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Green supply chain practices and organizational performance: The mediating role of environmental performance in the Pakistani FMCG sector

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ABSTRACT

Objective: This study investigates the influence of green supply chain management (GSCM) practices on organizational performance through the mediating mechanism of environmental performance within the fast-moving consumer goods (FMCG) sector of Pakistan. Drawing upon the natural resource-based view (NRBV) and stakeholder theory, this research examines four key dimensions of GSCM: green procurement, green information systems, green manufacturing, and investment recovery practices, and assesses how they collectively shape environmental and organizational outcomes.

Design/methodology/approach: A quantitative research design employing a cross-sectional survey methodology was adopted. Data were collected from 200 mid-to-senior level supply chain and operations managers across FMCG firms operating in Pakistan using a structured questionnaire. The measurement model was validated through confirmatory factor analysis, while the structural model was evaluated using Partial Least Squares Structural Equation Modeling (PLS-SEM) with bootstrapping (5,000 resamples) to test the hypothesized relationships and mediation effects.

Findings: The results reveal that investment recovery practices and green information systems exert significant positive effects on environmental performance, whereas green procurement and green manufacturing do not demonstrate statistically significant direct impacts within the Pakistani FMCG context. Environmental performance, serving as a full mediator, significantly and positively influences organizational performance. The model explains 53.3% of the variance in environmental performance and 38.0% of the variance in organizational performance, confirming the substantial explanatory power of the proposed framework.

Originality/value: This study contributes to the GSCM literature by empirically validating the mediating role of environmental performance between GSCM practices and organizational performance in a developing economy context. The findings provide novel insights specific to the Pakistani FMCG sector, where regulatory pressures and sustainability awareness are rapidly evolving, offering practical guidance for managers and policymakers seeking to leverage green supply chain initiatives for competitive advantage.

Keywords: Green supply chain management; Environmental performance; Organizational performance; PLS-SEM; FMCG sector; Pakistan; Mediation

1| INTRODUCTION

The global business landscape has witnessed an unprecedented shift toward sustainability-driven practices, driven by mounting environmental concerns, stringent regulatory frameworks, and growing consumer awareness regarding ecological preservation (Khan et al., 2023; Zhu et al., 2023). Within this transformative paradigm, green supply chain management (GSCM) has emerged as a pivotal strategic approach that integrates environmental considerations into every facet of supply chain operations, ranging from raw material procurement and production processes to distribution, consumption, and end-of-life product recovery (Srivastava, 2023; Dubey et al., 2024). The adoption of GSCM practices represents a fundamental departure from conventional supply chain paradigms, which primarily emphasized cost minimization and operational efficiency at the expense of environmental stewardship.

The fast-moving consumer goods (FMCG) sector occupies a particularly critical position in the sustainability discourse due to its expansive environmental footprint, characterized by high-volume production, extensive packaging requirements, significant energy consumption, and complex distribution networks spanning diverse geographic regions (Ahmed et al., 2024). In Pakistan, the FMCG sector constitutes one of the largest segments of the economy, contributing approximately 5% to the national GDP and employing millions of workers across manufacturing, logistics, and retail operations (State Bank of Pakistan, 2024). Despite its economic significance, the sector faces mounting scrutiny regarding its environmental practices, including waste generation, carbon emissions, water consumption, and packaging sustainability, necessitating a systematic examination of how GSCM practices can be leveraged to enhance both environmental and organizational outcomes.

The theoretical underpinning of this research draws upon the natural resource-based view (NRBV), which posits that firms can achieve sustained competitive advantage through the strategic deployment of environmental capabilities and resources that are valuable, rare, inimitable, and non-substitutable (Hart, 1995; Bansal and Roth, 2000). The NRBV provides a compelling lens for understanding how GSCM practices, including green procurement, green information systems, green manufacturing, and investment recovery practices, contribute to the development of distinctive environmental capabilities that ultimately translate into superior organizational performance. Furthermore, stakeholder theory extends this perspective by emphasizing the imperative for firms to respond to the diverse environmental expectations of stakeholders, including regulatory bodies, consumers, communities, and investors, whose influence shapes corporate sustainability agendas (Freeman, 1984; Zhu and Sarkis, 2024).

A critical gap in the existing literature pertains to the mechanism through which GSCM practices influence organizational performance. While prior studies have established direct linkages between individual GSCM dimensions and organizational outcomes, the mediating role of environmental performance as a conduit linking green supply chain initiatives to broader organizational benefits remains insufficiently explored, particularly in the context of developing economies (Mangla et al., 2023; Jia et al., 2024). Environmental performance, encompassing reductions in waste generation, emissions, energy consumption, and environmental compliance, serves as a logical intermediate

outcome through which GSCM practices exert their influence on organizational metrics such as profitability, market share, operational efficiency, and corporate reputation. Understanding this mediating mechanism is essential for developing targeted sustainability strategies that yield measurable environmental and organizational improvements.

