Environmental Sustainability Practices in Supply Chains and Manufacturing Firms' Performance: Evidence from Tanzania Breweries Limited

Elinala Lutufyo Mwansasu*[1] , **Leonada Raphael Mwagike[2]**

[1,2] Department of Procurement and Logistics Management, School of Business, Mzumbe University, Tanzania
* Corresponding author: elinalamwansasu5@gmail.com

Abstract

Purpose- This study investigates the influence of environmental sustainability practices in supply chains on the performance of manufacturing firms in Dar es salaam, Tanzania.

Design/Methodology- Employing a case study research design, the study utilized a mixed-methods approach, integrating qualitative and quantitative methodologies. A total sample of 155 respondents was selected using simple random sampling for questionnaires, while 13 participants were purposively selected for in-depth interviews. Data collection involved structured questionnaires and interviews, analyzed using descriptive and inferential statistics with SPSS to ensure robust findings.

Findings- The findings revealed a positive and significant influence of circular packaging on manufacturing firm performance. Adopting innovative packaging materials and clear disposal instructions can enhance competitive advantage, increase profit margins, and attract environmentally-conscious consumers, leading to higher market share and revenue.

Practical Implications- The study highlights the importance of environmental sustainability practices for manufacturing firms in Tanzania. By adopting sustainable approaches, businesses can contribute to a healthier environment, reduce their carbon footprint, and promote responsible consumption. This can have positive implications for both the local community and the global ecosystem. The study recommends that firms invest in circular economic practices, such as innovative packaging and recycling. Policymakers are urged to provide incentives, such as tax relief and subsidies, to support green technologies. Collaboration between public and private sectors to fund research and development is also emphasized. Additionally, consumer advocacy for sustainable products and practices is critical to driving change.

Introduction

In today's globalized world, businesses are increasingly recognizing the need to integrate sustainability into their operations. This shift goes beyond internal practices to include the entire supply chain. Growing awareness of the environmental and economic benefits of sustainable practices is a major driver of this change (Ismail et al., 2023). At the same time, companies are becoming more aware of the risks associated with increasing carbon footprints. This awareness is prompting businesses to act towards sustainability in their operations and supply chains (World Business Council for Sustainable Development, 2020). In Tanzania, environmental sustainability initiatives such as circular economic activities, carbon foot print reduction are said to raise potential benefits such as those associated with operational and reputational performance, a study by Elias and Changalima (2024) suggests that environmental sustainability strategies can enhance a company's competitive advantage, improve operational efficiency and attract environmental conscious consumers. This aligns with Tanzania's National Green Growth Strategy, which recognizes the importance of environmentally sustainable practices for long term economic development. Existing studies within show that managers recognize environmental sustainability as a strategic priority, impacting supply chain optimization (Pasupuleti et al., 2024; Wiredu et al., 2024; Hong & Xiao, 2024). Therefore, integrating environmental sustainability into supply chains presents a strong opportunity to the manufacturing organizations.

Tanzania Breweries Limited (TBL) as a leading beverage company in Tanzania, provides an ideal case study to explore the relationship between environmental sustainability practices and firm operational and reputational performance in a developing country context. TBL's extensive supply chain network, encompassing agriculture, logistics, and distribution, offers a unique opportunity to examine the effects of sustainability initiatives. Additionally, TBL's significant market presence and commitment to corporate social responsibility make it a relevant and influential player in the Tanzanian business landscape. For instance, TBL champions environmental sustainability such as renewable energy, causing a 40% reduction in carbon emissions. According to Sanga (2023), TBL transitioned to solar power in 2019, achieving a 15% reduction in energy costs while demonstrating their commitment to sustainability. While TBL has implemented various sustainability initiatives, a comprehensive assessment of their impact on the firm's financial, operational, and reputational performance is lacking.

However, a study conducted by Nkwabi (2019) revealed that many Tanzanian enterprises struggle with adopting and integrating new technologies required for environmental sustainability practices. There is often poor government support such as insufficient policy frameworks from the government making it challenging for firms to prioritize environmental sustainability practices. The consequences of this limited adoption are extensive and pose serious threats to both the environment and the long-term sustainability of the manufacturing sector. The continued reliance on traditional practices, which often lack environmental considerations, leads to significant environmental degradation, including the release of untreated industrial waste into the environment (World Bank, 2022). This not only contributes to pollution and degradation of natural resources but also poses risks to public health and ecosystem balance. Tanzania government has made progress through the National Environmental Management Council (NEMC) which has implemented regulations to control industrial pollution and promote sustainable waste management (NEMC, 2023). These efforts may not be sufficient to overcome the challenges faced by firms in the adoption and integration of the environmental sustainability initiatives.

While the importance of environmental sustainability is increasingly recognized, existing research on this topic often focuses on developed economies and large multinational corporations (Lartey et al., 2021; Mahran & Elamer, 2024). Limited empirical evidence exists on the adoption and impact of environmental sustainability practices in developing country contexts, particularly within the brewing industry. This study aims to bridge this

gap by examining the relationship between specific environmental sustainability practices, such as carbon emissions reduction, circular packaging and waste management and TBL's operational and reputational performance.

This research contributes to the existing literature as it provides empirical evidence on the effectiveness of such practices in a developing country context, where resource constraints and regulatory frameworks may differ from those in developed economies. Also, it sheds light on the specific challenges and opportunities faced by manufacturing firms in Tanzania in adopting and implementing environmental sustainability initiatives. Furthermore, the findings of this study can inform the development of sustainable supply chain strategies for TBL and other manufacturing firms in Tanzania, as well as provide valuable insights for policymakers and industry stakeholders.

