

Investigating green initiatives by logistics service providers in South Africa

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Abstract

Over the past several decades, considerable changes have taken place which have not only impacted the economy but have also transformed the supply chain. With the supply chain being revolutionized, demand for products has escalated, leading to a simultaneous increase in production. This has led to an increase in the utilization of raw material, energy and water consumption as well as adverse GHG emission, all resulting in detrimental environmental issues and climate change. The transport and logistics industry are known to account for a significant amount of GHG emissions globally. As such, knowledgeable consumers, together with government, non-government organizations and stakeholders have added pressure on logistics service providers to implement green strategies to mitigate their carbon footprint. However, the extent to which LSPs have heeded the call is unknown. Hence, the objective of this study is to investigate the green strategies implemented by LSPs and their impact on performance. A descriptive survey research design was followed. Data was collected from people working for LSPs in South Africa. Route planning and load consolidation were two most implemented green strategies among LSPs. The implementation of the green strategies was found to be positively correlated with economic, environmental, and operational performance of LSPs. In addition, implementation of the green strategies accrues benefits such as high asset utilization, customer satisfaction and reduced GHG emissions. The study reveals that green strategies implemented by LSPs are in nascent stages in emerging economies compared to those in developed economies.

Keywords

Logistics service providers (LSP), Sustainability, Green supply chain, Greenhouse Gas (GHG) and Logistics.

1. Introduction

The advent of globalization and technological advancement has not only resulted in complex and fragmented supply chains but has also fostered an environment whereby goods and services are procured internationally, ensuing a surge in international trade (Bullock, et al. 2024, Ishaya, et al. 2023). Technological evolution has created a global economy that is characterized as competitive, intricate and increasingly unpredictable (Glowik 2017, Omotayo 2018). Technology has allowed consumers to be more knowledgeable and as such there is an increasing demand for variety of products and services leading to a need for changes in processes within the supply chain in order to accommodate

and respond swiftly to these demands (Makan and Heyns 2018). Responding to these needs and demands has resulted in an increase in logistics activities within the supply chain. The growth and complexities within the supply chain have made logistics essential for ensuring smooth and effective operations (Chopra and Meindl 2016, Christopher 2016, König and Spinler 2016). The logistics and transportation sector plays a fundamental role in expediting trade and for many countries, it serves as an essential driver of economic growth (Evangelista, et al. 2017).

Further to this, the focus on core competency by organization has led to the outsourcing of non-core operations to Logistics Service Providers (LSP) also known as Third Party Logistics Providers (3PLs) (König and Spinler 2016, Marasco 2008). Growth in outsourcing has expanded the scale of services offered by LSPs, specifically those that are technologically sophisticated and value added (El Baz and Laguir 2017). Logistics outsourcing enables organizations to specialize in capabilities and expertise they lack in-house (Magenta, et al. 2018). Logistics outsourcing encompasses the delegation of some or all logistics functions to third-party LSPs who perform these tasks on behalf of the organization within the agreed time frame and budget (Akbari 2018, Hsiao, et al. 2011). Furthermore, LSP's serves as a fundamental intermediary between global stakeholders, fostering communication and collaboration to support and drive sustainable supply chain initiatives (Karia and Asaari 2016, Leung, et al. 2023, Murray, et al. 2017, Sureeyatanapas, et al. 2018).

Leung, et al. (2023) added that industry professionals are now taking cognizance of the social and environmental effects across the entire supply chain, especially with the rising concerns placed by the public. The logistics and transport industry significantly impacts the environment, substantially contributing to various forms of pollution, resource depletion, noise or vibration, congestion and global warming (Khan, et al. 2019, McKinnon, et al. 2015). According to ISO (2023), a third of the global carbon emission (CO₂) is associated with the logistics and transport sector. The transport sector alone contributed to 7.7 gigatons (GT) of CO₂ in 2021, of which freight transport contributed approximately 8% of the global greenhouse gas (GHG) emissions (ISO 2023). When including warehouse operations, this figure increases to 11% (ISO 2023).

