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Citation	Balfaqih, H. (2026). The Impact of Sustainability Practices on Supply Chain Efficiency: Evidence from Emerging Markets. European Journal of Sustainable Development, 15(1), 683-683.
DOI	10.14207/ejsd.2026.v15n1p683
Publisher	European Center of Sustainable Development
Download date	2026-05-16 12:04:58
Link to Item	https://repository.effatuniversity.edu.sa/handle/20.500.14131/2674

European Journal of Sustainable Development (2026), **15**, 1, 683-702 ISSN: 2239-5938
Doi: 10.14207/ejsd.2026.v15n1p683

The Impact of Sustainability Practices on Supply Chain Efficiency: Evidence from Emerging Markets

By Hasan Balfaqih[1]

ABSTRACT:
This research investigates the integration of sustainability practices within supply chain management and evaluates their impact on operational efficiency. Despite the increasing global focus on sustainable operations, a significant gap remains in understanding how sustainability efforts lead to measurable performance improvements, particularly in emerging markets.
This study addresses this gap by examining the relationship between environmental, social, and economic sustainability practices and supply chain efficiency. A quantitative approach was employed, using a structured questionnaire distributed to 120 supply chain professionals across various industries. Data analysis was conducted using SPSS for descriptive statistics and regression analysis.
The findings demonstrate a notable positive correlation between implementing sustainability practices—especially environmental initiatives like waste reduction and resource optimization—and supply chain efficiency. Social and economic practices also exhibit positive, albeit somewhat weaker, effects. These findings provide empirical support for the business case of sustainability, suggesting that environmentally responsible strategies can enhance logistical performance and operational outcomes.
The research contributes to the expanding literature on sustainable SCM and provides practical insights for managers seeking to balance efficiency with long-term ecological and social goals. Future research should consider utilizing longitudinal data and industry-specific models to explore causal relationships further.

Keywords: Sustainability, Supply Chain Efficiency, Green Supply Chain, Environment Control

1. Introduction

In an era marked by heightened environmental consciousness and increasing scrutiny from a diverse array of stakeholders, the management of sustainability within supply chains has emerged as an imperative area of focus for both academic researchers and industry practitioners (Kishor et al., 2025). Traditional supply chain models, which have historically been optimized primarily for cost efficiency and operational effectiveness, are now undergoing comprehensive re-evaluation to embed environmental and social considerations without compromising their economic objectives (Lim & Yue, 2025). This ongoing transition is driven by global sustainability initiatives, increasing regulatory requirements, and a growing awareness within the business community that achieving long-term resilience and competitive advantage is inextricably linked to the adoption of sustainable practices (Maharvi et al., 2025; Xin et al., 2023). Despite a burgeoning body of scholarly literature addressing Sustainable Supply Chain Management (SSCM), a noticeable paucity of empirical evidence remains that rigorously quantifies the specific impacts of

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diverse sustainability practices—encompassing environmental, social, and economic dimensions—on operational efficiency and overall supply chain performance (Alkahtani et al., 2020; Ghouati et al., 2025). Much of the existing research tends to focus on conceptual frameworks, policy alignment, or case-specific analyses, often neglecting the nuanced and measurable relationships that exist across various sectors and contexts (Abbasi et al., 2024; Goharshenasan, 2025). Addressing this critical research gap, the present study aims to empirically investigate how various facets of sustainability contribute to enhancing supply chain management efficiency (Ghouati et al., 2025). Utilising a dataset derived from 120 supply chain professionals and employing regression-based analytical methodologies, the research aims to determine whether the implementation of sustainability-driven initiatives—such as resource optimisation, ethical labour practices, and local sourcing—correlates with tangible improvements in performance metrics, including cost reduction, process optimisation, and increased reliability (Amin et al., 2023; Maharvi et al., 2025). From a theoretical standpoint, this investigation builds upon the Diffusion of Innovation (DOI) theory, providing a framework for understanding how sustainability-related innovations are adopted and integrated within supply chain operations. The study posits that such innovations tend to diffuse more rapidly and effectively when organizational readiness is high and when perceived performance benefits are recognized by stakeholders. Furthermore, the research contributes to the development of hybrid frameworks that combine environmental and operational metrics, offering a solid foundation for future scholarly inquiry. Practically, the findings deliver valuable, evidence-based insights to supply chain managers, especially those operating within developing economies, to inform strategic decision-making aimed at embedding sustainability as a core operational competency—thereby fostering improved efficiency and sustainable competitive advantage. As the global supply chain environment grows increasingly volatile and complex, integrating sustainability into core operational practices stands as a strategic imperative for firms seeking resilience and long-term success. The study is guided by two primary research questions: (1) What are the prevailing practices, challenges, and future objectives concerning sustainability in the supply chain management of food manufacturing companies operating within Saudi Arabia? and (2) How might these companies effectively address barriers to enhance their sustainability initiatives? By exploring these questions, the research aspires to shed new light on the current status of sustainability and operational efficiency within the Kingdom of Saudi Arabia's food manufacturing supply chains, while also identifying best practices and areas for future development.

2. Literature Review

It is enlightening to observe the rapid evolution underway in the manufacturing industry. For decades, production priorities focused solely on time-to-market and cost-reduction metrics, with little regard for external environmental or social impacts. However, modern consumers and community stakeholders now demand transparency in supply chain operations and compliance with sustainable standards. Market players increasingly understand that deregulated activities threatening public health and worker welfare undermine long-term business viability. Therefore, this literature review aims to fill this

knowledge gap by thoroughly examining existing research on the relationship between SSCM practices and cost implications within manufacturing firms. While manufacturers in developed economies have largely integrated sustainability through regulatory compliance and advanced technologies, firms in emerging markets often face additional constraints related to capital availability, institutional maturity, and supplier capability, making sustainability adoption more incremental and uneven.

