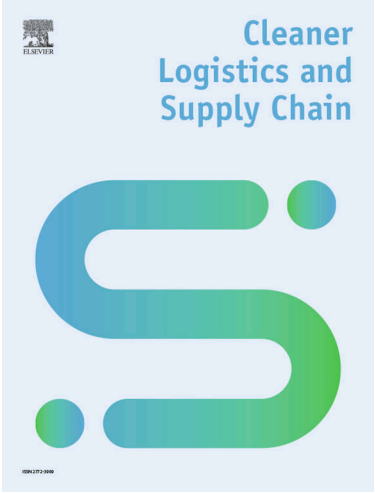
Journal Pre-proofs



Sustainable innovation as a catalyst: linking green supply chain practices to corporate reputation in emerging markets

Ahmad Mohammad Herzallah, Raed Ali M. Iriqat, Karam Zaki, Gamal S.A. Khalifa, Tagreed Awad Abdelhalim Abdelfadel, Mohammad Husni Hamed, Ahmed K. Elnagar

PII: S2772-3909(25)00044-7
DOI: https://doi.org/10.1016/j.clscn.2025.100245
Reference: CLSCN 100245

To appear in: *Cleaner Logistics and Supply Chain*

Received Date: 20 December 2024
Revised Date: 23 May 2025
Accepted Date: 4 July 2025

Please cite this article as: A.M. Herzallah, R.A.M. Iriqat, K. Zaki, G.S.A. Khalifa, T.A. Abdelhalim Abdelfadel, M.H. Hamed, A.K. Elnagar, Sustainable innovation as a catalyst: linking green supply chain practices to corporate reputation in emerging markets, *Cleaner Logistics and Supply Chain* (2025), doi: https://doi.org/10.1016/j.clscn.2025.100245

Sustainable Innovation as a Catalyst: Linking Green Supply Chain Practices to Corporate Reputation in Emerging Markets

Ahmad Mohammad Herzallah

Department of Business administration, Faculty of Business and Economics, Al-Quds University, Jerusalem-Palestine.

Email: ahirzallah@staff.alquds.edu

ORCID: https://orcid.org/0000-0002-9453-3777

Raed Ali M. Iriqat

Department of Business Administration, Faculty of Business, Arab American University, Jenin, Palestine.

E-mail: raed.iriqat@aaup.edu

ORCID: https://orcid.org/0000-0001-7186-2669

Karam Zaki

Business Administration Department, College of Science and Humanities, Shaqra University, 17452, Saudi Arabia; Hotel Studies Department, Faculty of Tourism and Hotels, Fayoum University, 63514, Egypt. kzaki@su.edu.sa

ORCID: https://orcid.org/0000-0001-6070-5449

Gamal S. A. Khalifa

Faculty of Business, Higher Colleges of Technology, AAWC, Abu Dhabi, UAE. Email: gkhalifa@hct.ac.ae

ORCID: https://orcid.org/0000-0003-1665-9291

Tagreed Awad Abdelhalim Abdelfadel

Administrative and Financial Sciences Department, Applied College, Taibah University, Medinah, 41461, Saudi Arabia.

Business Administration Department, College of Administrative Sciences, Omdurman Islamic University, Sudan., Dr.tagreed@windowslive.com

Mohammad Husni Hamed

School of Public Health, Al-Quds University, Jerusalem- Palestine. E-mail: Fahmawi101ps@yahoo.com

ORCID: 0009-0001-2645-3361.

Ahmed K Elnagar

Administrative and Financial Sciences, Applied College, Taibah University, Medinah, 41411, Saudi Arabia, Hotel Management. Faculty of Tourism & Hotel Management, Suez Canal University, Ismailia, 41522, Egypt.
aelnagar@taibahu.edu.sa

ORCID: https://orcid.org/0000-0003-1787-8189

Sustainable Innovation as a Catalyst: Linking Green Supply Chain Practices to Corporate Reputation in Emerging Markets

Abstract

This study examines the mediating role of sustainable innovation (SI) in the relationship between green supply chain management (GSCM) practices and corporate reputation (CR) within SMEs specialized in logistics and manufacturing sectors in Saudi Arabia. To address the limited understanding of how SI enhances the link between GSCM and CR, we developed a comprehensive model and validated it using partial least squares structural equation modeling (PLS-SEM). The model's authenticity was confirmed through rigorous tests of convergent and discriminant validity, composite reliability, and overall goodness-of-fit measures. Data were collected through a cross-sectional survey of 279 valid responses from SMEs identified based on the World Bank's manufacturing and logistics sectors, with data authentication ensured via thorough screening, pilot testing, and adherence to established reliability standards. The findings reveal that GSCM practices have a significant direct impact on CR and SI. Furthermore, SI positively influences CR and partially mediates the GSCM-CR relationship, as evidenced by substantial R^2 values and statistically significant path coefficients. These results underscore the critical role of SI in transforming GSCM efforts into enhanced reputational outcomes. From a practical standpoint, the study highlights the need for managers to integrate SI into their GSCM strategies to achieve both environmental and reputational benefits. Investment in eco-design, resource-efficient technologies, and customer collaboration are vital for fostering innovation and improving public perception. The research also offers theoretical contributions by extending the Resource-Based View (RBV) and stakeholder theory, emphasizing the mediating power of SI in sustainability frameworks.

Keywords: green supply chain management, corporate reputation, sustainable innovation, logistics and manufacturing, PLS-SEM.

1. Introduction

Corporate reputation (CR) represents one of the most critical intangible assets for organizations, directly influencing customer loyalty, stakeholders' trust, and overall business performance (Qoura and Khalifa, 2013). Defined as the collective perception of a company's credibility,

reliability, and ethical standing, CR is essential for securing competitive advantages in a rapidly evolving marketplace (Yusof et al., 2020). For small and medium-sized enterprises operating in the logistics and manufacturing sectors, CR is particularly crucial as these firms heavily rely on stakeholder relationships to maintain market position amid resource constraints. However, while the role of CR in driving business success is well established, its determinants in the context of SMEs remain underexplored, particularly in emerging economies like Saudi Arabia.

Green supply chain management (GSCM) has emerged as a cornerstone of sustainable development, integrating environmental considerations into supply chain activities—including product design, procurement, production, logistics, and waste management (Amemba et al., 2013). By reducing environmental harm and fostering sustainable practices, GSCM enhances corporate reputation by positioning firms as environmentally responsible and socially ethical organizations (Dzikriansyah et al., 2023). Internally, GSCM necessitates strong managerial commitment, environmental auditing, and cross-functional collaboration, while externally, it emphasizes partnerships with suppliers and customers to achieve shared sustainability goals (Wungkana et al., 2023). For SMEs in logistics and manufacturing, adopting GSCM is critical to aligning with increasing stakeholders' expectations for sustainable business practices, thereby reinforcing market credibility. However, while the link between GSCM and CR is well documented, the mechanisms through which these practices yield reputational benefits—especially the mediating role of sustainable innovation (SI)—remain insufficiently explored.

Sustainable innovations (SI) provide a transformative pathway to amplify the impact of GSCM on CR. SI involves the development and implementation of new products, processes, and technologies that enhance environmental performance while improving operational efficiency (Iriqat et al., 2025; Khalifa et al., 2023; Le et al., 2022). Examples include energy-efficient production methods, renewable energy adoption, and advanced waste management systems—all of which strengthen an organization's sustainability narrative (Aslam et al., 2019). By driving tangible advancement in environmental stewardship, SI acts as a critical mechanism for building trust and credibility among stakeholders and for differentiating SMEs in competitive markets. Additionally, SI enhances organizational agility, enabling firms to adopt evolving regulatory frameworks and market demands for eco-friendly practices (Hasyim and Bakri, 2023). Despite its potential, research examining the mediating role of SI in the GSCM-CR relationship—especially in SMEs operating within resource-constrained settings like Saudi Arabia—remains limited (Zaki et al., 2025).

Regarding comparison with MENA and ASEAN contexts, recent studies in the MENA region (e.g., UAE and Egypt) have shown that the integration of GSCM and SI significantly enhances CR, but often focus exclusively on large firms (AL-Shboul ,2025 Attia, 2025). Similarly, ASEAN research in India and China highlights the critical role of innovation in green operations for exporting SMEs (Wen et al., 2025). However, these works seldom examine the combined mediating effect of SI on the GSCM-CR linkage in SMEs, leaving a gap in understanding how small firms in comparable emerging markets can leverage both practices synergistically.

Saudi Arabia faces significant environmental challenges, including severe water scarcity, escalating pollution levels, and rapid resource depletion, alongside economic pressures that complicate sustainability efforts (Al-Hakimi et al., 2022; Eltayeb and Zailani, 2014; Zaki et al., 2025). From a practical standpoint, SMEs confront urgent challenges: tightening environmental

regulations, growing consumer demand for green products, and supply-chain disruptions that threaten operational continuity. These pressures create an immediate need for businesses to integrate SI with GSCM to maintain compliance, reduce costs, and differentiate their brand in the marketplace.

The study contributes to the academic discourse on sustainable supply chain practices by addressing two key gaps. First, it examines the underexplored relationship between GSCM and CR in the context of SMEs, highlighting the strategic importance of environmental practices for building reputational assets. Second, the study explicitly investigates how SI mediates the relationship between GSCM and CR by addressing the following research questions: (i) How do GSCM practices influence corporate reputation among SMEs in Saudi Arabia compared with other emerging-market contexts? (ii) What role does SI play in mediating this relationship, and how can SMEs leverage this integration to address practical business challenges?

By focusing on SMEs in Saudi Arabia, the research not only fills a critical gap in the literature but also offers theoretical contributions by extending the Resource-Based View (RBV) and stakeholder theory, and practical contributions by providing actionable strategies for integrating SI into GSCM practices to enhance both environmental performance and corporate reputation.