In south Africa, the third largest emitting sector responsible for approximately 55 megatons of CO₂ is transportation (Bizcommunity 2024), contributing to approximately 10.8% to the countries total GHG emissions (SABOA 2022). These statistics intensifies the pressure placed on LSP to reduce their carbon footprint and green their logistics processes, specifically due to the central role they play within the supply chain and the reliance that other stakeholders have on their capabilities (Colicchia, et al. 2013, Rossi, et al. 2013). Furthermore, in order to remain competitive, and to reduce carbon emissions, LSP's are required to "green" their operations (Leung, et al. 2023, Sureeyatanapas, et al. 2018). In response to being competitive, many LSP's are considering their impact on the environment, however the rate of implementation and efforts in greening their operations is unknown (Evangelista, et al. 2017). In addition, Evangelista, et al. (2017) further added that most research on environmental sustainability associated to the LSP industry are from a single country perspective and as such comparative research illustrating data collected from different country is scarce.

As such, the research problem deduced from the above is that the transport and logistics sector contribute greatly to dangerous carbon emission. To mitigate the detrimental effects, LSP needs to actively implement green processes. However, the extent of implementation of green initiatives by LSP's in South Africa is unknown. As a result, this study therefore aims to investigate the various green initiatives implemented by LSP's in South Africa and the extent to which these initiatives are being practiced and their influence on the company performance.

1.1 Objectives

This study aims to investigate the various green initiatives implemented by LSP's in South Africa and the extent to which these initiatives are being practiced and their influence on company performance. The following research objectives are addressed in this study:

1. Exploring the various green strategies implemented by LSPs.
2. Identifying the extent of implementation of green strategies by LSPs.
3. Understanding how these green strategies influence the performance of LSPs.

2. Literature Review

Growth of global economies has led to an increase in demand for products, essentially increasing the consumption of materials and energy (Nteta and Mushonga 2021). Effectively meeting customer demands has increased logistical

activities making it a critical component in decision making related to raw material acquisition, obtaining the required parts and components, storing and managing inventory and facilitating the movement of goods (Sun, et al. 2022). To add on, Qaiser, et al. (2017), stated that logistics serves as a connective framework that integrates various functions and participants within a supply chain. Successful logistics systems play a pivotal role in customer satisfaction, shaping a company's operational cost and overall profitability (Sun, et al. 2022).

Being a critical component within the supply chain of every company, most logistics operations are now outsourced so that businesses can focus on their core competencies (Abbasi, et al. 2024). In addition, most firms outsource their logistics activities to LSP in order to reduce cost, lead time and high investment cost (Akhtar 2023, Kumar and Singh 2012). LSP's are external firms that handles various logistic activities such as customs clearance, delivery and management of inventory, distribution of goods, transportation and provides expertise as well as resources to optimize supply chains and lower delivery cost (Akhtar 2023, Hassini, et al. 2012). The rapid growth in logistics demand has resulted in negative externalities such as congestion, pollution, traffic accidents, resource waste, failure with infrastructure and visual interferences (Lindholm and Blinge 2014). Logistics operation consumes a large amount of energy resources, ultimately producing large amounts of earths GHG emissions and essentially degrading the environment and causing radical changes to the climate (Browne 2005, Wehner, et al. 2022).

Concerns about the environment from various stakeholders, including government and non-government organizations has led to the implementation of green strategies to reduce the negative externalities on the environment. Luthra, et al. (2011) adds that social and environmental issues have become a core aspect for many organizations within the supply chain, operating within a rapidly changing global economy. With the growth in demand for environmentally sustainable practices, logistics providers are being pressured to provide services that are sustainable to the environment (Evangelista 2014). Based on literature, there are internal drivers that results in organization implementing contingency plans to avoid possible disruptions within the supply chain and utilizing materials and equipment's that reduces negative environmental impacts; whilst external drivers are governments, investors, non-government organizations and customers (Diabat and Govindan 2011). Intrinsically, it has become important for green practices to be incorporated into organizations strategic decisions and plans (Ersoy 2018). Zailani, et al. (2011), explicitly adds that increasing number of LSP's are transforming their strategies and operations to incorporate green supply chain practices. According to Lammgård (2012) and van Hoek and Johnson (2010), there are key areas pertaining to environmental initiatives that logistics service sectors focuses on. These include:

- Soaring demand for goods mobility has made addressing environmental concerns essential in logistics operations.
- Environmental sustainability now plays a pivotal role in selecting logistics partners.
- Adopting sustainable practices is increasingly viewed as a competitive advantage, contributing to cost savings (e.g., energy efficiency, tax benefits, financial incentives) and driving sales growth through customer preferences for eco-friendly services, enhanced client relationships, and participation in green programs.

