World Environment 2025, 15(1): 1-12
DOI: 10.5923/j.env.20251501.01

Factors Affecting Adoption of Green Packaging in Beverage Industries

Erick P. Massami[1,*], Godfrey R. Msae[2]

[1]Department of Maritime Transport Management, National Institute of Transport, Dar es Salaam, Tanzania
[2]Department of Logistics and Transport Studies, National Institute of Transport, Dar es Salaam, Tanzania

Abstract Despite the continued growth in importance, the packaging sector remains responsible for environmental degradation and climate change due to its key role in terms of hazardous waste. The purpose of this study is to assess the factors affecting adoption of green packaging in beverage industries based on the adapted PESTEL framework. The study uses both purposive sampling and stratified random sampling techniques. The purposive sampling was used to select two beverage companies whereas the stratified sampling technique was used to select the 80 respondents from the pre-identified strata for each beverage company. The SPSS (Version 27) was used to test the significance of hypothesized relationships. The results of the analysis show that socio-economic factors, and regulatory factors have a significant and positive effect on adoption of green packaging. Meanwhile the socio-economic factors have the most effect, suggesting the importance of social and economic support for successful adoption of green packaging. The positive and significant effect of regulatory factors, highlight the role of government policies and regulations towards the adoption of green packaging. However, technological factors show an insignificant positive effect, revealing limited focus on green technologies. Thus, beverage companies should put more emphasis on the use of green technologies. This calls for all stakeholders to take corrective actions for effective adoption of green packaging in beverage industries.

Keywords Green Packaging, Socio-economic Factors, Regulatory Factors, Technological Factors, Beverage Industries

1. Introduction

Packaging plays a crucial role in protecting, preserving and marketing products during their transport, storage and use [1]. It is also a prime component of branding, showcasing a product's identity and contributing to brand loyalty. However, used packaging products and their production processes are harmful to the environment. Packaging is a major source of non-biodegradable garbage that negatively impacts on the environment [2]. Thus, consumers and governments are nowadays taking initiatives to encourage manufacturing firms to decrease waste and over-packaging, and increase recyclability. More specifically, government regulations are being enforced and countries around the globe are adopting means of promoting environmental policies in order to mitigate pollution by improving environmental performance and increasing efficiency [3]. Green packaging plays a key role by minimizing the environmental impact of packaging through the use of materials and processes that are less harmful to the environment. This includes limiting the amount of packaging materials to reduce waste, using recyclable or biodegradable materials, and using renewable energy in production.

Despite of growing awareness of the importance of green packaging, the beverage industry still struggles with effective adoption of green packaging. The ineffective adoption of green packaging is aggravated by several factors that act as barriers to green supply chain management (GSCM). The lack of comprehensive understanding of the factors affecting adoption of green packaging, hinders the development and implementation of green packaging strategies. There is a knowledge gap of the faced constraints on adoption of green packaging within beverage industries [2]. Consequently, the lack of clarity on the factors affecting adoption of green packaging in beverage industries has resulted in missed opportunities for companies to enhance their environmental performance through cost reduction, consumer satisfaction, use of sustainable materials, enhance technology and meet regulatory requirements. Without a clear understanding of the factors affecting adoption of green packaging, beverage companies may struggle to develop and implement viable sustainability initiatives [4]. Understanding the factors and their effect on green packaging adoption is crucial for driving meaningful change towards sustainability. Despite the considerable efforts devoted to making changes in the packaging supply chain, there have been limited investigations of adoption of green packaging in beverage industries in

* Corresponding author:
erick.massami@nit.ac.tz (Erick P. Massami)
Received: Jun. 10, 2025; Accepted: Jul. 6, 2025; Published: Jul. 25, 2025
Published online at http://journal.sapub.org/env

Tanzania. The aim of this study is to assess the factors affecting adoption of green packaging in the beverage industries in Tanzania.

Studies exploring the role of green packaging on minimizing the environmental damage are not hard to find globally. Many studies strongly support the assertion that enhancing green packaging reduces environmental impact [2,5,6,7,8,9,10]. Imbambi and Kinoti [11] articulate that the behaviour of manufacturing firms towards sustainable packaging is a complex interplay of socio-economic factors, regulatory factors, and technological factors. Thus, understanding the influence of these factors is crucial for beverage companies, policy makers, and environmental advocates in order to promote eco-friendly packaging.

Despite the numerous studies that have examined the roles of socio-economic factors, regulatory factors, and technological factors, insufficient evidence exists on the direct relationship and significance of each dimension in the perspective of green packaging. More specifically, there is no study that has examined the factors affecting adoption of green packaging in beverage industries in Tanzania. Given the importance of these dimensions and the contradicting views in the literature, this study seeks to examine the existence of the relationship and the significance of each dimension on adoption of green packaging. Therefore, the key research question is:

To what extent do socio-economic factors, regulatory factors, and technological factors affect the adoption of green packaging?