Literature Review

Theoretical Literature Review

Stakeholder Theory

Stakeholder theory suggests that businesses should consider the interests of a broader range of stakeholders beyond just shareholders (Parmar et al., 2010; Changalima et al., 2021). These stakeholders include customers, employees, suppliers, communities, and the environment. By prioritizing the needs and concerns of these groups, businesses can build stronger relationships, enhance their reputation, and ultimately achieve long-term success. When applied to environmental sustainability, stakeholder theory suggests that businesses should integrate environmental considerations into their decision-making processes and operations. This involves not only reducing negative environmental impacts but also creating positive environmental outcomes. For example, by implementing circular economy practices such as circular packaging, businesses can reduce waste, conserve resources, and create new business opportunities (Khamis et al., 2022). Similarly, reducing carbon emissions through energy-efficient operations and renewable energy adoption can significantly contribute to environmental performance while improving operational efficiency and cost savings (Tan et al., 2016).

In relation to this study on environmental sustainability practices at TBL, the theory emphasizes the importance of stakeholder collaboration in implementing practices like carbon emissions reduction, circular packaging, and waste management, which are integral to improving operational and reputational performance. Unlike general applications of the theory, this study emphasizes the role of localized stakeholder dynamics in developing economies, such as Tanzania, where regulatory, social, and cultural contexts shape the implementation of sustainability initiatives (Ismail et al., 2023).

According to Sarkis et al. (2011), engaging with stakeholders in the development and implementation of environmental sustainability initiatives is essential. By involving customers, employees, suppliers, and the community, businesses can gain valuable insights, build trust, and ensure that their sustainability efforts are aligned with the needs and expectations of these groups. Ismail et al. (2023) highlight that customers may prefer products from companies with strong environmental reputations, leading to increased brand loyalty and sales. Suppliers may benefit from long-term partnerships with sustainable companies, as these companies often have stable demand and are less likely to engage in unethical practices (Changalima, 2024; Porter & Linde, 1995). Finally, communities may benefit from reduced emissions and improved environmental quality resulting from sustainable practices, leading to enhanced social license to operate (Jum'a et al., 2021). Hence, this collaborative approach can lead to more effective and sustainable solutions.

Additionally, integrating specific sustainability measures like circular packaging and carbon emissions reduction can further enhance stakeholder relationships. For instance, recent studies by Kumar et al. (2023) and Liu et al.

(2023) have shown that circular packaging significantly reduces environmental impacts while also boosting consumer trust and brand loyalty. Similarly, reducing carbon emissions not only meets regulatory compliance but also enhances a firm's reputation among environmentally conscious stakeholders.

Research has shown that environmental sustainability practices such as carbon footprint reduction, circular activities can positively impact manufacturing firms' performance in various ways. For example, a study by Tanveer et al. (2021), have found that companies with strong environmental performance tend to have higher financial performance, greater innovation capacity, and improved risk management. Additionally, environmental sustainability can enhance a company's reputation, attract environmentally conscious customers, and improve employee morale and retention (Elias & Changalima, 2024; Delphinus & Mwita, 2024). Hence, stakeholder theory provides a valuable framework for understanding the complex relationships between businesses and their stakeholders. By adopting environmental sustainability practices and engaging with stakeholders, manufacturing firms can create long-term value, mitigate risks, and contribute to a more sustainable future.

Empirical Literature Review

Environmental Sustainability Practices and Manufacturing Firms' Performance

The relationship between environmental sustainability and firm performance has been extensively explored, yet findings often vary depending on the context. Alshiqi et al. (2022) conducted a study, on the relationship between the green supply chain and firm performance of manufacturing firms operating in Turkey, the findings revealed that, internal and external green supply chain practices have a negative and statistically insignificant effect on the reduction of emissions, reduction of green costs and competitiveness, which are the performance indicators of the company. In addition, there was a positive correlation between internal green supply chain practices and external green supply chain practices. This implied that the collaboration of internal and external green practices allows firms to increase their green performance and that it is important to maintain internal green practices in order to increase external green cooperation. This contrasts with the Tanzanian context, where this study seeks to demonstrate that such practices, including carbon emissions reduction, circular packaging, and waste management significantly enhance both operational efficiency and reputational outcomes.

Also, studies show that firms with lower carbon emissions tend to have higher brand recognition and customer satisfaction (Nazir et al., 2024; Zhang et al. 2020). This can be attributed to the growing consumer preference for environmentally responsible products and services. Additionally, reducing carbon emissions can lead to improved process efficiency and cost savings, as firms optimize their operations to minimize energy consumption and waste. This aligns with TBL's initiatives, which integrate carbon reduction to enhance operational performance while meeting consumer expectations for sustainability. However, unlike other previous studies, this research investigates these outcomes within a specific supply chain and developing country context, highlighting challenges like resource constraints and regulatory inconsistencies.

A study conducted by Aquilas et al. (2024), on the effect of industrialization on environmental sustainability in Africa, taking into consideration the moderation effect of circular economic activities and also circular packaging revealed that the growth of the manufacturing industry in Africa leads to adverse environmental conditions, which in turn leads to environmental degradation, Hence there is a need for manufacturing firms to integrate circular economic activities in their operations which account for reducing waste associated with packaging hence mitigating environmental impacts. This study builds on their findings by specifically focusing on how circular packaging contributes to operational efficiency and reputational gains in TBL's supply chain, distinguishing it from broader analyses of industrialization.

Additionally, Suleiman (2023) conducted a study on the impact of tourism supply chain on sustainable performance in sub-Saharan Africa based on evidence from Tanzania and found that there was a positive relationship between green purchasing and environmental performance, suggesting that sustainable sourcing can contribute to environmental improvements. This study provides a detailed analysis of a specific company, TBL within a particular country, Tanzania. This allows for a more understanding of the challenges and opportunities associated with implementing green practices in a developing country setting. This study goes further by linking waste management to firm performance metrics such as process efficiency, customer satisfaction, employee retention and brand reputation, providing a more comprehensive perspective.