Transportation is regarded as a critical cornerstone to every aspect of logistics operation, significantly influencing the Net Present Value (NPV) and simultaneously contributing to logistics emissions, thus making emission reduction strategies, mode selection, and network optimization central to green logistics initiatives (Lu, et al. 2019, Sarkar, et al. 2019). Furthermore, decisions pertaining to improving efficient loading and unloading, adopting vehicles that are eco-friendly and enhancing vehicle routing influences sustainable supply chains (Trivellas, et al. 2020). In addition, electric vehicles have been seen as a transformative solution in reducing pollution, GHG emissions and creating a positive social influence by generating jobs and supporting sustainable developments (Bonsu 2020, Günther, et al. 2015). Modal distribution, frequency of mode changes, trip length, vehicle load efficiency, percentage of empty runs, and external impacts such as noise, accidents, and emissions per distance or throughput unit has been identified by McKinnon (2016) as critical factors to sustainable transportation.

On a global scale, South Africa has been considered as the 12th largest emitter of CO₂, and within the continent of Africa, it is accountable for half of the emissions (Jalard, et al. 2015). To reduce the escalating problems associated to the environment, the South African government has implemented various legislation that are continuously reviewed (Nteta and Mushonga 2021). Some of the legislation that has been implemented is the National Waste Management Strategy (DEA 2012), the National Environmental Management: Air Quality Act (Act No.39 of 2004), National Environmental Management: Waste Act (Act 59 of 2008), and the Carbon Tax. Furthermore, the SA government has also drafted an ambitious green transport strategy in 2018 (SABOA 2022). The measures of the strategy in mitigating the GHG problem is to promote the implementation of the "modal shift" notion, demand reduction measures especially

through carbon taxes, and promote use of more efficient vehicle technologies, more efficient operations and the use of alternative lower-carbon fuels (SABOA 2022). Although this is a government policy, there is not much that can be witnessed in the logistics industry regarding implementation of the green strategy among LSPs within South Africa, thus, the continued emission of harmful GHG to the environment. Some of the measures organizations use to implement green supply chain initiatives include green purchasing such as buying from ISO 14001 certified suppliers and developing green suppliers (Vijayvargy, et al. 2017). It might also include selecting green modes of transport (Zhu and Sarkis 2016), buying fuel with less carbon intensity (Esfahbodi, et al. 2016), reducing emission (Jakhar, et al. 2018) and implementing green reverse logistics.

Despite the emerging interest regarding sustainable practices, research regarding sustainable practices amongst LSP's are neglected (Ali, et al. 2021, Centobelli, et al. 2017, Centobelli, et al. 2020, Evangelista, et al. 2018, Laari, et al. 2018, Nagariya, et al. 2022). Most research as per Sureeyatanapas, et al. (2018), focused on general green logistics practices. While other studies focused on LSP's operational characteristics, strategic strengths, and technological advancements (Evangelista, et al. 2017, Evangelista, et al. 2013, Liu, et al. 2010). Additionally, Yang, et al. (2018) and Leung (2019) stated that while the enduring impact of climate change risks are still uncertain, LSP's tend to incorporate social and environmental performance into their strategic communications, tailoring their messaging to address the diverse expectations of different stakeholder groups. The above highlights a clear gap in research, particularly regarding the sustainable practices implemented by LSPs, with limited focus on these efforts from a South African perspective. As such, this research explores the sustainable initiative adopted by LSP within South Africa, with focus on the extent of implementation and its impact on the organization's performance.

3. Methods

A positivist philosophical orientation underpinned the methodological foundations of this study. Positivism as a philosophy is well suited for studies that seek to develop knowledge objectively using measurement and reason without the researcher's influence (Phoenix, et al. 2013). A quantitative research approach was followed to collect relevant primary data to answer the research questions. A descriptive survey research design was followed to investigate the effect of green strategies on the performance of LSPs. Employees of LSPs were surveyed to establish the drivers of sustainability and how they affect environmental and operational performance. The inclusion criteria were current employees in a LSP operating in South Africa and having knowledge on green supply chain management or green logistics. A combination of convenience sampling was used since the questionnaires were shared via a professional platform that was easily accessible. The study aimed to collect primary data from a sample of 400 respondents working for LSPs.