With insights from the PESTEL framework, this study advances knowledge of existing literature in green packaging by revealing the existence of relationship and significance of each dimension of adoption of green packaging. Logistics and supply chain managers can identify areas of improvement within their settings and be able to offer services that are in line with the United nations sustainable development goals (SDGs). The rest of this paper is organized as follows: Section 2 presents the theoretical and empirical review; The research methodology is presented in section 3; Section 4 presents the results and discussion; and section 5 presents the conclusion and implications of the findings.

2. Theoretical and Empirical Review

2.1. Theoretical Review

There are several theories and frameworks that can be used to analyse the external environment including the PESTEL framework, Porter's five forces model, Industry life cycle model, and Contingency theory. Despite the contribution of the other theories, the PESTEL framework gives highly integrated framework that groups external environmental influences into political, economic, social, technological, and legal factors. Consequently, PESTEL framework is adapted by this study.

The PESTEL framework was developed by Aguilar [12] as a strategic management tool that help firms to identify and evaluate the threats and opportunities in the external environment. The external factors can have dramatic effects on firm strategy. A change in any one of these factors can lead to the transformation of industries. Thus, a beverage firm can attain a competitive advantage provided it monitors and reviews the trends of these factors more promptly than its competitors. While the framework consists of six factors, it is crucial to use it based on integrated view of trends and changes. The rationale behind this framework is to provide a comprehensive understanding of the external influence on firm's strategic decision-making and overall performance. By assessing factors within the political, economic, social, technological, environmental, and legal spheres, firms can gain insights into potential opportunities and threats, enabling them to make more informed choices and adapt effectively to their outside-in influences.

The PESTEL framework has been used in a wide range of studies in recent years [13,14,15]. Torkelis et al. [16] use a PESTEL analysis to assess six critical factors: political, economic, socio-cultural, technological, ecological, and legal that influence the recycling of plastic and composite packaging waste. The findings reveal the robustness of the framework since it gives the key deficiencies within the recycling system for plastic and composite packaging waste, including inadequate technological capacity, the underdevelopment of the secondary polymer market, and the lack of ambitious political targets. Turkyilmaz et al. [17] argue that the PESTEL framework is useful for understanding the external factors that influence societal altitudes, market demand, regulatory requirements, technological advancements, and recycling processes. It is worth noting that the development of one of these PESTEL factors influences the development of others [18,19,20]. Matović and Arsić [21] present the use and the importance of PESTEL framework for the analysis of ecological factors in business environment. The findings help firms to improve their ecological performances through more efficient use of opportunities and elimination of threats. Another study in the same direction is by Puglieri et al. [22] who use PESTEL framework to review circular economy trends, opportunities, and threats in Brazil. Polat and Güngör [23] use PESTEL framework to foster collaborative planning and to ensure that the logistics framework aligns with social, economic, and environmental objectives in Izmir city. Gasde et al. [24] use PESTEL framework to identify drivers and barriers of the implementation of tracer-based-sorting (TBS) as an innovative identification technology in plastics packaging. The PESTEL framework is used to investigate the key challenges and opportunities of using recycled polyethylene terephthalate (rPET) for food contact packaging in Thailand [25]. Thus, the PESTEL framework is useful in assessing the external factors that influence market demand, societal attitudes, regulatory requirements, and technological advancements. In this study, the political and legal factors are combined to form regulatory factors since political influences are exhibited in government regulations; the economic and social factors are combined to form socio-economic factors. The environmental influence

is mirrored in green regulations and green technology. Consequently, the PESTEL framework is adapted to give the following external factors affecting adoption of green packaging: socio-economic factors, regulatory factors, and technological factors.

2.2. Empirical Review

The main objective of this study is to assess the effect of socio-economic factors, regulatory factors, and technological factors on adoption of green packaging. An in-depth understanding of the significance of a particular influential factor on adoption of green packaging helps logistics and supply chain managers to formulate strategies to enhance green packaging which in turn would attract more environmentally conscious consumers and drive demand for sustainable packaging. Thus, the research model in Figure 1 is developed based on the reviewed literature to illustrate the relationship between the predictors and the responsive variable of the study. The model has four variables: socio-economic factors, regulatory factors, technological factors, and adoption of green packaging. Socio-economic factors, regulatory factors, and technological factors are predictors whereas adoption of green packaging is a responsive variable.