Gull et al (2022) explored the relationship between waste management practices and firm performance. They found that firms with strong waste management systems experienced improved operational efficiency, reduced costs, and enhanced risk management. Furthermore, Malokani et al. (2023) concluded that through reducing waste firms can contribute to a cleaner environment and improve their social image. This can lead to increased employee satisfaction, improved community relations, and enhanced brand reputation. These insights are particularly relevant to TBL, where waste management is not only a compliance measure but also a strategic driver for reputational and operational performance. The current study advances this discussion by examining these dynamics within a localized supply chain framework, offering empirical evidence from Tanzania's brewing industry.

Methodology

Research Design

This study adopted a case study research design using both qualitative and quantitative methodologies, as it allowed for an in-depth exploration of a complex phenomenon within a real-world context. The mixed-methods approach was selected to integrate the strengths of both methodologies, enabling the researchers to comprehensively address the research question (Creswell & Creswell, 2018). The researchers aimed at filling the gap between environmental sustainability practices and manufacturing firms' performance by focusing on TBL, the researchers were able to explore the complexities of the environmental sustainability, providing rich, quantitative and qualitative data (Mohajan, 2018).

Sample Size

Data was obtained at Tanzania Breweries Limited located in Dar-es-salaam due to the company's size which facilitated access to comprehensive data, enabling a more thorough analysis of the relationships between environmental sustainability practices and firm performance. Simple random sampling was used for the quantitative data to ensure that each unit of analysis had an equal chance of selection, thereby minimizing bias and enhancing the generalizability of the findings. On the other hand, purposive sampling was utilized for the qualitative data to intentionally select participants who could offer rich, relevant, and detailed insights, ensuring a deeper understanding of the phenomena under investigation. This combination of sampling techniques allowed for a comprehensive approach to data collection, balancing objectivity and depth.

Hence, the sample size for the study was 155 participants for quantitative data, drawn from a target population of 253 participants using the Yamane formula. For qualitative data, 13 participants were selected for in-depth interviews. Although this sample size may appear small, it was sufficient to achieve data saturation, a point where no new themes or insights emerged (Guest et al., 2020). These 13 participants were purposefully selected from key stakeholder groups, including TBL suppliers, customers, and senior representatives, to ensure diverse perspectives. The saturation rule of thumb guided the decision to stop collecting qualitative data once no new information was being generated (Hennink & Kaiser, 2022).

Data Collection Methods

Primary data was collected directly from the selected respondents associated with TBL, through questionnaires and interviews. The questionnaires were comprised of the questions that reflect the study's variables (carbon emissions reduction, circular packaging and waste management) addressed in a Likert Scale which showed the respondent's degree of agreement or disagreement with the specific statements that address the independent and dependent variables. The respondents were able to respond to questionnaire at their working location during work hours, the situation which ensured convenience for them simply because time was put in consideration in structuring the questions. Also, this decision was guided by the principle of data saturation, where data collection ceases once no new information or themes emerge from additional responses (Hennink & Kaiser, 2022). The repetition of existing insights indicated that the data gathered was comprehensive enough to address the study's objectives effectively.

A sample size of 13 participants is often sufficient for achieving data saturation in qualitative research, especially in studies that aim to explore specific perspectives within a focused context. According to Hennink and Kaiser (2022), data saturation typically occurs when subsequent interviews fail to generate new themes or insights, suggesting that the collected data adequately represents the phenomenon under investigation. Furthermore, Guest et al. (2020) argue that even small sample sizes, such as 12 to 15 participants, can achieve data saturation in studies with homogenous groups or targeted research objectives, thereby providing robust qualitative insights. Additionally, Braun and Clarke (2021) emphasize that the quality of data and the depth of analysis are more critical than the number of participants in achieving saturation. In this study, the homogeneity of the respondents and the specificity of the research context ensured that 13 participants provided a comprehensive understanding of the phenomena under investigation.

Analysis and Presentation of Data

Data analysis in this study involved both quantitative and qualitative approaches to comprehensively address the research objectives, leveraging the strengths of each method for a strong understanding of the findings. Quantitative data were analyzed using the Statistical Package for Social Sciences (SPSS) due to its efficiency in handling large datasets and its wide acceptance in academic and professional research. The Likert scale data collected through structured questionnaires were treated as ordinal data, which is suitable for capturing subjective measures like perceptions and attitudes. Descriptive analysis, including frequencies and percentages, was employed to provide a clear overview of the respondents' characteristics and summarize findings for each research objective. This step was essential for identifying general trends and contextualizing the subsequent analyses.

Factor analysis was employed to reduce the dimensionality of the dataset by consolidating a large set of variables into fewer, more interpretable factors. This method was justified as it helps in identifying the underlying constructs influencing the observed variables, enhancing the interpretability of the results. The adequacy of the sample size for factor analysis was verified using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity (Pallant, 2020). These tests ensured the data met the prerequisites for meaningful factor analysis, where the correlation matrix was not an identity matrix. Principal Component Analysis (PCA) was used as the extraction method, as it is a robust technique for summarizing data variability into components while retaining as much information as possible. Factors with rotated loadings above 0.5 were retained, as this threshold ensures only meaningful variables are included. These factors were transformed into new variables and subsequently used as independent and dependent variables in the multiple regression analysis.

Multiple regression analysis was performed to examine the relationship between the dependent variable (firm performance) and multiple independent variables (carbon emissions reduction, circular packaging and waste management in the supply chain). This method was selected for its ability to model the influence of several

predictors simultaneously, which is critical in complex research scenarios like this. To ensure the validity of the regression results, multicollinearity was assessed using Variance Inflation Factors (VIF) and Tolerance. All values fell within the acceptable thresholds, with VIF below 10 and Tolerance above 0.2, confirming that multicollinearity was not a concern and that the predictors were sufficiently independent. Qualitative data obtained from interviews were analyzed narratively to complement the quantitative findings. The responses were systematically organized and thematically analyzed to provide deeper insights into the results generated by SPSS. This approach enhanced the understanding of the influence of environmental sustainability practices in supply chains and manufacturing firms' performance, offering a triangulated validation of the quantitative findings.