4. Data Collection

A structured questionnaire was used to collect primary data. The unit of analysis included transport, logistics and supply chain management professionals or their equivalents working for LSPs in South Africa. The data collected included the extent to which greening practices were implemented, greening technologies used and the likely benefits of greening to LSPs. The questionnaires were distributed and completed online via the SurveyMonkey® tool. The questionnaires were shared on professional platforms and the respondents who met the criteria were requested to participate. The data was analyzed using SPSS version 28 to answer the research questions set in this study. Ethics clearance was sought from the University Research Ethics Committee. Acceptable ethical standards were adhered to throughout the various phases of the study.

5. Results and Discussion

5.1 Numerical Results

The data reveals that 64.2% of the respondents were males. This is typical of the transport, logistics and supply chain industry in South Africa, whereby it is dominated by men (Naysmith and Rubincam 2012). The job positions of the respondents were examined and presented in Table 1. The respondents job distribution was relatively equally distributed except for the vice-president. Most of the respondents in the "other" category included positions such as Legal Counsel – logistics, Owner driver, BTO project manager, SHERQ Auditor, Head of Knowledge Hub, Junior trainer and Logistics Solutions Architect.

Table 1 Current job position

Job position	Percent
Transport or Logistics Manager	17.9
Supervisor	11.9
Manager	16.4
Senior Manager	16.4
Regional Manager	19.4
Vice-President	1.5
Other	16.4
Total	100.00

Many of the respondents were from the Gauteng Province, which is also the largest province in population as well as economically. Most of the respondents had obtained a post-matric qualification (Table 2), implying that they had the ability to understand the questions and respond appropriately.

Table 2. Highest level of Education

Highest level of education	Percent
Matric	13.4
Certificate/Diploma	34.3
Undergraduate degree	19.4
Honour's degree	17.9
Master's degree	14.9
Total	100

LSPs can be engaged in multiple logistics activities although majority of them especially in South Africa are involved in transportation (Table 3). Some of the LSPs involved in warehousing can include distribution network design as part of the activities they perform. The increasing significance of LSP's involvement in information technologies in improving customer services is revealed although only 4.5% of the respondents indicated that their firms offer logistics IT as a service.

Table 3. Distribution of dominant logistics activities

Logistics activities	Percent
Transportation	73.1
Warehousing	7.5
Freight Forwarding/clearing	7.5
Procurement/Ordering	3.0
Logistics consultancy	4.5
Logistics IT	4.5
Total	100

The approximate fleet size was presented in Table 4. Most of the respondents (25.4%) worked in firms with less than 10 vehicles revealing that the majority of firms in the transport sector in South Africa are small to medium in size, although the industry is dominated by a few large firms in terms of market share.

Table 4. Fleet size distribution in respondents' firm

Fleet size	Percent
Less than 10 vehicles	25.4
10 to 20 vehicles	9.0
21 to 50 vehicles	13.4
51 to 100 vehicles	11.9
101 to 200 vehicles	6.0
201 to 500 vehicles	11.9
501 to 1000 vehicles	10.4
Over 1000 vehicles	11.9
Total	100

The concept of sustainability has many definitions based on the context where it is used. As such, it was important to examine how the respondents understood sustainability given a set of definitions (Table 5). The majority of the respondents understood that sustainability is a balance between economic, social, and environmental dimensions as also argued by Rogers (2011).

Table 5. Definitions of sustainability

Statement of definition	Percent
Sustainability is about meeting current organizational needs	14.9
Sustainability is about meeting environmental needs	1.5
Sustainability is about meeting social needs	1.5
Sustainability is about preserving natural resources for future generations to meet their needs	17.9
Sustainability is a balance between the financial, human and environmental dimension	64.2
Total	100

5.2 Graphical Results

Cost savings and public perceptions were identified as the predominant drivers of sustainability to a large extent as well as regulatory requirements to a very large extent (Figure 1). The finding emphasizes the importance of government policy and consumer awareness influence in promoting sustainable practices.