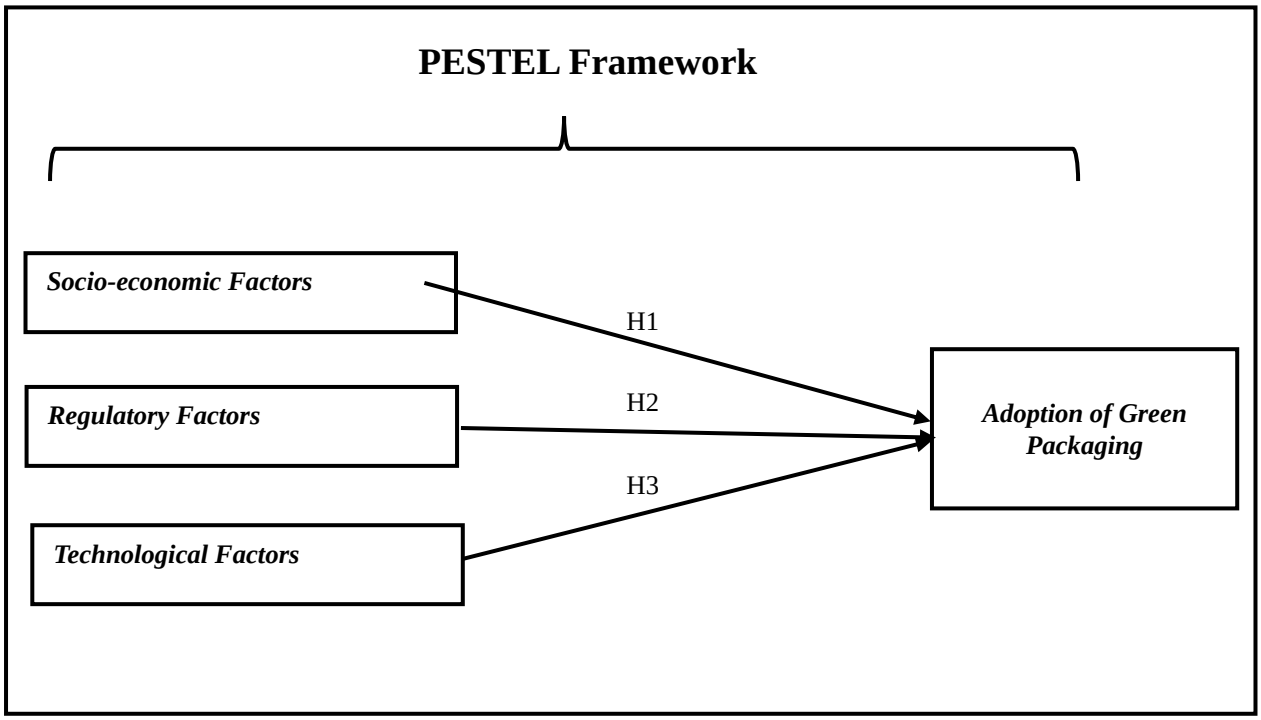

Figure 1. Research model **(*Source*:** *Literature review*)

2.2.1. Socio-Economic Factors and Adoption of Green Packaging

Socio-economic factors significantly affect the adoption of green packaging. Consumers' willingness to pay more for eco-friendly packaging is influenced by dimensions like norms, attitudes, environmental concerns, and demographics like education and household size. Enhancing public awareness and education about the environmental impact of packaging materials, along with incentivizing businesses to develop innovative eco-friendly alternatives, can collectively steer consumers towards more sustainable choices. Boz et al. [8] indicate that individuals are more likely to adopt sustainable packaging if their peers, family, or social circles promote such behaviour. Most firms are nowadays seeking to follow sustainable business practices because they have realised that consumers are more concerned about the environment and it will be a wise step to start practising sustainability [26]. In addition, firms are discovering that showing social awareness will enhance the brand loyalty and improve brand image [26].

The relationship between socio-economic factors and adoption of green packaging has been investigated in several studies albeit with mixed conclusions. Consumer altitudes such as social norms and cultural values have a significant positive influence on the adoption of green packaging [27]. Wondosell et al. [28] argue that firm commitments to corporate social responsibility (CSR) significantly and positively influences the adoption of green packaging. This is in line with the views of Rizos et al. [29] who argue that environmentally conscious consumers, particularly those with higher education and income, drive demand for adoption of green packaging. Many researchers assert that socio-economic factors have a positive influence on the use of sustainable packaging [5,6,8,26,30,31,32,33,34,35]. However, the high cost of green products has been identified as a deterrent to adoption of green packaging [8,36]. Isa and Yao [1] investigate the preference for green

packaging in consumer product choice and find that there is a positive but not significant relationship between green packaging and consumer product choice. Based on the identified contrasting views, this study assesses the effect of socio-economic factors on adoption of green packaging. Thus, this study proposes that:

H1: Socio-economic factors have a significant positive effect on adoption of green packaging.

