

Sustainable Supply Chain to Enhance the Environmental Performance in the Cleaning Detergents Manufacturing Industry: Case of Harare, Zimbabwe

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ABSTRACT

Business organizations are embracing the sustainability dimension by aligning functional organizational processes to demonstrate environmental responsibility. The scope of this study was on sustainability supply chain that could enhance the extent of environmental performance among firms in the cleaning detergents manufacturing sector in Zimbabwe. The study was drawn from the realization that this sector is more prone to contributing negatively towards environmental security and sustainability. Key objectives were focused on the influence of green sourcing, reverse logistics, supplier collaboration, and resource efficiency on environmental performance. A quantitative research methodology was pursued and a sample size of 186 participants from the leading cleaning detergent manufacturing sector was selected. Data was gathered using a structured questionnaire. Key research results indicated that green sourcing had the greatest positive contribution towards environmental performance while research efficiency had the least effect. The effect of all predictor variables on the level of environmental performance was found to be statistically significant and positive, which demonstrates that the cleaning detergents manufacturing sector is aligning its supply chain processes in pursuance of the sustainability dimension. The key conclusions state that e-procurement is a sustainable sourcing strategy that incorporates order tracking technologies to improve their environmental performance. The adoption of environmentally friendly and biodegradable chemicals has improved the environmental performance of firms in the cleaning detergents manufacturing sector. The main recommendations indicate that the cleaning detergents manufacturing sector is realizing the competitive effects associated with promoting environmental security to demonstrate their regulatory compliance. The key policy prescriptions incorporate the promotion of biodegradable chemicals in the manufacturing of these cleaning detergents so that end users can be able to properly recycle, reuse, and reduce the adverse effects of using such detergents on the environment.

Keywords—Green sourcing, reverse logistics, supplier collaboration, resources efficiency, environmental performance

INTRODUCTION

Organisations around the globe are aligning themselves with the sustainability dimension, which recognizes that even if organisations are driven by the profit motive, they are also duty bound to consider the impact that their activities have on the environment and the society at large (Obicci *et al.*, 2021). The creation of a sustainable supply chain is essential to ensure that the sourcing and end-of-life of products do not adversely affect the natural environment and generate positive benefits (Denton & Weber, 2022). Progressive organisations embrace eco-friendly production methods that leverage an efficient utilisation of resources while managing reverse logistics. Other initiatives to enhance the alignment of the supply chain management function with the sustainability drive have been progress towards establishing a green supply chain that utilizes technology as a substitute for manual processes (Zhang & Mohammad, 2024).

Research in Finland has shown that the adoption of sustainable supply chains that leverage the application of

technology has contributed to significant cost reductions with minimal adverse environmental impact (Karttunen, Lintukangas & Hallikas, 2023). The works of Brintrup *et al.* (2024) underscored that digitising the supply chains in the United Kingdom provided real-time monitoring across the activities and performance of supply chain partners. Insights from a German study by Schulze-Horn *et al.* (2020) confirmed that the use of technology across the supply chain facilitated supply chain partner collaboration and business deal negotiations to improve the overall performance of the supply chain. Despite these developments, research in Italy underscored that the poor implementation of reverse logistics reduced the appeal of supply chain performance (Cannas *et al.*, 2024).

A Malaysian study that focused on leveraging e-supply chains among ISO-certified organisations established that e-supply chains significantly enhanced environmental performance (Singh & Chan, 2022a). In the African context, research by Nsiah-Sarfo, Ofori, and Agyapong (2023) highlights that institutional impediment affected an effective implementation of sustainable supply chain practices in the detergents manufacturing sector in Ghana. Research in South

