Journal of Quality Management and Business (JQMB)

Vol. 1, No. 1 (2026), pp. 11–17
ISSN: XXX (Print) XXX (Online) Journal homepage: https://jurnal.aretelitera.com/jqmb

Article type: Integrative Literature Review | Received: 10 July 2026 | DOI: To be assigned
Revised: 24 July 2026 | Accepted: 30 August 2026 | Published: 11 August 2026

GREEN SUPPLY CHAIN MANAGEMENT AND OPERATIONAL PERFORMANCE: THE ROLE OF ENVIRONMENTAL MANAGEMENT PRACTICES IN SUSTAINABLE BUSINESS

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ABSTRACT

Purpose-This article explains how green supply chain management (GSCM) improves operational performance and clarifies the role of environmental management practices (EMPs) in converting environmental intentions into repeatable operating results. Design/methodology/approach-An integrative literature review synthesizes foundational and recent research on internal environmental management, green purchasing, eco-design, customer cooperation, reverse logistics, environmental management systems, and operational performance. Evidence was organized using natural-resource-based view, stakeholder theory, and capability logic. Findings-GSCM can reduce waste, resource use, lead-time variability, defects, disruption exposure, and lifecycle cost. These gains are inconsistent when green practices remain isolated projects. EMPs-policy and targets, responsibility, measurement, training, audit, supplier controls, and corrective action-provide the implementation architecture that embeds GSCM in daily routines. The proposed Green–Environmental–Operational Performance (GEOP) framework specifies a sequenced pathway from stakeholder pressure and green supply-chain practices through EMP maturity to environmental and operational outcomes, with supply-chain integration and digital visibility as enabling conditions. Originality/value-The article distinguishes adopting green practices from managing them as a coherent operating system. It positions EMP maturity as a mediating implementation capability and offers an auditable framework for sustainable businesses, including SMEs in emerging economies.

Keywords: green supply chain management; environmental management practices; operational performance; sustainable business; environmental performance; SMEs

1. INTRODUCTION

Supply chains account for a substantial share of firms' environmental burdens because materials, energy, transportation, packaging, product use, and end-of-life recovery extend beyond organizational boundaries. Green supply chain management (GSCM) responds by integrating environmental criteria into purchasing, design, production, distribution, customer cooperation, and reverse logistics. The strategic case is increasingly operational: resource productivity, process stability, supplier quality, regulatory continuity, and recovery of residual value can strengthen cost, quality, delivery, flexibility, and resilience simultaneously (Srivastava, 2007; Sarkis et al., 2011).

Evidence generally supports a positive association between GSCM and performance, but effects vary by practice, context, and measurement. The meta-analysis of Asian emerging economies by Geng et al. (2017) found positive relationships across performance dimensions, while Fang and Zhang (2018) showed that outcomes depend on the GSCM configuration and institutional setting. More recent meta-analytic evidence likewise reports a moderate positive relationship with operational performance (Holling & Backhaus, 2023). Variation persists because installing green purchasing criteria or a recycling program does not ensure disciplined execution across functions and partners.

This article argues that environmental management practices (EMPs) explain an important part of that implementation gap. EMPs include environmental policy, objectives, responsibility, training, operational controls, measurement, audit, management review, and corrective action. They turn

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environmental aspirations into routines that can be monitored and improved. Although internal environmental management is often listed as one GSCM dimension, the literature has not sufficiently distinguished individual green activities from the managerial architecture that coordinates them.
The article asks three questions: How does GSCM create operational value? Through which mechanisms do EMPs translate GSCM into sustained performance? Which organizational conditions strengthen or weaken the pathway? Its contribution is the Green–Environmental–Operational Performance (GEOP) framework. The framework integrates natural-resource-based view, stakeholder theory, and capability logic; positions EMP maturity as an implementation mediator; and offers propositions, measures, and a staged managerial roadmap.

2. CONCEPTUAL FOUNDATIONS

2.1. Green supply chain management

GSCM is the coordinated integration of environmental thinking into product and process design, material sourcing, supplier management, internal operations, logistics, customer relationships, and product recovery. Core practices include internal environmental management, green purchasing, supplier collaboration, eco-design, cleaner production, green logistics, customer cooperation, investment recovery, and reverse logistics (Zhu et al., 2008; Green et al., 2012). Internal practices improve processes under the focal firm's control; external practices extend expectations, information, and joint problem solving across organizational boundaries. Their complementarity matters because upstream materials and downstream recovery constrain what internal operations can achieve (Al-Sheyadi et al., 2019).