2.2.2. Regulatory Factors and Adoption of Green Packaging

Government regulations and policies serve as crucial drivers for promoting green packaging practices. Generally, stringent environmental regulations encourage firms to adopt sustainable innovations, including eco-friendly packaging solutions. Zhang and Zhao [4] posit that green policies create a conducive environment for firms to prioritize sustainability in their operations, aligning with societal expectations. Legislative and compliance requirements impose obligations on firms to adhere to specific environmental standards, thereby influencing their packaging decisions. Regulatory frameworks such as Extended Producer Responsibility (EPR) programs require producers to manage the end of life disposal of their packaging materials, incentivizing the adoption of recyclable and biodegradable packaging alternatives. Compliance with such regulations drives firms to invest in sustainable packaging solutions to mitigate environmental impacts and avoid penalties [37].

Many scholars support that regulatory factors play a crucial role on sustainable packaging [3,4,11,31,38,39]. However, regulatory frameworks are still developing, resulting in uncertainties on specific scopes and targets. For instance, while European countries are implementing stringent regulations on unsustainable packaging [2], regulations are still underdeveloped or leniently enforced in developing countries. Studies reveal that stricter environmental laws and government incentives encourage firms adopt eco-friendly packaging resulting into reduced waste and improved environmental performance. For instance, government policies that impose taxes on non-recyclable packaging or mandate recycling targets put pressure on firms to innovate sustainable packaging [40]. However, excessive regulatory burdens may impose challenges for smaller firms, making compliance costly and potentially stifling innovation. More specifically, the extent of regulatory factors on adoption of green packaging in the perspective of the current study is not clear. To address this gap, this study assesses the effect of regulatory factors on adoption of green packaging. Thus, the following hypothesis is proposed:

H2: Regulatory factors have a significant positive effect on adoption of green packaging.

2.2.3. Technological Factors and Adoption of Green Packaging

Technological factors focus on advancements in technology and their impact on industries, including new products, processes and innovations. Technological advancements play a significant role in the adoption of green packaging by improving both production efficiency and sustainability. Key technological drivers include innovations in bio-plastics, recycling technologies, and smart packaging systems. These technologies help manufacturers reduce environmental impacts while maintaining product functionality. For instance, firms are exploring bio-based materials such as polylactic acid (PLA) and polyhydroxyalkanoates (PHA) as alternatives to conventional plastic. The adoption of circular economy principles supported by technology is a driver of green packaging initiatives. In addition, the use of Internet of Things (IoT) technologies enables better tracking and monitoring of recyclable materials, supporting sustainable packaging life cycle [36]. However, challenges like high production costs and scalability hinder widespread adoption.

The technological factors have been found to have a positive effect on adoption of green packaging [1,2,24,30,41,42]. However, these studies they don't show clearly the extent of relationship between the technological factors and adoption of green packaging. In addition, Agyeman [6] argue that technological factors don't yield significant effects towards adoption of green packaging. This view is supported by Ahmed and Varshney [43] who argue that the integration of digital solutions like smart packaging and block chain technology do not enhance sustainability. Therefore, this study seeks to assess the effect of technological factors on adoption of green packaging. Thus, the following hypothesis is proposed:

H3: Technological factors have a significant positive effect on adoption of green packaging.

3. Research Methodology

3.1. Research Design

This study adopted a positivism research philosophy to explain the extent of how socio-economic factors, regulatory factors, and technological factors enable beverage firms to adopt green packaging. The positivism philosophy is rooted on the predefined theory and hypotheses which are used to examine the cause-and-effect relationships between the predictors and response variable [44]. In order to test the hypotheses, a research design was crafted. The research design is a plan that outlines how a study will be conducted to answer a specific research question [44]. It is a blueprint for data collection, measurement and analysis to address the research problem. This study employed a quantitative research design based on explanatory purpose. The choice of the quantitative research is based on the fact that it examines the relationships between variables, which are measured numerically and analysed using a range of statistical and graphical techniques [44]. In addition, considering the devised research question(s) (i.e. objectives), cross-sectional study based on a survey strategy was carried out and involved the collection of quantitative data and testing of hypotheses while ensuring high levels of validity and reliability of findings.

Existing literature has operationalized external factors in six variables: political factors, economic factors, social factors, technological factors, environmental factors, and legal factors [13,14,15,16]. In this study, the social and economic factors are combined to form socio-economic factors. On the other hand, the political and legal factors are integrated to form regulatory factors since political influences are reflected in government regulations. Also, the environmental influences are echoed in green regulations and green technology. Hence, this study operationalized factors affecting adoption of green packaging in beverage industries using three predictor variables, namely socio-economic factors, regulatory factors, and technological factors. The research model in Figure 1 presents the relationship among four reflectively measured latent variables namely, socio-economic factors, regulatory factors, technological factors, and adoption of green packaging. Socio-economic factors, regulatory factors, and technological factors are predictor variables whereas adoption of green packaging is a response variable.