Statement Of the Problem

The alignment of organizational processes in line with the sustainability dimension has been prominently researched and applied in developed economic contexts as opposed to developing nations (Mavlutova *et al.*, 2023). Research in developed economies has demonstrated that supply chains have been optimized for resource efficiency through technology infusion, collaboration, and reverse logistics for the benefits of environmental protection (Nsiah-Sarfo, Ofori, and Agyapong, 2023). However, the same does not relate in the Zimbabwean scenarios, especially when we consider the chaotic nature of the cleaning detergent supply chain that does not subscribe to the dictates of sustainability and environmental protection. The cleaning detergents sector in Zimbabwe faces capacity utilisation constraints that fall below 53.2% in 2023, making less than 9% contribution to the GDP (Confederation of Zimbabwe Industry, 2024). These challenges hamper cleaning detergent firms from effectively implementing the sustainable supply chain strategies in respect to green sourcing, reverse logistics, supply chain collaboration, and efficient use of resources, which affect their environmental performance. Despite the growing emphasis on sustainability, there is a lack of comprehensive research in Zimbabwe exploring sustainable supply chain strategies to enhance the environmental performance of the cleaning detergents manufacturing sector.

Research Objectives

The following objectives guide the study:

1. To evaluate the effect of green sourcing on the environment performance
2. To assess the influence of reverse logistics on the environmental performance
3. To analyse the effect of supplier collaboration on the environmental performance
4. To assess the effect of resource efficiency on the environmental performance

LITERATURE REVIEW

Green Sourcing and Environmental Performance

The use of sustainable procurement and sourcing strategies that incorporate the use of e-procurement has significantly reduced the carbon footprint that the cleaning detergents manufacturing sector could otherwise have made on the environment (Lerman, et al 2022, Mausin et al 2020). Green procurement strategies have been found to have the strongest influence on the environmental performance of the cleaning detergents sector. This comes out of the realization that companies in this sector are using biodegradable materials that have a minimal adverse impact on the environment, which contributes towards environmental protection and enhanced environmental performance of the sector.

The Effect of Reverse Logistics on The Environmental Performance

Reverse logistics is the process of planning, implementing, and controlling backward flows of raw materials, in-process inventory, packaging, and finished goods, from a manufacturing, distribution, or use point to a point of recovery or point of proper disposal (Rubio *et al.*, 2019). Ngadiman *et al.* (2016) define reverse logistics as the movement of products or materials in the opposite direction of the supply chain for the purpose of creating or recapturing value or for proper disposal. Muhammad *et al.* (2020) agree with the above definitions and articulate that reverse logistics is the movement of products or materials in the opposite direction of the supply chain for the purpose of creating or recapturing value or for proper disposal. Ribeiro *et al.* (2021) highlighted that reverse logistics moderates the environmental Behaviour of industries.

The effective and well-established reverse logistics operations have a positive impact on organizational growth, such as for its internal cost, inventory management, expanding its revenue, environmental cost reduction, competitive advantages, customer satisfaction, and all its services (Muhammad *et al.*, 2020). Insights from Pushpamali, Agdas, and Rose (2019) emphasise that reverse logistics reduces negative environmental externalities. From a public health perspective, the works of Yu *et al.* (2020) assert that “the rapidly increased amount of medical waste due to the COVID-19 outbreak needs to be collected and treated in a timely, safe, and effective manner in order to minimize the virus spread and the risk to humans.” According to De Lorena Diniz Chaves, Ballista, and Comper (2019), reverse logistics planning is complex compared to forward logistics planning due to higher levels of uncertainty involved.

Research by González *et al.* (2020) specified that the adoption of sustainable supply chain practices is associated with the financial performance of organisations in terms of cost savings as well as the qualitative performance of the organisation in terms of environmental protection through reducing negative externalities. The study also highlighted that the performance of organisations from a sustainable supply chain perspective is also related to improved energy efficiency and optimisation of resource usage

The Effect of Supplier Collaboration on The Environmental Performance

Supply chain collaboration relates to the mutually beneficial agreements between supply chain partners for the supply of services that satisfy the demands of clients (Casady *et al.*, 2023). The profits that are generated from the supply chain collaboration and shared amongst parties in accordance with the terms and conditions of the agreement; the competitive nature of supply chain collaboration is determined by the operating environment (Chikazhe *et al.*, 2023). The effectiveness of supply chain collaboration is based on putting in place sound communication mechanisms to enhance the supply of raw materials and finished products to the market to enhance overall environmental performance (Anjomshoe *et al.*, 2023). The adoption of supply chain collaboration initiatives amounts to lowering costs, reducing environmental impacts, and improving the quality of the overall products. Arora *et al.* (2020) established that supply chain collaboration is an intermediary role between supply chain and environmental performance.

