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Navigating the path to sustainable supply chains: A quantitative study of barriers and enablers in South African listed companies

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ABSTRACT

Recently, large corporations have faced mounting pressure to adopt manufacturing and operational practices that prioritize environmental responsibility and societal needs, paving the way for a sustainable future. Implementing sustainable supply chain management (SSCM) practices can enhance business sustainability and provide a competitive edge as companies are increasingly accountable for the environmental and social impacts. This study aims to evaluate the enablers and barriers of SSCM implementation in South Africa's listed companies. We analyzed panel data obtained from 46 premier listed firms on the Johannesburg Stock Exchange (JSE) employing a quantitative methodology alongside structural equation modelling. This research analyzes various factors influencing supply chains including government policy, stakeholder engagement, ethical sourcing, collaborative partnerships and the role of digitalization. The research findings underscore specific barriers, including market volatility, fluctuations in energy prices and escalating labour costs. In addition, the study identifies facilitators, particularly the growing demand for enhanced digitalization within procurement practices in public sector supply chain management. The findings suggest a growing imperative for private enterprises and governmental bodies to advocate for sustainable practices within the sector. Additionally, they underscore the distinct challenges faced by JSE-listed companies in the implementation of SSCM.

Contribution/Originality: This study makes two important contributions to the discourse on SSCM. First, it brings to light the often-overlooked enablers and barriers to SSCM within developing countries, particularly South Africa. It demands a departure from narrow research paradigms urging the adoption of sustainable practices integrated with broader theoretical frameworks, including environmental, social, and governance (ESG) principles. Furthermore, it highlights the necessity for the implementation of incentives, robust responsible sourcing regulations and active stakeholder engagement to create a collaborative ecosystem that advances a sustainable economy.

1. INTRODUCTION

In the past three decades, the integration of environmental and social sustainability initiatives into mainstream supply chain management (SCM) is gaining momentum as a viable path towards a sustainable future. Businesses are increasingly held accountable for the environmental, social and economic impacts of their operations and

extending accountability to their supply chain partners (Sánchez-Flores, Cruz-Sotelo, Ojeda-Benitez, & Ramírez-Barreto, 2020). Some critics contend that the costs associated with implementing SSCM practices may surpass the potential benefits for many publicly listed companies, especially in emerging economies such as South Africa while the economic implications of sustainable supply chain management (SSCM) are significant. Nevertheless, there is still a fragmented and uncoordinated understanding of how SSCM practices impact organizational performance and foster inclusive growth within the corporate sector. As a result, the adoption of sustainability practices within supply chain management and organizations has emerged as a critical area of research (Okeke & Asekomeh, 2024).

In today's environment of heightened awareness and stakeholder pressure, the effective and efficient implementation of SSCM is crucial for achieving sustainable corporate objectives, particularly within sectors such as manufacturing and oil and gas (Zhang, Yang, & Yang, 2023). Large firms have recognized the need to adopt SSCM practices to address critical environmental sustainability barriers including high carbon emissions, hazardous waste management and greenhouse gas emissions. The transition to sustainability initiatives has become a strategic imperative driven by the urgency to respond to environmental and socioeconomic impacts (Roy, Garza-Reyes, Kumar, Kumar, & Agrawal, 2022; Vidal et al., 2024).

A more comprehensive strategy that successfully ties into the social, economic, and environmental domains of sustainable development is required by the ESG framework. The shift to sustainable business models offers potential, developing nations, particularly those in Africa face special difficulties when implementing SSCM practices (Ahmed, Ahmed, Khan, & Ali, 2024; Carter, Hatton, Wu, & Chen, 2020; Carter & Rogers, 2008). Thus, a committed effort to move towards a circular economy that encourages the creative use of materials and reduces waste production to reap the benefits of sustainable development (Jabbour, Fiorini, Ndubisi, Queiroz, & Piato, 2020).

Prior research reveals a substantial knowledge gap despite the incalculable benefits of incorporating sustainability into the SCM system. Specifically, it occasionally fails to examine the factors that facilitate and hinder listed companies' efforts to incorporate sustainability practices into the SCM. Besides, some scholars contend that understanding the laws and factors that contribute to SSCM in these areas is still in its beginnings. Furthermore, businesses in developing nations like South Africa are unable to explore novel research approaches due to a dependence on constrained paradigms and procedures. In other words, some companies put short-term financial profits ahead of their social and environmental obligations despite the need for a sustainable future. Furthermore, previous researchers have surveyed sustainability and SCM with little attention to the multifaceted and intricate pressures that hindered the successful implementation of sustainable practices (Zhang et al., 2023). There is a conspicuous lack of agreement and consistency when it comes to determining and assessing the enablers that facilitate the successful implementation of SCCM practices in the direction of a sustainable economy. These academic inconsistencies and gaps in earlier studies force more investigation into the enablers and barriers in charge of SSCM adoption in listed companies.

This study aims to comprehensively assess the current state of SSCM in South Africa's listed companies, identifying key barriers and enablers to its successful implementation. We surveyed 46 of the top 100 JSE-listed companies to specifically explore the enablers and barriers to adopting SSCM practices, including government policy, stakeholder engagement, ethical sourcing, supply chain partners; collaboration, and digitalizing supply chains to facilitate the transition to sustainable supply employing a structural modelling technique. This paper underscores the critical importance of integrating sustainability practices into the SCM systems of listed companies emphasizing a holistic approach that considers environmental, social, and economic impacts beyond operational activities. The research focuses on the need to prioritize environmental protection and address societal needs, emphasizing the broader responsibility of companies within the broader context of sustainable development.

This study makes the following two critical contributions to the discourse on SSCM: First, it brings to light the often-overlooked enablers and barriers to SSCM within developing countries, particularly South Africa. It

demands a departure from narrow research paradigms urging the adoption of sustainable practices that are integrated with broader theoretical frameworks, including environmental, social, and governance (ESG) principles. Furthermore, it unequivocally highlights the necessity of government policy alignment with SSCM. It calls for the implementation of incentives, robust responsible sourcing regulations and active stakeholder engagement to create a collaborative ecosystem that advances a sustainable economy.

According to recent research by Okoumba, Mafini, and Bhadury (2020), South Africa's thriving manufacturing sector and wealth of resources listed companies are in a good position to set the norm for sustainable supply chain practices. Therefore, the shift to a sustainable future is essential given the nation's aspirational goals for both environmental sustainability and economic prosperity (Naude & Badenhorst-Weiss, 2011). Government departments must cooperate to fully realize the inclusive growth potential of South African companies to build a more sustainable and equitable future for all stakeholders in the country (Dubihlela & Omoruyi, 2014). Unquestionably, the South African government is working to increase public awareness of the importance of a sustainable global future but the program's adoption has been sluggish because of a lack of sufficient funding, encouraging policies, and a clear knowledge of its benefits and drawbacks (Mathu, 2021; Mofokeng & Chinomona, 2019; Naude, 2013; Rukuni, Maziriri, Booysen, & Zondo, 2022).

While much of the current research on SCM integrates components of sustainability and corporate social responsibility (CSR), it often does not establish a strong connection between important themes like environmental protection, sustainable financing, and the possibility of SSC practices (Andersen & Skjoett-Larsen, 2009; Gold, Seuring, & Beske, 2010; Kogg & Mont, 2012; Liu, Quan, Xu, & Forrest, 2019). However, as they relate to SCM, these factors are essential parts of the larger, more comprehensive ideas of CSR and sustainability. Research on SCM leadership provides insights into effective resource utilization and productivity and understanding (Carter et al., 2020; Gold et al., 2010; Sehnem, Jabbour, Pereira, & de Sousa Jabbour, 2019; Shekarian et al., 2024; Tate, Ellram, & Kirchoff, 2010).

This study aims to determine the fundamental causes of this disparity by analyzing the opportunities and obstacles listed that South African company seeking to implement sustainable supply chain strategies must overcome. We conducted an online poll including 46 out of 100 listed companies to obtain a comprehensive picture of the application of SSCL in South Africa's listed companies. We focused especially on the companies' current SSCL methods, opinions, and problems. The degree to which SSCL practices and principles are being applied, the benefits and drawbacks of SSCL adoption as seen by the industry, the role of government policy, industry cooperation, and investment in SSCL promotion, and the company's commitment to and understanding of ESG principles were among the significant elements that were evaluated.

To understand the challenges faced by South African businesses in navigating this path, the research was guided by two fundamental questions:

1. *What are the most significant enablers and barriers that South African listed companies face in adopting sustainable supply chain practices?*

This article's remaining sections are designed to thoroughly analyze the barriers and opportunities facing SSCL in South Africa's listed businesses. In section 2, important concepts and theories that guide the research are explored as we delve into the theoretical framework supporting sustainable development and its alignment with supply chain practices. In section 3, pertinent literature is reviewed, and testable hypotheses based on the body of current knowledge are developed. The study's materials and methods are described in section 4, which also includes information on the survey's design, data-gathering procedure, and analytical strategy. Section 5 presents the survey results and findings. Section 6 offers a thorough discussion and analysis of the data. In conclusion, section 7 presents recommendations for further research based on the research findings.

2. THEORETICAL FOUNDATION

2.1. Definition of Sustainable Supply Chain Concept

Sustainability in supply chains demands a Triple Bottom Line (TBL) framework encompassing social, environmental, and financial responsibilities. The framework necessitates shifting the focus beyond the cost reduction and profit maximization mindset (Qeke & Dubihlela, 2018). This framework guided our examination of key independent variables such as the existence of a dedicated SCM department, adherence to government SCM policies, the presence of a strategic plan, and the use of SCM strategies like e-procurement, just-in- time inventory, stakeholder engagement, ethical sourcing, and production strategies which are critical drivers for sustainability practices and reducing carbon emissions.