The operational definition of socio-economic factors is "the social and economic circumstances that influence the adoption of green packaging in beverage industries". These factors encompass various aspects, including income, education, occupation, and the broader community environment. For effective adoption of green packaging based on socio-economic factors, beverage firms should research on person's or household's financial resources; customers' level of formal education and the skills, customers' income and occupation; and the social and physical environment where customers live.

Regulatory factors are "government policies, laws, regulations, and industry standards that beverage firms must adhere to". For instance, environmental regulations which focus on packaging design and materials. For effective adoption of green packaging based on regulatory factors, beverage firms should comply with regulations which limit the amount of packaging material used; opt for materials like recycled paper; biodegradable plastics, plant-based materials; and use renewable energy sources during production process.

Technological factors are "influences related to equipment, software, and processes within a beverage firm that affect its operations and ability to innovate". These factors encompass automation, new technologies, and advancements in production techniques. For effective adoption of green packaging based on technological factors, beverage firms should adopt technologies which limit the amount of packaging material; design packaging to be reusable or easily recycled; and optimize processes to conserve energy.

Adoption of green packaging refers to "the process of beverage firms transitioning to packaging materials and methods that minimize environmental impact". It addresses the environmental concerns associated with traditional packaging by using recyclable, biodegradable or reusable materials, reducing waste, and optimizing production processes to conserve resources. For effective adoption of green packaging, beverage firms should choice materials like recycled paper, biodegradable plastics or plant-based materials over traditional plastics; minimize the amount of packaging used and creating packaging that is easily recycled or composted; adopting reusable packaging solutions like containers or packaging that can be used multiple times; implement processes that conserve energy and resources during production of green packaging; and educate consumers about the benefits of green packaging and encourage their participation in recycling and composting. To get rid of computational errors, all variables were measured based on multi-item indicators of five-point Likert scale ranging from 1=strongly disagree to 5=strongly agree [45,46].

3.2. Target Population, Sampling Techniques, and Data Collection Procedures

The target population comprised 390 staff, 298 staff from Coca-Cola Kwanza Ltd and 92 staff from Sayona Drinks Ltd. The two Tanzanian companies were purposively selected due to their market share in the beverage industries. The units of analysis consisted of relevant departments/sections, while units of inquiry comprised officers who play a key role in the adoption of green packaging. The respondents included: logistics officers, marketing officers, environmental officers, and production officers. The units of inquiry were used to represent departments'/sections' interests in the study aspects rather than personal views. Sample size was obtained by using the Slovan's formula, $n=N/[1+N(e)^2]$ where, n=sample size, N=population size, and e=acceptable sampling error [47]. Based on the nature of the study, a 10% margin error was assumed and a 90% confidence interval was allowed to obtain the maximum sample size. The sample size of this study was $n=390/[1+390(0.1)^2]$ =80 respondents. Consequently, the sample consisted of 61 respondents from Coca-Cola Kwanza Ltd and 19 respondents from Sayona Drinks Ltd.

Considering the constraints of time and other resources, a stratified sampling technique based on simple random sampling was used to select respondents from four departments /sections of the Coca-Cola Kwanza Ltd and Sayona Drinks Ltd, namely, Logistics, Marketing, Environment, and Production. The departments/sections were purposively selected, based on the fact that they are the ones responsible for adoption of green packaging. In each stratum, respondents were selected using the fishbowl draw procedure [48]. There are two types of data, namely, primary and secondary data. The primary data are the first-hand data that are collected directly from the respondents for the first time whereas secondary data are adopted from existing data sources. In this research, secondary data were collected by examining records such as relevant research papers, journals, reports, and government publications. Primary data, on the other hand, were collected using closed-ended survey questionnaire. The closed-ended questionnaires were chosen because they are cost-effective and time efficient and thus, enabled the collection of data from a large sample. The aim of this study

is to assess the factors affecting adoption of green packaging in the beverage industries, with Coca-Cola Kwanza Ltd and Sayona Drinks Ltd serving as units of analysis.