The principle of supplier collaboration brings out the necessity for firms to create strategic partnerships and links with other key value chain partners to create long-term benefits (Montalbán-Domingo *et al.*, 2021). The work of Rinaldi *et al.* (2022) confirms that supplier collaboration involves cooperative efforts between firms and different stakeholders with the aim of addressing environmental concerns collectively (Ghosh *et al.*, 2023). With respect to sustainable supply chains and environmental performance, supplier collaboration might incorporate partnerships between firms and different local and regional suppliers to promote environmentally sensible practices throughout the supply chain (EL Bizri *et al.*, 2023).

Jaffu & Changalima, (2023), highlighted the significance of environmental protection and collaboration in advancing sustainable supply chain practices and improving the overall performance of firms. Other researchers have also examined the key barriers to effective implementation of supplier collaboration (Ek Österberg & Zapata, 2023). Some of the prominent challenges that have been identified incorporate weak coordination amongst stakeholders, which more often results in differences in priorities and interests. Other schools also reported the existence of conflicts of interest among partners, which could potentially affect the effectiveness of supplier collaboration (Anjomshoe *et al.*, 2023).

Digital collaboration across the supply chain enables adaptation, coordination, and relationship-building effects amongst the supply chain partners (Zozaya González *et al.*, 2020). These relationships govern the plans and governance mechanisms of different partners, both in the supply chain and downstream (Anjomshoae *et al.*, 2023). The mutual exchange process, which arises from digital collaboration, is important for building trust and collaboration through the sharing of resources and capabilities along the supply chain (Rinaldi *et al.*, 2022).

The Effect of Resource Efficiency on The Environmental Performance

Resource efficiency is a concept related to the contribution that the supply chain makes towards the overall performance of an organisation (Kozuch *et al.*, 2024). The works of Ayarkwa *et al.*, (2020) confirm that resource efficiency is an evolution of the interests of researchers with respect to the popularity of the sustainability dimension which is also known as the creation of a green supply chain. Ayarkwa *et al.*, (2020) view resource efficiency as a concept that involves a logical process through which organisations are capable of meeting their requirements in terms of utilities, services, goods, and work in a manner that creates value for money only on an organisational lifetime basis. González *et al.*, (2020) concur that resource efficiency as a concept relates to the contribution of the supply chain function to corporate planning which is responsible for facilitating the environment alignment of the purchasing function.

Resource efficiency involves the components of social purchasing as well as environmental protection, with the aim of achieving the sustainability of the organisation from the purchasing function (Nazam *et al.*, 2020). An important feature of resource efficiency properties is creation of long-term relationships between the organisation and its different supply chain partners (Hartlapp, 2024). These relationships are built on trust over an extended period through recording transactions and long-term investments, which create mutually beneficial partnerships (Arora *et al.*, 2020).

RESEARCH METHODOLOGY

A quantitative research methodology was pursued, and a correlational research design was preferred as the most ideal design in this research. The research population of this study comprised of firms in the cleaning detergent manufacturing sector in Zimbabwe. Respondents were drawn from personnel in the purchasing or buying departments of respective firms in the detergent manufacturing sector in Zimbabwe. The target population included firms such as Nemchem, Barcol, Cernol, Multiklean, William and Scott and Trade Kings (Confederation of Zimbabwe Industry, 2024). The estimated population size of the detergent manufacturing sector along with supply chain partners stands at around 345; a figure was used for the computation of the sample size. The estimated sample size of 186 was used and stratified random sampling approach was used to select respondents. The cleaning services were put in different strategic groups in terms of participants that specialise in distinct lines of specialisation. Using this criterion, companies like Nemchem, Barcol, Cernol, Multiklean, William and Scott, Multi manufacturers, and Trade Kings, were selected. The study used a structured questionnaire to collect data, and the measurement of these constructs was achieved through the use of a 5-point Likert scale. This approach categorized responses into five classes: strongly agree, agree, indifferent, disagree, and strongly disagree.