2.2. Operational performance

Operational performance concerns how reliably and efficiently an organization transforms inputs into customer value. Relevant outcomes include quality, unit cost, productivity, lead time, delivery reliability, flexibility, capacity utilization, inventory, waste, downtime, and continuity. Environmental improvement can support these outcomes through pollution prevention, yield improvement, energy and material efficiency, safer processes, supplier consistency, packaging reduction, route optimization, and value recovery. Trade-offs can occur when compliance costs, technology uncertainty, supplier switching, or poorly coordinated redesign disrupt operations. Operational gains should therefore be measured net of implementation and transition costs.

2.3. Environmental management practices as implementation capability

EMPs form a management cycle: establish policy and material priorities; assign accountability; set measurable objectives; design controls; build competence; monitor indicators; audit conformity and performance; correct deviations; and review the system. ISO 14001 institutionalizes this plan–do–check–act logic without prescribing a single environmental performance level. Certification may signal discipline, but substantive routines—not the certificate alone—create capability. EMP maturity is reflected in cross-functional ownership, evidence-based targets, supplier integration, lifecycle perspective, and timely corrective action.

2.4. Theoretical integration

The natural-resource-based view proposes that pollution prevention, product stewardship, and sustainable development capabilities can become sources of advantage when embedded in complex organizational routines (Hart, 1995). Stakeholder theory explains why regulators, customers, communities, employees, and supply-chain partners create pressures and resources for environmental action. Dynamic-capability logic clarifies how firms sense material environmental risks, seize improvement opportunities, and reconfigure processes and relationships. Together, these lenses predict that GSCM creates durable operational value when EMPs convert external expectations and dispersed practices into coordinated learning routines.

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3. REVIEW METHOD

3.1. Design and evidence identification

An integrative review was selected because the question links operations management, environmental management, strategy, and sustainable supply chains. The objective was theory-building synthesis rather than a pooled causal estimate. Searches through 8 August 2026 combined "green supply chain management," "environmental management practices," "environmental management system," "operational performance," "green purchasing," "eco-design," "reverse logistics," "SME," and "emerging economy." Priority was given to peer-reviewed empirical studies, systematic reviews, meta-analyses, foundational theory, and ISO guidance.

3.2. Eligibility and synthesis

Sources were included when they defined or tested GSCM practices, EMPs, environmental performance, or operational performance; explained a relevant mechanism or boundary condition; or provided a recognized management framework. Purely technical optimization studies without organizational implications and promotional claims without transparent methods were excluded. Evidence was coded into antecedents, practice bundles, EMP mechanisms, outcomes, enablers, barriers, and contextual conditions. Recurring causal sequences were compared and integrated into the GEOP framework.

3.3. Methodological limitations

The review is conceptually purposive rather than statistically exhaustive. Construct definitions and performance measures vary considerably, most empirical evidence is cross-sectional and self-reported, and manufacturing dominates the literature. English-language sources may underrepresent locally embedded practices. Accordingly, the framework identifies plausible mechanisms and testable propositions; it does not claim universal causal effects.

4. HOW GSCM CREATES OPERATIONAL VALUE

4.1. Green purchasing and supplier development

Environmental specifications, supplier assessment, audits, and joint improvement can reduce hazardous inputs, quality variation, disruption exposure, and waste at source. Green purchasing is more effective when buyers provide clear criteria, share forecasts and technical knowledge, and develop suppliers rather than transferring cost and risk unilaterally. For SMEs, tiered requirements and collaborative capability building are often more feasible than immediate exclusion.

4.2. Eco-design and cleaner operations

Eco-design reduces material intensity, toxicity, packaging, energy use, and end-of-life burden while improving manufacturability and recovery. Cleaner production strengthens yield, process capability, maintenance discipline, and workplace safety. Early design choices have disproportionate lifecycle effects; therefore, environmental, quality, procurement, operations, and marketing functions must evaluate trade-offs before specifications are locked.