Early investments in renewable energy infrastructure, pollution abatement technologies, and staff training programmes undoubtedly incur short-term costs. Nevertheless, both qualitative and quantitative studies may demonstrate longer-term operational cost savings or other economic benefits derived from improved material management, risk mitigation, or stronger stakeholder relationships. By synthesising insights from previous empirical studies, this review will assist plant leadership in understanding the business case for prioritising environmental management and social impact metrics alongside economic ones. The findings can support this ongoing industrial paradigm shift in a wise, fact-based manner that preserves community livelihoods for years to come. The literature search was conducted using Web of Science, Google Scholar, and ThaiJo online databases to identify qualified articles. The review adhered to the prisma 2020 checklist and flow diagram, covering publications from 2019 to 2024. Additionally, all included articles were written in English. Initial keywords such as 'sustainable supply chain measurement', 'supply chain performance', 'cost', and 'manufacturing' were used to search the aforementioned databases to compile a list of relevant articles. A total of 62 articles were identified. Non-referred items such as notes, reports, and book reviews were excluded during the initial search. The titles and keywords of the remaining papers were then examined to refine the results. To eliminate unrelated publications, abstracts and conclusions of the remaining articles were reviewed. Figure 1 illustrates the review process. Ultimately, the review focused on 14 articles from major peer-reviewed journals and a book chapter that met the inclusion criteria and were included in the final analysis.

From a methodological perspective, this review aims to classify the existing literature to develop a detailed understanding of key themes and trends concerning the relationship between Sustainable Supply Chain Management (SSCM) and cost implications in manufacturing firms. In summary, papers addressing SSCM and meeting any of the above criteria were selected. This process resulted in the most relevant 14 papers from a pool of 62 that fit the scope of this study.

This literature review analyses and contributes to a deeper understanding of the interplay between SSCM and cost implications, providing valuable insights for organisations seeking to adopt sustainable practices.

2.1 Challenges of SSCM Implementation

Samah, Salah, and Imane (2022) emphasise that while SSCM provides many benefits, its implementation can be challenging. Companies often face resistance to change, a lack of knowledge, and limited resources, all of which can hinder the effective integration of sustainable practices in the supply chain. Makprang (2024) pointed out that SSCM implementation challenges affecting cost efficiency include consumer price sensitivity and limited awareness of sustainable product benefits. These factors can negatively impact market success and overall cost management.

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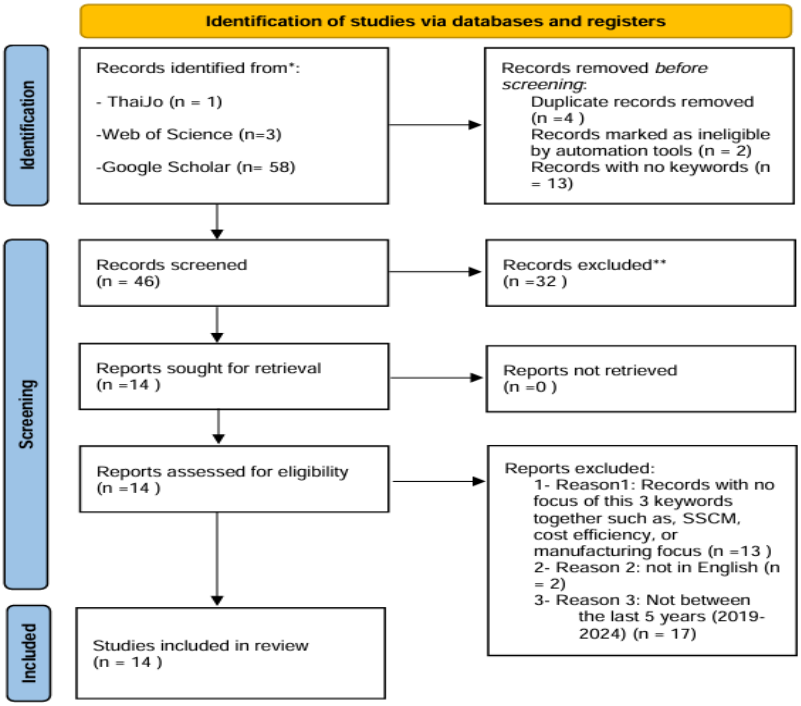

Figure 1: Research Flowchart Methodology

Among the identified barriers, cost sensitivity emerged as the most critical challenge, particularly for manufacturing firms operating under tight margins, followed by limited awareness and organizational resistance. Meanwhile, Yu, Khan, and Umar (2021) discuss various obstacles to implementing Sustainable Supply Chain Management (SSCM), particularly regarding information sharing. Effective communication is crucial for success; poor communication can slow Circular Economy (CE) practices, which are core to SSCM and influence costs. Many firms struggle with inadequate data on product design throughout the product lifecycle, hindering the implementation of sustainable practices. Jagtap et al. (2024) highlighted that although SSCM offers clear advantages, challenges such as resistance within organisations, the complexity of integrating sustainable practices into existing supply chains, and the need for staff training exist. Sokhetye (2024) noticed significant financial challenges linked to adopting sustainable practices. The costs associated with eco-friendly production and ethical labour compliance can be especially burdensome for small and medium-sized enterprises with limited resources. Govindan et al. (2020) identified a lack of consensus on performance measurement metrics, complicating SSCM effectiveness assessment and potentially hindering firms from realising cost benefits. Ahmed et al. (2024) noted that adopting SSCM necessitates substantial investments in new technologies and skills development, which can serve as barriers to the cost-efficient adoption of practices. Li (2024) discussed two main issues:

the complexity of evaluating supply chain performance, considering factors such as delivery timeliness, quality, and customer satisfaction, which makes cost assessments difficult, and the risks involved, including disruptions and market uncertainties, which can escalate costs. Effective risk management is crucial for maintaining cost efficiency. Similarly, Khanam and Ghosh (2022) noted that some SSCM initiatives, such as green packaging, are costly and may not yield immediate financial returns, presenting a challenge for firms in Bangladesh. Reynolds (2024) observed that resistance from suppliers unwilling or unable to meet sustainability standards can complicate SSCM implementation and lead to additional costs for training and capacity development.

2.2 Technological Innovations in SSCM

Shaker et al. (2023) explore the moderating role of Industry 4.0 technologies in enhancing the impact of SSCP on environmental performance (ENP) and economic performance (EP). It suggests that firms utilizing advanced technologies can experience a more substantial positive effect from sustainable practices, indicating that technological innovations are crucial for effective SSCM.