RESULTS

Response Rate

A total of 186 questionnaires were sent to a cross-section of representatives of the leading cleaning detergent manufacturing sector in Zimbabwe. From these, 161 valid responses were received, which represents an overall response rate of 86.56%.

Demographic Data

The demographic profiles of respondents are presented in Table 2

TABLE1: DEMOGRAPHIC PROFILES OF RESPONDENTS

	FREQUENCY	VALID PERCENTAGE
MALE	71	44.1
FEMALE	90	55.9
TOTAL	161	100.0
AGE GROUPS		
21 – 30 YEARS	5	3.1
31 – 40 YEARS	63	39.9
41-50 YEARS	72	44.7
51-60 YEARS	19	11.8
61 YEARS AND ABOVE	2	1.2
TOTAL	161	100
HIGHEST EDUCATION		
CERTIFICATE	16	9.9
DIPLOMA	64	39.8
BACHELORS	38	36.0
MASTERS	17	10.6
OTHER	6	3.7
TOTAL	161	100.0
EXPERIENCE		
1-5 YEARS	16	9.9
6-10 YEARS	58	36.0
11-15 YEARS	53	32.9
16 YEARS AND ABOVE	34	21.1
TOTAL	161	100.0

Descriptive Statistics

Descriptive statistics were used to analyse the variables in respect to the use of the mean and standard deviation, which could indicate the distribution of responses relating to the magnitude of agreement or disagreement with the statements. The basis for interpreting descriptive statistics is showcased in Table 2.

TABLE 2: MEAN INTERPRETATION

MEAN RANGE	
$1.0 \leq \text{MEAN VALUE} < 1.8.$	STRONGLY DISAGREE
$1.8 \leq \text{MEAN VALUE} < 2.6.$	DISAGREE
$2.6 \leq \text{MEAN VALUE} < 3.4.$	INDIFFERENT
$3.4 \leq \text{MEAN VALUE} < 4.2$	AGREE
$4.2 \leq \text{MEAN VALUE} < 5.0$	STRONGLY AGREE

Green Sourcing and Environmental Performance

Table 3: Green Sourcing and Environmental Performance

VARIABLE	ITEM	MEAN	STANDARD DEVIATION
GREEN SOURCING	GREEN SOURCING CONTRIBUTES TO IMPROVED ENERGY EFFICIENCY IN THE PRODUCTION OF CLEANING DETERGENTS.	3.79	1.009
	THE USE OF GREEN SOURCING PRACTICES IN CLEANING DETERGENT MANUFACTURING SIGNIFICANTLY REDUCES WASTE GENERATION	3.89	1.072
	IMPLEMENTING GREEN SOURCING INITIATIVES LEADS TO A MEASURABLE DECREASE IN HARMFUL EMISSIONS DURING THE MANUFACTURING PROCESS.	3.91	1.083
	THE ADOPTION OF SUSTAINABLE RAW MATERIALS POSITIVELY IMPACTS THE OVERALL ENVIRONMENTAL FOOTPRINT OF CLEANING DETERGENTS	3.92	1.043
	GREEN SOURCING PRACTICES ENHANCE THE COMPANY'S REPUTATION FOR ENVIRONMENTAL RESPONSIBILITY WITHIN THE CLEANING DETERGENT MARKET.	3.93	.972