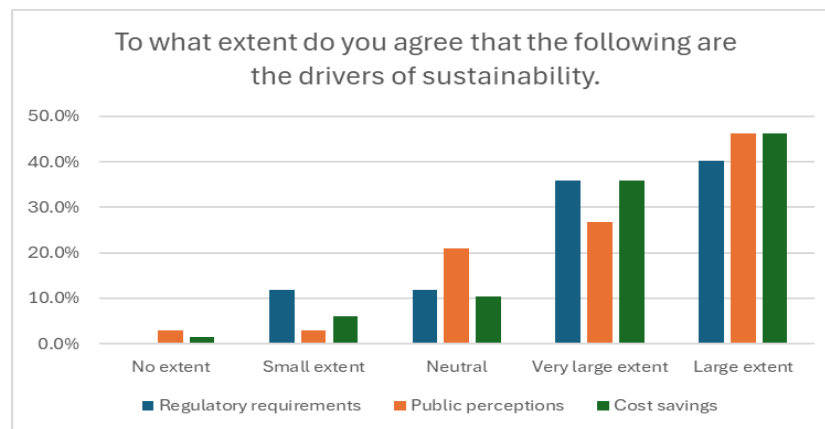


Figure 1. Drivers of sustainability

The various sustainability initiatives are implemented at various levels by the LSPs. Optimization initiatives related to route planning and load consolidation are fully implemented by over 60% of firms represented by the respondents

(Figure 2). This finding aligns with Wong, et al. (2018) study which established that truck route optimization can result in carbon reduction. It is encouraging to note that some firms have taken initiatives to implement green programmes that might not be a requirement for compliance (voluntary programmes) to enhance their operations.

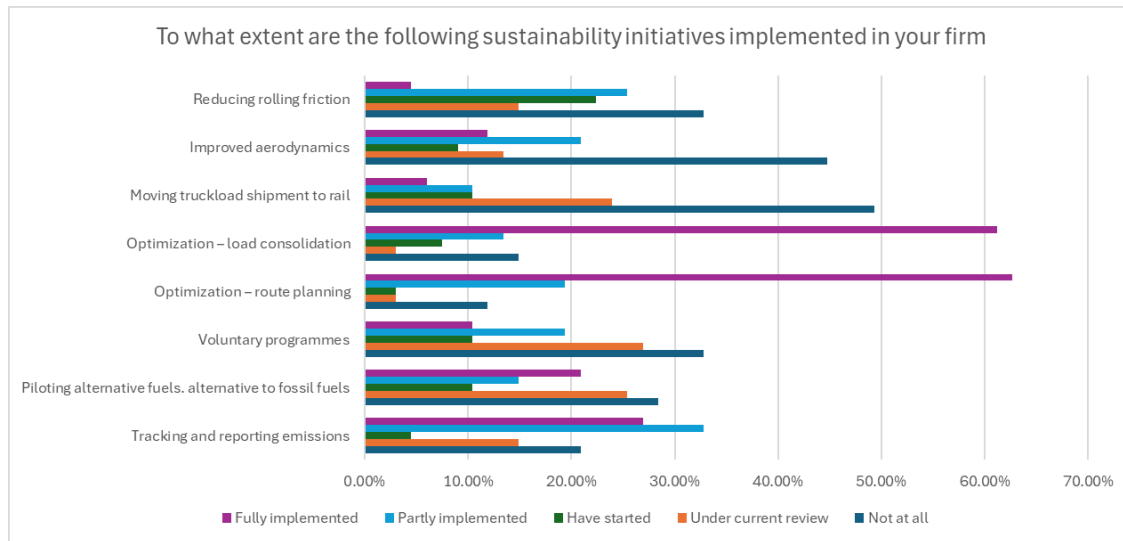


Figure 2. Implementation of sustainability initiatives

The study sought to identify the benefits of sustainability. The benefits of sustainability to a very large extent were identified as improved asset utilization, customer satisfaction, reduced out-of-route miles and reduced emissions among others (Figure 3). The finding aligns with Dey, et al. (2011) study in which they identified reduced emissions, financial and social benefits as some of the benefits of sustainable logistics operations.