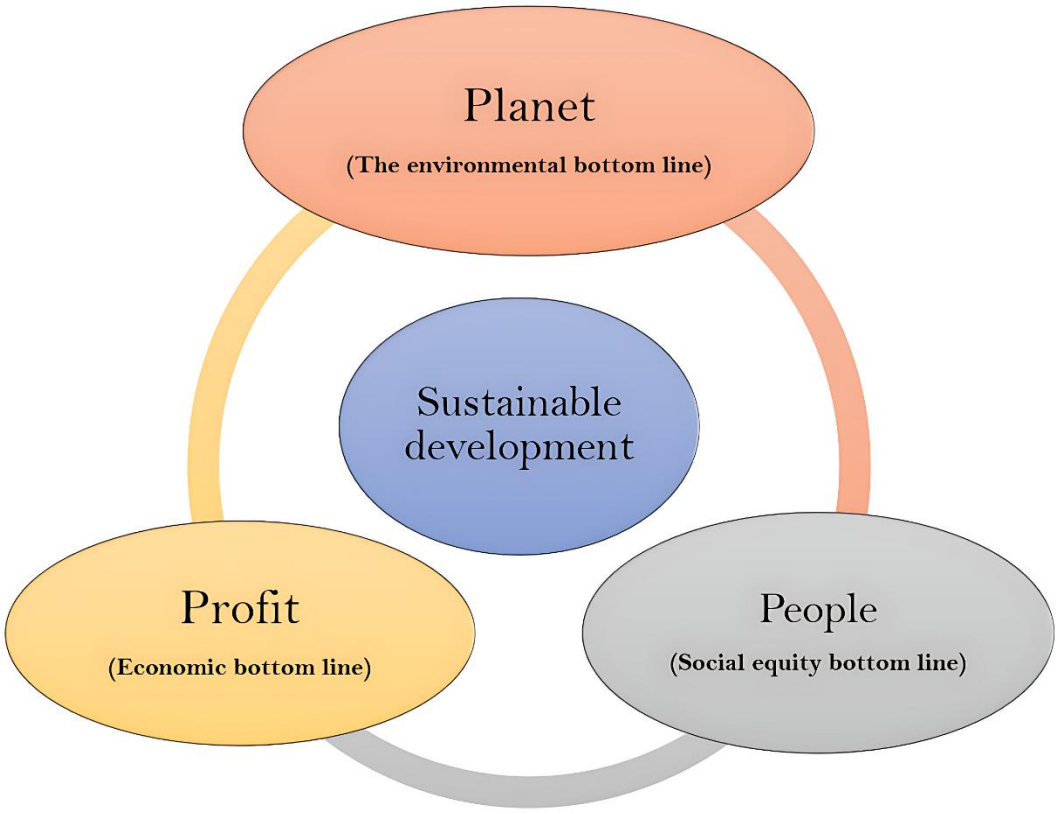

Figure 1. Triple bottom sustainable development framework.
Source: Osborne and Berroa (2023).

According to Figure 1, the theoretical SSCM framework utilizes resources to meet present needs without compromising future generations' ability to meet their own is becoming increasingly central to responsible business practices. Integrating the SSCL strategy with the TBL holds significant potential for South African listed companies to enhance their reputation, attract investors and contribute to inclusive growth (Liu et al., 2019). Existing literature demonstrates that South Africa's listed companies face a critical juncture to achieve SSCL, inclusive growth and enhanced corporate performance. Sustainable supply chains rooted in the TBL go beyond minimizing negative impacts and actively create positive, social and environmental value, recognizing the interconnectedness of a company's success with the well-being of its suppliers, workers, communities, and the environment. Therefore, the key to this important shift is accepting the TBL framework working with stakeholders, and using technology improvements (Ahi & Searcy, 2013; Mafini & Muposhi, 2017). Besides, the TBL framework is a roadmap for listed companies to address social inequalities, protect environmental resources, and foster long-term financial viability (Hmouda, Orzes, & Sauer, 2024; Qeke & Dubihlela, 2018).

There are many opportunities to support this shift, including developing technologies, increased consumer demand for sustainable goods and services, and cooperative alliances. It follows that South African listed firms may lead the way in SSCL, promoting inclusive growth and improving corporate performance by aggressively addressing the obstacles and making use of the opportunities (Naude & Badenhorst-Weiss, 2011). However, navigating this path is not without challenges. Henderson (2021) argues for reimagining capitalism to foster a more sustainable and equitable future. Her work emphasizes the need to accelerate the adoption of socially sustainable corporate leadership (SSCL) practices by large corporations to encourage inclusive growth, particularly within the context of the South African economy.

2.2. Sustainable Supply Chain Leadership and Corporate Social Responsibility

Recent research defines corporate social responsibility (CSR) as a business strategy that aims to create a positive social impact while also increasing a company's profits. This concept involves a commitment to sustainable economic development by enhancing the well-being of employees, their families, the local community, and society (Huang, Tian, & Cheablam, 2024; Zhao et al., 2021). According to Huang et al. (2024) CSR involves promoting management practices towards incentivizing the internal and external stakeholders which is a central business strategy to encourage the sustainable development of firms.

Current literature indicates that large corporations that adopt CSR initiatives experience reduced pressure from internal and external stakeholders. This approach also establishes a robust foundation for these companies to encourage multiple stakeholders to accurately forecast their behaviour and fulfil their SCM requirements (Wolf, 2014; Zhu & Lai, 2011). While existing research supports the interconnection between sustainability and CSR, it has not sufficiently clarified how the integration of CSR within the SCM framework could enhance sustainability efforts towards a sustainable future in South Africa. Therefore, it is essential to explore the relationship between sustainability and CSR research in the context of supply chains across these domains. This study seeks to create a comprehensive conceptual framework for SSCM that incorporates all aspects of ESG principles. The goal is to assist large publicly listed companies in South Africa in effectively adopting the SSCM model, enabling them to contribute to a sustainable future.

3. RELEVANT LITERATURE AND HYPOTHESIS DEVELOPMENT

3.1. Sustainable Supply Chains in South Africa: A Strategic Imperative for JSE-Listed Companies

Research indicates that the supply chain constitutes a significant portion of the environmental impact for most large corporations, primarily due to the energy-intensive nature of global production and transportation. As a result, these companies face mounting pressure to adopt sustainable business practices that balance environmental stewardship with societal welfare. While this shift is appealing from a corporate responsibility standpoint, the fundamental priorities of businesses often centre around cost reduction, profit maximization, and delivering robust returns on investment to shareholders. Thus, the pursuit of sustainability through enhanced supply chain strategies frequently becomes a secondary consideration since such initiatives typically incur additional implementation costs.

The adoption of sustainable supply chain methodologies has been gradually hindered by the need for green financing to elevate these practices to an effective scale. Moreover, achieving sustainability requires an integrated approach involving government, key stakeholders, and consumers working collaboratively. However, this level of coordination is not consistently observed, especially in regions like South Africa where systemic challenges may impede progress towards a more sustainable future.

Leu, Lee, Huang, and Huang (2021) provide valuable insights into the impact of sustainable supply chain management on the operational performance of manufacturing firms within Taiwan, an emerging market analogous to South Africa. Their study encompassed a survey of 290 companies and utilized structural equation modelling to analyse the data, a methodology that aligns with the approach we are employing in this investigation. The results

indicated a positive correlation between sustainable supply chain practices and both sustainability and business performance in small and medium-sized enterprises (SMEs), primarily facilitated through the integration of internal operations . However, the study presents a notable limitation as it focused exclusively on SMEs, thereby omitting larger manufacturing entities listed on stock exchanges despite employing structural modelling on a substantial sample size. This highlights a significant gap in the literature, warranting further investigation into the manufacturing sector, particularly among publicly traded firms, to enhance understanding and contribute additional insights into the field.

Several studies have investigated various aspects of SSCM practices, including the impact of green supply management on competitive advantage, the relationship between SSCM strategies and corporate social responsibility, the significance of supply chain management in green logistics and ethical sourcing, and the efficacy of adopting SSCM practices for achieving a circular economy. Gaining a critical understanding of how to incorporate these practices into a comprehensive supply chain framework remains a challenge in emerging economies such as South Africa despite the significant efforts of prior research. This limited focus in existing literature restricts a thorough understanding of how sustainable supply chain practices can facilitate large companies in moving toward a sustainable future, resulting in fragmented and inefficient solutions. Building on the findings discussed earlier, it is imperative to establish a future research agenda aimed at addressing the identified gaps in the current research.

Previous research on SSCM tends to focus predominantly on short-term outcomes (Yang & Yan, 2020; Zhu, Geng, & Lai, 2010) frequently neglecting the long-term implications of this innovative sustainable business model on overall sustainability performance. Such notable omissions can significantly hinder a comprehensive understanding of the potential value and impact of SSCM. Such omission limits the ability to assess its ultimate effectiveness in promoting sustainable business practices. This study seeks to enhance this understanding by critically evaluating the barriers and enablers associated with SSCM practices among publicly listed companies in South Africa.

Naude and Badenhorst-Weiss (2011) and Okoumba et al. (2020) argue that listed companies are well-suited to implement an integrated approach to environmental sustainability aiding South Africa's sustainable future. The adoption of SSCM practices not only fosters the development of sustainable business models but also facilitates a seamless transition to a circular economy (Dubihlela & Omoruyi, 2014). Nonetheless, proceeding studies have recognised several barriers that hinder the effective implementation of SSCM practices among listed companies (Naude, 2013; Naude & Badenhorst-Weiss, 2011). Firstly, there is a notable lack of comprehensive analysis regarding the drivers of sustainable supply chains such as government policy, investment inflows, and industry collaboration (Okoumba et al., 2020; Qeke & Dubihlela, 2018). Secondly, many existing studies tend to approach sustainable supply chains in isolation, thereby neglecting the intricate interactions among ESG principles which are essential for a successful transition to environmental sustainability (Mofokeng & Chinomona, 2019; Ozkan-Ozen, Kazancoglu, & Mangla, 2020). Similarly, the work of (e.g. (Hart, 1995; Kogg & Mont, 2012; Kramer & Porter, 2006)) highlights the crucial need to integrate sustainability strategies into the core business operations to enhance a company's competitive advantage and shared value. This concept is particularly relevant for SSCM in South Africa and is undeniable. Thus, further exploration in this area is vital to provide new insights that can guide large corporations in navigating their path toward sustainable growth.

