib. Environ. Manag.* 15, 322–337. doi: 10.1002/csr.173