Results

Carbon Emissions Reduction on Manufacturing Firms' Performance

From the descriptive statistics on Table 1, the findings revealed that a significant portion of the respondents, 46.6%, strongly agreed that TBL provides clear guidelines to help reduce carbon emissions, highlighting the company's commitment to offering actionable strategies for lowering its environmental impact. This finding suggests that TBL's transparency and structured approach may be key factors in its ability to influence carbon reduction efforts effectively. Moreover, half of the respondents (50.0%) agreed that prioritizing efficient transportation methods is crucial, underscoring the importance of operational strategies that reduce energy consumption and associated emissions.

Another result is that 48.6% of respondents strongly agreed on the importance of using renewable energy sources at TBL. This statistic indicates a strong consensus on the need for sustainable energy solutions within the company's operations, suggesting that renewable energy is seen as a critical component of achieving long-term environmental sustainability. Additionally, when asked whether TBL's investment in energy-efficient technologies is beneficial, 46.6% of respondents agreed, further confirming that TBL's efforts in adopting energy-efficient innovations are valued by those involved in the business. This supports the notion that energy-efficient technologies can play a pivotal role in advancing TBL's sustainability agenda.

Table 1: Descriptive Analysis for Carbon Emissions

Categories	SD	D	N	A	SA
	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)
Provides clear guidelines	11(7.5)	21(14.4)	7(4.8)	39(26.7)	68(46.6)
Prioritize efficient transportation methods	4(9.6)	19(13.0)	7(4.8)	73(50.0)	33(22.6)
Encourage using renewable energy sources	8(5.5)	16(11.0)	11(7.5)	40(27.4)	71(48.6)
Invest in energy efficient technologies	8(5.5)	28(19.2)	-	68(46.6)	42(28.8)
Track and monitor carbon emissions	16(11.0)	20(13.7)	11(7.5)	49(33.6)	50(34.2)

Source: Table by Authors (2024)

The study also found that 34.2% of respondents strongly agreed that TBL tracks and monitors carbon emissions throughout its supply chain. This indicates that a significant proportion of respondents view TBL's carbon emission tracking as an essential tool for accountability and continuous improvement in reducing environmental impact. These findings also align with qualitative feedback from respondents, who emphasized TBL's sustainability efforts as a central factor in their continued business relationships. In conclusion, the study's

findings suggest that TBL's clear guidelines, investment in energy-efficient technologies, and focus on renewable energy are viewed favorably by its stakeholders. These practices are not only aligned with global sustainability trends but are also key drivers of business loyalty and long-term partnerships.

Circular Packaging on Manufacturing Firms' Performance

The findings in Table 2 reveal several key insights regarding TBL's approach to circular packaging solutions. A significant portion of respondents (55.5%) agreed that TBL has implemented systems to collect and return used packaging materials for reuse or recycling, underscoring progress in sustainable practices. Additionally, a majority (67.8%) emphasized the importance of providing clear instructions on the disposal of used packaging materials on labels, suggesting that better communication could enhance consumer participation in recycling efforts.

Furthermore, the results highlight the need for innovation, with 64.4% agreeing that TBL should prioritize seeking innovative packaging solutions. This indicates strong support for exploring new technologies and materials that can reduce environmental impact. Notably, 60.3% of respondents strongly agreed that involving stakeholders in discussions is critical, reflecting the importance of collaboration in achieving sustainable packaging goals. However, a significant challenge was identified, as 61.6% agreed that the cost of implementing circular packaging solutions remains a major barrier to wider adoption within the TBL supply chain. This finding suggests that addressing financial constraints and finding cost-effective solutions will be vital for broader implementation. These statistics underscore both the opportunities and challenges TBL faces in advancing circular packaging solutions. The narrative highlights the importance of collaboration, clear communication, and innovation while acknowledging the financial hurdles that must be addressed to drive sustainable change effectively.

Table 2: Descriptive Analysis for Circular Packaging

Categories	SD	D	N	A	SA
	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)
Implement systems to collect & return used packaging materials	8(5.5)	16(11.0)	11(7.5)	81(55.5)	30(20.5)
Provides clear instructions on disposal of used packaging materials on labels	10(6.8)	13(8.9)	7(4.8)	99(67.8)	17(11.6)
Seeks innovative packaging solutions	6(4.1)	11(7.5)	3(2.1)	94(64.4)	32(21.9)
Involves its stakeholders in discussions on designing & implementation of circular packaging solutions	6(4.1)	20(13.7)	-	32(21.9)	88(60.3)
Implementation cost are major barrier to wider adoption	12(8.2)	14(9.6)	3(2.1)	90(61.6)	27(18.5)

Source: Table by Authors (2024)

Waste Management on Manufacturing Firms' Performance

From the descriptive statistics presented in Table 3, it was depicted that 32.9% of respondents agreed that their organization communicates clear waste management goals, indicating room for improvement in raising awareness and fostering a shared understanding of these objectives among employees. A significant majority (56.8%) agreed that well-defined procedures for waste segregation and collection are in place, reflecting a structured approach to managing waste at TBL. Furthermore, 56.8% of respondents strongly agreed that recycling and composting are prioritized over landfill disposal, underscoring the organization's commitment to sustainable waste management practices. Finally, 56.8% also agreed that regular monitoring and reporting on waste generation and disposal practices are conducted, demonstrating a proactive approach to tracking and optimizing waste management processes. These findings suggest that while TBL has established foundational waste management systems, there are opportunities to enhance communication of goals to align all stakeholders and further embed sustainability into the organizational culture.