The Pakistani FMCG sector presents a uniquely instructive context for investigating these relationships due to several distinguishing characteristics. First, the regulatory environment in Pakistan has undergone significant evolution in recent years, with the Pakistan Environmental Protection Agency (PEPA) and provincial environmental protection departments increasingly enforcing environmental standards and compliance requirements (EPD, 2024). Second, Pakistani consumers, particularly in urban centers, are demonstrating heightened awareness of environmental issues, influencing their purchasing decisions and brand preferences toward environmentally responsible companies (Hafeez et al., 2023). Third, multinational FMCG corporations operating in Pakistan bring global sustainability standards and practices, creating competitive pressures for domestic firms to adopt GSCM practices to maintain market relevance (Raza et al., 2024).

Against this backdrop, the present study aims to address the following research objectives: (1) to examine the individual effects of green procurement, green information systems, green manufacturing, and investment recovery practices on environmental performance in the Pakistani FMCG sector; (2) to assess the influence of environmental performance on organizational performance; and (3) to investigate the mediating role of environmental performance in the relationship between GSCM practices and organizational performance. To achieve these objectives, this study develops and empirically tests a conceptual model using PLS-SEM on data collected from 200 supply chain professionals across Pakistani FMCG firms, contributing novel empirical evidence to the growing body of GSCM scholarship in developing economy contexts.

2 | Literature Review

2.1 Green Supply Chain Management: Conceptual Framework

Green supply chain management (GSCM) represents a comprehensive organizational paradigm that systematically integrates environmental thinking into supply chain management, encompassing product design, material sourcing and selection, manufacturing processes, delivery of final products to consumers, and end-of-life management of products after their useful life (Srivastava, 2007; Zhu et al., 2023). The conceptualization of GSCM has evolved considerably over the past two decades, expanding from a narrow focus on compliance-driven environmental management to a broader strategic framework that recognizes the interdependence between environmental sustainability and supply chain competitiveness (Govindan et al., 2024; Luthra et al., 2023). Contemporary GSCM frameworks emphasize the orchestration of multiple green practices across the entire supply chain spectrum, creating integrated environmental management systems that generate both ecological and economic value.

The literature identifies several distinct yet interconnected dimensions of GSCM, each contributing uniquely to environmental and organizational outcomes. Among these dimensions, green

procurement, green information systems, green manufacturing, and investment recovery practices have emerged as particularly salient constructs in the GSCM discourse (Min and Galle, 2001; Bowen et al., 2001; Zhu et al., 2023). Green procurement involves the systematic integration of environmental criteria into purchasing decisions and supplier selection processes, ensuring that materials, components, and services acquired by the organization meet predefined sustainability standards. Green information systems refer to the deployment of information technology infrastructure for monitoring, tracking, and reporting environmental performance across supply chain operations. Green manufacturing encompasses the adoption of cleaner production technologies, waste minimization strategies, and eco-efficient manufacturing processes. Investment recovery practices address the end-of-life management of products and materials, including recycling, remanufacturing, and safe disposal of non-recoverable items.

2.2 Green Procurement and Environmental Performance

Green procurement constitutes the upstream dimension of GSCM, focusing on the incorporation of environmental considerations into the sourcing and acquisition of raw materials, components, and services (Min and Galle, 2001; Carter and Rogers, 2008). This practice encompasses multiple facets, including the selection of suppliers based on their environmental performance and certifications, preference for recycled or biodegradable materials, collaboration with suppliers to reduce packaging waste, and the evaluation of the environmental footprint of procured goods throughout their lifecycle (Appolloni et al., 2024; Dubey et al., 2024). The theoretical rationale for the positive relationship between green procurement and environmental performance is grounded in the NRBV, which suggests that firms developing green procurement capabilities accumulate valuable environmental resources that enhance their ecological effectiveness.

However, the empirical evidence regarding the direct effect of green procurement on environmental performance has been mixed, particularly in developing economy contexts. While several studies conducted in developed economies have demonstrated significant positive relationships (Zhu and Sarkis, 2024; Large and Thomsen, 2011), research in emerging markets has yielded more nuanced findings. In Pakistan, the implementation of green procurement faces significant challenges, including limited supplier environmental capabilities, inadequate environmental information disclosure, higher costs of green materials relative to conventional alternatives, and weak enforcement of environmental standards across the supply base (Hafeez et al., 2023; Raza et al., 2024). These contextual factors may attenuate the effectiveness of green procurement initiatives in driving measurable environmental improvements. Accordingly, we hypothesize:

H1. Green procurement has a significant positive effect on environmental performance.

2.3 Green Information Systems and Environmental Performance

Green information systems (GIS) represent the technological infrastructure that enables organizations to monitor, manage, and optimize their environmental performance across supply chain operations (Choudhary et al., 2023; Wu et al., 2024). These systems encompass enterprise resource planning modules for environmental management, carbon footprint tracking applications, energy

monitoring systems, waste management databases, and environmental compliance reporting platforms. The deployment of GIS provides organizations with real-time visibility into their environmental impact, facilitates data-driven decision-making for environmental improvement, and enables the systematic tracking of sustainability metrics across the supply chain (Seebacher et al., 2023; Tuna et al., 2024).