However, while these companies have made efforts to move towards a sustainable future, challenges remain. Often, they face obstacles like unsupportive government policies and limited collaborations with key stakeholders. This lack of comprehensive and consistent policies that incentivize sustainable practices within the supply chain can create a significant barrier for large companies. This underscores the critical need for the South African government to actively design supportive policies that encourage the adoption of SSCM practices by large corporations.

A comprehensive approach is required to address these limitations. The government should prioritize the development of clear and robust policies that incentivize sustainable practices within the supply chain, addressing issues like carbon emissions, waste management, and ethical sourcing. Furthermore, promoting collaboration between JSE-listed companies and key stakeholders is essential. This collaboration can lead to the development of innovative solutions, enhance knowledge sharing, and increase public awareness of the importance of sustainable supply chains. Against this backdrop, a holistic approach that goes beyond simply maximizing profits and prioritizes stakeholder engagement, responsible resource management, and equitable development may assist in enriching the current studies.

3.2. Drivers of Sustainability and Sustainable Supply Chain Management

The existing body of literature has identified a wide array of drivers influencing SSCM practices which can be categorized into internal and external drivers (Lopes, Gomes, Pacheco, Monteiro, & Santos, 2022; Moktadir, Rahman, Rahman, Ali, & Paul, 2018; Oubrahim & Sefiani, 2023; Saeed & Kersten, 2019). We acknowledge the contributions made by researchers in this field. There remains a lack of consensus regarding the specific drivers that facilitate the implementation of SSCM, particularly within the manufacturing sector. A comprehensive examination of the influence and significance of these drivers throughout the supply chain has not been thoroughly documented. Previous studies have highlighted various drivers but have failed to establish a coherent set of listings or definitions that align with their effects on promoting sustainability (Aslam, Rashid, Wahla, & Tahira, 2018; Ho et al., 2021; Karmaker et al., 2021). Consequently, further research in this area could prove beneficial for academics, policymakers, and practitioners in formulating sustainability-oriented initiatives, particularly as the effective management of the supply chain remains a primary focus of this paper.

Previous research shows a multitude of drivers of SSCM practices. However, the analysis identified key external drivers to sustainable supply chains outside a company's boundaries involving selection and collaboration with suppliers (Aditi, Govindan, & Jha, 2024; Asif, Lau, Nakandala, Fan, & Hurriyet, 2020; Silvestre, Monteiro, Viana, & de Sousa-Filho, 2018) attracting environmentally conscious consumers, appealing to responsible investors, and reducing operating costs (Ferreira, Lopes, Gomes, & Rammal, 2023; Hussain, Alsayegh, & Boshnak, 2024; Ruberti, 2024; Tsang, Fan, & Feng, 2023).

Earlier research emphasizes that the adoption of SSCM practices is vital for mitigating environmental degradation and promoting corporate social responsibility within the manufacturing sector in emerging countries (Eweje & Sajjad, 2013; Sánchez-Flores et al., 2020; Uniyal, Mangla, Sarma, Tseng, & Patil, 2021). Even though scholars have presented a set of drivers responsible for the adoption of SSCM practices especially within the large corporate sector, understanding how to effectively integrate sustainability into business operations is essential for achieving widespread SSCM adoption. Recent research by Ho et al. (2021) and Lopes et al. (2022) indicates that regulatory policies and market pressures are essential drivers of SSCM practices. The external drivers focus on promoting sustainable innovation and enhancing employee engagement (Moktadir et al., 2018; Oubrahim & Sefiani, 2023). In contrast, internal drivers emphasize an organization's competitive advantage, innovation, and reputation. Although several authors have explored SSCM practices, a thorough examination of the specific enablers in this context is necessary to facilitate effective implementation.

The adoption of sustainable supply chain management (SSCM) among listed companies is driven by various enablers that promote organizational sustainability (Aditi et al., 2024). Research has examined SSCM through corporate social responsibility (Khoshnaw, Ali, & Mousa, 2024; Zhao et al., 2021) and the impact of stakeholder pressure on sustainability performance (Almagtome, Khaghaany, & Önce, 2020). Additionally, the role of digitalization in advancing sustainable practices has been highlighted (Deepu & Ravi, 2021; Lemoun, Dellagi, Daoud, & Abusalma, 2024). A critical gap remains regarding the specific drivers for successful SSCM implementation in listed companies (Andersen & Skjoett-Larsen, 2009; Gold et al., 2010; Tate et al., 2010). Current

understanding of SSCM enablers in emerging economies is limited. A thorough analysis of these drivers and barriers is essential to inform effective policy interventions and support a broader transition to sustainability.

Firstly, sustainability efforts in listed companies within emerging economies like South Africa are limited (Munny et al., 2019). Research that attempts to evaluate the effectiveness of SSCM practices in enhancing sustainability often fails to focus adequately on integrating the triple bottom line into the supply chain management system. Secondly, advocates for sustainability are often hesitant to apply insights gained from other industry contexts due to the mixed responses from many academics and the community regarding the potential benefits of SSCM drivers. Therefore, further exploration within stock exchange markets is necessary to generate new knowledge. Furthermore, Saeed and Kersten (2019); Ho et al. (2021) and Lopes et al. (2022) state that the regulatory policy and market pressures are fundamental drivers of SSCM for the implementation of sustainability practices. These external drivers tend to concentrate on enhancing sustainable innovation and employee engagement (Moktadir et al., 2018; Oubrahim & Sefiani, 2023). The internal drivers advocate for organizations' competitive advantage, innovation and reputation.

Many companies eagerly embrace initiatives that support a sustainable future. Research by Kato and Manchidi (2022) indicates that 83% of JSE-listed companies in South Africa lack a defined governmental policy on SCM. This absence makes it challenging for these companies to fully integrate sustainable supply chain management (SSCM) practices. As a result, they face a tough choice, adopt sustainable practices and risk trailing competitors in an unsupportive environment or focus on short-term profits at the expense of long-term sustainability. This dilemma often leads to indecision regarding investment in SSCM.

3.3. Barriers to Sustainable Supply Chain Leadership Performance

There is a pressing need for government agencies and the corporate sector to embrace SSCM practices more decisively. However, the current ambiguity in policy frameworks significantly hinders these efforts. It is imperative to consolidate regulatory policies to drive sustainable practices effectively. A robust, multifaceted strategy must be implemented with the government taking a proactive stance in establishing clear policies that promote sustainability. This should encompass financial incentives for the adoption of SSCM, mandatory sustainability reporting and active collaboration with industry groups to establish sector-specific benchmarks.

Sustainable supply chain leadership implementation in emerging economies has faced a multitude of barriers ranging from limited funding, lack of knowledge, and organizational resistance to change despite its advantages. Understanding these obstacles is crucial for advancing sustainable practices. According to Han and Huo (2020) companies must change their ways because of the global movement towards sustainable development, especially around supply chains. There is a movement towards SSCL due to the pressing need to solve environmental and social concerns and the increasing recognition of their interdependence (Dangelico, Pontrandolfo, & Pujari, 2013). Correspondingly, Bag, Telukdarie, Pretorius, and Gupta (2021) draw attention to a major research void concerning the use of Industry 4.0 technologies to manage the sustainability of supply chain networks. Out of 53 publications, only 10 of them examined the relationship between Industry 4.0 and supply chain practices in the manufacturing sector. The papers highlight the need for further research on supply chain sustainability emphasizing the importance of considering social aspects as previous studies have largely overlooked this.

While the transition towards environmentally sustainable practices has garnered increasing interest from both academics and practitioners (e.g., (Hina, Chauhan, Kaur, Kraus, & Dhir, 2022)), the practical implementation of sustainable supply chain management (SSCM) within the corporate sector remains a challenge. This is largely attributed to the perception that SSCM initiatives may detract from core business objectives, such as profitability and expansion. While some engage in deliberate greenwashing activities (e.g., (Jabbour et al., 2020)). Others continue to prioritize short-term profits over long-term sustainability (e.g., (Jia, Zuluaga-Cardona, Bailey, & Rueda, 2018; Sánchez-Flores et al., 2020)). This creates a significant challenge as the number of highly sustainable firms

remains relatively low compared to those with limited environmental commitment (e.g., (Ozkan-Ozen et al., 2020)). According to Romero et al. (2017) if corporations can be convinced that environmentally friendly practices are in fact profit increasing, then even the most environmentally indifferent, but profit-seeking firm would go green. These concerns highlight the interconnectedness of global sustainability challenges and the need for a more equitable and responsible approach to business practices. Companies and governments must work together to accelerate progress toward sustainable development goals and ensure that the pursuit of profit does not come at the expense of people and the planet.

A significant gap persists between the urgency of sustainable development and the pace of corporate action despite the commendable efforts of environmental activists in fostering the roadmap to sustainable development (Shekarian et al., 2024). Large corporate manufacturing and services companies continue to face pressure from stakeholders, including non-governmental companies to assume responsibility for their entire supply chains. Hence, these companies must recognize the importance of implementing environmentally friendly management systems to address sustainability challenges (Fernando, Bee, Jabbour, & Thomé, 2018; Krause, Vachon, & Klassen, 2009). According to Golicic and Smith (2013) sustainable supply chains face challenges beyond affordability, including social and political inertia and a lack of sustainable financial instruments. Addressing these challenges requires demonstrating circularity's economic and environmental benefits, attracting investors, and collaborating with stakeholders. Fahimnia, Sarkis, and Davarzani (2015) emphasize the need for a robust regulatory framework in South Africa to encourage sustainable practices in supply chains.

4. RESEARCH METHOD

4.1. Background to the Study

Despite the growing recognition of the importance of SSCM practices within the context of publicly listed large companies (Galal & Moneim, 2016; Kato & Manchidi, 2022; Leu et al., 2021; Roy et al., 2022) studies that examine the future trajectory of SSCM within the African stock market sector remain scarce. The knowledge gap is particularly dominant in the South African perspective characterized by unique enablers and barriers for listed companies to embrace sustainable practices that have not been comprehensively explored. Based on this literature, this study poised data in 2020 with the primary purpose of contributing to an understanding of the future trajectory of SSCM within listed companies in South Africa. Our motivation for this work is grounded in the fact that currently, a few scholars have made efforts to investigate this specific topic. Hence, this creates a demand for new data that could provide a baseline for future analysis and insights into the landscape of SSCM within listed companies in South Africa.