2. Literature review

2.1 Theory foundation and hypotheses development

This study theoretically integrated the resource-based view of the firm to explain the mediating effect of sustainable innovation on GSCM–CR linkage in the context of logistics and manufacturing SMEs in Saudi Arabia. The whole process is highlighted in Figure 1. Based on the resource-based view (RBV), the way organizations exploit the strategic resources that are rare, valuable, but difficult to imitate by its competitors in the market determines competitors' advantage (Khalifa et al., 2025; 2025b; Al-Swidi et al., 2024). However, it is important to acknowledge that while RBV provides valuable insights into resource utilization, its applicability in the resource-constrained environment of Saudi Arabian SMEs may be limited due to differences in institutional support and market maturity. Resources, regarding a firm's resources, are the firm's assets, capabilities, processes, qualities, and knowledge a firm controls and with which it can design and execute an effective strategy (Barney, 1986). Furthermore, stakeholder theory complements the RBV by emphasizing that firms must address the needs and expectations of diverse stakeholders, although its normative assumptions may not fully capture the dynamic and complex stakeholder relationships in emerging markets. We then apply RBV to the relationship between GSCM -CR where GSCM is a necessary resource to produce and sustain higher performance and competitive edge for the firm. GSCM enables firms to eliminate or minimize all the waste streams regarding the design, production, and disposal of waste products and materials. In this regard, firms adopting GSCM practices not only demonstrate environmental responsibility but also enhance their competitive niche and reputational capital (Elshaer et al., 2024).

The relationship between GSCM practices and CR can be accomplished and realized by applying the lenses of Resource-Based View (RBV) and Signaling Theory. From an RBV perspective, green operations are not just beneficial to internal resources like SI but also beneficial to externalities directly towards improved reputation among stakeholders (H1,

H2). SI, as a VRIN resource, enables firms to introduce green products and processes to the marketplace, thus supporting market differentiation as well as stakeholder trust, ultimately reinforcing corporate reputation (H3) (Dangelico & Pujari, 2010). Thus, H1 and H2 are grounded in RBV, with GSCM being a foundation to build up sustainable innovation to lead to improved organizational position. RBV theorizes that companies realize and maintain a competitive advantage by means of valuable, rare, inimitable, and non-substitutable resources. This analysis encompasses environmentally sustainable supply chain practices like green supplier selection, monitoring, and alliances. These practices spur operational efficiency and non-compliance risk mitigation related to environmental issues, hence developing the firm's reputation among its stakeholders by means of sustainability dedication (Komakech et al., 2024). In parallel, Signaling Theory sheds an externally focused explanation of how GSCM and SI influence CR. Firms performing under GSCM and SI transmit some credible signals to external stakeholders—customers, investors, and regulators—about their pledge to environmental sustainability and long-term value creation (Spence, 1974; Connelly et al., 2011). These signals shape stakeholder perceptions, underpinning the firm's reputation (H1, H3). Above all, sustainable innovation plays a mediating function (H4) in elevating the reputational impact of GSCM by translating the greening of operations into visible outcomes that stakeholders are able to interpret as indicators of authenticity and sustainability leadership (Delmas & Burbano, 2011). Accordingly, whereas RBV explains the internal value creation through innovation, Signaling Theory explains the external validation process, providing a robust theoretical foundation for all four hypotheses. Conversely, other studies show that some leading enterprises in SI can gain competitive benefits with reputation and green image differentiation and with product usefulness differentiation at low cost (Al-Swidi et al., 2024).

Figure 1. Insert ~~about~~ here

The importance of environmental sustainability has become increasingly pronounced, prompting firms across industries to adopt GSCM performances (Centobelli et al., 2021; Gherbi et al., 2024a; 2024b). These practices aim to reduce environmental harm while enhancing operational efficiency and CR. Notably, studies focusing on emerging markets and the Middle East have underscored the unique challenges and opportunities associated with sustainability practices in these regions (e.g., Edwards, 2005; Sultan, 2011), thereby providing additional context to our study.

GSCM integrates eco-friendly processes throughout the supply chain, from product design and material sourcing to production and logistics (Ali et al., 2023; Gherbi et al., 2024). This shift toward greener supply chains is driven by growing consumer awareness, regulatory pressures, and the pursuit of competitive advantage (Sarkis, 2012; Zhu et al., 2007). CR, defined as stakeholders' collective perceptions of a firm's ability to meet societal and environmental obligations, is a critical determinant of business success (Roberts and Dowling, 2002). Firms with strong reputations enjoy enhanced customer loyalty, investor confidence, and market position. In recent years, the relationship between GSCM practices and CR has garnered significant academic attention, as firms increasingly utilize sustainability initiatives to strengthen their public image (Darwish et al., 2021; Yan et al., 2022).

At the intersection of GSCM and CR lies the concept of SI (Padilla-Lozano and Collazzo,

2022). SI, which refers to the development of new products, processes, and technologies that minimize environmental impact, has emerged as a crucial mediator between GSCM practices and CR (Porter and Linde, 1995). Firms that adopt GSCM practices are often driven to innovate, introducing eco-friendly solutions that amplify their sustainability efforts and signal a commitment to environmental stewardship (Silva et al., 2019). However, the existing literature sometimes presents inconsistencies regarding the extent to which SI translates into enhanced CR, highlighting a gap that this study aims to address by critically analyzing these relationships in the Saudi Arabian SME context. This innovation not only strengthens their CR but also enhances competitiveness by meeting evolving market demands for green products and services (Le et al., 2022).

To better understand the dynamic between GSCM, SI, and CR, this chapter reviews the existing literature and develops hypotheses grounded in key theories. The chapter presents three core hypotheses: first, that GSCM practices positively influence CR; second, that GSCM practices drive SI; and third, that SI mediates the relationship between GSCM practices and CR. These hypotheses are derived from a synthesis of prior research and theoretical insights, yet also address identified gaps in the literature, particularly regarding sustainability practices in emerging markets (Sarkis, 2012; Zhu et al., 2007). This framework not only contributes to the growing body of research on GSCM but also provides practical implications for firms seeking to enhance their reputation through SI. By developing eco-friendly innovations that resonate with stakeholder values, firms can bolster their reputation and gain a competitive edge in increasingly sustainability-conscious markets.

2.2 Hypotheses development

2.2.1 Green supply chain practices to corporate reputation

GSCM practices have been widely recognized for their significant impact on CR, reflecting a firm's commitment to environmental sustainability and ethical business conduct (Darwish et al., 2021). GSCM integrates eco-friendly practices into all stages of the supply chain, from product design and material sourcing to production and logistics (Zhu et al., 2007). This comprehensive approach not only reduces environmental harm but also enhances a company's public image by showcasing its dedication to sustainability (Sarkis, 2012). Recent studies, particularly in the context of the Middle East, have shown that SMEs can leverage GSCM to overcome resource limitations and improve CR (Eltayeb and Zailani, 2014). According to Wolf (2014), organizations that adopt GSCM practices demonstrate their proactive stance on environmental responsibility, which significantly enhances their CR among stakeholders. This is further supported by Yusof et al. (2020), who found that firms implementing robust GSCM practices enjoy considerable reputational advantages, as stakeholders perceive them as more stable, professional, and committed to long-term sustainability goals.

Internal GSCM practices, such as environmental management and eco-design, play a crucial role in this dynamic. Internal environmental management involves the integration of environmental considerations into organizational processes, supported by senior and middle management (Dzikriansyah et al., 2023). This commitment is often reflected in improved operational efficiencies and reduced environmental impact, which positively influences stakeholder perceptions (Sarkis, 2012). Eco-design, another key internal practice, focuses on creating products and processes that minimize resource use and waste, further reinforcing a firm’s

green credentials (Zhu et al., 2007).

External GSCM practices, including green purchasing and collaboration with customers, also contribute to enhancing CR. Green purchasing involves selecting suppliers who adhere to environmental standards, thereby aligning the entire supply chain with sustainability goals (Zhu et al., 2007). Cooperation with customers to develop eco-friendly packaging and engage in cleaner production practices underscores a firm's commitment to reducing its environmental footprint, which is positively perceived by stakeholders (Dzikriansyah et al., 2023). This external engagement not only minimizes environmental impacts but also signals to stakeholders the company's dedication to corporate social responsibility (Baruah and Panda, 2020).

The RBV theory provides an insightful lens for understanding how GSCM practices impact CR. According to this theory, organizations are accountable not only to shareholders but also to a wider range of stakeholders, including customers, suppliers, and the community (Freeman, 2010). By adopting GSCM practices, firms address the environmental concerns of these diverse stakeholders, enhancing trust and goodwill, which in turn strengthens their reputation. However, the translation of these theoretical insights into practical outcomes remains underexplored in Saudi Arabian SMEs, where market dynamics and resource limitations may affect implementation. Corporate image on the other hand is the total impression that the stakeholders have towards the corporate's ability to fulfill its social responsivity/obligation to the environment (Yan et al., 2022). Companies with a strong reputation benefit from customer loyalty, investor confidence, and a competitive advantage in the market (Roberts and Dowling, 2002). GSCM and SI contribute to CR by demonstrating a company's commitment to environmental sustainability and ethical practices (Darwish et al., 2021).

According to (Branco and Rodrigues, 2006), firms that engage in green practices are more likely to be seen as socially responsible and environmentally conscious, which boosts their reputation. Firms in Saudi Arabia, where sustainability is becoming a significant concern, can strengthen their reputation by adopting GSCM and innovating in sustainable ways to meet local and global environmental challenges. CR is also aligned with the Signaling Theory, which suggests that firms send positive signals to stakeholders by adopting GSCM practices and innovations that demonstrate their commitment to sustainability (Spence, 1974). Strong reputational signals contribute to positive perceptions among consumers, investors, and the broader community, enhancing a company's market position. Based on this understanding, the hypothesis is formulated as follows:

H1: GSCM Practices positively influence CR.