Table 3: Descriptive Analysis for Waste Management

Categories	SD	D	N	A	SA
	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)
Communicates clear waste management goals	17(11.6)	25(17.1)	11(7.5)	48(32.9)	45(30.8)
Well defined procedures for waste segregation and collection	14(9.6)	15(10.3)	3(2.1)	83(56.8)	31(21.2)
Prioritizes recycling & composting of waste materials over landfill disposal	11(7.5)	20(13.7)	-	32(21.9)	83(56.8)
Regularly monitors & reports on waste generation & disposal practices	13(8.9)	21(14.4)	3(2.1)	83(56.8)	26(17.8)

Source: Table by Authors (2024)

Inferential Analysis

This part was carried out to extend the results provided by the descriptive analysis. The researcher performed factor analysis in order to drop all poor loading items for both variables and later applied multiple regression analysis so as to measure the causal effect relationship between the dependent variables and independent variables, with respect to the study specific objectives.

Factor Analysis

Factor analysis was performed on the variables to prepare data for further analysis (see Table 4). Furthermore, this study used a cut-off of 0.5 for the factor loadings as demonstrated by Taherdoost et al. (2022), and Kalkbrenner (2021), that a minimum loading of 0.5 and above for items are considered to be very good. Hence, for each variable of independent variable (carbon emissions reduction, circular packaging and waste management) the attributes with acceptable factor loading which is above 0.5 were retained, then transformed to create new variables (carbon emissions reduction, and circular packaging) representing each independent variable which was used for further analysis.

Table 4: Component Matrix for Environmental Sustainability

Rotated Component matrix

	Component		
	1	2	3
V201a	*0.891*	-0.113	0.641
V201b	0.288	0.120	0.693
V201c	*0.767*	0.308	0.009
V201d	*0.706*	0.395	0.272
V201e	*0.853*	0.146	0.277
V202a	0.032	0.290	0.800
V202b	0.097	0.150	0.761
V202c	0.314	*0.863*	0.099
V202d	0.649	0.473	0.369
V202e	0.406	*0.628*	0.457
V203a	0.716	0.051	0.124
V203b	0.035	0.861	0.048
V203c	0.512	0.487	0.323
V203d	0.298	0.614	0.466

Source: Table by Authors (2024)

Regression Results

Multiple regression model was used to measure the influence of the independent variable on the dependent variable (firm performance). Before the presentation of coefficient, the researcher investigated the goodness of fit of the model and the assumptions of the multiple regression whereby the coefficient of correlation (R) value of 0.946 implied there is a stronger relationship between the variables. Further, the R-Square value (coefficient of determination) which presents how the variation in the dependent variable is explained by the independent variables was .895. This implies that 89.5 percent of variation in the firm performance is explained by the independent variables which are carbon emissions reduction and circular packaging. Furthermore, analysis of variance was used to assess the goodness of the multiple regression model. P-value was used as a criterion for the model fit whereby the overall model was statistically significant with a p-value of 0.000, indicating the model fit the data and was appropriate for use, meaning the independent variables affected the firm performance.

Regression Coefficients

The findings presented in Table 5 demonstrate a regression analysis that examines the effects of carbon emissions reduction and circular packaging on firm performance. The findings indicate that circular packaging has a significant positive impact on firm performance (B =0.167, t=4.619, p <0.001), suggesting that adopting circular packaging strategies contributes to performance improvements, likely by enhancing cost savings, reducing waste, and appealing to environmentally conscious consumers. In contrast, carbon emissions reduction shows a non-significant effect on firm performance (B=-0.026, t=−0.175, p=.236), indicating that its influence may be indirect or context-dependent. This result suggests that the relationship between carbon emissions reduction and firm performance may not be straightforward. The lack of statistical significance could imply that the influence of carbon emissions reduction on firm performance is indirect, mediated by other factors, or highly dependent on specific contextual variables such as industry type, regulatory environment, or stakeholder expectations. Further investigation into these potential moderating or mediating factors could provide deeper insights into the nuanced effects of carbon emissions reduction efforts on firm performance.

The results also highlight circular packaging as a significant driver of performance, while carbon emissions reduction may require supportive external factors, such as regulatory incentives or consumer awareness, to impact firm outcomes. These findings suggest that further research should explore the mechanisms through which different sustainability practices affect performance, offering insights into the strategic value of environmentally sustainable practices.

Generally, the findings in Table 5 revealed that the value of constant β_0 (0.384) presents the estimated change in the manufacturing firms' performance, thus, when other factors remain constant manufacturing firms' performance will increase by 0.384, which is statistically significant with a p-value 0.000. The study also, aimed to assess the influence of circular packaging on manufacturing firms' performance, the findings reveal a small positive effect of 0.167, which is statistically significant with a p-value 0.000. However, carbon emissions reduction was statistically insignificant (p-value > 0.05) indicating it has no influence on the manufacturing firms' performance. Lastly, according to the regression results, VIF was below 10 and Tolerance was above 0.2 hence, multicollinearity was not a concern.

The observed relationships may result from the distinct ways in which circular packaging and carbon emissions reduction interact with firm operations and market expectations. Circular packaging directly impacts operational efficiencies by minimizing resource use, reducing waste, and potentially lowering production costs, all of which can improve profitability and appeal to environmentally conscious consumers, leading to enhanced firm performance. Additionally, circular packaging aligns with increasing consumer and stakeholder demands for sustainable products, which can enhance brand reputation and competitiveness. On the other hand, carbon emissions reduction may have a less immediate or direct effect on firm performance, as it often requires substantial upfront investment and may not yield immediate cost savings. The benefits of carbon emissions reduction might be more pronounced in the long term, potentially depending on external factors such as regulatory policies, incentives, and public awareness, which are not yet at a level to make carbon reduction a direct contributor to firm performance in all contexts. This contradiction suggests that while circular packaging directly benefits a firm's operational and reputational metrics, the financial returns of carbon emissions reduction are more complex and may unfold steadily in response to broader industry and regulatory developments.