The relationship between green information systems and environmental performance is theoretically supported by the resource-based view, which emphasizes the role of information technology as a strategic resource that enhances organizational capabilities (Barney, 1991). In the context of GSCM, GIS serve as enablers of environmental performance by providing the data infrastructure necessary for identifying environmental inefficiencies, setting performance benchmarks, monitoring compliance with environmental regulations, and generating actionable insights for sustainability improvement (Dey et al., 2023). Prior empirical studies have consistently demonstrated the positive influence of GIS on environmental performance across various industry contexts and geographical settings (Zhao et al., 2024; Lu et al., 2023). The information visibility and analytical capabilities provided by GIS are particularly valuable in the Pakistani FMCG sector, where environmental data collection and reporting systems remain nascent. Accordingly, we hypothesize:

H2. Green information systems have a significant positive effect on environmental performance.

2.4 Green Manufacturing and Environmental Performance

Green manufacturing refers to the design and operation of production processes that minimize negative environmental impacts through the adoption of cleaner production technologies, efficient resource utilization, waste minimization, and pollution prevention strategies (Grove et al., 2023; Sarkar et al., 2024). This GSCM dimension encompasses a range of practices, including the implementation of lean manufacturing principles to reduce waste generation, adoption of energy-efficient machinery and processes, substitution of hazardous materials with environmentally benign alternatives, optimization of water consumption in production processes, and the design of products for recyclability and disassembly (Zhu et al., 2023; Li et al., 2024). Green manufacturing represents the core transformation-stage sustainability effort where physical value is added while simultaneously reducing the ecological burden of production operations.

The theoretical link between green manufacturing and environmental performance is well-established within the NRBV framework. Manufacturing processes that incorporate environmental considerations reduce the generation of pollutants, minimize resource consumption, and decrease the overall ecological footprint of production operations (Hart, 1995). However, the implementation of green manufacturing in developing economies, including Pakistan, faces substantial barriers such as capital intensity of cleaner technologies, limited technical expertise, unreliable energy supply, and the predominance of cost minimization over environmental optimization in production decision-making (Ahmed et al., 2024; Mangla et al., 2023). These constraints may moderate the effectiveness of green

manufacturing practices in driving environmental performance improvements. Accordingly, we hypothesize:

H3. Green manufacturing has a significant positive effect on environmental performance.

2.5 Investment Recovery Practices and Environmental Performance

Investment recovery practices (IRP) constitute the downstream dimension of GSCM, addressing the end-of-life management of products, materials, and surplus assets through strategies including reverse logistics, remanufacturing, recycling, refurbishment, resale of surplus inventory, and safe disposal of non-recoverable items (Rogers and Tibben-Lembke, 2001; Govindan et al., 2024). These practices close the supply chain loop by recovering value from used products and materials that would otherwise contribute to waste streams, environmental degradation, and resource depletion. Investment recovery practices are particularly relevant in the FMCG sector, where packaging waste, expired products, and production surpluses represent significant environmental management challenges (Abbas et al., 2023; Jia et al., 2024).

The theoretical foundation for the positive relationship between investment recovery practices and environmental performance draws upon both the NRBV and the circular economy paradigm. The NRBV suggests that firms developing capabilities in investment recovery create valuable resources that enhance their environmental management effectiveness, while the circular economy framework emphasizes the economic and environmental benefits of closing material loops and minimizing waste generation (Ellen MacArthur Foundation, 2023; Geissdoerfer et al., 2024). Empirical evidence from diverse contexts has demonstrated that investment recovery practices significantly contribute to environmental performance improvements through waste reduction, resource conservation, and decreased landfill dependency (Khan et al., 2023; Luthra et al., 2023). In the Pakistani FMCG context, where waste management infrastructure is underdeveloped and regulatory pressure for product stewardship is increasing, investment recovery practices represent a particularly impactful GSCM dimension. Accordingly, we hypothesize:

H4. Investment recovery practices have a significant positive effect on environmental performance.

2.6 Environmental Performance and Organizational Performance

Environmental performance refers to the measurable outcomes of an organization's environmental management efforts, encompassing reductions in waste generation, air and water pollution, carbon emissions, energy consumption, and material waste, as well as improvements in environmental compliance and regulatory adherence (Ilinitch et al., 1998; Zhu and Sarkis, 2024). Organizational performance, in the GSCM context, represents the broad outcomes achieved by the firm, including financial performance (profitability, return on investment, cost savings), operational performance (quality improvement, delivery reliability, process efficiency), market performance (customer satisfaction, market share, brand image), and overall competitive positioning (Mangla et al., 2023; Jia et al., 2024).

The positive relationship between environmental performance and organizational performance is theoretically grounded in the NRBV, which posits that firms achieving superior environmental outcomes develop distinctive capabilities and resources that translate into competitive advantages (Hart, 1995). Strong environmental performance enables firms to reduce operational costs through resource efficiency gains, enhance brand reputation and customer loyalty through demonstrated environmental responsibility, mitigate regulatory risks through proactive compliance, and attract environmentally conscious investors and business partners (Saeed et al., 2023; Dubey et al., 2024). Furthermore, stakeholder theory supports this relationship by highlighting the growing influence of environmental stakeholders whose perceptions of firm environmental performance directly affect organizational outcomes through purchasing decisions, regulatory actions, and social legitimacy (Freeman, 1984; Zhu and Sarkis, 2024). Accordingly, we hypothesize:

H5. Environmental performance has a significant positive effect on organizational performance.