Yu, Khan, and Umar's (2021) paper emphasises the role of Industry 4.0 technologies, such as blockchain technology (BCT), artificial intelligence (AI), and the Internet of Things (IoT). The paper stated that these technologies facilitate coordination, integration, and transparency, which are crucial for improving operational efficiency and enhancing market share. Similarly, Jagtap et al. (2024) discussed that technological advancements play a pivotal role in facilitating SSCM. The integration of Industry 4.0 technologies, such as IoT and big data analytics, can enhance transparency and efficiency in supply chains.

Whereas Holloway (2024) focused on how AI, IoT, and blockchain are pivotal in optimising inventory management processes. These innovations facilitate real-time monitoring and predictive analytics, which support data-driven decision-making that prioritizes sustainability alongside traditional economic considerations. Ahmed et al. (2024) review highlights that technological innovations, such as blockchain for traceability and artificial intelligence for predictive analytics, play a crucial role in enhancing cost efficiency within SSCM. These technologies enable more effective resource management and informed decision-making, resulting in lower costs and enhanced sustainability outcomes. Li, F. (2024) mentioned that the integration of automation and innovative technologies can streamline operations, reduce labour costs, and minimise errors in the supply chain. These innovations can lead to significant cost savings while also improving overall supply chain performance.

2.3 Environmental and Social Dimensions

Yu, Khan, and Umar (2021) noted that implementing CE practices not only boosts economic performance but also helps firms manage their resources effectively, balancing economic and environmental goals. They highlighted that this dual focus is essential for achieving sustainable outcomes in the automobile industry.

Sokhetye (2024) emphasises the importance of ethical consumerism, which focuses on fair labour practices and ethical sourcing. This dimension is crucial for manufacturers aiming to align with consumer expectations while managing costs

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effectively. Meanwhile, (Govindan et al., 2020) stress the importance of both environmental and social sustainability practices. It notes that while firms are increasingly adopting green practices, there remains a significant gap in addressing social issues, which can impact overall performance and cost efficiency.

Sánchez-Flores et al. (2023) extensively discuss the environmental and social dimensions of SSCM, including green practices, sustainable sourcing, manufacturing, logistics, and customer service. The paper provides a comprehensive overview of the environmental and social facets of Sustainable Supply Chain Management (SSCM). Key findings include the importance of implementing green practices throughout the supply chain, such as utilising renewable energy, reducing waste, and minimising emissions. The paper also emphasises the need for sustainable product design, compliance with environmental regulations, and the use of life cycle assessment to evaluate environmental impact. Regarding the social aspects, the paper highlights the importance of fair labour practices, community engagement, and ethical sourcing. By considering both environmental and social factors, organisations can create more sustainable and responsible supply chains that contribute to a more sustainable future.

(Holloway, 2024) stated that integrating environmental and social considerations into inventory management is crucial for fostering sustainability. Organisations that proactively address these dimensions are better positioned to attract eco-conscious consumers and maintain investor confidence, which can lead to long-term economic benefits. (Makprang, 2024) mentioned in his paper that while the environmental and social dimensions of SSCM are crucial, they also have cost implications. By adopting sustainable practices, organisations can reduce their carbon footprint and minimise waste generation, which can lead to lower operational costs and improved resource efficiency.

2.4 SSCM Framework

Jermsittiparsert and Somjai (2019) introduce the RDT framework, elucidating how manufacturing firms collaborate with suppliers to implement sustainable practices within the supply chain. This collaboration is vital, as firms rely on suppliers for green resources and expertise, thereby strengthening their sustainability efforts.

Ahmed et al. (2024) present the circular economy as a paradigm shift in supply chain management. This framework supports a closed-loop system where products and materials are reused, refurbished, recycled, and recovered. Adoption of these principles enables companies to reduce costs, waste, and resource consumption while fostering sustainable economic systems. Yu, Khan, and Umar (2021) identify various CE practices such as recycling, remanufacturing, and green purchasing, which form the foundation of a framework for implementing sustainable supply chain management strategies, as depicted in Figure 2.

Building on these concepts, Makprang (2024) and Saqib et al. (2023) advocate exploring intelligent power-routing microgrid frameworks to create more resilient and sustainable energy infrastructures, which are vital for supporting sustainable supply chain operations. Additionally, Makprang emphasizes the need to refine existing frameworks for measuring and evaluating supply chain sustainability, which is crucial for accurate assessments and continuous improvement. His work also introduces a comprehensive multi-pronged framework aimed at mitigating greenhouse gas emissions across the entire

supply chain, addressing transportation, energy use, and waste management to identify and implement emission reduction strategies from sourcing to delivery.

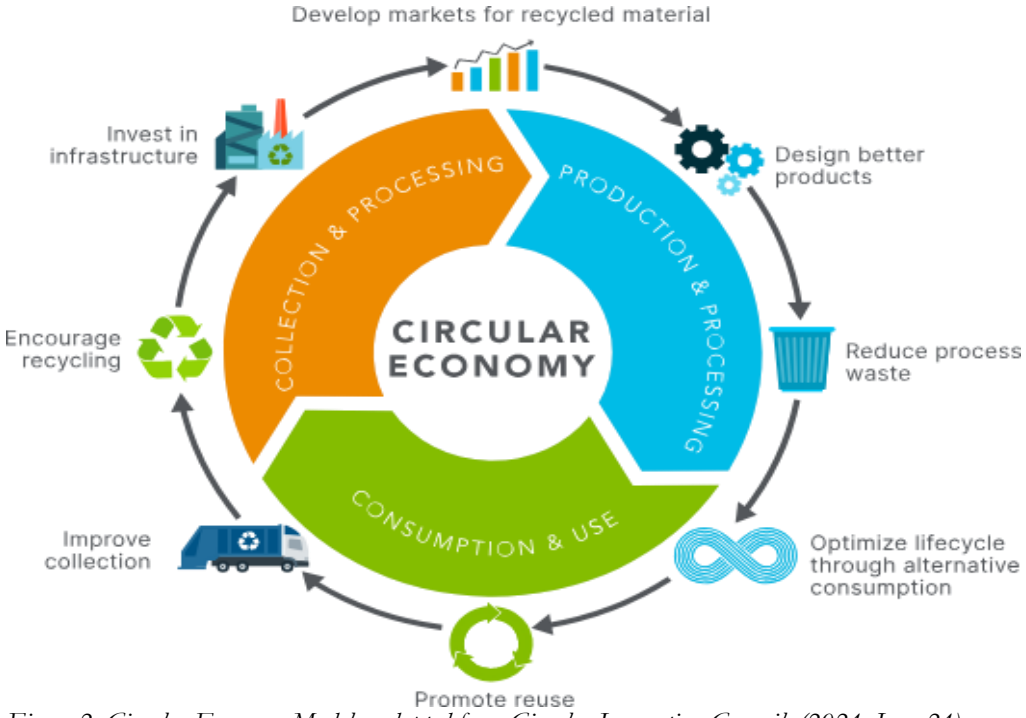

Figure 2: Circular Economy Model - adapted from Circular Innovation Council. (2024, June 24).