4.2. Sample and Data Collection

We established a robust research plan, drawing heavily on the insights gained from previous similar studies to accurately measure the critical enablers and barriers encountered by JSE-listed companies in their transition to sustainable business models. Notably, an earlier survey of Aslam et al. (2018) that involved 80 manufacturing companies in developing nations provides a solid foundation for this study. We effectively minimize the risks of selection bias and subjectivity in participant selection by aligning our criteria with relevant prior studies.

We employed a quantitative approach to collect cross-sectional data from a reliable sample of 400 (N=400) JSE-listed companies for the period ending December 31, 2020. Data used for this study was drawn from two primary sources including 100 (N=100). Boards of promising high-quality companies and SMEs and the main board encompassing 300 well-known companies that are looking to grow. The decision to utilize the JSE database is justified by its prominent performance within Africa's financial market. As the largest financial market on the continent followed by the Lagos Stock Exchange in second place, the Nairobi Stock Exchange in third, and the Cairo Stock Exchange in fourth, the JSE's reputation ensures that we generate valid and reliable results, free from

bias. In this study, we focused primarily on JSE-listed companies while intentionally excluding certain manufacturing and services industries that could have enriched our findings. However, our judicious selection of the top 100 companies of the year effectively mitigates any bias that could compromise the integrity of our sample.

We chose a sample of 100 JSE-listed companies based in South Africa using a stratified random sampling method enhanced by a purposive sampling technique to ensure that our selected samples accurately represent the entire study population and effectively address the various study issues. The selected study sample of 100 top JSE-listed companies cuts across various sectors (see Table 1). For instance, manufacturing industries, mining, quarrying and agriculture, wholesale finance and business services, property and hospitality, logistics and storage, commercial agents, and allied agents. Our selection in this process was also supported by their highest returns on shareholders' investment in the previous five years as documented by the JSE published annual accounts.

Table 1. Sample analysis: JSE-listed companies by sector.

Surveyed sectors	No of respondents
Catering, accommodation, property and hospitality	1
Finance and business services	1
Information and communication technology (ICT), transport, logistics and storage	4
Manufacturing	12
Mining, quarrying, and agriculture	3
Other sectors	11
Retail, wholesale trade, commercial agents and allied services	9
No sector was provided by respondents.	5
Grand total	46

Table 1 shows the distribution of the sample by the sectors with manufacturing presenting a higher response of 12 listed companies followed by other companies accounting for 11 companies and retail, wholesale trade, commercial agents and allied services presenting nine companies. It is important to note that the manufacturing and retail, wholesale trade, commercial agents and allied services sectors accounted for 46% of the response rates. The study's emphasis on SSCL and the sample's noteworthy inclusion of manufacturing and other sectors suggest that the main forces behind sustainability initiatives fairly depict the performance of the JSE stock exchange market. These industries have a significant role in the landscape of sustainability and reducing the possibility of bias in the findings.

However, key sectors like catering, accommodation, finance and business services were underrepresented. This limited representation might hinder the generalizability of findings to all JSE-listed companies and potentially introduce bias due to sector-specific challenges and trends.

Data was collected using a standardized 5-point Likert questionnaire tool and each participating organization's designated contact person received an electronic copy of the material. The companies answered the online survey with both closed-ended and open-ended queries. Then, we generated quantitative data utilizing statistics from an online Monkey poll with evidence from 46 of the top 100 JSE-listed companies. Since multiple-choice questions provide pre-defined responses for quick information, respondents were able to express how much they agreed or disagreed with comments regarding components of SSCL by using a combination of closed-ended and multiple-choice items in the questionnaire. Moreover, it provided deeper insights by allowing respondents to comment on their ideas and experiences via open-ended questions. Research by Karlen, McNair, Perseguers, Mazza, and Mermod (2007) finds that a response rate of 46% can be considered adequate while recent systematic reviews of postal questionnaires indicate that response rates of at least 70% are necessary for external validity. Based on these results, the response rate of 46% obtained for this study is insufficient to produce unbiased data.

A pre-test of the questionnaire was conducted with 10 esteemed specialists within the SCM field to ensure the validity and reliability of the data while addressing any potential mixed reactions. A statistical method commonly

referenced by researchers to confirm the appropriateness of tests and scales to assess the reliability of the data collection tool, we utilized Cronbach's alpha. Our analysis was conducted with a 5% margin of error and a 95% confidence level resulting in a confidence level of 97%. This outcome emphasizes the instrument's robustness as the acquired results present a higher confidence level with a reduced margin of error of 3%.

4.3. Variable Measurement

This study assessed factors that pertain to how South African JSE-listed companies operate and grow over the long run to SSCL procedures. The opportunities and barriers the JSE-listed companies encountered in shifting to inclusive growth and improving their SSCL performance approximated the dependent variable. Regressing SSCM practices on sustainability-related performance and sustainable development outcomes in a sustainable economy. Quantitative data analysis methods included bivariate analysis and descriptive statistical analysis.

We used a 5-point Likert scale to rate each research variable with 1 representing "strongly disagree" and 5 representing "strongly agree." Ensuring control variables maintained ensured adherence to previous research findings. The study also demonstrated how different relationships might exist between businesses that track and report sustainability performance. There is evidence that high levels of environmental concern and performance are associated with high levels of disclosure and the ensuing monitoring and reporting processes, even though the literature has not established a link between effective monitoring and reporting procedures and sustainability performance (Aboagye-Otchere & Boateng, 2023). These traits, which have a significant impact on a company's operational competence and technological prowess, served as the control variables to gauge how well the SSCL deployment went. Larger companies are more adept at implementing green practices, according to studies (Vijayvargy, Thakkar, & Agarwal, 2017). This study illustrates how many interactions may arise between businesses that monitor and disclose their sustainability performance.

4.4. Ethical Considerations

The study received ethical approval from the Ethics Clearance Committee, College of Economic and Management Sciences of the University of South Africa on 8th March 2022, ERC Ref #: 2021_CRERC_045 FA, before the commencement of the fieldwork field. The participants gave their written consent to take part in a study involving voluntary human subjects from which they might withdraw at any time without facing repercussions.

5. RESULTS

5.1. Descriptive Statistics

The descriptive statistics in this part are crucial for grasping the opportunities and barriers related to the adoption of the SSCL approach in South African listed companies. We notably highlight the important SSCL-related variables such as the industry sector categorization, employee experience, job positions, mean, and standard deviation. This gave us a basic grasp of the SCCL environment in South Africa.

Table 2. Sector distribution of respondents in the survey of JSE-listed companies.

Business sectors	No of respondents	Percentage (%)
Catering, accommodation, property and hospitality	1	2.2%
Finance and business services	1	2.2%
ICT, transport, logistics and storage	4	8.7%
Manufacturing	12	26.1%
Mining, quarrying, and agriculture	3	6.5%
Other sectors	11	23.9%
Retail, wholesale trade, commercial agents and allied services	9	19.6%
No sector was provided by respondents.	5	10.9%
Total	46	100

Table 2 highlights a significant presence of manufacturing (26.09%) and "other sectors" (23.91%) within JSE-listed companies suggesting the potential for widespread impact on SSCL initiatives. Limited representation of sectors like catering, accommodation, and finance calls for targeted engagement. The significant number of respondents not providing their sector (10.87%) indicates potential data bias and underscores the importance of comprehensive sector representation in future surveys. In essence, efforts focused on high-impact sectors, engaging underserved sectors, and addressing data gaps can leverage the potential of JSE-listed companies to drive a sustainable future for the country and the region. This analysis seeks to address inconsistencies observed in empirical research on SSCL providing insights into the specific barriers and opportunities within the South African context. This study will also contribute to the growing body of literature on SSCL valuable for policymakers, businesses, and stakeholders seeking to accelerate the transition toward a more sustainable and inclusive future for South Africa. Furthermore, we provide descriptive information that highlights the significant years of staff management experience in the 46 JSE-listed companies that were the focus of this study's inquiry.

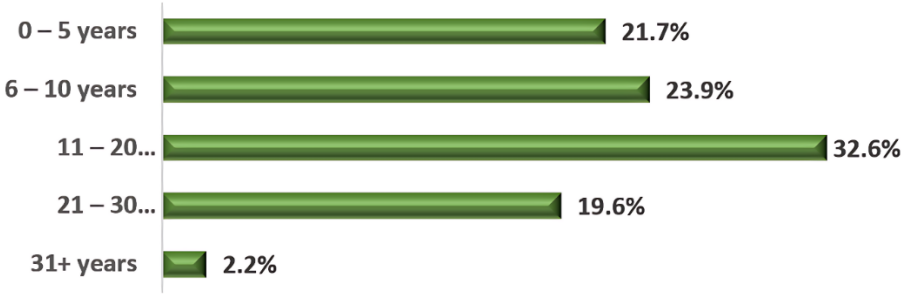

Figure 2. Experience in staff management in financial markets.

Figure 2 displays data gathered from the employees' background experience from individuals with less than five years of experience to more seasoned professionals with over thirty years. The survey data reveals a significant concentration of experienced staff within the surveyed listed companies with a majority (78.3%) possessing over five years of experience. This indicates a wealth of institutional knowledge and practical expertise within these companies. Notably, a large portion of the respondents (32.6%) have worked for their companies for 11 to 20 years, demonstrating a significant familiarity with operation excellence and existing supply chains.

We examined their job positions as outlined in Figure 3 to further validate the experience of respondents and gain insights into their potential contributions to a positive transition towards SSCL.