2.2.2 Green supply chain practices for sustainable innovation

The positive impact of GSCM practices on SI is significant, as GSCM practices often drive firms to pursue and implement innovative environmental solutions (Silva et al., 2019). GSCM practices, which encompass strategies like eco-design, green purchasing, and internal environmental management, create an environment conducive to the development and adoption of SIs (Zhu and Sarkis, 2004). These practices not only mitigate environmental impacts but also

stimulate firms to explore and integrate new technologies and processes that enhance their overall sustainability performance (Sarkis, 2012). GSCM practices encourage firms to rethink traditional approaches and seek innovative solutions to reduce environmental harm. For example, eco-design, which focuses on designing products with minimal environmental impact, often leads to the development of new, more sustainable materials and processes (Dzikriansyah et al., 2023). Similarly, green purchasing practices that prioritize suppliers adhering to environmental standards drive firms to explore and adopt innovative supply chain solutions that further reduce their environmental footprint (Zhu and Sarkis, 2004). This proactive approach to integrating sustainability into supply chain management fosters an innovation-driven culture that continuously seeks to improve environmental performance.

The RBV theory supports this hypothesis by suggesting that GSCM practices serve as valuable resources that enable firms to develop and leverage SIs (Barney, 1991). Firms that implement GSCM practices are better positioned to identify and exploit opportunities for innovation that align with their environmental goals. This alignment between GSCM practices and SI enhances a firm's ability to achieve competitive advantage through improved environmental performance (Le et al., 2022).

Empirical research reinforces the notion that GSCM practices positively influence SI. For instance, (Zhu et al., 2007) demonstrated that firms with strong GSCM practices are more likely to engage in innovative activities that reduce resource consumption and waste. Similarly, (Dzikriansyah et al., 2023) found that firms adopting comprehensive GSCM practices, including eco-design and green purchasing, exhibit higher levels of SI. This relationship highlights the role of GSCM in fostering an environment where innovation can thrive, ultimately leading to more sustainable business practices. Moreover, the theory of dynamic capabilities explains how GSCM practices enhance a firm's ability to adapt and reconfigure its resources to pursue SIs (Teece et al., 1997). Firms that effectively implement GSCM practices are better equipped to respond to evolving environmental standards and stakeholder expectations, driving continuous innovation in their sustainability efforts.

In conclusion, GSCM practices positively impact SI by creating a framework that encourages and facilitates the development of new, environmentally friendly technologies and processes. This relationship is supported by RBV theory, which highlights the value of GSCM practices as resources for fostering innovation, and dynamic capabilities theory, which emphasizes the role of GSCM in enabling firms to adapt and innovate in response to environmental challenges (Barney, 1991; Le, 2022; Teece et al., 1997). Given the unique challenges faced by Saudi Arabian SMEs, further empirical investigation is warranted to better understand how these practices translate into sustainable innovation in emerging markets. Based on these extensive studies, the subsequent hypothesis is proposed:

H2: The GSCM practices positively influence SI.

2.2.3 Sustainable innovation to corporate reputation

SI is pivotal in shaping and enhancing CR by aligning a firm's practices with societal and environmental expectations (Lin, 2024). It involves the development of eco-friendly products, resource-efficient processes, and innovative green technologies that reduce environmental harm while addressing market needs (Ghobakhloo et al., 2021). Such innovations based on D'(Amato et al., 2009) showcase a company's proactive approach to sustainability, signaling a commitment to long-term environmental and ethical responsibilities. This approach resonates positively with stakeholders, including customers, investors, and communities, strengthening their trust and perception of the firm as a socially responsible entity (Weidner et al., 2021). The relationship between SI and CR is well-grounded in signaling theory (Delgado-Verde et al., 2021). This theory suggests that sustainable innovations serve as strong signals to stakeholders about a firm's priorities and values (Khan et al., 2021). By investing in cutting-edge solutions such as energy-efficient products or waste-reducing processes, companies demonstrate sustainability leadership, enhancing their public image and credibility (Spence, 1974). These signals are particularly impactful in an era where stakeholders increasingly value corporate accountability for environmental and social outcomes. Organizations that innovate in sustainability are often perceived as forward-thinking and ethical, earning them competitive advantages such as improved customer loyalty, investor confidence, and favorable media attention (Porter and Linde, 1995).

Empirical research supports the positive impact of SI on CR. Studies have found that firms that integrate SI into their operations enjoy heightened stakeholder goodwill and reputational benefits. Paparoidamis and Tran, (2019), reported that businesses that adopt green technologies and eco-friendly practices gain a more favorable market position as they are seen as addressing environmental challenges responsibly. Similarly, Le (2022) highlighted that SI amplifies a company's green credentials, making its commitment to sustainability more visible and credible to stakeholders. These outcomes reflect the ability of SI to transform a company's environmental initiatives into tangible and publicly recognized achievements.

Furthermore, sustainable innovation aligns with institutional theory, which explains how organizations conform to societal norms and expectations to maintain legitimacy (DiMaggio and Powell, 2000). By introducing innovations that reduce environmental footprints and improve resource efficiency, firms meet rising regulatory demands and societal pressures for sustainability (Adams and Comber, 2013). This compliance not only strengthens their legitimacy but also enhances their reputation as organizations committed to broader societal goals.

Notably, in Saudi Arabia, SI provides a critical pathway for firms to differentiate themselves in a competitive landscape marked by increasing environmental awareness and regulatory pressures (Edwards, 2005; Sultan, 2011).

Based on these insights, the following hypothesis is formulated:

H3: SI positively influences CR.

2.2.4 The role of sustainable innovation as a mediating variable

SI plays a crucial mediating role in the relationship between GSCM practices and CR (Makhlouf et al., 2023). While GSCM practices directly contribute to a firm's environmental performance and reputation, sustainable innovation enhances and amplifies these effects by introducing new, environmentally friendly products, processes, and technologies (Porter and Linde, 1995). This mediation effect is vital for understanding how GSCM practices translate into reputational benefits. GSCM practices, which include internal strategies like eco-design and external strategies such as green purchasing, lay the foundation for a firm's environmental responsibility (Zhu et al., 2007; Khan et al., 2024). However, the mere adoption of these practices may not be sufficient to fully capitalize on their reputational benefits. Sustainable innovation acts as a bridge by developing novel solutions that align environmental goals with market demands, thereby enhancing the effectiveness of GSCM practices in improving corporate reputation (Alqarni et al., 2023). For example, innovations that reduce carbon emissions or enhance resource efficiency can significantly bolster a firm's green credentials, making its commitment to sustainability more visible and credible to stakeholders.

Also, signaling theory provides an alternative framework for understanding this mediation effect, suggesting that firms use sustainable innovation as a signal to stakeholders about their commitment to environmental sustainability (Spence, 1974). By introducing green innovations, firms send positive signals that enhance their corporate reputation by demonstrating leadership in sustainability. Furthermore, institutional theory explains that sustainable innovation helps firms conform to the rising societal and regulatory pressures to adopt environmentally responsible practices, which enhances their legitimacy and reputation (DiMaggio and Powell, 2000). Empirical evidence underscores the mediating role of SI. (Le et al., 2022) found that SI significantly enhances the positive effects of GSCM practices on CR by integrating new technologies and processes that meet stringent environmental criteria. Also, (Aslam et al., 2019) highlight those green innovations, such as energy-efficient products or waste-reducing processes, amplify the reputational benefits of GSCM practices by showcasing a firm's commitment to cutting-edge environmental solutions.

Moreover, SI contributes to a firm's organizational agility, allowing it to better align with evolving stakeholder expectations and regulatory requirements (Hasyim and Bakri, 2023). This adaptability is particularly important in regions where environmental standards are becoming more stringent, as it enables firms to maintain and enhance their reputational standing amidst increasing pressure to demonstrate sustainability (Alqarni et al., 2023). Critically, while previous studies have highlighted this mediation effect, there remains a lack of focus on how these dynamics operate within the unique institutional and market context of Saudi Arabian SMEs.

In conclusion, SI mediates the relationship between GSCM practices and CR by enhancing the effectiveness of GSCM practices in achieving reputational benefits. By introducing new, eco-friendly products, processes, and technologies, sustainable innovation amplifies the positive impact of GSCM practices, leading to stronger reputational outcomes. This mediation effect is supported by RBV theory and dynamic capabilities theory, which highlight the unique advantages and adaptability provided by SI in reinforcing a firm's commitment to environmental sustainability (Barney, 1991; Le et al., 2022; Teece et al., 1997). Building on these extensive studies, the following hypothesis is proposed:

H4: SI mediates the relationship between GSCM and CR.

3. Methodology

3.1 Sampling and procedure

A cross-sectional methodology was employed to gather data from the logistics and manufacturing sectors within the Saudi Arabian context, as well as, it is an effective approach for testing the strength and direction of relationship among GSCM, SI, and CR in SMEs. **To ensure initial scale reliability and validity, a pilot test was conducted with 30 industry practitioners, yielding Cronbach's alpha values above 0.70 for all constructs and informing minor item refinements.** This design was chosen to capture a snapshot of current sustainability practices among SMEs at a specific point in time, providing valuable insights despite its limitations in establishing causality. As reported by (Al-Hakimi et al., 2022), the SMEs engaged in logistics and manufacturing were in the second rank of importance after the construction and trade sector, employing numerous individuals. The target demographic was all personnel within Saudi SMEs, and a snowball sampling technique was employed. **While snowball sampling is practical for reaching hard-to-access decision-makers, it may introduce biases such as network homogeneity and volunteer bias. To mitigate these risks, we diversified initial seed contacts across multiple industry associations, imposed referral quotas per chain, and performed early vs. late respondent analyses to check for non-response bias.** A total of 500 structured surveys were disseminated, yielding 350 responses, thus achieving a response rate of 70%. Following the exclusion of invalid submissions, 279 valid surveys were subjected to analysis for this study. This response rate is considered relatively high (Baruch and Holtom, 2008).