Furthermore, Sokhetye (2024) discusses green marketing as a broad strategy emphasizing environmental responsibility. This approach encourages the adoption of sustainable sourcing and reduction in carbon footprints, guiding manufacturers to develop environmentally sustainable supply chains. Green marketing not only reduces environmental impact but also offers a competitive advantage by appealing to eco-conscious consumers. Sokhetye also references Ethical Consumerism theory, highlighting its role in helping manufacturers understand the expectations of socially conscious consumers through fair labor practices, ethical sourcing, and community development. Aligning supply chain practices with these values fosters brand loyalty and positions companies as agents of positive social change, as illustrated in Figure 3.

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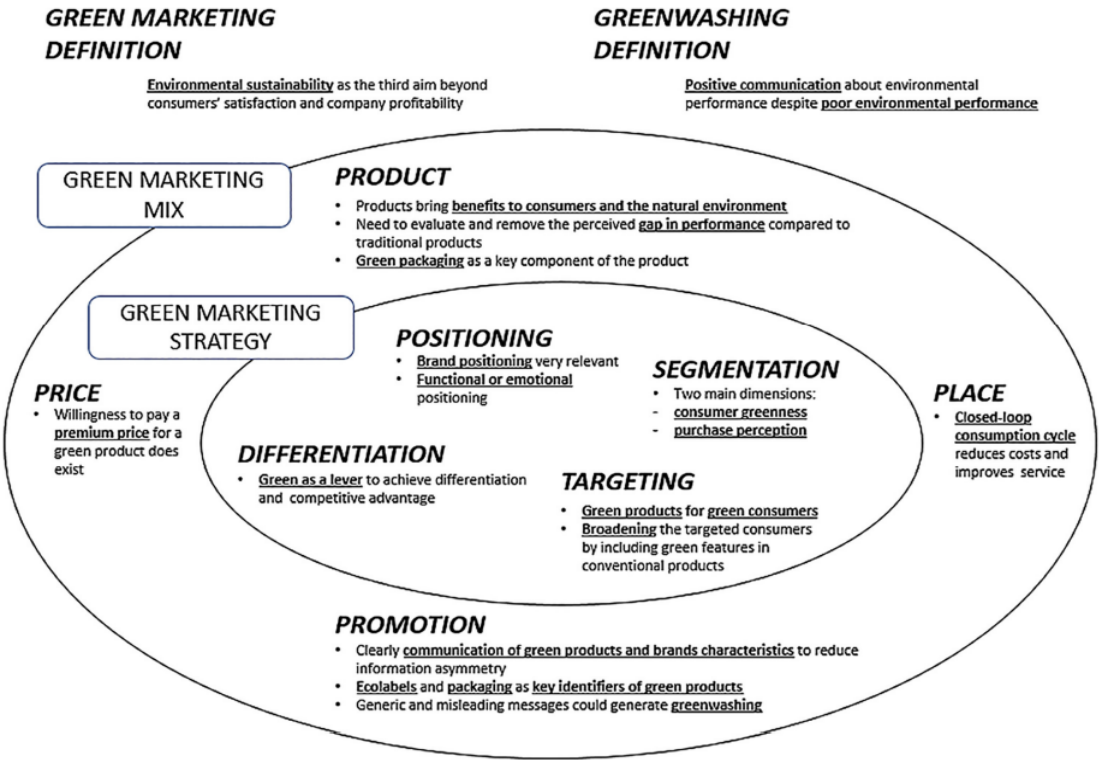

Figure 3: Green Marketing Strategy and the Green Marketing Mix (adapted from Kotler and Armstrong, 2014).

2.5 Gaps and Unresolved Issues ramework

Makprang (2024) highlights gaps in stakeholder transparency and collaboration that may hinder the full benefits of SSCM, emphasising the need to address these for cost efficiency and sustainability. Sokhetye (2024) emphasises the importance of industry collaboration and supportive regulations to help smaller businesses overcome financial challenges and enhance their SSCM support systems. Sánchez-Flores et al. (2023) identify research gaps, including inconsistent performance metrics and a lack of empirical studies on the environmental performance links of GSCM. Jermsittiparsert and Somjai (2019) note a lack of empirical research on the impact of SSCM on performance in emerging economies, particularly regarding costs. Khanam and Ghosh (2022) note the absence of studies on the effect of SSCM on cost performance in least developed countries, such as Bangladesh, suggesting future research in eco-friendly supply chains.

Yu, Khan, and Umar (2021) identify a gap in understanding how supply chain capabilities can facilitate the adoption of green practices and a circular economy. Samah, Salah, and Imane (2022) highlight gaps in long-term SSCM outcomes, particularly in terms of cost efficiency and sustainable performance. Jagtap et al. (2024) call for metrics that

measure the economic benefits of sustainable initiatives. Holloway (2024) discusses systemic barriers in sustainable inventory management and recommends researching collaborative strategies. Ahmed et al. (2024) highlight the lack of studies on the long-term impacts of SSCM on cost efficiency, particularly on how organisations can scale practices and overcome barriers.

2.6 Literature Review Outcomes

This review highlights the complex relationship between SSCM practices and costs. While long-term cost savings are associated with resource efficiency, waste reduction, and risk mitigation, initial implementation incurs significant short-term expenses. Benefits such as market differentiation, brand enhancement, and regulatory compliance are well-supported, yet challenges like high upfront costs and resistance persist, necessitating a comprehensive approach. SSCM should be viewed as a long-term investment, with technological innovations like blockchain, AI, and IoT playing crucial roles in enhancing supply chain transparency and efficiency. Successful implementation requires active stakeholder engagement. The economic viability of SSCM varies by industry, firm size, and region, highlighting the need for robust evaluation methods. Future research should develop standardized metrics, longitudinal studies, and explore SSCM in emerging economies and different sectors to address existing gaps. Future studies could employ longitudinal designs to track sustainability investments and efficiency outcomes over multiple periods, allowing researchers to better isolate causal effects and assess whether the dominance of environmental practices persists over time compared to social and economic dimensions.