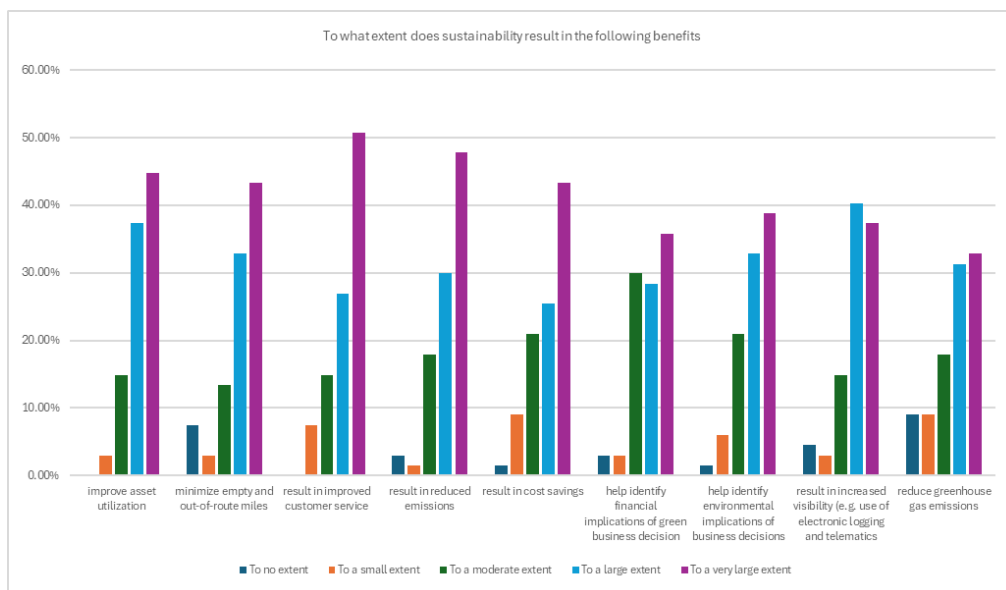


Figure 3. Benefits of sustainability

Sustainability helps to improve asset utilization among logistics service providers. In addition, sustainability results in improved customer service and reduced emissions in that order (Figure 4). Benefits related to cost savings and financial implications of green business decisions were ranked least. The findings align with the claims by Wong, et al. (2018) who developed a routing model to minimize emissions and improve truck utilization.

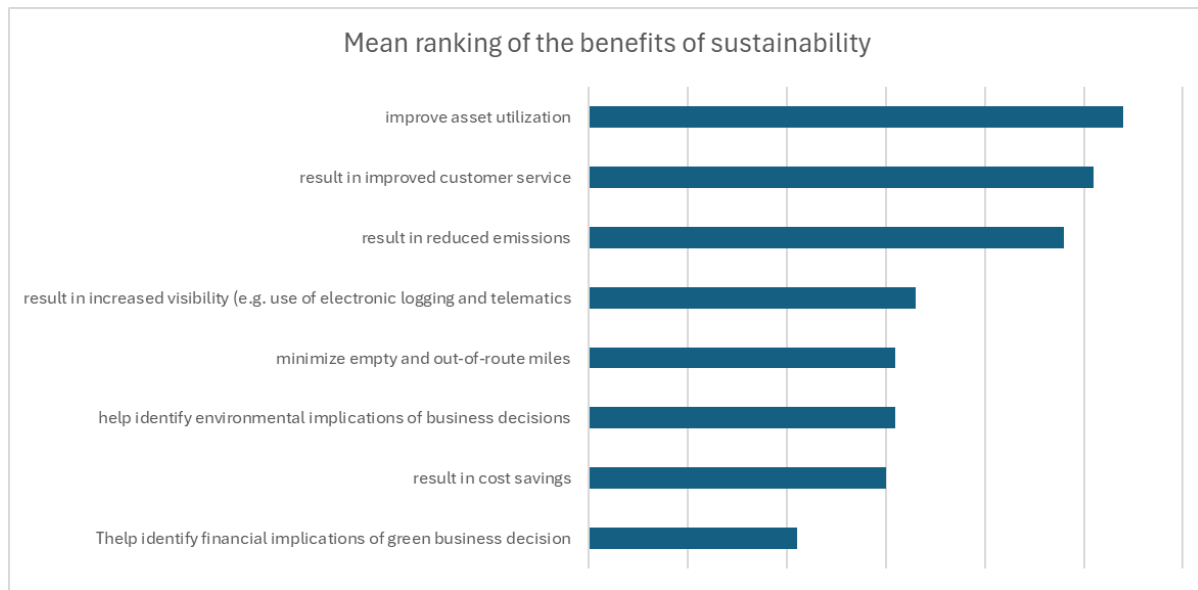


Figure 4. Ranking the benefits of sustainability

The factors related to the environmental performance of the firms were ranked (Figure 5), whereby improving the firm's environmental situation was the most important measure. Decrease in consumption of toxic materials, environmental related accidents, and the reduction in waste were among the most significant factors in environmental performance of a firm. Reduction of greenhouse gas emissions was not considered a significant measure of environmental performance of firms especially in emerging economies such as South Africa.



Figure 5. Rank of environmental performance factors

The factors related to the economic performance of a firm from a sustainability perspective were examined and ranked in the order of importance. Reduction in environmental fines, reduced waste treatment fees and decrease in cost of energy consumed were identified as critical factors in economic performance (Figure 6).