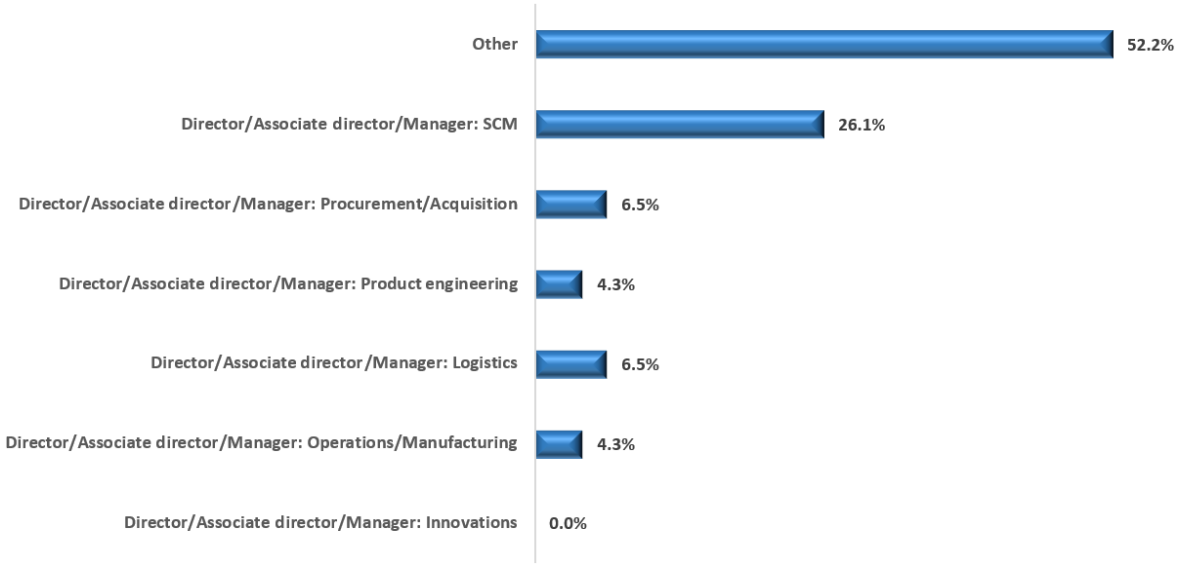

Figure 3. Category of the respondents by job description.

Figure 3 illustrates the findings which reveal that more than 52.2% (n=24) of the respondents gave a job title that was not on the list while 26.1% (n=12) indicated a position directly in charge of supply chain management. A smaller proportion of less than 6.5% of senior management assigned job titles related to procurement/acquisition, product engineering, logistics, operations, or manufacturing. In this regard, the most crucial thing to remember is that every department in a firm is involved in supply chain management. The fact that a larger percentage of respondents (52.2%) did not fit into the SCM categories is indicative of this. More specifically, the human resource department, ICT, and finance and administration are essential to the SSCL's successful implementation. In summary, job descriptions play a critical role in forming supply chains in business companies given that top management is ultimately responsible for making decisions regarding the supply chains' implementation.

5.2. Estimating Barriers and Opportunities to SSCL

This section provides a statistical analysis of the opportunities and barriers found in the survey data to have a better understanding of the elements promoting and impeding the adoption of SSCL in JSE-listed companies. To address research question one (*how do corporate companies assess and measure the effectiveness of their sustainable supply chain leadership initiatives?)*, this analysis first examines the role of separate SMC departments in corporate entities. We evaluate and quantify the success of their SCM activities. The analysis then focuses on providing answers to the specific research questions stated in the methodology.

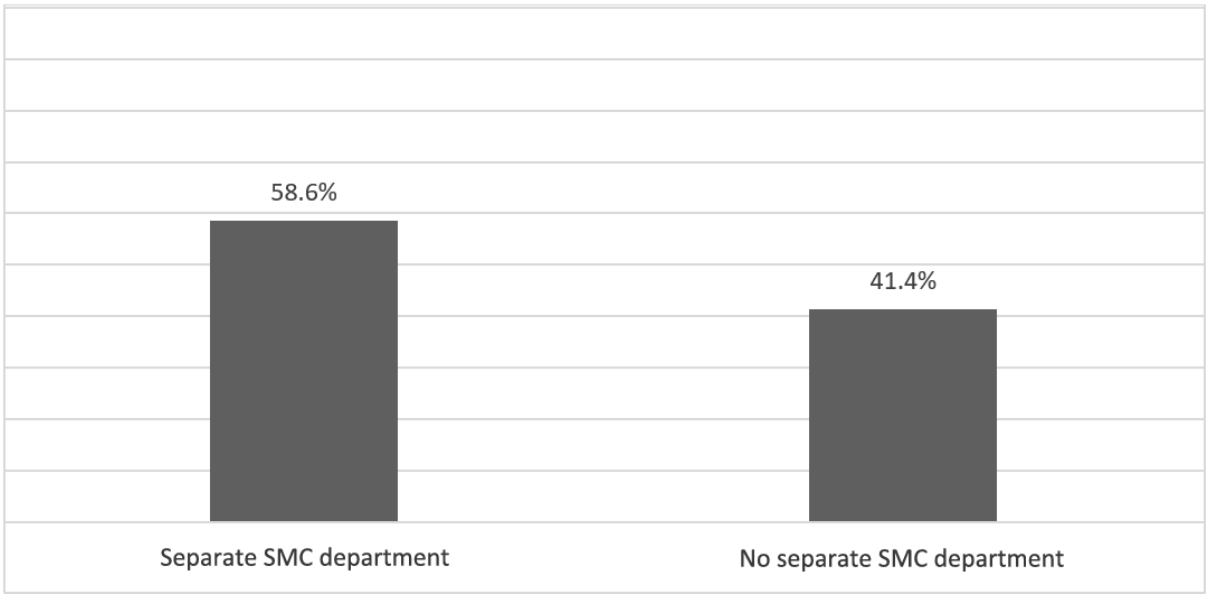

Figure 4. Corporate supply chain management department.

Figure 4 revealed that nearly 59% of JSE-listed companies have dedicated SCM departments while the remaining 41% do not. This highlights the growing importance of dedicated SCM structures for driving sustainability initiatives. A dedicated department acts as a centralized hub for integrating sustainable practices, leading to a more strategic and comprehensive approach to SSCL. Strong leadership and a clear commitment to sustainability can still foster a culture of responsibility although companies deprived of a dedicated SCM department may face challenges in achieving company-wide sustainability goals. Ultimately, a dedicated SCM department provides a structured framework that significantly enhances the potential for successful SSCL implementation.

We examined whether respondents followed a specific strategic SCM plan as a key element in transitioning to the SSCL strategy to assess the importance of an independent SCM department within corporations. This analysis,

illustrated in Figure 6 sheds light on the relationship between strategic planning and organizational structure in driving sustainable supply chain practices.

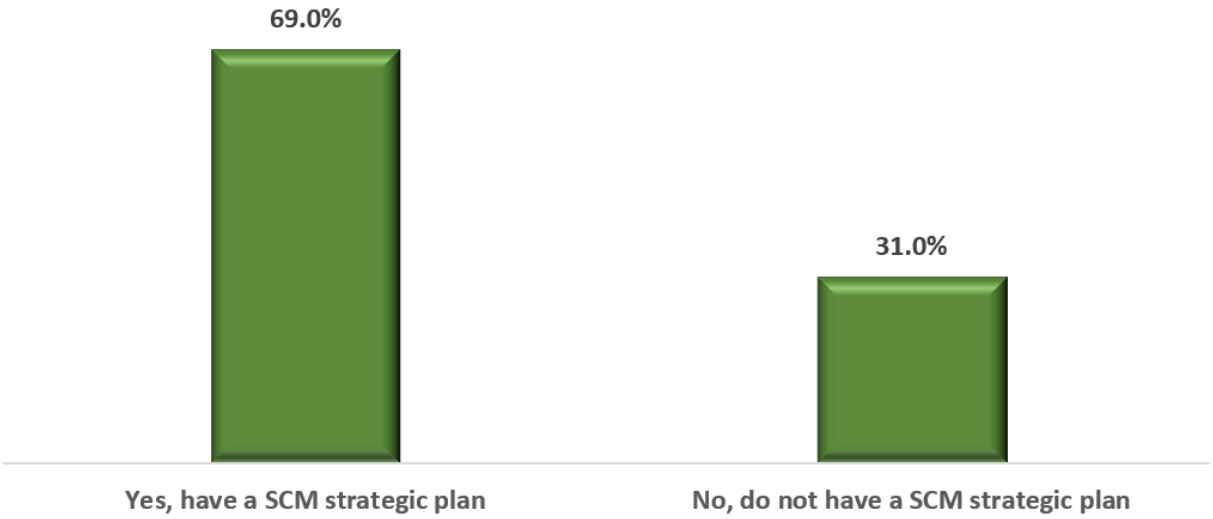

Figure 5. Use of a strategic SCM plan by corporate companies.

The survey results in Figure 5 reveal that 69% of JSE-listed companies follow a designated strategic SCM plan, while 31% do not strongly align with the presence of dedicated SCM departments. A dedicated department fosters a centralized approach enabling the development and execution of a comprehensive plan that integrates sustainability considerations into core operations. The survey highlights the importance of strategic planning and dedicated resources for effectively managing complex supply chains and achieving sustainable business outcomes.

We also examined the impact of a distinct SMC department on compliance levels and its ability to adhere to open SCM standards to have a deeper understanding of how it operated. We asked the respondents whether JSE-listed companies operate under specific public policies related to SCM. This inquiry was crucial for understanding how government regulations and corporate practices align to advance sustainability within these large corporations, particularly considering their potential carbon emissions.