Before data collection, a preliminary (i.e. pilot) data collection was carried out whereby few questionnaires were administered to the purposively selected staff to assess the content validity. Their feedback helped to refine the research instrument to give clarity of questions in the questionnaire. The Cronbach's alpha was used to measure the indicators internal consistency reliability. Generally, an alpha value (α) above 0.70 is considered acceptable. Using SPSS software version 27, the results of the reliability test were promising: Socio-economic factors (α=0.810), Regulatory factors (α=0.870), Technological factors (α=0.750), and Adoption of green packaging (α=0.885). When undertaking data collection exercise, questionnaires with request letters, specifying the purpose of the research, respondents' roles, and guaranteed confidentiality were sent to potential respondents for onsite completion. The collected data were coded into IBM SPSS 27 (.csv) data file. All 80 survey questionnaires were filled, making a 100% response rate. Based on the previous studies: 77% [49] and 73% [50], the response rate is considered very high and acceptable. Table 1 presents the demographic profile of respondents.

Table 1. Demographic profile of respondents

Category	Variable	Frequency	Percentage
Gender	Male	51	63.7%
	Female	29	36.3%
	Total	**80**	**100%**
Age Group	18-30 years	19	23.8%
	31-40 years	39	48.7%
	41-50 years	15	18.7%
	51 years and above	7	8.8%
	Total	**80**	**100%**
Education Level	Primary Education	1	1.3%
	Secondary	11	13.7%
	Certificate/Diploma	27	33.7%
	Degree	38	47.5%
	Master's	3	3.8%
	Total	**80**	**100%**
Department/ Section	Logistics	14	17.5%
	Marketing	39	48.7%
	Environment	2	2.5%
	Production	25	31.3%
	Total	**80**	**100%**

Source: Field Data (2025)

3.3. Data Analysis Method

Data analysis entailed examination of the relationship between indicators and variables, and the hypothesized relationships [51,52].

In this study, the relationship between predictor variables and response variable was modelled as Multiple Linear Regression Model as given by equation (1).

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon \quad (1)$$

Where Y: Adoption of green packaging, $\beta_k | k \in \{0,1,2,3\}$: Regression coefficient, ε: the error term, X_1: Socio-economic factors, X_2: Regulatory factors, X_3: Technological factors. IBM SPSS (version 27) was used to estimate the model. The choice was based on the benefits provided by this software such as presence of user-friendly interface, ability to handle a wide range of statistical tests, possession of advanced data management capabilities, ability to present graphical output, and compatibility with other software [53]. In addition, the software can handle different regression models (e.g. Multiple linear regression). Furthermore, it has the ability to implement many latest modules without difficulties.

3.4. Interpretation of the Model Parameters

The correlation coefficient (R-Value) indicates the relationship between the predictor variables and response variable. The R-Value ranges from -1 to 1. If R=-1, then there exists a perfect negative relationship between the predictor variables and response variable; If R=0, then there is no relationship between predictor variables and response variable; If R=1, then there exists a perfect positive relationship between the predictor variables and response variable. The coefficient of determination (R^2) provides the proportion of the variance in the adoption of green packaging that is explained by the factors of the adapted PESTEL framework. The P-Value (Probability value) whose value lies in the closed interval $[0, 1]$, gives the lowest significance at which the alternative hypothesis is accepted meanwhile the null hypothesis is rejected. Thus, if the P-Value $< \alpha$ (level of significance), the alternative hypothesis is accepted. The F-value is a test for statistical significance of the regression equation which shows whether the developed linear regression model fits the data better than the other model which doesn't contain the existing predictor variables [54]. By rule of thumb, an F-Value of greater than 4.0 is usually statistically significant. Given the level of significance α corresponding to the confidence interval $[I_1, I_2]$ and if ∄ t-Value $\in [I_1, I_2]$, then the t-Value can explain the changes in the response variable and hence the null hypothesis is rejected in favour of the alternative hypothesis [55]. For instance, in order to confirm the existence of significant relationship at $\alpha = 5\%$, the t-Value > 1.96 [56]. The beta coefficient (B_k) refers to the degree of change in the response variable for every 1-unit of change in the predictor variable. It should be noted that for the significance testing of beta coefficient, t-test is used. If the beta coefficient is positive ($B_k > 0$) and significant, then for each 1-unit increase in the predictor variable (X_k), the response variable (Y) increases by the beta coefficient value (B_k). If the beta coefficient is negative ($B_k < 0$) and significant, then for each 1-unit increase in the predictor variable, the response variable decreases by the beta coefficient (B_k).

4. Results and Discussion

4.1. Results

The general objective of the study is to assess the factors affecting the adoption of green packaging using selected firms in beverage industries in Tanzania. In order to achieve this objective, the predictor variables (Socio-economic factors, Regulatory factors, and Technological factors) were regressed against adoption of green packaging. Using the SPSS (Version 27) software, the values of model parameters and coefficients were deduced.