The majority were male (72.4%), while females represented 27.6%. In terms of age, most respondents were between 40 and 49 years old (60.2%), followed by those aged 30–39 (31.5%), 50 and above (5.7%), and a small portion aged 20–29 (2.2%). Regarding educational background, 64.63% held an undergraduate degree, 22.26% had completed secondary education or below, and 13.11% possessed a postgraduate qualification. When looking at work experience, 68.5% had more than 11 years of tenure, while 31.5% had less than 10 years. A significant percentage (77.4%) occupied managerial positions, whereas 22.6% were line staff. In terms of firm characteristics, 55.2% of the surveyed SMEs had between 1 and 50 employees, while 44.8% employed more than 51 people. Moreover, most companies had been in operation for over 20 years (82.1%), with only 17.9% being less than 20 years old (Table 1).

Table 1

Demographic profile.

Respondents	Frequency (%)	SMEs	Frequency (%)
Gender		Firm size	
Male	202 (72.4)	1-50 employees	154 (55.2)
Female	77 (27.6)	More than 51employees	125 (44.8)
Tenure		Position	
Less than 10	88 (31.5)	Line staff	63 (22.6)
More than 11	191 (68.5)	Managerial	216 (77.4)
Age		Company age Less than 20 years More than 20 years	50 (17.9) 229 (82.1)
20–29	6 (2.2)		
30–39	88 (31.5)		
40–49	168 (60.2)		
50 and above	16 (5.7)		
Education			
Secondary and below	73 (22.26)		
Undergraduate	212 (64.63)		

Respondents	Frequency (%)	SMEs	Frequency (%)
Postgraduate	43 (13.11)		

3.2 Measures

The systematically developed questionnaire comprises twenty-nine items and aims to explore three primary constructs SI, GSCM loops, and CR. The survey instrument was adapted from established measures in prior studies, ensuring both content validity and construct reliability. Prior pilot testing and previous research (e.g., Hernández-Linares et al., 2021). All variables were assessed using a 7-point Likert scale. The GSCM construct was derived from (Dzikriansyah et al., 2023) and was operationalized through nineteen items, including internal environmental management (five items), eco-design (four items), collaboration with customers (two items), green purchasing (five items), and return on investment (three items). Alqarni et al., (2023), Provided five items for the mediating variable, SI, while (Le, 2023) adapted five items to evaluate the dependent variable, CR.

3.3 Data Analysis

Partial Least Squares Structural Equation Modeling (PLS-SEM) was selected as the analytical method due to its suitability for testing complex mediation models and handling small to medium sample sizes, as well as its robustness in dealing with non-normal data distributions. This method allows us to simultaneously examine the relationships among GSCM, SI, and CR and is particularly effective in exploratory research contexts like that of Saudi SMEs.

3.4 Sample Size and Representativeness

The final sample size of 279 valid responses is considered adequate for PLS-SEM analysis, in line with the (Hair et al., 2017) recommendations. While acknowledging the inherent limitations of non-probability sampling methods, the diverse demographic profile presented in Table 1 suggests that the sample is representative of the target population in Saudi Arabia's logistics and manufacturing sectors.

4. Results ~~and discussions~~

4.1 Descriptive analysis

While the PLS does not require the data input to be uniform (Hair. et al., 2017), the data in this study follow normal distributions. (Shohat, 1929) in turn, propose that the skewness within a ±2.0

range and a kurtosis below 7 is acceptable. The data in Table 2 shows skewness and kurtosis values, confirming that no violation of normality occurs among variables. Thus, it is assumed that all variables have a normal distribution. In the current study, 500 questionnaires were distributed.

The absence of multicollinearity is indicated when variables related to a specific variable account for a significant portion of their variance (O'brien, 2007). To assess multicollinearity, two primary metrics are used: The Variable Inflation Factor (VIF) and tolerance (O'brien, 2007). Tolerance reflects the proportion of variance in a variable that is not explained by other variables within the same cluster, while its reciprocal represents VIF (Hair et al., 2011). A VIF exceeding thresholds of 10 or 5, along with a tolerance level below 0.1 or 0.2, may signal potential detrimental effects on the model (Elshaer et al., 2024; Hair et al., 2011; Hair. et al., 2017; Khalifa et al., 2025; Myers, 1990). As demonstrated in Table 2, there are no indications of multicollinearity among the predictors (Hair, et al., 2013), as all tolerance values exceed 0.2 and all VIF values remain below 5.

Common Method Variance (CMV)

As highlighted by Podsakoff et al. (2003), the use of self-reported questionnaires, particularly when both independent and dependent variables are collected from the same respondents, necessitates the assessment of common method variance (CMV) to mitigate the risk of measurement bias. Concerns regarding same-source bias are well documented in prior literature, including the observations by Podsakoff et al. (2003), who noted that method bias may compromise the validity of findings when constructs are measured using a single data source. To address these concerns, this study employed Harman's single-factor test as a diagnostic tool for detecting CMV, consistent with recommendations from Sharma, et al., (2009). Using exploratory factor analysis with unrotated principal component extraction, all relevant items were loaded, and the resulting factor structure was examined. The analysis produced a multi-factor solution in which the first unrotated factor accounted for only 27.45% of the total variance, well below the 50% threshold commonly used as an indicator of CMV presence. The seven-factor solution in total explained 78.35% of the variance. These results suggest that no single factor dominated the variance, thus indicating that CMV was not a serious concern in this study, in line with the criteria outlined by Podsakoff et al. (2003).

4.2 The measurement model

As noted by Hair et al. (2017), evaluating a measurement model requires confirming its goodness of fit, reliability, and validity. Measurement errors, whether from poorly constructed questions or inappropriate use of statistical techniques, can lead to both random and systematic biases, which in turn impact the reliability and validity of results. While such errors are unavoidable in multivariate analyses, accurately accounting for them strengthens research conclusions. The PLS regression model weights, as depicted in Figure 2, were computed using PLS version 4.0 software. Although PLS-SEM lacks a universal goodness-of-fit metric, scholars like (Bentler and Huang, 2014) have proposed indicators such as the standardized root mean square

residual (SRMR) for validating models. According to (Henseler et al., 2015; Elnagar et al., 2025), an SRMR value below 0.08 signals a good model fit, as demonstrated by the SRMR value of 0.062 in this case, indicating that the PLS model fits the data well.

The reliability of the measurement was confirmed through Cronbach's alpha and composite reliability (Elshaer et al., 2024; Khalifa et al., 2025; Quintana-García et al., 2021), both of which reflected strong internal consistency. The reliability threshold was satisfied when Cronbach's alpha and CR values exceeded 0.7. Additionally, indicator reliability was assessed through factor loadings, where values above 0.70 were deemed significant. Table 3 illustrates robust construct reliability, with all Cronbach's alpha and CR values surpassing the 0.7 benchmark, and all factor loadings above 0.70, confirming the reliability of the indicators. For convergent validity, the Average Variance Extracted (AVE) criterion was applied, with values over 0.50 indicating acceptable validity. Table 3 further affirms the convergent validity of all constructs, as each AVE value surpasses 0.5, suggesting that the constructs are well represented by their indicators. For instance, the CR construct shows high reliability with a Cronbach's alpha of 0.897, a CR of 0.898, and an AVE of 0.709, while Cooperation with Customers similarly demonstrates strong reliability with a CR of 0.852 and an AVE of 0.868.

Table 2

Construct reliability and validity.

		Loading	**Mean**	**Std. Deviation**	**kurtosis**	**Skewness**	**α**	**CR**	**AVE**	**VIF**
Corporate Reputation (CR)	CR1: Customers see us as being a very professional organization	0.824	5.09	1.47	0.31	-0.87	0.897	0.898	0.709	2.725
	CR2: Customers view our firm as one that is successful	0.839	4.93	1.53	0.16	-0.84				2.857
	CR3: Our firm reputation is highly regarded	0.852	4.81	1.64	-0.30	-0.65				2.9

										54
	CR4: Customers view our firm as being one that is stable	0.839	4.83	1.54	-0.19	-0.67				3.0655
	CR5: Our firm is viewed as well-established by customers	0.855	4.99	1.54	-0.02	-0.83				2.5144
Cooperation with Customers (CWC)	CWC1: Cooperation with customers for cleaner production	0.937	5.06	1.56	0.47	-1.00	0.8488	0.8522	0.8688	2.1885
	CWC2: Cooperation with the customer for the development of an environmentally friendly packaging	0.926	5.06	1.67	0.16	-0.96				2.1885
Eco-design (Eco)	Eco1 - Design of products to reduce the use of materials and energy	0.757	5.21	1.59	0.71	-1.11	0.8211	0.8211	0.6522	1.4225
	Eco2- Design of products for recycling materials	0.785	4.65	1.75	-0.66	-0.44				1.6933
	Eco3- Design of products for recovery of materials and components	0.851	5.01	1.52	0.28	-0.86				2.2944
	Eco4- Product design to prevent or reduce the use of dangerous and toxic products	0.833	5.40	1.48	1.01	-1.17				2.0800

Green Purchase (GP)	GP1: Selection of certified suppliers ISO 14001	0.788	5.28	1.56	0.63	-1.08	0.857	0.859	0.637	1.811
	GP2: Collaborate with suppliers to achieve environmental management goals	0.744	5.54	1.45	1.57	-1.32				1.673
	GP3: Delivery to suppliers of environmental guidelines for each product to be purchased	0.783	5.15	1.48	0.85	-0.98				1.736
	GP4: Assessment of the environmental management of second-tier suppliers (suppliers of your suppliers)	0.851	4.82	1.62	-0.15	-0.73				2.902
	GP5: Conducting environmental audits within the supplier companies	0.821	4.71	1.58	-0.32	-0.70				2.636
Internal Environmental Management (IEM)	IEM1: Senior management is dedicated to green initiatives	0.884	5.29	1.63	0.96	-1.21	0.924	0.924	0.766	3.1559
	IEM2: Middle managers are offered with support	0.888	5.20	1.58	0.42	-0.99				3.2009
	IEM3: A cross-functional collaboration for environmental improvements is available	0.866	5.33	1.57	0.67	-1.13				2.7611
	IEM4: Environmental management with total quality	0.868	5.05	1.43	0.93	-1.07				2.7666