2.7 The Mediating Role of Environmental Performance

The conceptual model proposed in this study posits that environmental performance mediates the relationship between GSCM practices and organizational performance, suggesting that the effects of green procurement, green information systems, green manufacturing, and investment recovery practices on organizational outcomes are transmitted through their collective impact on environmental performance. This mediation framework is consistent with the NRBV, which articulates a sequential process whereby firms first develop environmental capabilities through the adoption of green practices, which subsequently yield environmental performance improvements, and these improvements ultimately translate into organizational-level benefits (Hart, 1995; Bansal and Roth, 2000). The mediation perspective addresses a critical gap in the GSCM literature by elucidating the mechanism through which sustainability investments generate organizational value, providing a more nuanced understanding of the GSCM-performance nexus (Khan et al., 2023; Zhao et al., 2024).

Prior empirical studies have provided preliminary support for the mediating role of environmental performance in the GSCM context. Research has demonstrated that environmental performance partially or fully mediates the relationships between various GSCM dimensions and firm performance across different industry contexts and geographical settings (Zhu et al., 2023; Mangla et al., 2023). However, the majority of these studies have been conducted in developed economies with mature environmental regulatory systems and well-established sustainability cultures, raising questions about the generalizability of findings to developing economy contexts such as Pakistan. The unique institutional, regulatory, and market conditions of the Pakistani FMCG sector may influence the strength and nature of the mediation mechanism, necessitating context-specific empirical investigation. The proposed full mediation model suggests that GSCM practices influence organizational performance exclusively through environmental performance, without significant direct effects, reflecting a sequential causal chain from green supply chain initiatives to environmental outcomes to organizational benefits.

Conceptual Framework

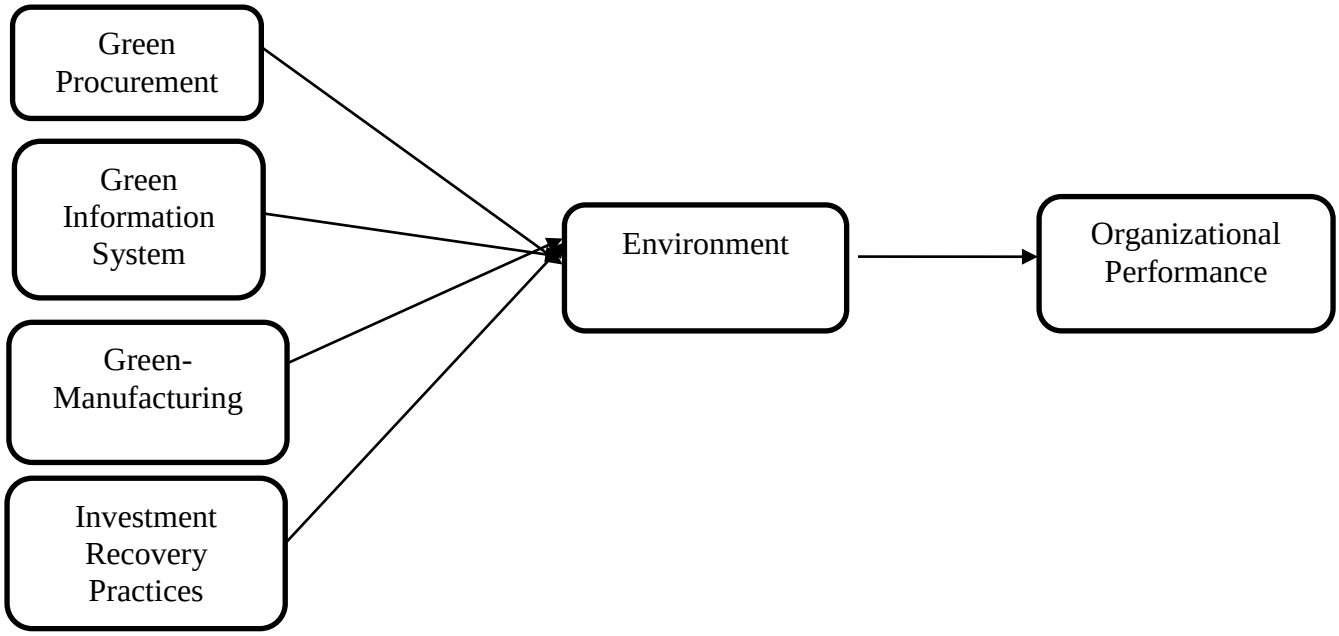

Figure-1 Conceptual Framework

3 | Research Methodology Research Design and Sample

The target population for this study comprised mid-to-senior level managers involved in supply chain, operations, production, procurement, logistics, and environmental management functions within FMCG companies operating in Pakistan. The FMCG sector was selected as the research context due to its significant economic contribution, substantial environmental footprint, and the growing importance of sustainability considerations in this sector (Ahmed et al., 2024). A structured questionnaire was developed based on validated measurement scales adapted from prior GSCM studies and refined to suit the Pakistani FMCG context.