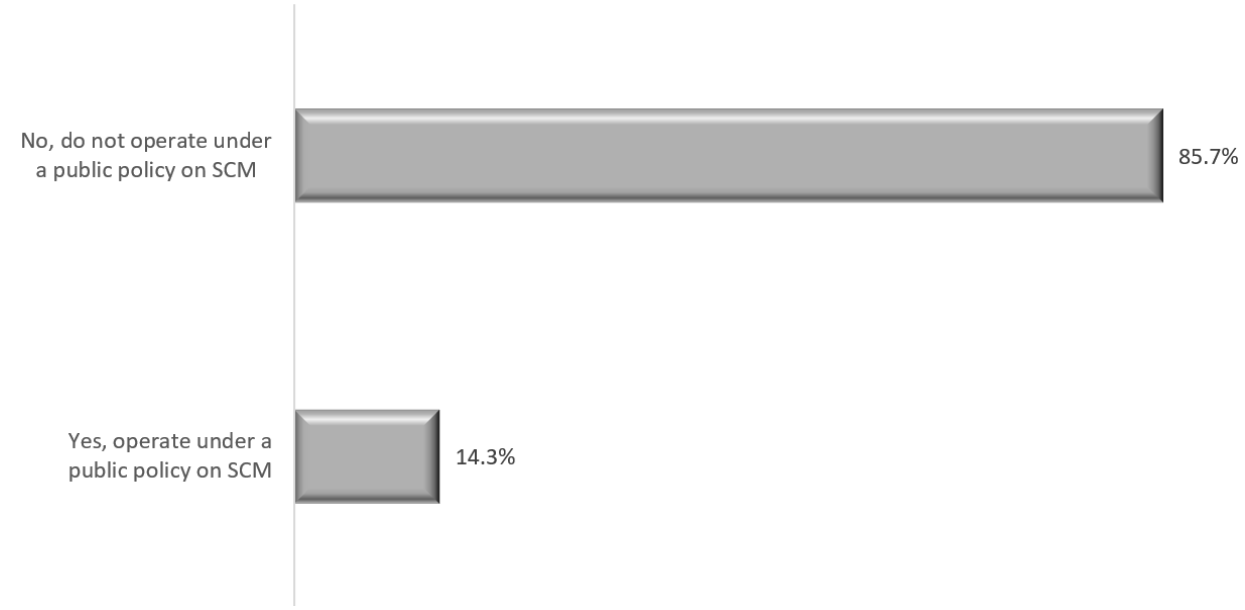

Figure 6. Corporate companies' compliance with public policy on supply chain management.

According to Figure 6, the survey revealed that 59% of JSE-listed companies maintain a separate SCM department and 69% follow a designated strategic supply chain plan, factors typically associated with strong adherence to regulatory frameworks. Nonetheless, a surprising 86% reported not operating under any specific public policies or regulations related to SCM. This discrepancy underscores a potential gap between industry practices and government policy in the realm of SSCL. To advance SSCL, an efficient and functional SCM department can facilitate the allocation of resources strategically, provide specialized knowledge, and provide a structured framework for attaining operational efficiency, cost savings, and risk reduction (Sehnem et al., 2019). This finding suggests a need for strengthening or developing more robust public policies that align with industry efforts towards SSCL, particularly considering the significant role of large corporations in driving sustainability initiatives.

5.3. Technological Factors Influencing Adoption of SSCL Practices

Our study investigated the technological landscape of sustainability efforts in South African corporations by examining the adoption of 15 key technologies commonly associated with SSCL. We surveyed companies across various sectors and evaluating the extent to which these technologies were being utilized. The findings summarized in Figure 7 offer insights into the technological maturity of South African businesses in their pursuit of sustainable supply chain practices.

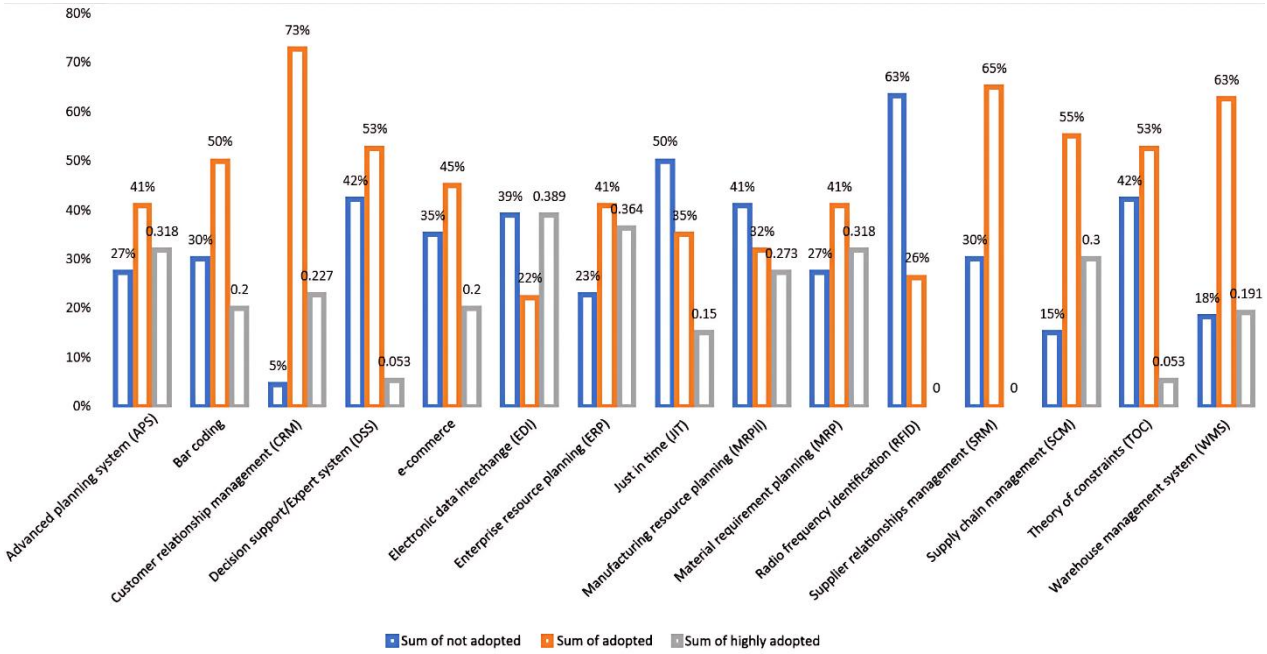

Figure 7. Factors influencing corporate companies' technological potential for sustainability performance.

According to Figure 7, 73% of companies have adopted customer relationship management (CRM) which fosters trust and transparency with customers. The findings highlight the significant progress these companies have made in CRM. A review of the literature reveals that the increasing pressure from customers and stakeholders is critical for the adoption of SSCM practices. Considering the positive outcome of a 73% achievement in this area, it suggests that there is less pressure from these groups as operational activities appear to align with their social needs. This is further evidenced by a notable 65% growth in supplier relationship management (SRM) indicating that a strong connection between customers and suppliers facilitates effective collaboration. This partnership enables companies to implement ethical sourcing and sustainability standards throughout their supply chains. Similarly, a warehouse management system (WMS) with a significant adoption rate of 63% demonstrates positive advancements in waste management, energy efficiency and the optimization of warehouse operations highlighting

the essential need to mitigate the environmental impact (Fernando et al., 2018). The strategies outlined in the previous paragraph clearly illustrate a robust commitment to sustainable business practices. Consequently, South African companies exhibit high adoption rates for CRM, SRM and WMS, positioning themselves strategically to leverage these technologies for sustainable supply chain leadership.

Some drivers registered a low percentage below 60% such as e-commerce (45%), electronic data interchange (EDI) (22%), enterprise resource planning (ERP) (41%), just-in-time (JIT) (35%), material resource planning (MRPII) (32%), MRP (41%), and radio frequency identification (RFID) (26%), they play a crucial role in helping listed companies optimize production, reduce waste, utilize resources efficiently, and mitigate risks. The gradual growth of digitalizing SCM systems represents a significant opportunity for growth in the South African business landscape. Accelerating technological practices in SSCM requires increased investments in data analytics, cloud computing, and advanced automation. These components are essential for corporate companies to effectively implement strategies and maximize their potential within the SSCM ecosystem.

5.4. Factors Influencing Sustainable Supply Chain Leadership Practices

Survey data was gathered on a variety of topics thought to promote SSCL as supported by earlier researchers such as Han and Huo (2020); Mafini and Muposhi (2017); Okoumba et al. (2020) and Rukuni et al. (2022) to obtain a thorough grasp of the challenges experienced by the listed firms in integrating the SSCL with their operational activities. Table 3 presents the results of a survey exploring the perceived impact of various factors on the adoption of SSCL practices in listed companies.

Table 3. Perceived impact of factors on sustainable supply chain adoption.

Factors	High impact (%)	Moderate impact (%)	Low impact (%)
Raw materials price fluctuations	57	28	15
Currency fluctuations	50	39	11
Sum of market changes	68	27	5
Energy or fuel price volatility	68	16	16
Environmental catastrophes	41	35	24
Raw material scarcity	47	12	41
Rising labour costs	74	21	5
Geopolitical instability	56	33	11
Supplier/ Partner bankruptcy	26	42	32
Change in technology	42	32	26
Unplanned IT disruptions	56	28	16
Counterfeiting	17	28	56

According to Table 3, a considerable majority of respondents (74%) cited growing labor costs as the biggest perceived difficulty. This was followed by market changes (68% and energy or fuel price volatility (68%). Significant obstacles also come from raw material variations and shortages with 57% of respondents agreeing that these factors constitute a barrier. These results highlight the necessity of proactive ethical sourcing plans to reduce material risks and guarantee supply chain stability. The volatility of raw material prices emphasizes the necessity for strong tactics including contract diversification, sourcing diversification, and alternative material exploration.

Correspondingly, geopolitical instability was acknowledged by most as a key obstacle, with many respondents (56%) concurring that it affects their capacity to apply SSCL methods. This emphasizes how susceptible international supply chains are to changes in geopolitics and how important it is to have reliable sourcing and environmentally friendly production methods.

The data suggests that some potential threats to SSCL adoption may be underestimated while cost-related factors dominate the concerns. Currency fluctuations are considered moderate by 39% of respondents, reflecting a less consistent approach to risk management. Similarly, 16% of companies view energy/fuel price volatility as

moderate highlighting the need for a more consistent approach to managing this impact. Perhaps most surprisingly, only 17% of respondents identify counterfeiting as a high-impact factor. This suggests a potential blind spot as counterfeiting poses a significant threat to both supply chain integrity and brand reputation. Companies must prioritize developing anti-counterfeiting measures, collaborating with authorities, and educating consumers. Moreover, the potential impact of supplier or partner bankruptcy was also highlighted with 42.1% somewhat agreeing and 26.3% agreeing that it is a barrier to SSCL. This emphasizes the importance of strong supplier relationships, diversification of supply sources and robust risk management strategies to mitigate the impact of such events.