3. Methods

This study employed a mixed-methods approach, incorporating both quantitative and qualitative data collection. The survey included both closed-ended questions for quantitative analysis and open-ended questions, including an 'Other' option, to facilitate qualitative insights. However, no responses were provided for the open-ended questions.

The quantitative aspect of the study involved collecting numerical data through structured multiple-choice and closed-ended questions. These questions assessed the level of sustainability adoption, resource allocation, and the perceived economic impact of SSCM practices. Statistical analysis of the responses revealed key trends, such as the degree of focus on sustainability, the frequency of challenges encountered, and the perceived cost-benefit relationship of sustainable practices. This quantitative data provided measurable insights into the state of SSCM in the surveyed companies, offering a clear snapshot of their progress and priorities.

A structured questionnaire was developed and distributed via Google Forms to gather information from the selected participants. The survey questions were adapted from the work of Khan et al. (2022) and Millar & Russell, (2011), whose research provided a foundational framework for examining sustainable supply chain practices. Their study provided a comprehensive set of questions to assess sustainability in supply chain operations, which was incorporated into the current questionnaire. This ensured that the

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survey captured critical data points and adhered to established methodologies for evaluating sustainability in supply chain management.

The questionnaire was designed to include 21 multiple-choice,14 closed-ended and 7 open-ended questions, which were aimed at ensuring a standardized and consistent collection of data. The use of closed-ended questions enables more structured responses and facilitates straightforward data analysis. The first two questions of the questionnaire gathered demographic information about the participants, focusing on Years of experience in Supply Chain Management and current job title within the SCM department. These initial questions provided context for the responses and allowed for a better understanding of the participants' backgrounds and expertise. The subsequent questions were designed to assess the sustainability practices and efficiency measures implemented within the SCM departments of the manufacturing companies. These questions were designed to evaluate how these companies integrate sustainability into their supply chain processes and the efficiency of their operations.

3.1 Research Hypotheses and Questions

The following hypotheses guided the study:

H1: Companies in the food manufacturing sector of Saudi Arabia that adopt Sustainable Supply Chain Management (SSCM) practices will experience improved environmental and economic performance compared to those that do not implement such practices.

H2: The alignment of SSCM practices with Saudi Arabia's Vision 2030 initiatives will positively influence the cost efficiency and overall long-term economic performance.

These hypotheses formed the basis for examining the relationship between sustainable practices, economic outcomes, and alignment with national objectives, with a specific focus on the food manufacturing sector.

This research was guided by two key questions that sought to explore the dynamics of Sustainable Supply Chain Management (SSCM) practices in Saudi Arabia's manufacturing sector. These questions were designed to assess the current state of SSCM implementation, identify the challenges faced, and explore potential strategies for improvement. Below is an explanation of each research question:

Q1. What are the current practices, challenges, and future goals related to sustainability in the supply chain management of manufacturing companies in Saudi Arabia?

This question aims to assess the present state of SSCM practices within Saudi Arabian manufacturing companies. It examines the specific sustainability initiatives implemented by companies, including waste reduction, renewable energy utilisation, and ethical sourcing. Additionally, this question examines the challenges that hinder successful implementation, including financial constraints, resistance to change, and a lack of expertise. Future goals, such as plans to align with Vision 2030 initiatives or expand sustainable practices, are also examined to understand the trajectory of sustainability efforts in the sector.

Q2. How can manufacturing companies address barriers to enhance their sustainability efforts?

This question focuses on identifying solutions to overcome the challenges associated with adopting SSCM practices. It seeks to uncover actionable strategies that companies can employ to address financial, operational, and logistical barriers. Potential solutions may include leveraging advanced technologies like blockchain and AI, fostering collaboration with suppliers, or investing in employee training programs. By addressing this question, the study aims to provide practical recommendations for enhancing sustainability efforts in the supply chain.

Together, these research questions form the foundation for the study, providing a clear framework for investigating the adoption, challenges, and opportunities for SSCM in Saudi Arabia's manufacturing sector. They are designed to offer insights not only into the current state of sustainability practices but also into how companies can achieve long-term economic and environmental success.

3.2 Data Collection

An online questionnaire was created using Google Forms and distributed to the Supply Chain Management (SCM) department managers of two national manufacturing companies in Saudi Arabia. A total of 15 responses were collected, providing valuable insights into the current practices, challenges, and perceptions related to the sustainable supply chain processes within these two organizations.

The participants in this study include male and female managers with over four years of experience in the SCM departments of two national manufacturing companies located in Jeddah, Saudi Arabia. The sampling method employed was judgmental Sampling, a non-probability sampling method where participants are selected based on specific characteristics, such as, their expertise in Supply Chain Management and their position as managers in the SCM department, and because sustainable approaches are a strategic or higher management duty; the sampling method employed was judgmental sampling. This will ensure that only knowledgeable individuals contribute to the research findings, thereby enhancing the validity of the insights gained. By focusing on those with relevant experience, the research can better address the complexities of implementing sustainable practices within supply chains, ultimately leading to more informed recommendations for strategic management.

4. Findings and Discussion

4.1 Approaches to Sustainability in Supply Chain Management:

This question will illustrate how companies approach sustainability in supply chain management, which involves integrating environmentally and socially responsible practices. Q: How would you describe your company's approach to sustainability in supply chain management?

The data shows that the majority of responses (57.1%) are somewhat focused on sustainability, indicating a moderate commitment to integrating sustainable practices. Equal proportions of responses (14.3% each) are either proactive and highly focused on sustainability, neutral or balanced in their approach, or exhibit minimal focus on sustainability. This distribution shows that while most organisations prioritise sustainability

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to some extent, only a minority place strong or minimal emphasis on it. This suggests that sustainability is becoming a key focus in the supply chain practices of the two surveyed manufacturing companies. With 57.1% of respondents reporting a moderate commitment to sustainability, it is evident that organizations are taking steps toward integrating sustainable practices, albeit at a mid-level intensity. This suggests that sustainability is recognised as an important aspect, but has not yet reached the level of being a core strategic priority for most.