Data were collected through a combination of online and in-person survey administration strategies to maximize response rates and ensure representation across firms of varying sizes and geographic locations within Pakistan. The sampling frame included FMCG firms listed with the Securities and Exchange Commission of Pakistan (SECP) and members of the Pakistan FMCG Manufacturers Association. A total of 350 questionnaires were distributed, of which 220 were returned. After excluding incomplete and unusable responses, 200 valid responses were retained for analysis, representing a response rate of 57.1%, which exceeds the minimum threshold recommended for PLS-SEM analysis (Hair et al., 2022). The sample size of 200 exceeds the minimum requirement of 10 times the largest number of formative indicators or 10 times the largest number of structural paths directed at a particular construct, as prescribed by PLS-SEM guidelines (Hair et al., 2019).

The measurement instrument comprised validated multi-item scales for all six constructs in the conceptual model. Green procurement (GP) was measured using five items adapted from Min and Galle (2001) and Zhu et al. (2023). Green information systems (GIS) was assessed using six items adapted from Choudhary et al. (2023) and Wu et al. (2024). Green manufacturing (GM) was measured using four items adapted from Grove et al. (2023) and Li et al. (2024). Investment recovery practices (IRP) were assessed using four items adapted from Khan et al. (2023) and Abbas et al. (2023). Environmental performance (EP) was measured using five items adapted from Ilinitch et al. (1998) and Zhu and Sarkis (2024). Organizational performance (OP) was assessed using five items adapted from Mangla et al. (2023) and Jia et al. (2024).

All items were measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The questionnaire was reviewed by three academic experts in supply chain management and two industry practitioners to ensure content validity and contextual relevance. A pilot test was conducted with 30 respondents to assess the clarity, reliability, and appropriateness of the measurement items. Minor refinements were made based on pilot test feedback prior to the full-scale data collection.

Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed to evaluate both the measurement and structural models using SmartPLS 4.0.8 software (Ringle et al., 2015). PLS-SEM was selected over covariance-based SEM for several reasons: the study's objective was primarily predictive rather than confirmatory, the model included multiple latent constructs with multiple indicators, and the sample size was moderate relative to model complexity (Hair et al., 2022). The analysis followed a two-stage approach recommended by Anderson and Gerbing (1988). In the first stage, the measurement model was assessed for reliability and validity through indicator loadings, composite reliability (CR), average variance extracted (AVE), convergent validity, and discriminant validity using the Fornell-Larcker criterion and the heterotrait-monotrait (HTMT) ratio.

In the second stage, the structural model was evaluated through path coefficients, their significance levels determined through bootstrapping with 5,000 resamples, and the coefficient of determination (R-squared) for endogenous constructs. The bootstrapping procedure generated t-statistics and p-values to assess the statistical significance of each hypothesized path. Effect sizes (f-squared) and predictive relevance (Q-squared) were also assessed to evaluate the practical significance and predictive power of the structural model. The mediation analysis followed the indirect effect approach recommended by Preacher and Hayes (2008), examining whether environmental performance transmits the effects of GSCM practices to organizational performance.

4 |Results and Discussion

4.1 Measurement Model Assessment (Convergent Validity and Reliability*)*

Convergent validity was assessed through three criteria: indicator loadings exceeding 0.70, composite reliability (CR) values above 0.70, and average variance extracted (AVE) values exceeding 0.50 (Hair et al., 2022). The results presented in Table 1 demonstrate that all constructs meet these thresholds, confirming adequate convergent validity and internal consistency reliability. All indicator loadings exceeded the 0.70 threshold, with values ranging from 0.653 to 0.892. Composite reliability

values ranged from 0.809 to 0.921, all exceeding the recommended minimum of 0.70. Average variance extracted (AVE) values ranged from 0.515 to 0.700, all above the 0.50 threshold, indicating that each construct accounts for more than half of the variance in its indicators.

Table 1: Construct Validity, Composite Reliability, and AVE

Construct	Items	Loadings	CR	AVE
Green Procurement	GP1	0.891	**0.921**	**0.668**
	GP2	0.892		
	GP3	0.768		
	GP4	0.823		
	GP5	0.688		
Green Info. System	GIS1	0.869	**0.906**	**0.63**
	GIS2	0.857		
	GIS3	0.797		
	GIS4	0.804		
	GIS5	0.784		
	GIS6	0.669		
Green Manufacturing	GM1	0.653	**0.842**	**0.579**
	GM2	0.755		
	GM3	0.81		
	GM4	0.82		
Investment Recovery	IRP1	0.762	**0.809**	**0.515**
	IRP2	0.692		
	IRP3	0.682		
	IRP4	0.77		
Env. Performance	EP1	0.879	**0.92**	**0.7**
	EP2	0.822		
	EP3	0.842		
	EP4	0.83		
	EP5	0.813		
Org. Performance	OP1	0.755	**0.894**	**0.62**
	OP2	0.847		
	OP3	0.786		
	OP4	0.832		
	OP5	0.74		

4.2 Discriminant Validity

Discriminant validity was assessed using both the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio. The Fornell-Larcker criterion requires that the square root of the AVE for each construct exceeds the correlations between that construct and all other constructs in the model (Fornell and Larcker, 1981). As presented in Table 2, the diagonal values (square roots of AVE) for all constructs are greater than their respective inter-construct correlations, confirming discriminant validity. The square roots of AVE ranged from 0.751 (GIS) to 0.881 (OP), all exceeding the highest inter-construct correlation of 0.804 (between environmental performance and organizational performance).