Table 5: Coefficients^a for Regression Model

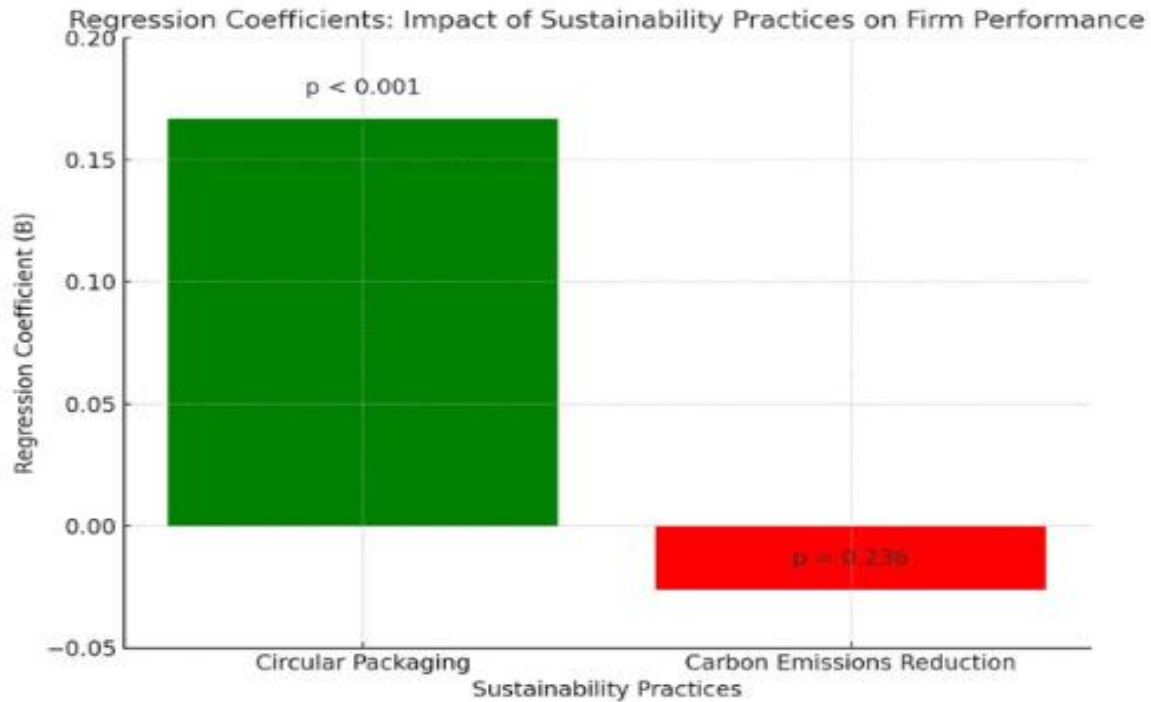| Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	0.384	0.106		3.622	0.000		
Carbon Emission Reduction	-0.026	0.054	-0.042	-0.175	0.236	0.303	3.301
Circular Packaging	0.167	0.036	0.241	4.619	0.000	0.278	3.597
a. Dependent Variable: Firm performance							

Source: Table by Authors (2024)

Figure 1: A Graphical Representation of the Regression Model's Findings

The graphical representation (Figure 1) highlights the regression coefficients for the impact of sustainability practices on firm performance. It shows two key practices: circular packaging and carbon emissions reduction. Circular packaging has a positive and statistically significant effect on firm performance, as indicated by the green bar ($p < 0.001$). This suggests that adopting circular packaging enhances firm performance. Conversely, carbon emissions reduction has a slightly negative effect, represented by the red bar, and is statistically insignificant ($p = 0.236$). This indicates that its impact on firm performance is negligible or potentially negative, and the relationship is not strong enough to be conclusive. Figure 1 effectively demonstrates the direction, magnitude, and statistical significance of the variables.

Discussion

The findings of this study reveal that manufacturing companies can significantly reduce their environmental impact by adopting sustainability practices similar to or more advanced than those implemented by TBL. Specifically, the study demonstrates that circular packaging practices positively affect manufacturing firms' performance. This underscores the value of using innovative packaging materials, providing clear disposal instructions, and implementing effective recycling processes. These practices enhance operational efficiency, boost competitive advantage, and increase profitability. This aligns with a previous study conducted by Aquilas et al. (2024) who argued that, there is a need for manufacturing firms to integrate circular economic activities in their operations which account for reducing waste associated with packaging hence mitigating environmental impacts. Furthermore, environmentally conscious packaging fosters a positive brand image, attracting environmentally-aware consumers and potentially leading to market share growth and higher revenue.

However, one of the key findings in this study, the non-significant impact of carbon emissions reduction on firm performance raises important questions. This finding contrasts with studies such as those by Nazir (2024) and Malokani et al. (2023), which suggest a positive relationship between carbon emissions reduction and firm performance, particularly in terms of enhanced customer satisfaction and operational efficiency. In contrast,

the current study points to external factors such as inadequate regulatory frameworks and enforcement, which might limit the effectiveness of carbon emissions reduction strategies. Alshiqi et al. (2022) similarly noted that in the absence of robust external support, including regulatory incentives, the impact of sustainability practices can be undermined, resulting in an insignificant correlation between emissions reduction and competitive advantage. The absence of direct financial returns from carbon reduction initiatives in developing countries, as highlighted by Aquilas et al. (2024), further intensifies this challenge, making firms less liable to prioritize such initiatives despite their long-term environmental benefits. This difference suggests that while carbon emissions reduction is undoubtedly important for long-term sustainability, its direct impact on firm performance in the short term may be lessened by external situational factors like regulatory inadequacies.