	IEM5: Environmental compliance and audit programs	0.869	5.04	1.63	0.14	-0.91				2.653
Return on Investment (ROI)	ROI1: Sale of excess materials/inventory	0.907	4.25	1.75	-0.85	-0.33	0.8669	0.8775	0.7922	2.668
	ROI2: Sale of scrap and used materials	0.892	4.69	1.61	-0.66	-0.44				2.188
	ROI3: Sale of equipment	0.870	4.00	1.76	-1.00	-0.19				2.184
Sustainable Innovation (SI)	SI1: We have introduced products, processes, and organizational, or marketing innovations that reduce energy use.	0.782	5.03	1.57	0.14	-0.89	0.8777	0.8800	0.6733	1.713
	SI2: We have introduced products, processes, and organizational, or marketing innovations that reduce carbon dioxide production.	0.842	5.35	1.56	0.50	-1.06				2.328
	SI3: We have introduced products, processes, and organizational, or marketing innovations that replace materials with less polluting or hazardous substitutes.	0.735	4.44	1.70	-0.71	-0.47				1.596
	SI4: We have introduced products, processes, organizational, or marketing innovations that reduce soil, water, noise, or air pollution.	0.874	5.03	1.51	-0.17	-0.77				3.291
	SI5: We have introduced products, processes, organizational, or marketing innovations to recycle waste, water, or materials	0.860	5.06	1.65	-0.34	-0.78				2.894

Table 3 presents the formative construct assessment for Green Supply Chain Management (GSCM). The outer weights, t-values, p-values, and variance inflation factors (VIF) indicate the significance and contribution of each indicator to the formative construct. Return on Investment (ROI) has the highest outer weight (0.351), with a t-value of 6.000 and a p-value of 0.000, highlighting its substantial influence on GSCM. Internal Environmental Management also contributes significantly, with a weight of 0.309 and strong statistical significance (p-value = 0.000). Eco-design, Cooperation with Customers, and Green Purchases show moderate weights, all statistically significant ($p < 0.05$), confirming their roles. The VIF values, all below 5, suggest no multicollinearity concerns.

Table 3

Formative Construct assessment.

Construct		Outer weights	t-value	P values	VIF
Green Supply Chain Management (Formative)	Internal Environmental Management	0.309	4.534	0.000	2.979
	Eco-design	0.164	2.200	0.028	4.087
	Cooperation with Customers	0.153	2.462	0.014	3.441
	Green Purchase	0.150	2.198	0.028	4.660
	Return on Investment	0.351	6.000	0.000	2.585

Table 4 presents the discriminant validity results using both the Fornell-Larcker criterion and the HTMT (Heterotrait-Monotrait) ratio. The Fornell-Larcker criterion shows that the square root of the AVE for each construct (diagonal values) is higher than the correlations with other constructs, indicating that each construct shares more variance with its indicators than with other constructs. For example, the square root of the AVE for CR (Quintana-García et al., 2021) is 0.842, which exceeds its correlation with other constructs, confirming discriminant validity.

The HTMT ratio, a more stringent test, shows that all values are below the threshold of 0.90, further validating that the constructs are distinct from one another. For instance, the HTMT ratio between Cooperation with Customers (CWC) and Internal Environmental Management (IEM) is 0.778, confirming strong discriminant validity across constructs. These results collectively confirm the model's adequacy in distinguishing between the different constructs.

Table 4

Discriminant validity Results.

	Forner-Larker Criterion							HTMT Ratio						
	CR	CWC	Eco	GP	IEM	ROI	SI	CR	CWC	Eco	GP	IEM	ROI	SI
CR	**0.842**													
CWC	0.771	**0.932**						0.883						
Eco	0.779	0.740	**0.807**					0.802	0.882					
GP	0.789	0.709	0.726	**0.798**				0.897	0.844	0.881				
IEM	0.757	0.691	0.781	0.766	**0.875**			0.830	0.778	0.894	0.862			
ROI	0.781	0.734	0.717	0.717	0.651	**0.890**		0.877	0.844	0.844	0.820	0.719		
SI	0.755	0.719	0.763	0.756	0.767	0.748	**0.820**	0.758	0.828	0.793	0.867	0.850	0.853	

4.3 Structural model analysis

Table 5 and Figure 2, present the results of the hypothesized relationships between GSCM, CR (Quintana-García et al., 2021), and SI. H1: The relationship between GSCM and CR is significant and positive, with a path coefficient (β) of 0.521, indicating a strong positive impact of GSCM on CR. The high t-value of 9.185 and the p-value of 0.000 confirm the statistical significance of this relationship, meaning GSCM significantly enhances CR. H2: GSCM also has a significant and

strong positive effect on SI, with a high path coefficient (β = 0.847). The t-value of 31.693, along with the p-value of 0.000, underscores the robustness of this relationship. This suggests that effective GSCM practices play a crucial role in driving SI within organizations. H3: The path from SI to CR is also positive and significant, with a path coefficient (β) of 0.414. A t-value of 6.634 and a p-value of 0.000 shows that SI significantly contributes to enhancing CR, reinforcing the importance of innovation for corporate success.

The table provides additional insights into the structural model through the assessment of R^2, F^2, Q^2, and VIF values for the relationships between GSCM, CR (Quintana-García et al., 2021), and SI. **The R^2 value for corporate reputation (CR) is 0.808, indicating that 80.8% of the variance in CR is explained by the combined influence of green supply chain management (GSCM) and sustainable innovation (SI). This value significantly exceeds the thresholds proposed in the literature. According to Falk and Miller (1992), an R^2 of 0.10 is acceptable; Cohen (1988) deemed 0.26 as substantial, while Hair et al. (2017) recommended values above 0.65 and 0.75 respectively for substantial explanatory power. Similarly, the R^2 for SI is 0.718, showing that GSCM alone explains 71.8% of the variance in SI, which is also considered substantial. These findings confirm that the model has a high level of predictive capability. The effect size (f^2) was also evaluated to determine the relative impact of each exogenous construct. According to Cohen (1988), f^2 values of 0.02, 0.15, and 0.35 indicate small, medium, and large effects, respectively. In this study, GSCM demonstrated a large effect ($f^2 = 0.547$) on SI and a large effect ($f^2 = 0.398$) on CR, while SI had a medium effect ($f^2 = 0.252$) on CR. These results indicate that GSCM is a strong predictor of both SI and CR, while SI plays a meaningful role in enhancing CR. Finally, the predictive relevance (Q^2) was assessed using the blindfolding procedure. The Q^2 values were 0.566 for CR and 0.475 for SI, which are both greater than zero, indicating that the model has satisfactory predictive relevance (Hair et al., 2017). Based on Hair et al.'s guidelines, these values reflect medium to large predictive relevance, confirming the model's robustness in forecasting the outcomes of key constructs.** The VIF of 3.547 is within acceptable limits, ensuring that multicollinearity does not pose a problem in this model.

Figure 2. Insert ~~about~~ here

Table 5

Direct hypotheses results.

H	Relationship	B	SD	T	P values	R^2	F^2	Q^2	VIF
H1	Green Supply Chain Management -> Corporate Reputation	0.521	0.057	9.185	0.000	0.808	0.398	0.566	3.547

H2	Green Supply Chain Management -> Sustainable Innovation	0.847	0.027	31.693	0.000	0.718	0.547	0.475	1.000
H3	Sustainable Innovation -> Corporate Reputation	0.414	0.062	6.634	0.000		0.252		3.547

The method proposed by Preacher and Hayes (2004) was adopted to more accurately assess indirect effects. Given the potential biases and complexities involved in exploring multiple mediators and their correlations, a bootstrap analysis with 5,000 resamples was conducted. The results in H4 provide important insights into the mediating role of SI in the relationship between GSCM and CR (Quintana-García et al., 2021). Table 6 presents the path coefficient for the indirect effect of GSCM on CR through SI is significant ($\beta = 0.351$, $t = 6.850$, $p = 0.000$), with a 95% confidence interval ranging from 0.239 to 0.440. This indicates that SI plays a meaningful role in transmitting the positive impact of GSCM on CR. The Variance Accounted for (VAF), calculated as 45.3%, indicates that 45.3% of the total effect of GSCM on CR is explained through the mediating effect of SI. Since the VAF is between 20% and 80%, it confirms partial mediation, suggesting that while SI mediates a significant portion of the relationship, GSCM also directly influences CR (Hair et al., 2017).