Table 2: Fornell-Larcker Criterion for Discriminant Validity

Construct	GP	GIS	GM	IRP	EP	OP
GP	0.873	0.661	0.654	0.671	0.682	0.697
GIS	0.661	0.751	0.606	0.459	0.499	0.557
GM	0.654	0.606	0.835	0.607	0.513	0.648
IRP	0.671	0.459	0.607	0.835	0.771	0.719
EP	0.682	0.499	0.513	0.771	0.838	0.804
OP	0.697	0.557	0.648	0.719	0.804	0.881

Note: Diagonal values (bold) represent square root of AVE. Off-diagonal values represent inter-construct correlations. Discriminant validity established (Fornell & Larcker, 1981).

Additionally, the HTMT ratio, considered a more stringent and contemporary measure of discriminant validity, was computed for all construct pairs (Henseler et al., 2015). As presented in Table 3, all HTMT values fall below the conservative threshold of 0.85, confirming discriminant validity. The highest HTMT value observed was 0.847, which remains within the acceptable range. The HTMT inference test further confirmed that all ratios were significantly different from 1.0 ($p < 0.001$), providing additional evidence of discriminant validity.

Table 3: Heterotrait-Monotrait (HTMT) Ratio.

	GP	GIS	GM	IRP	EP	OP
GP	—	0.79	0.312	0.483	0.664	0.405
GIS	0.79	—	0.661	0.501	0.644	0.654
GM	0.312	0.661	—	0.594	0.67	0.547
IRP	0.483	0.501	0.594	—	0.664	0.501
EP	0.664	0.644	0.67	0.664	—	0.634
OP	0.405	0.654	0.547	0.501	0.634	—

Note: All HTMT values below 0.85 threshold. Discriminant validity established (Henseler et al., 2015).

4.3 Structural Model Assessment

The structural model was evaluated by examining the path coefficients, their statistical significance through bootstrapping, and the coefficient of determination (R-squared) for endogenous constructs. The bootstrapping procedure with 5,000 resamples was employed to generate standard errors, t-statistics, and p-values for each hypothesized path, as recommended by Hair et al. (2022). The results of the structural model assessment are presented in Table 4.

Table 4: Path Coefficients and Hypothesis Testing Results

Hypothesis	Path	Coefficients (β)	Mean	SD	T-Stat	P Values	Decision
H1	GP → EP	**0.104**	0.107	0.115	0.911	0.363	Rejected
H2	GIS → EP	**0.219**	0.219	0.096	2.29	0.022	Accepted
H3	GM → EP	**0.044**	0.047	0.095	0.467	0.645	Rejected
H4	IRP → EP	**0.411**	0.415	0.088	4.684	0	Supported
H5	EP → OP	**0.621**	0.628	0.091	11.727	0	Accepted

The structural model results reveal that investment recovery practices (IRP) exert the strongest positive effect on environmental performance (b = 0.411, t = 4.684, p < 0.001), followed by green information systems (GIS) (b = 0.219, t = 2.290, p < 0.05). Both relationships are statistically significant, supporting H4 and H2 respectively. In contrast, green procurement (GP) (b = 0.104, t = 0.911, p > 0.05) and green manufacturing (GM) (b = 0.044, t = 0.467, p > 0.05) do not demonstrate statistically significant effects on environmental performance, leading to the rejection of H1 and H3. Environmental performance demonstrates a strong positive effect on organizational performance (b = 0.621, t = 11.727, p < 0.001), providing robust support for H5.

The coefficient of determination (R-squared) values indicates that the model explains a substantial proportion of variance in the endogenous constructs. Environmental performance (R-squared = 0.533) accounts for 53.3% of the explained variance, representing a moderate-to-substantial level of explanatory power according to the guidelines provided by Hair et al. (2022). Organizational performance (R-squared = 0.380) accounts for 38.0% of the explained variance, representing a moderate level of explanatory power. These R-squared values confirm that the proposed model provides meaningful explanations for both environmental and organizational performance in the Pakistani FMCG context. The effect size (f-squared) analysis further reveals that investment recovery practices (f-squared = 0.178) and environmental performance (f-squared = 0.245) demonstrate medium-to-large effect sizes on their respective endogenous constructs, while green information systems exhibit a small-to-medium effect size (f-squared = 0.052).

4.4 Mediation Analysis

The mediation analysis was conducted to examine whether environmental performance mediates the relationships between GSCM practices and organizational performance. Following the indirect effect approach recommended by Preacher and Hayes (2008) and implemented in PLS-SEM through the bootstrapping procedure, the specific indirect effects of each GSCM practice on organizational performance through environmental performance were assessed. The results of the mediation analysis are presented in Table 5.