The model summary is presented in Table 2 which contains the values of R, R-squared, Adjusted R-squared and Standard Error of the Estimate (SE). The model shows a strong fit with an R-value of 0.688 implying that there is a moderately strong positive correlation between the predictor variables (i.e. Socio-economic factors, Regulatory factors, Technological factors) and responsive variable (i.e. Adoption of green packaging). The findings are in concomitant with the views of other scholars who articulate that socio-economic, regulatory and technological factors positively influence the adoption of green packaging [5,8,11,38,57,58].

From Table 2, the coefficient of determination (R-squared =0.473) indicates that 47.3% of the variation in the adoption of green packaging in beverage industries is explained by the three factors (Socio-economic factors, Regulatory factors, and Technological factors). Other factors, therefore, explain the remaining 52.7%. These factors could be investigated by future studies. On the other hand, the Analysis of Variance (ANOVA) at 5% level of significance gave the values of the parameters as indicated in Table 3.

In Table 3, the value of the computed F is greater than 4.0 ($F_{comp} = 22.754 > 4.0$). Thus, the developed regression model is significant in predicting the effect of external factors on adoption of green packaging.

On the other hand, the regression coefficients, t-values, and levels of significance are presented in Table 4. Using regression coefficients in Table 4, equation (1) becomes equation (2).

$$Y = -0.744 + 0.471X_1 + 0.139X_2 + 0.179X_3 + \varepsilon \quad (2)$$

Where Y: Adoption of green packaging, ε: the error term, X_1: Socio-economic factors, X_2: Regulatory factors, X_3: Technological factors. From equation (2), a number of findings are established.

If the external factors are not considered, the adoption of green packaging is 74.4% below standards; a unit increase in socio-economic status results into 47.1% adoption of green packaging; a unit increase in green policies/regulations result into 13.9% adoption of green packaging; and a unit increase in packaging technology results into 17.9% adoption of green packaging in beverage industries. This implies that socio-economic status, green policies/regulations, and packaging technology play a key role in adopting green packaging. Consequently, the beverage firms should craft and implement strategies to effectively adopt green packaging. More specifically, the proposed strategies should take one or more of the following benefits: diminished reliance on fossil fuels, reduced use of natural resources, increased use of recycled products, more energy-efficient manufacturing methods, increased use of renewable resources, and cleaner and safer oceans.

Table 2. Modal summary

Model	R	R Squared (R^2)	Adjusted R Squared (R_{aj}^2)	Std. Error of the Estimate
1	0.688[a]	0.473	0.452	0.378

a. *Predictors*: Constant, Socio-economic factors, Regulatory factors, Technological factors.

Table 3. Analysis of variance (ANOVA)

Model		Sum of Squares (SS)	df	Mean Square (MS)	F-Value	Sig.
1	Regression	9.730	3	3.243	22.754	0.000[b]
	Residual	10.833	76	0.143		
	Total	20.563	79			

b. *Predictors:* Constant, Socio-economic factors, Regulatory factors, Technological factors.

Table 4. Regression coefficients, standard error, t-values and levels of significance (p-values)

Model		Unstandardized Coefficients		Standardized Coefficients	t-Value	p-Value
		B	Std. Error	Beta		
1	(Constant)	-0.744	0.358		2.078	0.041
	Socio-economic factors	0.471	0.118	0.447	3.999	0.000
	Regulatory factors	0.139	0.052	0.239	2.676	0.009
	Technological factors	0.179	0.124	0.164	1.441	0.154

The envisaged strategies for effective adoption of green packaging include dematerialization and material efficacy: Reducing packaging material use to minimize landfill and carbon footprint; Biodegradable packaging: Using packaging made from plant-based sources which breakdown completely in a composting environment, turning into nutrient-rich soil instead of lingering in landfills; Education and behaviour: The full potential of sustainable packaging can only be realized when consumers understand and engage with the process; Reusable packaging: Promises better efficiency and material use since the packaging can be used hundreds or thousands of times, instead of discarded after a single use. However, reusable packaging systems require additional logistics infrastructure (reverse logistics) to collect, wash, and redistribute the packaging. Furthermore, the beverage firms should continuously allocate resources for research and development (R & D) to create genuinely eco-friendly packaging products aligning with various United Nations Sustainable Development Goals (UN SDGs): SDG 7 (Affordable and clean energy), SDG 9 (Industry innovation and infrastructure), SDG 11 (Sustainable cities and communities), SDG 12 (Responsible consumption and production), and SDG 15 (Life on land). The existence of a positive relationship between each of the external factors and adoption of green packaging is confirmed by the p-values and t-values.