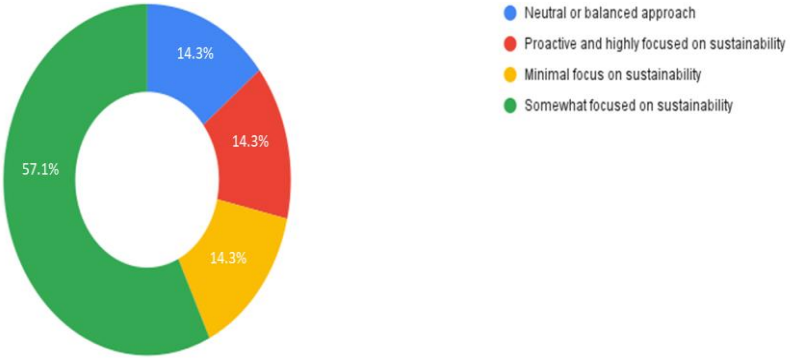

Figure 4: Approaches to Sustainability in Supply Chain Management

4.2 Specific Practices for Environmental Sustainability (ISO 14001):

Experts This question illustrates how companies approach sustainability through specific practices in their supply chain management, particularly in alignment with their mention of ISO 14001 certification on their websites. The responses provide insight into the environmental strategies implemented to promote sustainability. Q: Your company has mentioned ISO 14001 certification (Environmental Management System) on its website. What specific approaches or practices have you implemented in your supply chain management to address environmental sustainability?

The data show that 100% of respondents reported implementing both waste reduction and recycling initiatives, as well as energy-efficient production processes, in their supply chain management. Additionally, 93.3% of respondents reported using renewable energy sources, while 73.3% reported adopting eco-friendly packaging solutions. However, only 26.7% of respondents focus on monitoring and reducing transportation carbon footprints, and only 6.7% engage in sustainable procurement and sourcing. Notably, no respondents reported practices related to tracking suppliers' environmental impact or setting environmental performance targets for suppliers.

The results suggest that companies place strong emphasis on internal environmental practices, such as waste reduction, energy efficiency, and renewable energy use, which are widely implemented. These practices align with the core principles of ISO 14001 certification and reflect proactive efforts to minimize the environmental impact of production and operations.

However, external or supplier-focused sustainability initiatives, such as sustainable procurement and supplier performance tracking, are significantly underdeveloped or absent. This highlights an area for improvement, as collaboration along the supply chain

could amplify sustainability efforts. Furthermore, the relatively low focus on carbon footprint monitoring in transportation indicates that logistical sustainability may not yet be a priority for these organizations, potentially leaving a gap in achieving comprehensive supply chain sustainability.

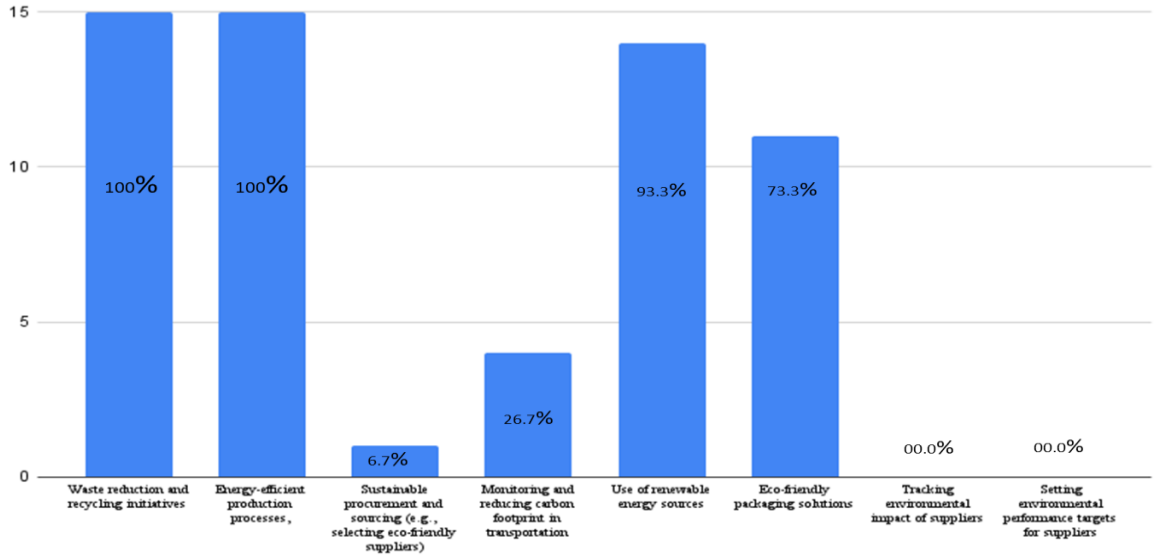

Figure 5: Specific Practices for Environmental Sustainability (ISO 14001)

4.3 Sustainability as a Key Priority in Supply Chain Strategies:

This question explores whether sustainability is currently a key focus in the supply chain management strategies of the respondents, shedding light on their commitment to integrating sustainable practices into their operations. Q: Is sustainability a key priority in your current supply chain management strategy?

The data reveals that only 13.3% of respondents consider sustainability a top priority in their supply chain management strategy. Meanwhile, 33.3% acknowledge sustainability as important but not their primary focus. Notably, 40% of respondents stated that sustainability is not currently a priority, but it is something they plan to focus on in the future. Finally, 13.3% indicated that sustainability is not a priority at all in their supply chain management strategy.

The responses show a mixed level of commitment to sustainability in supply chain management. While a small portion (13.3%) treats it as a top priority, the largest group (40%) has yet to prioritize it but recognizes its importance for future planning. This suggests that sustainability is gaining attention but has not yet fully taken hold as a strategic focus for the two organizations.

The fact that 33.3% of respondents see sustainability as necessary but not central highlights that many companies are still balancing sustainability with other competing

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priorities. However, the 13.3% who do not view sustainability as a priority at all may indicate a lack of awareness, limited resources, or a perceived lack of urgency in addressing environmental concerns. Overall, while there are promising signs of progress, the data suggests that sustainability is still an evolving focus rather than an established norm in supply chain management strategies.