Descriptive statistics relating to green sourcing indicate that respondents agreed that the alignment towards the use of sustainable approaches to the sourcing of raw materials significantly improved the level of environmental responsibility and performance of the cleaning detergents manufacturing sector. This is shown by the mean values, which range between 3.79 and 3.93, indicating agreement with the items that we tested. Research findings of this study also support the work of Arora *et al.* (2020) proposes that strengthening the institutional capacity amongst firms through enhanced training and resource allocation is of paramount importance to enhance better governance and adherence to green sourcing policies. Current research results are in support of related outcomes that emerged from a study by Zeadat (2024) in which the operationalization of the green sourcing strategy was singled out as statistically significant in lowering organisational risks that potentially disrupt supply chains. It is apparent that current research results corroborate outcomes from the works of Hartlapp (2024) who specified that leveraging the use of green sourcing as a sustainable strategy was in improving organisational efficiency and resilience to environmental changes.

Reverse Logistics and Environmental Performance

Table 4: Reverse Logistics and Environmental Performance

VARIABLE	ITEM	MEAN	STANDARD DEVIATION
REVERSE LOGISTICS	I BELIEVE THAT REVERSE LOGISTICS PLAYS A CRUCIAL ROLE IN PROMOTING ENVIRONMENTAL RESPONSIBILITY WITHIN OUR INDUSTRY.	3.71	1.041

	THE ADOPTION OF REVERSE LOGISTICS POSITIVELY AFFECTS OUR COMPANY'S CARBON FOOTPRINT.	3.84	1.016
	OUR REVERSE LOGISTICS PROCESSES ENHANCE THE OVERALL SUSTAINABILITY OF OUR SUPPLY CHAIN	3.88	1.039
	REVERSE LOGISTICS INITIATIVES CONTRIBUTE TO IMPROVED RECYCLING RATES OF OUR PRODUCTS	3.97	.869
	THE IMPLEMENTATION OF REVERSE LOGISTICS PRACTICES IN OUR ORGANIZATION SIGNIFICANTLY REDUCES WASTE GENERATION.	3.99	.908

In relation to the mean interpretation scale presented in Table 4 the mean for reverse logistics ranged between 3.71 and 3.99. These statistics indicate that respondents were generally in agreement that reverse logistics, as it is practiced in the cleaning detentions manufacturing sector, is playing a pivotal role in promoting environmental responsibility.

Current research results corroborate outcomes from a study by Pushpamali *et al.*, (2019) where it was emphasized that reverse logistics reduces negative environmental externalities. Relatedly, current research results support insights by Muhammad *et al* (2020) whose study indicated that developing a sound reverse logistics strategy positively influences on organisational growth projections in respect to cost containment and the achievement of sustainable competitive advantage.

Supplier Collaboration and Environmental Performance

The descriptive statistics related to supply collaboration and the environmental performance of the cleaning detergent manufacturing sector are presented in Table 5

TABLE 5: SUPPLIER COLLABORATION AND ENVIRONMENTAL PERFORMANCE

VARIABLE	ITEM	MEAN	STANDARD DEVIATION
SUPPLIER COLLABORATION	COLLABORATIVE INITIATIVES WITH SUPPLIERS HAVE POSITIVELY IMPACTED OUR ENVIRONMENTAL PERFORMANCE METRICS.	3.77	1.044
	ENGAGING SUPPLIERS IN SUSTAINABILITY EFFORTS HAS FOSTERED INNOVATION THAT BENEFITS OUR ENVIRONMENTAL GOALS	3.83	.965
	OUR PARTNERSHIP WITH SUPPLIERS HAS RESULTED IN MEASURABLE REDUCTIONS IN WASTE AND RESOURCE CONSUMPTION.	3.91	.921
	EFFECTIVE COMMUNICATION WITH SUPPLIERS LEADS TO	3.93	,919

	IMPROVED ENVIRONMENTAL OUTCOMES IN OUR SUPPLY CHAIN.		
	SUPPLIER COLLABORATION SIGNIFICANTLY ENHANCES OUR ORGANIZATION'S ABILITY TO IMPLEMENT SUSTAINABLE PRACTICES	4.00	1.006

Given the mean interpretation scale, descriptive statistics presented in Table 5 indicate that respondents were generally in agreement that supplier collaboration is an influence on environmental performance. This is evidenced by the mean scores, which range between 3.77 and 4.00.