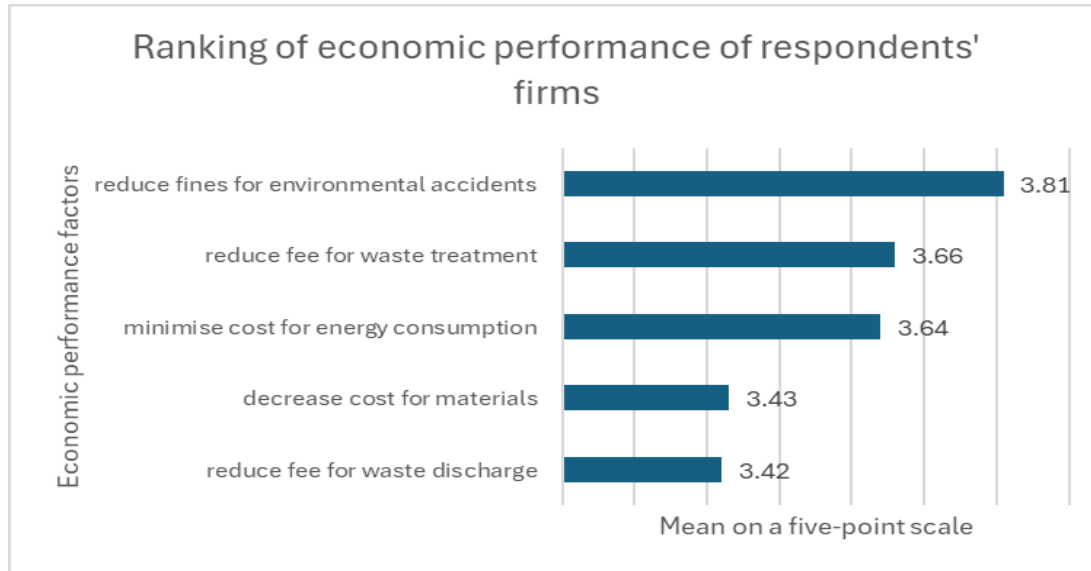


Figure 6. Rank of economic performance factors

The operational performance of a logistics service provider was examined from a sustainability perspective. The top three factors identified were improved capacity utilization, timely deliveries, and decreased inventory levels (Figure 7).