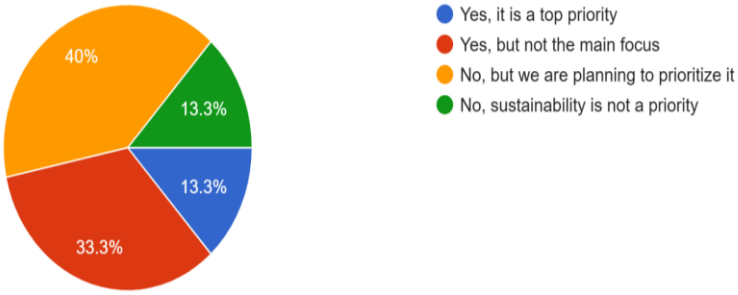

Figure 6: Sustainability as a Key Priority in Supply Chain Strategies

4.4 Future Investments in Sustainable Supply Chain Practices:

This question examines whether the companies plan to increase their investments in sustainable supply chain practices over the next five years, providing insight into their future commitment to sustainability. Q: Does your company plan to increase investments in sustainable supply chain practices over the next 5 years?

The data shows that 66.7% of respondents indicated their company plans to increase investments in sustainable supply chain practices within the next five years. However, 33.3% of respondents are unsure if their company has plans to do so.

The results suggest that the two companies are gearing up to allocate more resources toward sustainable supply chain practices, reflecting a growing recognition of the importance of sustainability in future business strategies. This is an encouraging sign of progress, as it indicates that many organizations are preparing to address environmental challenges proactively in the coming years. Overall, while the data points to a positive trend, it also underscores the need for further advocacy and support to ensure broader industry-wide adoption of sustainable practices.

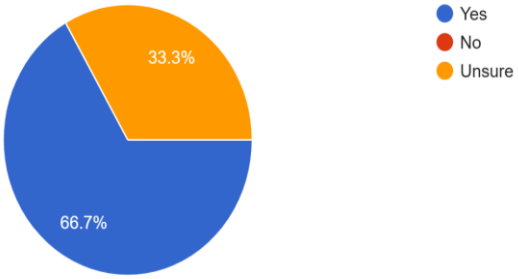

Figure 7: Future Investments in Sustainable Supply Chain Practices

4.5 Future Sustainability Goals for Supply Chains:

This question aims to identify the future sustainability goals the companies have set for their supply chains, providing an overview of the areas they plan to prioritize for environmental and ethical improvements. Q: What future sustainability goals does your company have for its supply chain?

The data reveals that 100% of respondents have set a goal to reduce energy consumption in their supply chains. Additionally, 93.3% of respondents aim to focus on minimising waste, increasing recycling, utilising renewable resources, and ensuring ethical labour practices throughout the supply chain. A slightly smaller percentage (86.7%) prioritize reducing carbon emissions, while 80% plan to work on increasing supplier transparency and traceability.

Goals related to waste reduction, renewable resources, and ethical labor practices are also widely shared, reflecting a comprehensive approach to both environmental and social aspects of sustainability.

However, slightly fewer responses in their company are focusing on reducing carbon emissions (86.7%), which may suggest that while energy use is being addressed, companies might not yet be fully targeting emission reduction as a distinct goal. Similarly, supplier transparency and traceability, though still significant (80%), are slightly less emphasized, which could point to challenges in implementing or managing these practices across complex supply chains.

Overall, the data highlights that the two companies are aligning on key sustainability goals but may still need to strengthen efforts in specific areas, such as emissions and supplier accountability, to achieve a fully sustainable supply chain.

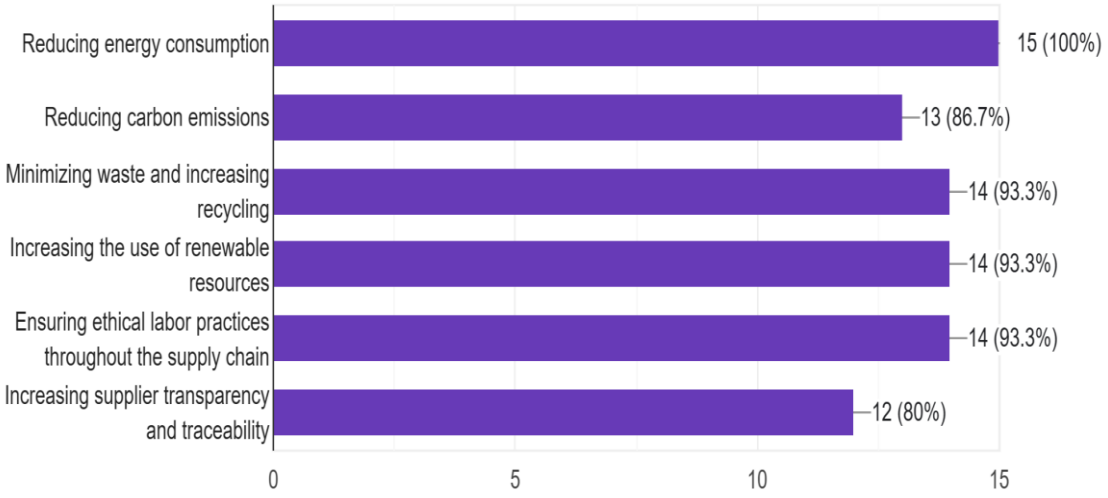

Figure 8: Future Sustainability Goals for Supply Chains

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4.6 Barriers to Adopting Sustainable Supply Chain Practices:

This question identifies the key barriers preventing companies from adopting more sustainable supply chain practices. Understanding these challenges can help address gaps and develop strategies to overcome them. Q: What barriers prevent you from adopting more sustainable supply chain practices?

The data shows that cost concerns and lack of technological infrastructure are the most common barriers, with 75% of respondents identifying them as challenges. Additionally, 68.8% of respondents cited a lack of support from suppliers, while 50% mentioned a lack of knowledge or expertise as a barrier. The findings indicate that financial and technological constraints are the most significant obstacles for companies aiming to implement more sustainable supply chain practices. This suggests that high costs and insufficient infrastructure can deter organizations from making necessary changes, even if they recognize the importance of sustainability.