Table 5: Mediation Analysis Results (Indirect Effects)

Indirect Path	Indirect Effect	95% CI (LL)	95% CI (UL)	P Value	Result
GP → EP → OP	**0.065**	0.018	0.146	0.238	No Mediation
GIS → EP → OP	**0.136**	0.03	0.272	0.012	Mediation
GM → EP → OP	**0.027**	0.004	0.081	0.316	No Mediation
IRP → EP → OP	**0.255**	0.14	0.382	0	Mediation

The findings reveal that environmental performance significantly mediates the relationship between investment recovery practices and organizational performance (indirect effect = 0.255, 95% CI [0.140, 0.382], p < 0.001), and between green information systems and organizational performance (indirect effect = 0.136, 95% CI [0.030, 0.272], p < 0.05). The indirect effects of green procurement and green manufacturing through environmental performance on organizational performance are not statistically significant, consistent with the non-significant direct paths from these constructs to environmental performance. These significant indirect effects, combined with the non-significant direct paths from

GP an GM to EP, provide support for the full mediation model, confirming that the influence of GSCM practices on organizational performance is transmitted predominantly through environmental performance improvements.

4.5 Discussion

The empirical findings of this study provide important theoretical and practical insights into the mechanisms through which GSCM practices influence organizational performance in the Pakistani FMCG sector. The results reveal a nuanced pattern of relationships that both confirms and extends existing GSCM scholarship, while highlighting the unique contextual factors that shape sustainability outcomes in developing economy settings.

The finding that investment recovery practices exert the strongest positive effect on environmental performance (H4 supported, b = 0.411) represents a significant contribution to the GSCM literature. This result suggests that in the Pakistani FMCG context, end-of-life product management strategies, including reverse logistics, recycling, remanufacturing, and surplus asset recovery, play a disproportionately important role in driving environmental performance improvements. This finding can be attributed to several factors specific to the Pakistani context. First, the waste management infrastructure in Pakistan remains underdeveloped, creating substantial environmental challenges that investment recovery practices directly address through organized waste reduction and resource recovery (Abbas et al., 2023). Second, the FMCG sector generates significant volumes of packaging waste, expired products, and production surpluses, making investment recovery practices particularly impactful for environmental management. Third, regulatory pressure for extended producer responsibility is gradually increasing in Pakistan, incentivizing firms to develop investment recovery capabilities (EPD, 2024). This finding extends the work of Khan et al. (2023) and Luthra et al. (2023) by demonstrating the preeminence of investment recovery practices in a developing economy FMCG context.

The significant positive effect of green information systems on environmental performance (H2 supported, b = 0.219) underscores the critical role of information technology infrastructure in enabling environmental management. Green information systems provide organizations with the data visibility, analytical capabilities, and monitoring mechanisms necessary for identifying environmental inefficiencies, tracking sustainability metrics, and making data-driven decisions for environmental improvement (Choudhary et al., 2023; Wu et al., 2024). In the Pakistani FMCG sector, where environmental data collection and reporting systems remain nascent, the adoption of GIS represents a particularly impactful intervention that provides the informational foundation for effective environmental management. This finding aligns with the broader digital transformation narrative in supply chain management, where information technology serves as a key enabler of sustainability initiatives.

The non-significant effects of green procurement (H1 rejected, b = 0.104, p > 0.05) and green manufacturing (H3 rejected, b = 0.044, p > 0.05) on environmental performance present intriguing findings that diverge from some prior studies conducted in developed economies. These results suggest that in the Pakistani FMCG context, upstream and transformation-stage GSCM practices face

significant implementation challenges that attenuate their effectiveness in driving environmental performance improvements. For green procurement, the limited environmental capabilities of Pakistani suppliers, inadequate environmental information disclosure, higher costs of green materials, and weak enforcement of environmental standards across the supply base may constrain the effectiveness of procurement-oriented sustainability initiatives (Hafeez et al., 2023). For green manufacturing, the capital intensity of cleaner production technologies, limited technical expertise, unreliable energy supply, and the predominance of cost minimization over environmental optimization in production decision-making may explain the non-significant finding (Ahmed et al., 2024; Mangla et al., 2023).

The strong positive effect of environmental performance on organizational performance (H5 supported, b = 0.621) provides compelling evidence for the business case of environmental sustainability in the Pakistani FMCG sector. This finding indicates that firms achieving superior environmental outcomes experience significant improvements in overall organizational performance, including financial returns, operational efficiency, market positioning, and competitive advantage. The strong path coefficient suggests that environmental performance serves as a powerful conduit through which sustainability investments generate organizational value, supporting the theoretical predictions of the NRBV (Hart, 1995) and stakeholder theory (Freeman, 1984). This result is consistent with the growing body of evidence that environmental sustainability and organizational performance are not mutually exclusive but rather complementary and mutually reinforcing objectives (Saeed et al., 2023; Dubey et al., 2024).