With respect to sustainable supply chains and environmental performance, supplier collaboration might incorporate partnerships between firms and different local and regional suppliers to promote environmentally sensible practices throughout the supply chain (EL Bizri *et al.*, 2023). Extant literature from the works of Rinaldi *et al.* (2022), has confirmed that supplier collaboration creates synergy among supply chain partners that are essential in promoting environmental awareness. (Ghosh *et al.*, 2023). Despite the conceptual application of supplier collaboration, there is scant literature which relates the collaboration of suppliers in the cleaning detergents sector to sustainable environmental performance

Resource Efficiency and Environmental Performance

TABLE 6: RESOURCE EFFICIENCY AND PERFORMANCE

VARIABLE	ITEM	MEAN	STANDARD DEVIATION
RESOURCE EFFICIENCY	OUR CURRENT RESOURCE MANAGEMENT STRATEGIES LEAD TO MEASURABLE IMPROVEMENTS IN SUSTAINABILITY	3.87	1.032
	ENHANCED RESOURCE EFFICIENCY CONTRIBUTES TO BETTER COMPLIANCE WITH ENVIRONMENTAL REGULATIONS	3.91	1.054
	INVESTING IN RESOURCE EFFICIENCY INITIATIVES HAS RESULTED IN A NOTICEABLE DECREASE IN WASTE PRODUCTION.	3.93	1.038
	IMPLEMENTING RESOURCE-EFFICIENT PRACTICES SIGNIFICANTLY REDUCES OUR ORGANIZATION'S OVERALL ENVIRONMENTAL IMPACT	4.02	.974
	OUR CURRENT RESOURCE MANAGEMENT STRATEGIES LEAD TO MEASURABLE IMPROVEMENTS IN SUSTAINABILITY.	4.12	.947

Descriptive statistics related to resource efficiency indicate the mean, which ranges between 3.87 and 4.12. Generally, these statistics imply that there is optimal resource usage in the cleaning detergent manufacturing sector, which does not contribute to environmental degradation. Efficiency in the utilisation of organisational resources is in compliance with the Environmental Management Authority regulations as well as reducing the adverse impact of organisational operations on the environment. Statistics indicated that improvement in

resource efficiency is associated with a change in the overall environmental performance of the cleaning detergents manufacturing sector. Even though resource efficiency has the lowest contribution to environmental performance, it is still instrumental to avoid the wastage of resources, which can ensure that the operations within the cleaning detergents manufacturing sector leverage resource savings that can benefit future generations and reduce the emission of negative externalities that threaten environmental performance.

These research findings validate with the works of Hartlapp (2024) who stipulated that an important feature of resource efficiency properties is the creation of long-term relationships between the organisation and its different supply chain partners. These research results resonate with the views of Eltoum *et al* (2021) where it was stipulated that organisations with rich resource endowments are capable of conversing the natural ecology in a manner that supports the sustainability of supply chains.

CONCLUSIONS

The following are conclusions drawn from the study

Results shows that there is an improvement in the green sourcing strategies. The implications of these statistics are that the movement towards sustainable sourcing practices, which reduces negative externalities on the environment, such as air, noise, and water pollution, has significant effects in promoting environmental performance.

The cleaning detergents manufacturing has adopted the use of environmentally friendly and biodegradable chemicals that do not negatively affect the environment.

One area that has been noticeable in the cleaning detergents manufacturing sector has been the collaboration in terms of procurement, which has benefitted the sector in terms of cost reduction, efficiency in delivery times, and their ability to be effective in achieving their financial and strategic goals.

Even though resource efficiency has the lowest contribution to environmental performance, it is still instrumental to avoid the wastage of resources, which can ensure that the operations within the cleaning detergents manufacturing sector leverage resource savings that can benefit future generations and reduce the emission of negative externalities that threaten environmental performance.

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