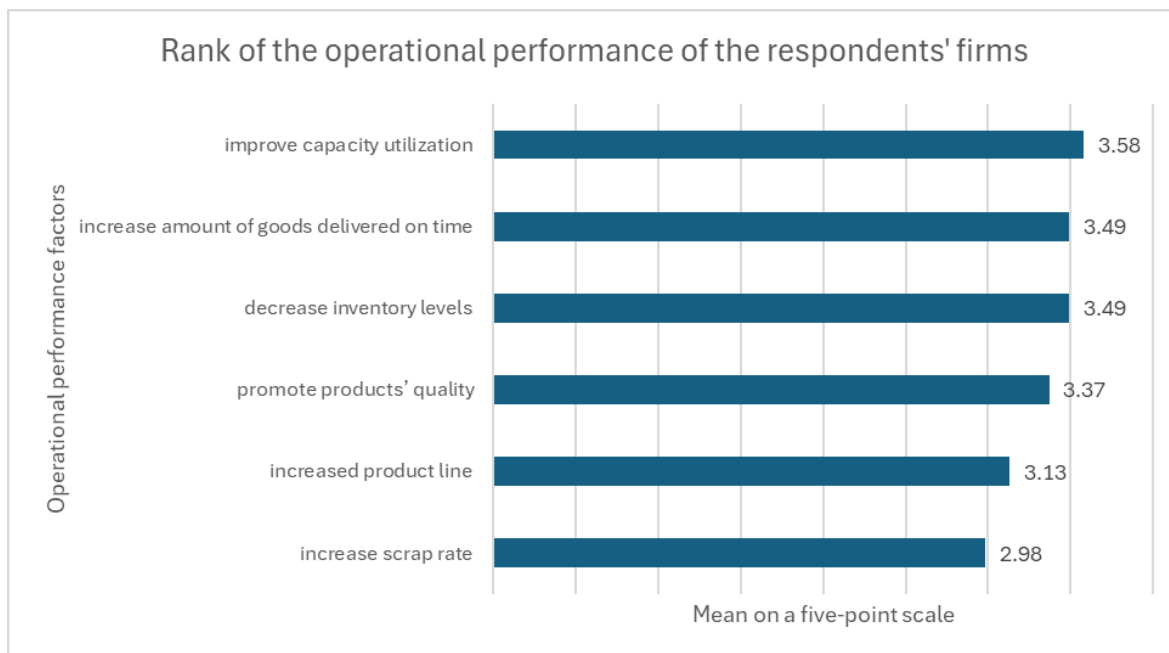


Figure 7. Rank of operational performance factors

The relationship between the green initiatives implemented in the respondents' firms and performance was tested using correlation analysis while controlling for gender (Table 6). The green initiatives implemented by LSPs were positively correlated with economic performance, environmental performance and operational performance. The finding reveals the importance of implementing green initiatives within the logistics network to improve performance of LSPs. The findings are consistent with the study by Fulzele and Shankar (2022) which claimed that green practices

result in higher overall performance of firms. In addition, there was a high correlation between economic performance and environmental performance as well as operational performance.

Table 6. Correlations

Control Variables			Green initiative	Environ Perf	Economic Perf	Operational Perf
Gender	Green initiative	Correlation	1.000			
		Significance (2-tailed)	.			
	Environ Perf	Correlation	0.5	1.000		
		Significance (2-tailed)	<.001	.		
	Economic Perf	Correlation	0.518	0.762	1.000	
		Significance (2-tailed)	<.001	<.001	.	
	Operational Perf	Correlation	0.441	0.665	0.792	1.000
		Significance (2-tailed)	<.001	<.001	<.001	.

The extent of the implementation of the green initiatives was reported by the respondents (Table 7). The results reveal that LSPs in South Africa have implemented route planning and load consolidation to a large extent. However, the reporting on emissions has just started with just a few firms doing the reporting. Although there are some efforts such as the third-party access (TPA) to rail regarding freight modal shift from road to rail only a few of the LSPs are reviewing this. This finding is consistent with existing data which reveal that over 80 percent of freight is moved via road in South Africa.

Table 7. Extent of implementation

	Mean	
Green initiatives	Statistic	Implementation status
To what extent are you implementing optimization – route planning	4.18	Implemented
To what extent are you implementing optimization – load consolidation	4.03	Implemented
To what extent are you tracking and reporting emissions	3.30	Have started
To what extent are you piloting alternative fuels. alternative to fossil fuels	2.75	under current review
To what extent are you reducing rolling friction	2.54	under current review
To what extent are you implementing voluntary programmes	2.48	under current review
To what extent are you investing in improved aerodynamics	2.42	under current review
To what extent are you moving truckload shipment to rail	2.00	under current review

6. Conclusion

In this study green initiatives implemented by LSPs were identified to include route planning and load consolidation, which on average are fully implemented. Some of the LSPs have started reporting on emissions, especially in their sustainability reports, which help improve a firm's outlook to its customers. Other important initiatives which might require high capital investments such as adoption of alternative fuels and improved aerodynamics are currently under review. Surprisingly, the modal shift from road to rail is also under review given that the rail sector in South Africa is far from being efficient. It is important to highlight that the green initiatives by LSPs have revealed a significant positive relationship with economic performance, environmental performance and operational performance. Thus, implementing green initiatives such as route planning and load consolidation is likely to result in higher overall performance of LSPs in South Africa. The study reveals that green initiatives in the logistics sector in South Africa and indeed other countries in Sub-Saharan Africa are in their nascent stage (supporting Dhillon, et al. (2023)) compared to their North American and European counterparts who are implementing alternative fuels and improving aerodynamics in addition to leveraging on artificial intelligence to achieve high fuel efficiencies. Practitioners in emerging economies are informed to focus on implementing green initiatives to improve their overall logistics performance. Government policies should incentivize LSPs to implement green initiatives as a public good, although

regulations should also be in place to clamp down on non-compliance with environmental laws. Some of the actionable policy recommendations include providing low interest rates loans to fund the initiatives, introducing tax rebates, encouraging partnerships between public entities and LSPs and improvement of rail infrastructure. The findings of this study might be limited to the study to the specific green strategies investigated within the South African context and any generalisation should be considered carefully. The study findings might also be limited by potential sampling biases. Future studies can be longitudinal to track the long-term impact of green initiatives or investigations into specific barriers to the adoption of other green technologies. Future studies can also consider the impact of the green supply chain initiatives on SMEs versus the large firms.

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