Additionally, the study emphasizes the significance of engaging stakeholders such as suppliers, customers, and communities in sustainability initiatives. This aligns with Aquilas et al. (2024), who argue that stakeholder involvement is essential in achieving the goals of circular economic activities, especially in the African context, where industrialization has led to environmental degradation. The collaborative nature of circular economic activities plays an essential role in reducing packaging waste and mitigating environmental impacts. The importance of stakeholder engagement also resonates with Abu-Bakar and Charnley (2018), who emphasize the need for incentives and support mechanisms to facilitate the widespread adoption of circular practices. In the Tanzanian context, where economic constraints are a significant barrier to the adoption of green practices, this study's findings support the arguments made by these scholars. Respondents in this study also identified cost-related challenges as major obstacles to adopting sustainable practices, including circular packaging and carbon reduction strategies. Therefore, addressing these economic constraints through subsidies, tax incentives, or partnerships could encourage broader adoption of circular packaging and carbon reduction strategies.

Conclusion

The study concludes that environmental sustainability has a subtle impact on manufacturing firms' performance. Circular packaging strategies stand out as a significant contributor, enhancing efficiency, reducing waste, and appealing to consumers. In contrast, the relationship between carbon emissions reduction and performance remains unclear, suggesting the need for further investigation into moderating factors. Future research should explore why practices like circular packaging have a stronger impact and assess the potential benefits of advanced waste management in reducing costs, boosting brand reputation, and ensuring regulatory compliance. These findings offer actionable insights for firms aiming to adopt sustainable and performance driven practices.

This study recommends that manufacturing firms prioritize environmental sustainability within their supply chains by investing in circular economic activities, such as innovative circular packaging and recycling processes, firms can secure a competitive edge, foster stronger stakeholder relationships, and enhance profitability. Specifically, adopting circular practices enables firms to reduce waste, optimize resource use, and respond to increasing consumer demand for sustainable products. By aligning their business models with environmental sustainability goals, companies not only contribute to the environment but also capitalize on long-term growth opportunities.

The study suggests that policymakers introduce specific and targeted incentives, such as tax relief for firms adopting green technologies, subsidies for companies investing in renewable energy solutions, and grants to support innovation in waste management and recycling technologies. These incentives would lower the financial barriers for firms, making it easier for them to invest in sustainable practices. Moreover, such initiatives would accelerate progress toward national environmental sustainability goals and create a more attractive business environment for environmentally sustainable practices. In Tanzania, for example, incentives like tax breaks for companies investing in solar power or waste-to-energy technologies could encourage the transition to more sustainable practices within the manufacturing sector.

Additionally, agencies should consider investing in research and development to drive innovation in sustainable technologies and provide resources that help firms implement environmentally friendly practices effectively. This could involve funding pilot projects that showcase the effectiveness of circular economy models or facilitating public-private partnerships to create scalable solutions. A favorable regulatory landscape, combined with public and private sector collaboration, would significantly promote environmental sustainability across industries, contributing to the broader transition toward a sustainable economy.

Furthermore, the study emphasizes the critical role of consumers in promoting environmental sustainability. By choosing products from companies with strong environmental sustainability commitments, consumers can directly support sustainable business practices. Moreover, consumers are encouraged to advocate for change by expressing their preferences for sustainable products and services to companies. For instance, consumers can demand clearer product labeling that highlights sustainable sourcing and eco-friendly production processes. By prioritizing and demanding environmentally sustainable products, consumers can send a powerful message to businesses, reinforcing that environmental sustainability is a critical factor in purchasing decisions. This collective action from consumers, government agencies, and businesses can foster a shift toward a more sustainable and responsible economy.

This study faced several limitations that may restrict the generalization of its findings. First, it focused on a single case study to assess the influence of environmental sustainability practices such as carbon emissions reduction, circular packaging, and waste management on supply chains and manufacturing firms' performance. This narrow scope made it challenging to determine whether the observed relationships apply to other firms with different characteristics, industries, or operating environments. Additionally, the study excluded financial performance metrics, limiting a comprehensive understanding of the overall impact of environmental sustainability practices. While non-financial measures provide valuable insights, financial indicators often offer a more complete view of organizational success. Given these limitations, future research should explore the influence of environmental sustainability practices across various industries and firm sizes, adopting a broader survey design that includes multiple firms. Furthermore, incorporating financial performance indicators could enhance understanding of the overall impact of these practices, providing a more holistic view of their role in supply chain and organizational performance.

Conflicts of Interest: The authors declare no conflict of interest.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author, [ELM], upon reasonable request

References

Abu-Bakar, H., & Charnley, F. (2024). Developing a strategic methodology for circular economy roadmapping: A theoretical framework. *Sustainability, 16*(15), 6682.

Alshiqi, S., Dogan, M., Cerci, H. S., & Koyluoglu, A. S. (2022). The Effect of Green Supply Chain Practices on the Firm Performance: An Empirical Research. *Eastern-European Journal of Enterprise Technologies, 118*(13). 61-67.

Aquilas, N. A., Ngangnchi, F. H., & Mbella, M. E. (2024). Industrialization and environmental sustainability in Africa: The moderating effects of renewable and non-renewable energy consumption. *Heliyon, 10*(4), 25681.

Braun, V., & Clarke, V. (2021). *Thematic Analysis: A Practical Guide*. SAGE Publications.

Changalima, I. A. (2024). The predicting role of sustainable supplier selection on lead-time performance in public procurement: relational capability as a moderator. *Journal of Public Procurement, 24*(3), 302-319.

Changalima, I. A., Mushi, G. O., & Mwaiseje, S. S. (2021). Procurement planning as a strategic tool for public procurement effectiveness: Experience from selected public procuring entities in Dodoma city, Tanzania. *Journal of Public Procurement, 21*(1), 37-52.

Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). SAGE Publications.

Delphinus, L., & Mwita, K. M. (2024). The Role Green Human Resource Management Practices on Environmental Performance: The Mediating Role of Perceived Organisational Support toward the Environment. *SEISENSE Journal of Management, 7*(1), 153-169.

Elias, R., & Changalima, I. A. (2024). The behavioural uncertainty and environmental sustainability of restaurant businesses: the moderating role of purchasing technical knowledge. *LBS Journal of Management & Research, 22(*1), 1-13.