4.3. Green logistics, customer cooperation, and reverse flows

Load consolidation, route planning, modal choice, reusable packaging, and energy-efficient warehousing can lower emissions and logistics cost. Customer cooperation improves demand information, responsible use, return quality, and packaging recovery. Reverse logistics can capture products, components, and materials for repair, reuse, remanufacture, or recycling. Its operational value depends on return predictability, inspection standards, disassembly design, recovery economics, and traceability.

4.4. Environmental performance as an operational mechanism

Lower energy, water, materials, emissions, and waste are environmental outcomes and intermediate operating mechanisms. Resource efficiency lowers variable cost; reduced hazardous material simplifies handling and compliance; better yield improves capacity and delivery; and waste visibility exposes process instability. Environmental performance therefore partially mediates the GSCM–

operational performance relationship, although some practices—such as supplier integration—may also affect quality and resilience directly.

5. THE ROLE OF ENVIRONMENTAL MANAGEMENT PRACTICES

5.1. Strategic alignment and accountability

EMPs translate broad sustainability commitments into material priorities, owners, budgets, controls, and review routines. Leadership must connect environmental objectives with operational scorecards and capital decisions. When environmental responsibility is confined to a specialist department, purchasing and production may optimize conflicting targets. Cross-functional accountability makes trade-offs visible and prevents green initiatives from becoming episodic projects.

5.2. Measurement, audit, and corrective action

Operational improvement requires baselines and process-level indicators. Absolute impacts should be paired with intensity metrics and boundary definitions to avoid misleading improvement caused by volume changes or outsourcing. Internal audits test both conformity and control effectiveness; management review allocates resources; corrective action investigates systemic causes rather than treating symptoms. Digital traceability can improve timeliness, but data governance and verification remain essential.

5.3. Competence, participation, and organizational learning

Employees and suppliers need competence to interpret requirements, identify losses, and respond to deviation. Training is most effective when linked to roles, improvement teams, standard work, feedback, and recognition. Participation uncovers tacit process knowledge and reduces resistance. Repeated plan–do–check–act cycles convert local experiments into organizational memory, enabling environmental and operational gains to persist despite personnel and market changes.

5.4. Substantive versus symbolic implementation

Formal policy, reporting, or certification can become symbolic when targets are detached from material impacts and audits emphasize documentation over results. Substantive EMPs show evidence of risk-based priorities, resource commitment, operational controls, verified data, closed corrective actions, supplier engagement, and management consequences. The distinction explains why similarly certified organizations can achieve different outcomes.

6. THE GEOP FRAMEWORK

The Green–Environmental–Operational Performance framework proposes a sequence: stakeholder and resource pressures shape GSCM adoption; the GSCM bundle creates improvement opportunities; EMP maturity embeds and coordinates these opportunities; environmental performance records reduced ecological burden; and operational performance captures cost, quality, delivery, flexibility, productivity, and resilience. Supply-chain integration and digital visibility enable information and joint action, while firm size, sector risk, institutional pressure, and environmental dynamism condition the strength of the relationships.

GEOP stage	Managerial question	Core practices	Illustrative evidence
1. Material priorities	Where are lifecycle impacts and operating losses concentrated?	Materiality assessment; stakeholder and legal analysis; baseline.	Defined boundary, risk register, resource-flow baseline.
2. Green practice bundle	Which upstream, internal, and downstream practices must work together?	Green purchasing; eco-design; cleaner operations; logistics; recovery.	Practice owners, supplier/customer agreements, implementation plan.
3. EMP embedding	How will practices become controlled routines?	Objectives; competence; operational controls; monitoring; audit; corrective action.	Controlled procedures, trained roles, verified indicators, closed actions.
4. Environmental results	Are resource use and impacts genuinely improving?	Energy, material, water, emissions, waste and hazardous-input controls.	Absolute and intensity trends; normalized and externally checked data.
5. Operational results	Do environmental gains create customer and operating value?	Integration with quality, cost, delivery, flexibility and resilience reviews.	Yield, defects, lead time, cost, downtime, service and recovery value.

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GEOP stage	Managerial question	Core practices	Illustrative evidence
6. Learning and renewal	What must be standardized, redesigned, scaled, or stopped?	Management review; supplier learning; investment; innovation; target reset.	Replicated gains, revised standards, capability and portfolio decisions.