On the other hand, a significant portion of respondents (27.8%) believe that counterfeiting is a conceivable barrier suggesting that it is still possible for certain businesses even though most respondents (55.6% disagree) do not view it as an important barrier. Correspondingly, geopolitical instability was widely recognized as a significant barrier with a majority (55.6%) of respondents agreeing that it impacts their ability to implement SSCL practices. This suggests that companies are grappling with the rapid pace of technological advancements and the need to adapt their supply chains accordingly. Significant proportions (35.3%) of respondents are somewhat concerned indicating that this issue is emerging as a potential concern for the future.

We also looked at the important perceived internal factors that corporate companies encountered while adopting an SSCL model to observe the ESG principles in their daily operational activities. Numerous variables were examined as shown below.

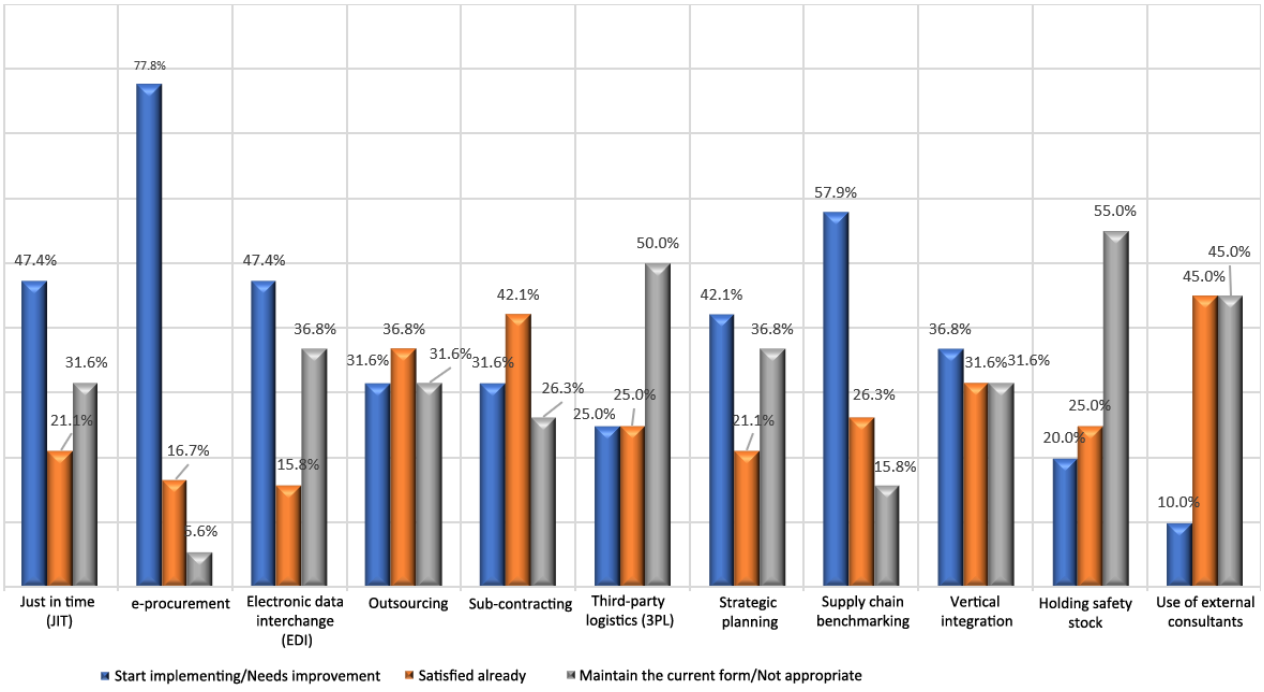

Figure 8. Internal factors influencing sustainable supply chain leadership.

According to Figure 8, the results revealed a notable high demand for e-procurement improvements (77.8%) signifying a major bottleneck, as companies struggle to achieve transparency, optimize resource utilization, and ensure responsible sourcing practices. Furthermore, the desire for improvement in supply chain benchmarking (57.9%), just-in- time inventory management (47%), and electronic data interchange (47%) reveals a lack of readily available tools, resources and expertise to implement efficient and sustainable practices. These gaps can lead to increased costs compromised ethical sourcing and missed opportunities for optimizing supply chain performance.

In addition, the need for improvements in strategic planning (42.1%) and outsourcing practices (36.8%) suggests a lack of comprehensive and long-term vision for SSCL. Companies struggle to align operational

strategies with sustainability goals leading to inconsistent implementation and missed opportunities to create true value from their SSCL initiatives. These findings support the respondents' assessment of unanticipated IT disruptions as one of the main external barriers with a significance score of over 84% (56% high impact and 28% moderate impact). It is necessary to invest in technology, training, and cooperative methods to overcome these obstacles and hasten the shift to sustainable and ethical supply chain processes. The study emphasizes the importance of corporate businesses prioritizing SSCL strategies to successfully execute the strategy, highlighting the urgent need for significant efforts to achieve the desired level of effectiveness and contribute to sustainable development.

6. DISCUSSION

A thorough analysis and interpretation of the results to establish a framework for navigating the path to sustainable supply chains was conducted. The discussion of findings is systematically organized around the designated research questions, utilizing a quantitative assessment of the barriers and enablers associated with SSCM practices among publicly listed companies in South Africa.

6.1. Drivers of Sustainable Supply Chain Leadership

We deliberately examined the role of the SCM department in promoting sustainability initiatives to assess the extent of the adoption of SSCM practices within both the manufacturing and services sectors. The data collected from 46 publicly listed companies indicated that 59% of these companies maintained a dedicated SCM department while 69% adhered to SCM strategic plans as a framework for executing their SCM activities. The synergy of these two factors offers powerful inspiration for employees and external stakeholders to champion effective labour conditions, advocate for ethical sourcing and minimize their negative impact on society and the environment.

Additionally, the commitment to sustaining a dedicated SCM department and an endorsed SCM strategic plan has been identified as a critical driver for fostering the adoption of SSCM principles within operational excellence frameworks. Notably, an integration of these two drivers can assist in fostering a refined ESG model performance across a broad product lifecycle of the large corporate sector in South Africa, thus underlining a more sustainable future (Power, 2005; Sauer & Seuring, 2019). Numerous studies have predominantly concentrated on small and medium-sized enterprises, often lacking a critical examination of sustainable SSCM practices (Kato & Chiloane-Phetla, 2022; Kato, Chiloane-Tsoka, & Mugambe, 2024).

In contrast, this study provides valuable insights into the specific enablers and barriers to implementing SSCM practices in large business enterprises. There is evidence of a positive environment that supports the transition to sustainable supply chain projects (Jelačić et al., 2021; Kayikci, Kazancoglu, Gozacan-Chase, Lafci, & Batista, 2022; Ngibe & Lekhanya, 2020).

While the growing significance of ESG considerations underscores the need for dedicated SCM departments, a notable deficiency exists. 41% of JSE-listed companies lack such a structure. Planning and executing SSCL procedures effectively requires a dedicated SCM department to strengthen departmental collaboration and ensure that sustainability permeates corporate operations and culture. However, Sharma and Singla (2021) point out that the lack of specialized sustainable finance often hinders the implementation of these initiatives as companies prioritize profit maximization and expanding their product and service offerings. This highlights the need for a dedicated SCM department to advocate for and secure the resources necessary to achieve ambitious sustainability goals.

A critical gap remains despite the following valuable insights: the specific drivers that enable successful implementation of SSCM practices in listed companies are insufficiently explored and recognized (Andersen & Skjoett-Larsen, 2009; Gold et al., 2010; Tate et al., 2010). Current approaches to understanding the essential enablers of SSCM in emerging economies are limited, creating a notable gap in the sustainability framework. Hence,

we strongly advocate for a more comprehensive analysis of the drivers and barriers to adoption is needed to guide effective policy interventions and facilitate a broader transition.

Echoing the conclusions derived from earlier scholarly works, the journey to adopting SSCM practices among the listed JSE companies is influenced by a set of drivers ranging from both internal and external enablers which shape the organisational sustainability performance of the company (Aditi et al., 2024; Gold et al., 2010; Okoye et al., 2024).

The experience of senior management in SCM and their leadership roles is crucial to the successful adoption of SSCL practices within organizations. Our analysis revealed that the companies we studied have a substantial pool of senior management with extensive experience in the field with over 50% possessing more than a decade of expertise. This depth of knowledge is a significant asset in accelerating the implementation of SSCL initiatives, especially within senior management positions. Prior studies by Dubey, Gunasekaran, and Ali (2015) have demonstrated that seniority in management and work experience are critical components of effective transitions to sustainable production. These seasoned managers are in a unique position to encourage a movement in culture towards responsible practices by enticing their peers and external stakeholders to accept and uphold sustainability ideals. They have a strong basis for creating a sustainable future because of their existing contacts, in-depth knowledge of business dynamics and lessons learned from previous experiences.

An in-depth analysis of the factors driving SSCM practices, especially regarding the use of technological advancements, revealed significant improvements in key areas. Notably, there was a 73% enhancement in customer relationship management (CRM), a 65% increase in warehouse management systems (WMS), and a 63% boost in overall performance. These findings highlight that strong collaboration and transparency are essential for accelerating ethical sourcing practices and reducing environmental impacts, which are crucial for promoting sustainable business solutions.

These results align with earlier studies by Dao, Langella, and Carbo (2011) and Prajogo and Olhager (2012) which emphasize the important role of digitalized supply chains in advancing sustainability. This study has practical implications as it underscores the value of integrating technology into supply chain management. It advocates for increased investment in digital SCM practices and their inclusion in sustainability strategies, ultimately contributing to a more sustainable future.

The best part is that South Africa can decrease waste, encourage sustainable resource use, and lessen its impact on the environment by using technologies like CRM, SRM, and WMS. This is in line with the nation's objectives to tackle climate change, promote sustainable growth, and transition to an environmentally conscious economy. Investing in these technologies proactively draws in sustainable investors. The adoption of technology such as barcoding, decision expert support system (DSS), advanced planning system (APS), theory of constraints (TOC), and SCM software shows potential for production optimization, waste reduction, and sustainability decision-making. However, there is potential for growth, particularly in cloud computing and data analytics given the low adoption rates of e- commerce, RFID, JIT, MRP, EDI, and ERP.