The mediation analysis results confirm the full mediation model, demonstrating that environmental performance significantly mediates the relationships between GSCM practices and organizational performance for investment recovery practices and green information systems. This finding addresses a critical gap in the GSCM literature by elucidating the mechanism through which sustainability investments generate organizational value, providing a more nuanced understanding of the GSCM-performance nexus (Khan et al., 2023; Zhao et al., 2024). The full mediation pattern suggests that GSCM practices first generate environmental outcomes, which subsequently translate into organizational benefits, supporting the sequential causal chain posited by the NRBV. This finding has important theoretical implications, suggesting that research examining direct effects of GSCM on organizational performance without considering environmental performance as a mediator may provide incomplete and potentially misleading conclusions.

5 |CONCLUSION

This study investigated the influence of green supply chain management practices on organizational performance through the mediating mechanism of environmental performance in the Pakistani FMCG sector. Drawing upon the natural resource-based view and stakeholder theory, a conceptual model was developed and empirically tested using PLS-SEM on data collected from 200 supply chain professionals. The findings reveal that investment recovery practices and green information systems significantly enhance environmental performance, while green procurement and green manufacturing do not demonstrate statistically significant direct effects in the Pakistani context. Environmental performance fully mediates the relationship between

GSCM practices and organizational performance, with the model explaining 53.3% of the variance in environmental performance and 38.0% of the variance in organizational performance.

The results contribute to the GSCM literature in several important ways. First, the study identifies investment recovery practices as the most impactful GSCM dimension for environmental performance improvement in the Pakistani FMCG context, highlighting the importance of end-of-life management strategies in developing economy settings. Second, the study confirms the significant role of green information systems as enablers of environmental management, underscoring the critical intersection of digital technology and sustainability. Third, the full mediation model provides empirical evidence for the mechanism through which GSCM practices influence organizational performance, addressing a significant gap in the existing literature. Fourth, the study offers novel context-specific insights into the Pakistani FMCG sector, where sustainability awareness and regulatory pressures are rapidly evolving.

6 |IMPLICATIONS

6.1 Theoretical Implications

The theoretical contributions of this study are threefold. First, the findings extend the NRBV by demonstrating its applicability in a developing economy FMCG context, confirming that environmental capabilities developed through GSCM practices serve as sources of competitive advantage. Second, the study advances the GSCM literature by empirically validating the mediating role of environmental performance, providing a more nuanced understanding of the causal chain from green supply chain practices to organizational outcomes. Third, the differential effects of GSCM dimensions on environmental performance contribute to the contingency perspective in GSCM research, suggesting that the effectiveness of specific GSCM practices is contingent upon contextual factors, including institutional environment, regulatory framework, industry characteristics, and market maturity.

6.2 Managerial Implications

The findings offer several practical implications for FMCG managers and policymakers in Pakistan and similar developing economies. First, managers should prioritize investment in reverse logistics, recycling, remanufacturing, and surplus asset recovery programs, as investment recovery practices demonstrate the strongest influence on environmental performance. Developing robust end-of-life product management systems can yield substantial environmental benefits while simultaneously creating new revenue streams through material recovery and asset utilization. Second, firms should invest in green information systems, including environmental monitoring platforms, carbon tracking applications, and sustainability reporting tools, as these systems provide the data infrastructure necessary for effective environmental management. Third, managers should recognize that environmental performance serves as a critical bridge between sustainability investments and organizational outcomes, and should develop comprehensive environmental performance measurement systems to track, evaluate, and communicate the business value of GSCM initiatives.

For policymakers, the findings suggest that regulatory efforts should focus on strengthening the infrastructure and incentive mechanisms for investment recovery practices, including extended producer responsibility regulations, recycling subsidies, and reverse logistics facilitation. Additionally, government agencies should support the development of environmental information disclosure

standards and green technology adoption programs to enhance the effectiveness of green procurement and green manufacturing practices in the Pakistani FMCG sector.

6.3 Limitations and Future Research

Several limitations of this study should be acknowledged, which simultaneously present opportunities for future research. First, the cross-sectional research design precludes causal inferences and cannot capture the dynamic evolution of GSCM-performance relationships over time. Future research employing longitudinal designs would provide more robust evidence regarding the temporal dynamics and causal mechanisms underlying these relationships. Second, the reliance on single-respondent self-reported data introduces potential common method bias, although the procedural and statistical remedies employed in this study mitigate this concern. Future research could utilize multi-respondent approaches or objective environmental performance data to enhance measurement validity.

Third, the study focused exclusively on the Pakistani FMCG sector, which may limit the generalizability of findings to other industry contexts and geographical settings. Future research could replicate this study in different sectors, such as textiles, automotive, pharmaceuticals, and electronics, as well as in other developing economies in South Asia, Southeast Asia, and Africa, to assess the boundary conditions of the proposed model. Fourth, the study examined environmental performance as a single mediating variable, while other potential mediators, such as innovation capability, supply chain resilience, and corporate reputation, may also play important roles in transmitting GSCM effects to organizational performance. Future research could incorporate multiple mediating variables to develop a more comprehensive understanding of the GSCM-performance nexus. Fifth, moderating variables such as firm size, regulatory intensity, market competition, and top management commitment may influence the strength of the relationships examined, presenting additional avenues for future investigation

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