Table 1. Green–Environmental–Operational Performance (GEOP) implementation architecture

6.1. Research propositions

Proposition 1. A complementary bundle of internal and external GSCM practices has a stronger positive association with operational performance than isolated practices.
Proposition 2. EMP maturity positively mediates the relationship between GSCM adoption and environmental performance by embedding green practices in accountable operating routines.
Proposition 3. Environmental performance positively mediates the relationship between substantively implemented GSCM and operational performance.
Proposition 4. Supply-chain integration strengthens the effect of GSCM on EMP maturity by improving information quality, joint problem solving, and alignment of controls.
Proposition 5. Digital environmental visibility strengthens—but does not substitute for—the effect of EMP maturity on environmental and operational performance.
Proposition 6. Symbolic environmental management weakens the GSCM–performance relationship, whereas substantive implementation increases persistence of gains over time.

7. DISCUSSION

The synthesis clarifies why GSCM sometimes produces strong operational gains and sometimes generates cost without sustained improvement. Green practices identify where supply-chain activities should change; EMPs determine whether those changes are governed, measured, corrected, and learned. This distinction moves analysis beyond the question of whether a firm has adopted a practice toward how deeply the practice has been integrated into its management system.

The GEOP framework contributes by separating five related constructs: GSCM adoption, EMP maturity, environmental performance, operational performance, and contextual enablers. This reduces conceptual overlap and makes causal testing more precise. It also reconciles natural-resource-based value creation with stakeholder pressure: external pressure initiates action, but internally embedded capabilities determine whether compliance evolves into process advantage.

7.1. Managerial implications

Managers should start with material environmental flows that also create operating losses, then select a complementary practice bundle rather than a collection of visible initiatives. A practical sequence is to baseline resource use and defects, identify lifecycle hotspots, assign joint owners, establish supplier and customer controls, train affected roles, pilot improvements, verify environmental and operational results, close corrective actions, and standardize only demonstrated gains. SMEs can prioritize high-payback measures and use associations, anchor customers, universities, or shared digital platforms to access expertise and verification.

Dashboards should link leading indicators—supplier conformance, training competence, preventive actions and process controls—to lagging environmental and operational outcomes. Managers should monitor absolute impacts alongside intensity metrics, disclose boundary changes, and test for burden shifting. Digital tools are valuable when they strengthen traceability and decisions; technology acquisition without process ownership, data quality, and review routines merely digitizes weak management.

7.2. Policy implications

Public policy can support adoption through stable standards, technical assistance, green finance, common measurement protocols, supplier-development programs, and shared testing or recovery infrastructure. Requirements should be proportionate to firm size and risk while preserving outcome integrity. Large buyers should avoid pushing reporting costs onto small suppliers without capability support. Sector roadmaps and interoperable data standards can lower transaction cost and reduce fragmented compliance.

7.3. Research agenda and limitations

Future studies should test EMP maturity as a mediator using longitudinal, multi-respondent, and objective process data. Researchers should distinguish adoption breadth from implementation depth, compare complementary practice configurations, and model time lags and transition costs. More evidence is needed from services, microenterprises, informal supply networks, and emerging economies. Studies should examine digital visibility, circular business models, climate risk, supplier power asymmetry, and possible rebound effects. The present review is conceptual and purposive; its propositions require empirical validation across sectors and institutional settings.

8. CONCLUSION

GSCM can improve operational performance through better inputs, eco-design, cleaner processes, efficient logistics, customer cooperation, and recovery of value. The benefits are not automatic. Environmental management practices provide the implementation architecture that aligns objectives, assigns responsibility, builds competence, controls processes, verifies results, and drives corrective learning. The GEOP framework therefore positions EMP maturity between green-practice adoption and sustained environmental and operational outcomes. Sustainable business is achieved not by labeling a supply chain green, but by managing environmental improvement as a disciplined operating capability.

DECLARATIONS

Author contributions (CRediT): Conceptualization, Methodology, Investigation, Formal analysis, Resources, Writing-original draft, Writing-review and editing, Visualization, and Project administration.

Funding: This research received no external funding.

Institutional review board statement: Not applicable. This study analyzed published literature and involved no human participants or identifiable personal data.

Informed consent statement: Not applicable.

Data availability statement: No new dataset was generated. Sources and the synthesis procedure are reported in the article.

Conflicts of interest: The author declares no conflict of interest.

Use of generative AI: Generative AI was used to assist language drafting, structural organization, and document formatting. The author reviewed and verified the arguments, citations, and final content and accepts full responsibility for the article.

Acknowledgments: None.

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