Additionally, corporations have previously prioritized cost reduction and supply chain efficiency. A recent trend of taking sustainability problems into account has emerged as society becomes more conscious of social and environmental issues. This modification resulted in a comprehensive SSCL plan that takes ESG factors into account. Large companies are facing pressure to make SSCL practices a top priority to boost their financial and environmental results. Liu et al. (2019), Sánchez-Flores et al. (2020) and Kogg and Mont (2012) have all mentioned that the government and international development partners are the main sources of this pressure.

6.2. Barriers to Implementing Sustainable Supply Chain Practices

The survey data reveals a significant gap between the desired state of SSCL and current practices within South African companies. An effective implementation remains a challenge while the need for SSCL is recognized. A

striking finding is that 77.5% of companies identify a need for improvement in e-procurement, suggesting that a substantial proportion is not utilizing this crucial technology. Furthermore, a significant portion of companies require improvement in supply chain benchmarking (57.9%) and just-in-time inventory management (47%), highlighting a broader lack of readily available tools, resources, and expertise to effectively transition to a more sustainable approach. This gap underscores the need for targeted interventions to support the adoption of these key SSCL practices.

A significant discrepancy arises with the finding that 89% lack public SCM policies while 69% of surveyed companies have strategic SCM plans in place and 59% report utilizing dedicated SCM departments. This disparity between internal planning and public policy adherence presents a major obstacle to the widespread adoption of SSCL. Companies may prioritize cost-cutting and short-term profit maximization over long-term sustainability goals, leading to decisions that potentially harm the environment and society. Strong support for these findings comes from a related earlier study (Ambe & Badenhorst-Weiss, 2012). Their research outlines the obstacles preventing the public sector in South Africa from implementing supply chain management.

Many obstacles remain unresolved, including non-compliance with SCM policies and regulations, fraud and corruption, and a lack of appropriate knowledge and skills despite evidence that SCM has been fully implemented in all areas of government and customized policies that have been developed following the SCM policy. To avoid this, the government, along with advocates for environmental sustainability especially international development partners must collaborate closely with businesses. Some effective strategies to accomplish this include raising awareness, implementing penalties for noncompliance, and, most importantly, fostering sustainable financing. The study by Chen and Kim (2024) emphasized the crucial role of government and highlighted the urgent need for action. Similarly, their study reiterated the importance of government and advocated for this decisive action. Recent research by Hong, Zhang, and Ding (2018), Ahmed I Kato and Manchidi (2022) and Okoye et al. (2024) points out the limited resources available for nurturing sustainability initiatives within large corporations. These findings align with the resource-based view (RBV) theory, suggesting that possessing superior resources is vital for developing a sustainable competitive advantage. Although this theory presumes the presence of internal resources, many organizations lack these essential assets leading to only temporary financial successes (Gold et al., 2010; Golicic & Smith, 2013; Prajogo & Olhager, 2012). As a result, they continue to encounter various obstacles, including restricted access to sustainable financing, gaps in skills, and inadequate regulatory frameworks.

Furthermore, the analysis of results reveals a complicated web of internal and external obstacles that prevent South Africa from adopting SSCL. There is a dearth of understanding regarding other possible dangers, which calls for proactive risk management techniques despite the prevalence of cost-related worries. Notably, most respondents (74%) identified rising labour costs as the most perceived challenge followed by market changes (68%) and energy or fuel price volatility (68%); fuel coming in second and third, respectively. These results are consistent with studies that indicate cost-related issues pose major barriers to the adoption of sustainable practices (Gold & Seuring, 2011; Walker, Di Sisto, & McBain, 2008).

However, the data also highlights a potential gap in risk management with currency fluctuations while recognized by 50% of respondents, perceived as moderate by 39%. This suggests a need for a more consistent approach to managing this risk. The low recognition of counterfeiting as a high-impact factor (only 17%) presents a significant blind spot as counterfeiting poses a significant threat to supply chain integrity and brand reputation (Hmouda et al., 2024). Furthermore, rapid changes in technology are emerging as a concern for companies, highlighting the need to adapt their supply chains and adopt new practices (Dao et al., 2011). A significant proportion of respondents are somewhat concerned indicating this issue is gaining recognition and will likely become increasingly relevant in the future while environmental catastrophes are not perceived as a major barrier by the majority. The survey also identified areas of success, particularly in maintaining safety stock (80% achievement rate) and the use of external consultants (90% achievement rate), highlighting the importance of robust risk

management practices and expert guidance in navigating the complexities of SSCL implementation despite threatening barriers to SSCL adoption.

Notwithstanding a high concentration of experienced staff in South African companies, barriers such as resistance to change and limited exposure to the latest sustainable practices exist. However, harnessing their experience, fostering continuous learning, and promoting communication can facilitate a successful transition to more sustainable supply chains. Emerging markets face unique challenges, particularly the rapid pace of technological change requiring significant financial investment for adaptation (Lahane, Kant, Shankar, & Patil, 2024). Furthermore, the absence of robust public SCM policies and strategic plans within many South African companies poses a significant obstacle to achieving sustainable development, highlighting the need for government intervention and a commitment from businesses to prioritize sustainable practices.

Assessing how SSCL adoption affects organizational performance is proving to be challenging for industrial companies in emerging nations. The study emphasizes the importance of big businesses prioritizing SSCL strategies to successfully execute the strategy, highlighting the urgent need for significant efforts to achieve the desired level of effectiveness and contribute to sustainable development.

7. CONCLUSION AND RESEARCH IMPLICATIONS

In the contemporary landscape of sustainable development, the transition to SSCM is no longer a mere choice but a critical imperative for fostering efficient and sustainable business models that align with long-term goals. Nevertheless, implementing this transformative paradigm is not a straightforward endeavor. It demands a shift beyond traditional profit-driven models to encompass a more holistic perspective accounting for society's needs and environmental considerations. This study seeks to explore the barriers and enablers of SSCM within South African listed companies. The objective is to support these companies in their transition towards a sustainable future through the adoption of the SSCM model.

The study makes three significant practical and policy contributions. First, a large body of recent literature tends to neglect the specific enablers and barriers of SSCM practices met by companies in developing countries like South Africa. This is particularly true for research approaches in SCM that tend to rely on a limited range of paradigms, methods, and theoretical lenses, hindering the exploration of novel and unconventional approaches. This study provides valuable insights for advocates of environmental sustainability, assisting them in the development of effective strategies and policy regulations that promote sustainable business practices within this vital sector.

Second, the study makes a significant contribution by recognizing the unique barriers faced by JSE-listed companies in adopting sustainable supply chain practices. Moreover, the study promotes the integration of diverse theoretical frameworks, including ESG principles that go beyond cost considerations and a wider range of exploratory factors impacting SSCL adoption in developing nations.

Furthermore, the study highlights the crucial need for government policy alignment with SSCM practices, particularly through incentives for sustainable investments, regulations promoting responsible sourcing, and stakeholder engagement frameworks. This alignment is critical for fostering a robust collaborative ecosystem among stakeholders and facilitating the widespread adoption of SSCM within listed companies, ultimately contributing to a more sustainable and resilient economy.

8. LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

The implementation of SSCM practices among publicly traded companies depends on a complicated interaction between obstacles and facilitators of organizational sustainability (Aditi et al., 2024). Although current surveys provide useful insights, there remains a significant gap in understanding the specific barriers and facilitators related to the adoption of effective SSCM practices within these companies (García-Muiña, Medina-Salgado, Ferrari, & Cucchi, 2020; Yosef, Jum'a, & Alatoom, 2023). The lack of strategies for tackling crucial enablers of SSCM in

developing countries has created a notable deficiency in knowledge within the sustainability framework. As a result, a comprehensive approach is vital to fill these gaps and enhance our comprehension of this important issue.

The growing global interest in sustainable supply chain management (SSCM) practices among large corporations catalyzes the transition to a sustainable future, paving the way for future research opportunities. These corporations are under increasing pressure from governments and various stakeholders to prioritize SSCM practices, aiming to enhance both their financial and environmental outcomes (Kogg & Mont, 2012; Liu et al., 2019; Sánchez-Flores et al., 2020).

Transitioning to SSCM offers numerous advantages to publicly listed companies, contributing positively to both the firms themselves and their stakeholders. Key benefits include a commitment to sustainable business practices, environmental stewardship, and social responsibility (Evans et al., 2017; Khoshnaw et al., 2024; Schoneveld, 2020; Zhao et al., 2021) which positions these companies as responsible corporate citizens in a rapidly changing global landscape. While this trend holds promise for a more sustainable future, the pathway to widespread adoption remains uncertain despite the trend's possibility of a more sustainable future.

The study's focus on JSE-listed companies limits the generalizability of its findings to other African stock exchange markets. To address this limitation, future research should delve deeper into top financial stock markets across Africa, exploring and comparing the challenges faced in implementing SSCM practices. This would necessitate expanding the sample size and scope to include major African stock exchanges such as the Nairobi Stock Exchange (NSE) and the Lagos Stock Exchange. Such research would provide invaluable insights and guidance for policymakers and companies, ultimately contributing to a more sustainable and prosperous future for Africa.

While the current empirical study provides valuable insights into the contributions of listed companies towards a sustainable future in South Africa, it is essential to acknowledge the significant role of SMEs in this endeavor. SMEs have been identified as key players in addressing environmental challenges such as carbon emissions, climate change, poor waste management, and unethical sourcing, all of which contribute to a negative environmental impact (Dey et al., 2022; Leu et al., 2021; Mabasa, Akinradewo, Aigbavboa, & Oguntona, 2023; Saqib, Qin, Menhas, & Lei, 2023). Future research examining the impact of adopting SSCM practices within SMEs on inclusive growth and competitiveness is crucial to providing new data and insights into this critical area. A focused effort on integrating SMEs into the pursuit of sustainable development is paramount to achieving a more sustainable future for South Africa.

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