Table 6

Indirect hypotheses results

H	Relationship	B	SD	T	P values	2.5%	97.5 %	VAF	Mediation Type
H 4	Green Supply Chain Management -> Sustainable Innovation -> Corporate Reputation	0.351	0.051	6.850	0.000	0.239	0.440	45.3 %	Partial Mediation

5. Discussion

This study provides insights into the mediating role of SI in the relationship between GSCM and CR (Quintana-García et al., 2021) within Saudi's manufacturing sector. Our findings contribute to the theoretical understanding by reinforcing the Resource-Based View (RBV), which suggests that unique organizational capabilities—such as sustainable innovation—are critical for developing a competitive advantage and enhancing **CR**. Additionally, the results reflect key aspects of stakeholder theory, as firms that engage in eco-friendly practices signal a commitment to broader societal and environmental responsibilities, thereby earning stakeholder trust and support. The study affirms the significance of GSCM in enhancing CR and identifies SI as a crucial intermediary, amplifying the positive impact of GSCM on CR. These findings align with previous studies emphasizing the importance of environmental practices and SI in improving corporate image and competitive advantage (Alam and Islam, 2021; Hernández-Linares et al., 2021). The results demonstrate a positive, significant relationship between GSCM and CR ($\beta = 0.521$, $p < 0.001$), indicating that corporations investing in green practices are more likely to enhance their reputation. This supports the notion that green initiatives serve as a strategic resource that not only minimizes environmental harm but also differentiates firms in the eyes of their stakeholders. As such, these practices can be seen as key drivers of both operational and reputational performance (Jalilvand, 2017). In particular, components such as internal environmental management and green purchase were found to have substantial impacts on GSCM, highlighting that both internal policies and environmentally conscious purchasing decisions enhance CR. This outcome suggests that corporations emphasizing eco-friendly supply chain practices can attain a distinct competitive edge by positioning themselves as environmentally responsible entities.

A key finding is that SI significantly mediates the relationship between GSCM and CR, strengthening the impact of GSCM on CR (Quintana-García et al., 2021). The robust relationship between GSCM and SI ($\beta = 0.847$, $p < 0.001$) illustrates that effective GSCM practices foster SI, consistent with research indicating that sustainable practices stimulate innovation as firms seek novel ways to minimize environmental impact (Hair et al., 2017). This finding is particularly significant in the context of the RBV, as it demonstrates how the integration of sustainable practices can generate innovative capabilities that serve as unique, valuable resources, ultimately translating into reputational gains. In the context of Saudi Arabia, surging concerns about environmental sustainability through the lens of national initiatives (Vision 2030) have raised public and governmental expectations for firms to perform in a sensible stage. As a result, companies performing with GSCM practices are seen as progressive and aligned with national priorities and also imperatively increase their corporate image. **They act as indicators of legitimacy and moral conduct, reinforcing stakeholder views in a reputationally attuned society (Shi et al., 2023). Compared to countries like Vietnam, where environmental initiatives are often untainted by the burden of centralized control (Nguyen, 2022), or China, where GSCM is mainly a product of regulatory pressure and not social demand (Zhu & Sarkis, 2007), Saudi firms gain a reputational boost through voluntary commitment to sustainability objectives.** SI's direct positive impact on CR ($\beta = 0.414$, $p < 0.001$) underscores its pivotal role in reinforcing CR through innovative, eco-friendly approaches, suggesting that SI not only reduces ecological footprints but also enhances corporate perception in the eyes of stakeholders. **The RBV supports this connection by exhibiting GSCM as a dynamic capability empowering institutions to innovate with sustainable practices, while Signaling Theory enlightens how these modernizations interconnect environmental leadership to stakeholders**

(Alhomaid & Lefi, 2024). SI in Saudi Arabia is a common but market differentiator on the edge of competition and evolution. Companies introducing green products and cleaner production technologies increase the trust of stakeholders in performing their activities in modernization and responsibility-based performances. This impact is strengthened by increasing public environmental awareness and the promotion of Environmental, Social, and Governance (ESG) criteria in regional stock markets. Consumers in China are moving into a new stage of awareness and sensibility, but firms still innovate more for acquiescence rather than image (Zheng et al., 2023). Moreover, the mediating effect of SI can be interpreted as an indicator of how internal innovations and external stakeholder communications work in tandem to reinforce a company's image. This dynamic is particularly relevant for emerging markets like Saudi Arabia, where firms must balance resource limitations with the need to conform to increasingly stringent environmental and social expectations. By integrating SI into their operations, companies can signal both operational efficiency and ethical responsibility, thus fostering a stronger, more resilient corporate reputation. The mediating effect aligns with the RBV model, which posits that unique capabilities, such as SI, contribute to sustained competitive advantage (Chen and Chang, 2010). **In the KSA industries of sustainability landscape, mediation acts as how GSCM can leverage firms to introduce innovative solve points in the linkage of regulatory expectations and stakeholders' desires as well as improve CR (Iqbal & Nourelhadi, 2024). Compared with other developing countries, Saudi Arabia's unique combination of aspirational national sustainability initiatives and cultural business conventions offers a singular path where SI complements the reputation effect of GSCM.** In summary, our study demonstrates that GSCM practices play a crucial role in enhancing CR and that SI serves as a significant mediator in this relationship. These findings offer both theoretical and practical implications, as they extend the RBV and stakeholder theories and provide actionable insights for firms seeking to bolster their reputational capital through sustainable innovation.

5.1 Theoretical contributions

The study makes significant contributions to sustainability literature by uncovering the mediating role of SI in the relationship between GSCM and CR. Our findings extend the Resource-Based View (RBV) and stakeholder theory by demonstrating that sustainable innovation not only serves as a unique organizational capability but also translates green practices into enhanced reputational outcomes. This contextualization within the Saudi manufacturing sector—characterized by distinct ecological and economic challenges—provides insights that are both locally relevant and globally transferable. Moreover, the study offers a deeper understanding of the mechanisms through which GSCM practices influence corporate outcomes, positioning SI as a critical enabler for achieving both environmental and reputational objectives. Moreover, the study offers methodological contributions through the application of structural equation modeling (SEM) to examine complex mediating relationships, providing a robust and replicable framework for future research in emerging markets.

5.2 Practical implications

This study offers actionable guidance for managers in Saudi Arabian SMEs at each stage of GSCM:

- Eco-design: Invest in lifecycle analysis tools and cross-functional eco-design teams to embed sustainability from the product development phase.
- Procurement and supplier audits: Allocate resources to conduct regular environmental audits of suppliers and establish green purchasing scorecards that reward compliance.
- Production and operations: Implement advanced recycling and energy-efficiency technologies on the shop floor, prioritizing processes with the highest environmental impact.
- Customer collaboration: Co-develop packaging and reverse-logistics programs with key clients to close the loop on materials.

By following these targeted steps, firms can maximize the reputational payoff of their GSCM investments and ensure tangible environmental gains.

5.3 Limitations and future research directions

Despite its contributions, this study has several limitations that open avenues for future exploration. Firstly, the cross-sectional design limits the ability to establish causal relationships; future research could adopt longitudinal approaches to capture dynamic changes over time. Secondly, the reliance on self-reported data may introduce biases, and future studies should consider triangulating these findings with objective measures. Lastly, while our sample is representative of SMEs in the targeted sectors, extending the research to incorporate firms from diverse regions and sectors within Saudi Arabia—and beyond—could further validate and expand these findings. These directions will help refine the understanding of how GSCM and SI jointly contribute to enhanced corporate reputation in varying economic, industrial, and cultural contexts.

6. Conclusion

This research underscores the critical importance of strategic investment in sustainable innovation as the linchpin for translating GSCM practices into enhanced corporate reputation. Key findings reveal that prioritizing eco-design, supplier audits, and production-stage innovations delivers the highest reputational returns for SMEs in Saudi Arabia's manufacturing sector, aligning with Vision 2030's sustainability targets. By fostering longitudinal improvement in environmental practices and adopting regionally tailored strategies, managers can secure a sustainable competitive advantage and drive stakeholder trust.

Ethical approval

Not applicable to this methodology of research.

Credit authorship contribution statement

Ahmad Herzallah: Writing – original draft, Validation, Conceptualization, Supervision, Project administration.

Raed Iriqat: Writing – original draft, Review & editing, Validation.

Gamal Khalifa: Software, Formal analysis, Data curation, Formal analysis.

Karam Zaki: Methodology, Data curation, Conceptualization.

Targeted Abdelfadel: Investigation, review & editing, Conceptualization.

Mohammad Hamed: Writing, Review & editing, Conceptualization.

Ahmed Elnagar: Writing – original draft, review & editing, Validation, Conceptualization, Supervision.

Funding

There is no funding for the research.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

References

Adams, M., Comber, S., 2013. Knowledge Transfer for Sustainable Innovation: A Model for Academic-Industry Interaction to Improve Resource Efficiency within SME Manufacturers. J. Innov. Manag. Small Medium Enterp. 1–21. https://doi.org/10.5171/2013.999612.

Alam, S.M.S., Islam, K.M.Z., 2021. Examining the role of environmental corporate social responsibility in building green corporate image and green competitive advantage. Int. J. Corp. Soc. Responsib. 6, 8. https://doi.org/10.1186/s40991-021-00062-w.

Al-Hakimi, M.A., Al-Swidi, A.K., Gelaidan, H.M., Mohammed, A., 2022. The influence of green manufacturing practices on the corporate sustainable performance of SMEs under the effect of green organizational culture: A moderated mediation analysis. J. Clean. Prod. 376, 134346. https://doi.org/10.1016/j.jclepro.2022.134346.

Alhomaid, A., & Lefi, L. (2024). The role of green sustainable innovation as a mediator of the relationship between green market orientation and competitive advantage: Insights from Saudi Arabia. Journal of Infrastructure, Policy and Development, 8(16), 10494. https://doi.org/10.24294/jipd10494.

Ali, H.H., Ali, H.H., Kalf, H.A.I., Shaikhan, M.H., 2023. Investigating The Integration of Environmentally Friendly Practices and Green Materials Throughout the Construction Supply Chain. M H 13..

Alqarni, K., Agina, M.F., Khairy, H.A., Al-Romeedy, B.S., Farrag, D.A., Abdallah, R.M., 2023. The Effect of Electronic Human Resource Management Systems on Sustainable Competitive Advantages: The Roles of Sustainable Innovation and Organizational Agility. Sustainability, 15, 16382. https://doi.org/10.3390/su152316382.

AL-Shboul ,M. A., 2025. Assessing sustainability of green supply chain performance: The roles of agile innovative products, business intelligence readiness, innovative supply chain process integration, and lean supply chain capability as a mediating factor. Journal of Open Innovation: Technology, Market, and Complexity, 11(1), p.100476. https://doi.org/10.1016/j.joitmc.2025.100476.