The lack of supplier support, identified by 68.8% of respondents, highlights the critical role suppliers play in the sustainability journey. If suppliers do not align with sustainability goals, it becomes challenging for the companies to build a cohesive, sustainable supply chain. Finally, the 50% reporting a lack of knowledge or expertise suggests that the companies may struggle with understanding how to implement sustainability initiatives effectively, pointing to a need for education, training, or external guidance.

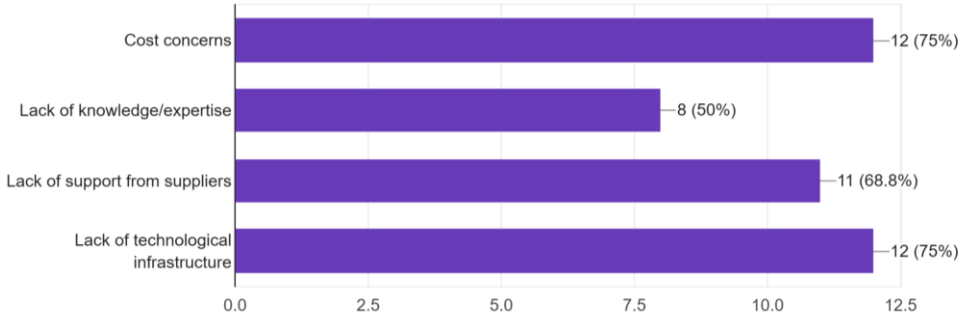

Figure 9: Barriers to Adopting Sustainable Supply Chain Practices

In a nutshell, the survey responses provide valuable insights into the sustainability practices and challenges faced by the two companies. The data indicates a moderate commitment to integrating sustainable practices in supply chain management, with a majority of responses somewhat focused on sustainability. Internal environmental practices, such as waste reduction and energy efficiency, are widely implemented, aligning with the principles of ISO 14001 certification. However, external sustainability initiatives like sustainable procurement and supplier performance tracking are underdeveloped. As data were collected from two manufacturing firms, firm-specific operational practices may have influenced respondents' perceptions, which limits the generalizability of the findings. While some companies prioritize sustainability in their supply chain management strategies, others are still balancing it with competing priorities. The data also shows a positive trend towards increasing investments in sustainable practices over the next five years, reflecting a growing recognition of the importance of sustainability. Future

sustainability goals include reducing energy consumption, minimizing waste, and ensuring ethical labor practices. Barriers to adopting more sustainable practices include cost concerns, lack of technological infrastructure, and insufficient supplier support. Addressing these challenges will be crucial for companies to enhance their sustainability efforts in the future.

5. Conclusion

This study underscores the pivotal role of Sustainable Supply Chain Management (SSCM) in shaping the future of Saudi Arabia's manufacturing sector, particularly in alignment with Vision 2030. The findings reveal that while companies are taking meaningful steps toward sustainability, their efforts are primarily focused on internal practices, such as waste reduction and energy efficiency. However, external collaboration with suppliers and logistical sustainability remains underexplored, highlighting significant areas for growth.

The research also emphasizes the duality of SSCM's impact. While implementing sustainable practices poses initial financial and operational hurdles, the long-term benefits, ranging from cost savings and regulatory compliance to enhanced brand reputation, far outweigh these challenges. Furthermore, the integration of advanced technologies such as AI, IoT, and blockchain presents a transformative opportunity to streamline sustainable practices and build resilience within supply chains.

Despite progress, the study identifies several barriers, including resistance to change, resource constraints, and a lack of standardized performance metrics. Addressing these issues requires a concerted effort by industry leaders, policymakers, and stakeholders to foster collaboration, incentivize sustainable practices, and create a culture of accountability and innovation.

In conclusion, SSCM is not merely a strategic option but an essential path forward for manufacturing companies in Saudi Arabia. By embracing sustainability as a long-term investment rather than a cost, organizations can unlock economic, environmental, and social benefits, ultimately contributing to a more sustainable and competitive national economy. Among the sustainability practices examined, waste reduction, energy efficiency, and resource optimization offer the most immediate efficiency gains for manufacturing firms. This research serves as a stepping stone for future studies to explore sector-specific challenges and strategies, enabling a holistic transformation of supply chain practices in the region.

5.1 Recommendations

Building on the findings of this study, several key recommendations can be put forth to enhance further the adoption and implementation of Sustainable Supply Chain Management (SSCM) in Saudi Arabia's manufacturing sector. These recommendations aim to address the identified areas of growth, harness the transformative potential of technology, and cultivate a culture of sustainability within industry.

To minimize transportation emissions and reduce supply chain carbon footprints, companies should adopt sustainable sourcing practices. This can be achieved by sourcing materials locally, thereby reducing the need for long-distance transportation. Furthermore,

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companies should prioritize partnering with suppliers with a proven track record of sustainability, ensuring their supply chains align with environmental and social responsibility goals. By doing so, companies can not only reduce their environmental impact but also enhance their reputation and contribute to a more sustainable national economy.

Employee engagement and training are crucial for the successful implementation of SSCM. To this end, companies should conduct regular awareness programs and workshops to educate employees on the importance of sustainability and their role in driving sustainable practices within the organization. Moreover, companies should incentivize employee-driven sustainable initiatives, providing a platform for employees to suggest and implement innovative ideas that contribute to a more sustainable supply chain. By empowering employees and fostering a culture of sustainability, companies can unlock a significant source of innovation and drive long-term success.

The integration of advanced technologies such as data analytics, AI, and blockchain offers companies a transformative opportunity to streamline sustainable practices and build resilience in their supply chains. It is recommended that companies utilise data analytics to pinpoint inefficiencies and implement targeted interventions to minimise waste, reduce energy consumption, and lower emissions. By harnessing technology, companies can drive operational excellence, enhance competitiveness, and contribute to a more sustainable national economy.

In conclusion, these recommendations offer a roadmap for companies in Saudi Arabia's manufacturing sector to enhance their SSCM practices, address identified barriers, and unlock long-term benefits. By embracing sustainability as a core business strategy, companies can drive economic, environmental, and social benefits, ultimately contributing to a more sustainable and competitive national economy.

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