Guest, G., Namey, E., & Chen, M. (2020). A simple method to assess and report thematic saturation in qualitative research. *PloS one*, *15*(5), e0232076.

Hennink, M., & Kaiser, B. N. (2022). Sample sizes for saturation in qualitative research: A systematic review of empirical tests. *Social Science & Medicine, 292*, 114523.

Hong, Z., & Xiao, K. (2024). Digital economy structuring for sustainable development: the role of blockchain and artificial intelligence in improving supply chain and reducing negative environmental impacts. *Scientific Reports, 14*(1), 3912.

Ismail, I. J., Amani, D., & Changalima, I. A. (2023). Strategic green marketing orientation and environmental sustainability in sub-Saharan Africa: Does green absorptive capacity moderate? Evidence from Tanzania. *Heliyon, 9*(7), e18373.

Jum'a, L., Zimon, D., & Ikram, M. (2021). A relationship between supply chain practices, environmental sustainability and financial performance: evidence from manufacturing companies in Jordan. *Sustainability, 13*(4), 2152.

Kalkbrenner, M. T. (2021). Enhancing Assessment Literacy in Professional Counseling: A Practical Overview of Factor Analysis. Professional Counselor, 11(3), 267-284.

Khamis, A. A., Munishi, E. J., & Issa, I. M. (2022). The Challenges Faced by Manufacturing Companies in Implementation of Green Supply Chain: Evidence from the Bakhresa Food Products Limited in Dar es Salaam–Tanzania. *International Journal of Social Science Research and Review,* 5(7), 69-81.

Lartey, T. A., Amankwah-Amoah, J., Danso, A., Adomako, S., Khan, Z., & Tarba, S. Y. (2021). Environmental sustainability practices and offshoring activities of multinational corporations across emerging and developed markets. *International Business Review, 30*(5), 101789.

Mahran, K., & Elamer, A. A. (2024). Chief Executive Officer (CEO) and corporate environmental sustainability: A systematic literature review and avenues for future research. *Business Strategy and the Environment, 33*(3), 1977-2003.

Malokani, D. K. A. K., Qureshi, A. A., Inayat, A., & Mahar, Q. (2023). Impact of Reduction of Waste and Waste, Green Employee Behavior and Reduction of Resource Use on Environmental Strategy: Manufacturing Companies top management's Perception. *Journal of Social Sciences Review, 3*(2), 27-39.

Mohajan, H. K. (2018). Qualitative research methodology in social sciences and related subjects. Journal of Economic Development, Environment and People, *7*(1), 23-48.

National Environmental Management Council (NEMC). (2023). *The 6ᵗʰ Scientific Conference on Wetland Management for Sustainable Development*. Arusha, Tanzania.

Nazir, S., Zhaolei, L., Mehmood, S., & Nazir, Z. (2024). Impact of green supply chain management practices on the environmental performance of manufacturing firms considering institutional pressure as a moderator. *Sustainability, 16*(6), 2278.

Nkwabi, J. M. (2019). Supply chain management constraints in Tanzanian small and medium enterprises. *African Journal of Business Management*, 13(16), 564-570.

Pallant, J. (2020). *SPSS Survival Manual: A step by step guide to data analysis using IBM SPSS* (7th ed.). New York, United States: Routledge.

Parmar, B. L., Freeman, R. E., Harrison, J. S., Wicks, A. C., Purnell, L., & De Colle, S. (2010). Stakeholder theory: *The state of the art. Academy of Management Annals, 4*(1), 403-445.

Pasupuleti, V., Thuraka, B., Kodete, C. S., & Malisetty, S. (2024). Enhancing supply chain agility and sustainability through machine learning: Optimization techniques for logistics and inventory management. *Logistics, 8*(3), 73.

Porter, M. E., & Linde, C. V. D. (1995). Toward a new conception of the environment-competitiveness relationship. *Journal of Economic Perspectives, 9*(4), 97-118.

Sanga, C. (2023). *Tanzania Breweries to reduce electricity cost by 15% from solar energy*. The Citizen. Dar es salaam, Tanzania.

Sarkis, J., Zhu, Q., & Lai, K. H. (2011). An organizational theoretic review of green supply chain management literature. *International Journal of Production Economics, 130*(1), 1-15.

Suleiman, M. A. (2023). The impact of tourism supply chain on sustainable performance in sub-Saharan Africa: evidence from Tanzania. *Management of Environmental Quality: An International Journal, 34*(2), 492-510.

Taherdoost, H., et al (2022). Exploratory factor analysis; concepts and theory. Advances in applied and pure mathematics, 27, 375-382.

Tan, C. L., Zailani, S. H. M., Tan, S. C., & Shaharudin, M. R. (2016). The impact of green supply chain management practices on firm competitiveness. *International Journal of Business Innovation and Research, 11*(4), 539-558.

Tanveer, A., Anwer, M. A., & Umar, M. (2021). The impact of environmental sustainability and financial resources utilization on firm financial performance: the mediating role of leadership styles. *Annals of Social Sciences and Perspective, 2*(2), 389-407.

Wiredu, J., Yang, Q., Sampene, A. K., Gyamfi, B. A., & Asongu, S. A. (2024). The effect of green supply chain management practices on corporate environmental performance: Does supply chain competitive advantage matter?. *Business Strategy and the Environment, 33*(3), 2578-2599.

World Bank. (2022). Tanzania Environment & Natural Resources Management Country Profile.

World Business Council for Sustainable Development (WBCSD). (2020). *Embracing a Better Future: 2020 Progress Report*. The WBCSD. HW Amsterdam, The Netherlands.

Zhang, Q., Cao, M., Zhang, F., Liu, J., & Li, X. (2020). Effects of corporate social responsibility on customer satisfaction and organizational attractiveness: A signaling perspective. *Business ethics: A European review, 29*(1), 20-34.