Al-Swidi, A.K., Al-Hakimi, M.A., Al-Hattami, H.M., 2024. Sustain or perish: how lean manufacturing practices predict the sustainable performance of manufacturing SMEs? A moderated mediation analysis. Int. J. Lean Six Sigma 15, 1317–1342. https://doi.org/10.1108/IJLSS-02-2023-0026.

Amato, A., Henderson, S., Florence, S., 2009. Corporate Social Responsibility and Sustainable Business. A Guide to Leadership Tasks and Functions. Cent. Creat. Leadersh. Greensb.

Amemba, C.S., Nyaboke, P.G., Osoro, A., Mburu, N., 2013. Elements of Green Supply Chain Management.

Aslam, H., Waseem, M., Khurram, M., 2019. Impact of Green Supply Chain Management Practices on Corporate Image: Mediating role of Green Communications.

Attia, A., 2025. The effect of commitment to sustainable supply chain management and reverse logistics on performance in context of UAE food industry. Sustainable Futures, 9, p.100442. https://doi.org/10.1016/j.sftr.2025.100442.

Barney, J., 1991. Firm Resources and Sustained Competitive Advantage. J. Manag. 17, 99–120. https://doi.org/10.1177/014920639101700108.

Barney, J.B., 1986. Organizational Culture: Can It Be a Source of Sustained Competitive Advantage? Acad. Manage. Rev. 11, 656. https://doi.org/10.2307/258317.

Baruah, L., Panda, N.M., 2020. Measuring corporate reputation: a comprehensive model with enhanced objectivity. Asia-Pac. J. Bus. Adm. 12, 139–161. https://doi.org/10.1108/APJBA-10-2019-0215.

Baruch, Y., Holtom, B.C., 2008. Survey response rate levels and trends in organizational research. Hum. Relat. 61, 1139–1160. https://doi.org/10.1177/0018726708094863.

Bentler, P.M., Huang, W., 2014. On Components, Latent Variables, PLS and Simple Methods: Reactions to Rigdon's Rethinking of PLS. Long Range Plann. 47, 138–145. https://doi.org/10.1016/j.lrp.2014.02.005.

Branco, M.C., Rodrigues, L.L., 2006. Corporate Social Responsibility and Resource-Based Perspectives. J. Bus. Ethics 69, 111–132. https://doi.org/10.1007/s10551-006-9071-z.

Centobelli, P., Cerchione, R., Esposito, E., Passaro, R., Shashi, 2021. Determinants of the transition towards circular economy in SMEs: A sustainable supply chain management perspective. Int. J. Prod. Econ. 242, 108297. https://doi.org/10.1016/j.ijpe.2021.108297.

Chen, H.M., Chang, W.Y., 2010. The essence of the competence concept: Adopting an organization's sustained competitive advantage viewpoint. J. Manag. Organ. 16, 677–699. https://doi.org/10.5172/jmo.2010.16.5.677.

Cohen, J., 1988. Statistical Power Analysis for the Behavioral Sciences. 2nd Edn., Lawrence Erlbaum Associates, Hillsdale, New Jersey.

Connelly, B. L., Certo, S. T., Ireland, R. D., & Reutzel, C. R. (2010). Signaling Theory: A Review and Assessment. Journal of Management, 37(1), 39–67. https://doi.org/10.1177/0149206310388419.

Dangelico, R. M., & Pujari, D. (2010). Mainstreaming Green Product Innovation: Why and How Companies Integrate Environmental Sustainability. Journal of Business Ethics, 95(3), 471–486. https://doi.org/10.1007/s10551-010-0434-0.

Darwish, S., Shah, S.M.M., Ahmed, U., 2021. The role of green supply chain management practices on environmental performance in the hydrocarbon industry of Bahrain: Testing the moderation of green innovation. Uncertain Supply Chain Manag. 9, 265–276. https://doi.org/10.5267/j.uscm.2021.3.006.

Delgado-Verde, M., Martín-de Castro, G., Cruz-González, J., Navas-López, J.E., 2021. Complements or substitutes? The contingent role of corporate reputation on the interplay between internal R&D and external knowledge sourcing. Eur. Manag. J. 39, 70–83. https://doi.org/10.1016/j.emj.2020.07.001.

Delmas, M. A., & Burbano, V. C. (2011). The Drivers of Greenwashing. California Management Review, 54(1), 64–87. https://doi.org/10.1525/cmr.2011.54.1.64.

DiMaggio, P.J., Powell, W.W., 2000. The iron cage revisited institutional isomorphism and collective rationality in organizational fields, in: Advances in Strategic Management. Emerald (MCB UP), Bingley, pp. 143–166. https://doi.org/10.1016/S0742-3322(00)17011-1.

Dzikriansyah, M.A., Masudin, I., Zulfikarijah, F., Jihadi, M., Jatmiko, R.D., 2023. The role of green supply chain management practices on environmental performance: A case of Indonesian small and medium enterprises. Clean. Logist. Supply Chain 6, 100100. https://doi.org/10.1016/j.clscn.2023.100100.

Edwards, A.R., 2005. The sustainability revolution: Portrait of a paradigm shift. New Society Publishers..

Elnagar, A.K., Khalifa, G.S.A., Herzallah, A.M., Derbali, A.M.S., Elgabrony, S.A.A. & Iriqat, R.A.M. (2025). Exploring the Link between Self-Leadership and Innovative Work Behaviours in Luxury Hotels: Validating a Moderated Mediation Model. African Journal of Hospitality, Tourism and Leisure, 14(1), 63-73. DOI: https://doi.org/10.46222/ajhtl.19770720.586

Elshaer, A. M., Khalifa, G. S., Guirat, R. B., Bulatovic, I., El-Aidie, S. A. M., & Marzouk, A. M. (2024). Managing stress and building resilience in tourism and hospitality entrepreneurship: the power of psychological and social capital. Journal of Tourism and Services, 15(28), 89-115.

Elshaer, I.A., Azazz, A.M.S., Elsaadany, H.A.S., Elnagar, A.K., 2024. Social CRM Strategies: A Key Driver of Strategic Information Exchange Capabilities and Relationship Quality. Information, 15, 329. https://doi.org/10.3390/info15060329.

Eltayeb, T.K., Zailani, S., 2014. Going Green through Green Supply Chain Initiatives Toward Environmental Sustainability. Oper. Supply Chain Manag. Int. J. 93–110. https://doi.org/10.31387/oscm040019

Falk, R. F., & Miller, N. B. (1992). A primer for soft modeling. University of Akron Press.

Freeman, R.E., 2010. Strategic Management: A Stakeholder Approach. Cambridge University Press, Cambridge. Cambridge University Press, Cambridge.

Gherbi, E. A. H., Khalifa, G. S. A., & Kwilinski, A. (2024a). Forecasting Entrepreneurial and Employability Opportunities in the UAE: A Government Finance Analysis. Virtual Economics, 7(4), 92-121.

Gherbi, E. A. H., Khalifa, G. S. A., & Kwilinski, A. (2024b). Mitigating CO2 Emissions through Economic Growth, Green Finance, and Renewable Energy: Evidence from an ARDL Analysis. In Forum Scientiae Oeconomia. 12(4), 99-121.

Ghobakhloo, M., Iranmanesh, M., Grybauskas, A., Vilkas, M., Petraitė, M., 2021. Industry 4.0, innovation, and sustainable development: A systematic review and a roadmap to sustainable innovation. Bus. Strategy Environ. 30, 4237–4257. https://doi.org/10.1002/bse.2867.

Hair, J.F., Ringle, C.M., Sarstedt, M., 2011. PLS-SEM: Indeed a Silver Bullet. J. Mark. Theory Pract. 19, 139–152. https://doi.org/10.2753/MTP1069-6679190202.

Hair, J.F., Ringle, C.M., Sarstedt, M., 2013. Partial least squares structural equation modeling: Rigorous applications, better results and higher acceptance. Long Range Plann. 46, 1–12.

Hair, J.R., Matthews, L.M., Matthews, R.L., Sarstedt, M., 2017. PLS-SEM or CB-SEM: updated guidelines on which method to use. Int. J. Multivar. Data Anal. 1, 107. https://doi.org/10.1504/IJMDA.2017.087624.

Hasyim, H., Bakri, M., 2023. Organizational Evolution: Navigating Change and Innovation for Sustainable Development. J. Manaj. Bisnis 10, 889–909. https://doi.org/10.33096/jmb.v10i2.824.

Henseler, J., Ringle, C.M., Sarstedt, M., 2015. A new criterion for assessing discriminant validity in variance-based structural equation modeling. J. Acad. Mark. Sci. 43, 115–135. https://doi.org/10.1007/s11747-014-0403-8.

Hernández-Linares, R., Kellermanns, F.W., López-Fernández, M.C., 2021. Dynamic capabilities and SME performance: The moderating effect of market orientation. J. Small Bus. Manag. 59, 162–195. https://doi.org/10.1111/jsbm.12474.

Iqbal, T., & Nourelhadi, T. (2024). An empirical investigation of green supply chain management (GSCM) and environmental sustainability in Saudi manufacturing SMEs: The mediating role of operations analytics. https://growingscience.com/beta/uscm/7111-an-empirical-investigation-of-green-supply-chain management-gscm-and-environmental-sustainability-in-saudi-manufacturing-smes-the-mediating-role of-operations analytics.html.

Iriqat, R.A., Shkairat, R., Herzallah, A.M. and Elnagar, A.K. (2025). Enhancing corporate sustainability in SMEs through smart technologies: supply chain flexibility and agility as mediator. Industrial Management & Data Systems, Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/IMDS-10-2024-1000.

Jalilvand, M.R., 2017. The effect of innovativeness and customer-oriented systems on performance in the hotel industry of Iran. J. Sci. Technol. Policy Manag. 8, 43–61. https://doi.org/10.1108/JSTPM-08-2016-0018.

Khalifa, G. S., Alkheyi, A. A., Hossain, M. S., Alneadi, K. M., El-Aidie, S., & Alhaj, B. K. (2025b). Organisational performance from a resource-based view: a study of public service sector in the United Arab Emirates. International Journal of Public Sector Performance Management, 15(1), 90-109.

Khalifa, G. S., Elshaer, A. M., Hussain, K., & Elnagar, A. K. (2025a). What drives customers' participation behaviour? Unveiling the drivers of affective satisfaction and its impacts in the restaurant industry. *Journal of Hospitality and Tourism Insights*, *8*(2), 612-636. https://doi.org/10.1108/JHTI-01-2024-0100.

Khalifa, G.S.A., Abuelhassan, A.E., Khreis, S.H.A., Soliman, M., Hossain, M.S., 2023. Innovation Mechanism in the Hospitality Industry: A Mediated-Moderated Model. J. Tour. Serv. 14, 173–196. https://doi.org/10.29036/jots.v14i26.492.

Khan, P.A., Johl, Satirenjit Kaur, Johl, Shireenjit K., 2021. Does adoption of ISO 56002-2019 and green innovation reporting enhance the firm sustainable development goal performance? An emerging paradigm. Bus. Strategy Environ. 30, 2922–2936. https://doi.org/10.1002/bse.2779.

Khan, S. K., Benhamed, A., Soliman, M., & Khalifa, G. S. (2024). Understanding corporate social responsibility's influence on brand reputation, employer branding, and performance. Tourism & Management Studies, 20(4), 73-84.

Komakech, R. A., Ogoro Ombati, T., Kikwatha, R. W., & Githii Wainaina, M. (2024). Resource-based view theory and its applications in supply chain management: A systematic literature review. Management Science Letter, 15.

Le, T.T., 2022. How do corporate social responsibility and green innovation transform corporate green strategy into sustainable firm performance? J. Clean. Prod. 362, 132228. https://doi.org/10.1016/j.jclepro.2022.132228.

Le, T.T., 2023. Corporate social responsibility and SMEs' performance: mediating role of corporate image, corporate reputation and customer loyalty. Int. J. Emerg. Mark. 18, 4565–4590. https://doi.org/10.1108/IJOEM-07-2021-1164.

Le, T.T., Vo, X.V., Venkatesh, V.G., 2022. Role of green innovation and supply chain management in driving sustainable corporate performance. J. Clean. Prod. 374, 133875. https://doi.org/10.1016/j.jclepro.2022.133875.

Lin, W.L., 2024. The role of corporate social responsibility and corporate social irresponsibility in shaping corporate reputation: An analysis of competitive action and innovation strategies. Corp. Soc. Responsib. Environ. Manag. 31, 1451–1468. https://doi.org/10.1002/csr.2640.

Makhlouf, H., Chatti, N., Lakhal, L., 2023. The impact of TQM and green innovation on corporate sustainability: the mediating role of green supply chain management. Int. J. Qual. Reliab. Manag. 40, 2592–2611. https://doi.org/10.1108/IJQRM-10-2022-0291.

Myers, N., 1990. The biodiversity challenge: Expanded hot-spots analysis. The Environmentalist 10, 243–256. https://doi.org/10.1007/BF02239720.

Nguyen, L.-T. (2022). The relationship between environmental performance and financial performance: evidence from an emerging East Asian economy. International Journal of Disclosure and Governance, 20(1), 1–14. https://doi.org/10.1057/s41310-022-00152-6.

O'brien, R.M., 2007. A Caution Regarding Rules of Thumb for Variance Inflation Factors. Qual. Quant. 41, 673–690. https://doi.org/10.1007/s11135-006-9018-6.

Padilla-Lozano, C.P., Collazzo, P., 2022. Corporate social responsibility, green innovation and competitiveness – causality in manufacturing. Compet. Rev. Int. Bus. J. 32, 21–39. https://doi.org/10.1108/CR-12-2020-0160.

Paparoidamis, N.G., Tran, H.T.T., 2019. Making the world a better place by making better products: Eco-friendly consumer innovativeness and the adoption of eco-innovations. Eur. J. Mark. 53, 1546–1584. https://doi.org/10.1108/EJM-11-2017-0888.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. Journal of applied psychology, 88(5), 879.

Porter, M.E., Linde, C.V.D., 1995. Toward a New Conception of the Environment-Competitiveness Relationship. J. Econ. Perspect. 9, 97–118. https://doi.org/10.1257/jep.9.4.97.

Preacher, K.J., Hayes, A.F., 2004. SPSS and SAS procedures for estimating indirect effects in simple mediation models. Behav. Res. Methods Instrum. Comput. 36, 717–731. https://doi.org/10.3758/BF03206553.

Qoura, O., Khalifa, G.S.A., 2013. The Impact of Reputation Management on Hotel Image among Internal Customers: The Case of Egyptian Hotels. J. Fac. Tour. Hotels Fayoum Univ. 7, 261–274.

Quintana-García, C., Benavides-Chicón, C.G., Marchante-Lara, M., 2021. Does a green supply chain improve corporate reputation? Empirical evidence from European manufacturing sectors. Ind. Mark. Manag. 92, 344–353. https://doi.org/10.1016/j.indmarman.2019.12.011.

Roberts, P.W., Dowling, G.R., 2002. Corporate reputation and sustained superior financial performance. Strateg. Manag. J. 23, 1077–1093. https://doi.org/10.1002/smj.274.

Sarkis, J., 2012. A boundaries and flows perspective of green supply chain management. Supply Chain Manag. Int. J. 17, 202–216. https://doi.org/10.1108/13598541211212924.

Sharma, R., Yetton, P., & Crawford, J. (2009). Estimating the effect of common method variance: the method—method pair technique with an illustration from TAM research. Mis Quarterly, 473-490.

Shi, L., Udemba, E. N., Emir, F., Khan, N. U., Hussain, S., & Boukhris, I. (2023). Mediating role of finance amidst resource and energy policies in carbon control: A sustainable development study of Saudi Arabia. Resources Policy, 82, 103521. https://doi.org/10.1016/j.resourpol.2023.103521.

Shohat, J., 1929. INEQUALITIES FOR MOMENTS OF FREQUENCY FUNCTIONS AND FOR VARIOUS STATISTICAL CONSTANTS. Biometrika 21, 361–375. https://doi.org/10.1093/biomet/21.1-4.361.

Silva, G.M., Gomes, P.J., Sarkis, J., 2019. The role of innovation in the implementation of green supply chain management practices. Bus. Strategy Environ. 28, 819–832. https://doi.org/10.1002/bse.2283.

Spence, M., 1974. Competitive and optimal responses to signals: An analysis of efficiency and distribution. J. Econ. Theory 7, 296–332. https://doi.org/10.1016/0022-0531(74)90098-2.

Sultan, S.S., 2011. Knowledge, innovation and new technologies for sustainable development: Case of the Occupied Palestinian Territory. GSTF Bus. Rev. GBR 1, 266.

Teece, D.J., Pisano, G., Shuen, A., 1997. Dynamic capabilities and strategic management. Strateg. Manag. J. 18, 509–533. https://doi.org/10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z.

Weidner, K., Nakata, C., Zhu, Z., 2021. Sustainable innovation and the triple bottom-line: a market-based capabilities and stakeholder perspective. J. Mark. Theory Pract. 29, 141–161. https://doi.org/10.1080/10696679.2020.1798253.

Wen, C., Xing, Y., Wang, T., Liao, S. and Gao, K., 2025. How do green supply chain management and renewable energy consumption influence carbon emissions in China and India? A comparative analysis. Energy Economics, p.108186. https://doi.org/10.1016/j.eneco.2025.108186.

Wolf, J., 2014. The Relationship Between Sustainable Supply Chain Management, Stakeholder Pressure and Corporate Sustainability Performance. J. Bus. Ethics 119, 317–328. https://doi.org/10.1007/s10551-012-1603-0.

Wungkana, F.A., Siagian, H., Tariga, Z.J.H., 2023. The influence of eco-design, green information systems, green manufacturing, and green purchasing on manufacturing performance. Int. J. Data Netw. Sci. 7, 1045–1058. https://doi.org/10.5267/j.ijdns.2023.6.001.

Yan, X., Espinosa-Cristia, J.F., Kumari, K., Cioca, L.I., 2022. Relationship between Corporate Social Responsibility, Organizational Trust, and Corporate Reputation for Sustainable Performance. Sustainability 14, 8737. https://doi.org/10.3390/su14148737.

Yusof, N., Tabassi, A.A., Kamal, E.M., 2020. Do environmental, economic and reputational advantages strengthen green practices' impact on environmental performance? Corp. Soc. Responsib. Environ. Manag. 27, 2081–2093. https://doi.org/10.1002/csr.1948.

Zaki, K., Alhomaid, A., Ghareb, A., Shared, H., Raslan, A., Khalifa, G.S.A., Elnagar, A.K., 2025. Digital Synergy and Strategic Vision: Unlocking Sustainability-Oriented Innovation in Saudi SMEs. Adm. Sci. 15, 59. https://doi.org/10.3390/admsci15020059.

Zhu, Q., & Sarkis, J. (2007). The moderating effects of institutional pressures on emergent green supply chain practices and performance. International Journal of Production Research, 45(18–19), 4333–4355. https://doi.org/10.1080/00207540701440345.

Zhu, Q., Sarkis, J., 2004. Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. J. Oper. Manag. 22, 265–289. https://doi.org/10.1016/j.jom.2004.01.005.

Zhu, Q., Sarkis, J., Lai, K., 2007. Green supply chain management: pressures, practices and performance within the Chinese automobile industry. J. Clean. Prod. 15, 1041–1052. https://doi.org/10.1016/j.jclepro.2006.05.021.