In Table 4, $\beta = 0.471 \neq 0, p = 0.000 < 0.05$, $t = 3.999 > 1.96$, implies that socio-economic factors significantly and positively affect adoption of green packaging since beta coefficient is greater than 0, p-value is less than 0.05 and t-value is greater than 1.96. The findings are supported by many scholars who argue that the social and economic factors have a significant positive influence on adoption of green packaging [5,6,8,26,30,31,32,33].

Based on beta coefficient, p-value and t-value in Table 4, regulatory factors ($\beta = 0.139 \neq 0, p = 0.009 < 0.05$, $t = 2.676 > 1.96$) significantly and positively affect adoption of green packaging as the beta coefficient is greater than 0, p-value is less than 0.05 and t-value is greater than 1.96. These findings mirror the results of studies conducted by many researchers who posit that green policies and laws play a key role on sustainable packaging [3,4,11,31,38,39].

In regard to beta coefficient, p-value and t-value in Table 4, technological factors ($\beta = 0.179 \neq 0, p = 0.154 > 0.05$, $t = 1.441 < 1.96$) have positive but not statistically significant effect on adoption of green packaging since the beta coefficient is greater than 0, p-value is greater than 0.05 and t-value is less than 1.96. The positive value of a beta coefficient suggests a positive effect albeit not statistically significant. These findings are supported by Agyeman [6] who articulate that technological factors don't yield significant effect on adoption of green packaging. However, this contradicts with the views of some scholars who argue that technological advancement has a significant positive effect on adoption of green packaging [1,2,24,38,41,42]. Consequently, more studies are welcome for further investigation in different research settings.

4.2. Discussion

This study was guided by the adapted PESTEL framework and it involved the testing of three hypotheses, namely H1, H2 and H3. The hypotheses H1 and H2 were supported since the p-value was less than 0.05 and the t-value was greater than 1.96 meanwhile the hypothesis H3 was not supported since the p-value was greater than 0.05 and the t-value was less than 1.96. However, All the three hypotheses revealed a positive direct effect since the beta value was greater than 0. The findings confirmed a significant positive effect of socio-economic factors and regulatory factors on adoption of green packaging. Thus, these variables play a key role for effective adoption of green packaging in beverage industries. The results of the hypotheses test are discussed in the next sub-sections.

4.2.1. Relationship between Socio-Economic Factors and Adoption of Green Packaging

This study reveals the existence of a significant positive relationship between socio-economic factors and adoption of green packaging. The findings are supported by many scholars who assert that socio-economic factors have a positive influence on the use of sustainable packaging [5,6,8, 26,30,31,32,33]. Generally, consumers' willingness to pay more for sustainable packaging is influenced by dimensions like norms, attitudes, environmental concerns, and demographics like education and household size. Thus, beverage firms when analyzing the intention and behaviour of using green packaging, it is very crucial to consider of the social, cultural and psychological factors since they have a significant impact on the shopping behaviour [11]. If customers' socio-status are improved, beverage firms will be able to effectively adopt green packaging [28,34,35]. Based on this view, Pālsson and Molina-Besch [33] argue that both internal and external collaborations are the nuts and bolts for successful green packaging development. During development stage of the packaging life cycle, beverage firms need to collaborate with customers and other stakeholders to obtain features that will enhance the adoption of green packaging. Thatte and Rao [59] expound that the co-creation of marketing strategies with existing and potential customers improves the time to market green products.

4.2.2. Relationship between Regulatory Factors and Adoption of Green Packaging

Also, this study indicates the existence of a significant positive effect of policies and regulations on adoption of green packaging. The outcome suggests the need of engaging the government in sustainable packaging solutions. The positive effect of regulatory factors on adoption of green packaging is echoed in various studies [3,11,31,38,39]. Green policies and regulations serve as crucial drivers for promoting green practices. Zhang and Zhao [4] demonstrate that stringent environmental regulations encourage firms to adopt sustainable innovations, including eco-friendly packaging solutions. These policies and regulations significantly shape

how firms prioritize sustainability in their supply chains, aligning with societal expectations. The government can choose different policy instruments such as levies and bans. For instance, government policies that impose taxes on non-recyclable packaging or mandate recycling targets put pressure on firms to innovate sustainable packaging [40]. Furthermore, the adoption of a high tax rate results in zero consumption of products using non-sustainable packaging since the new price including tax exceeds the maximum consumer willingness to pay.

4.2.3. Relationship between Technological Factors and Adoption of Green Packaging

On the other hand, the study indicates the existence of a positive but insignificant relationship between use of green technology and adoption of green packaging. This means that green technology has no statistically significant effect on the adoption of green packaging. The findings are supported by Ahmed and Varshney [43] who argue that the integration of digital solutions like smart packaging and block chain technology do not enhance sustainability. This view is in line with Agyeman [6] who argue that technological factors don't yield significant effects towards adoption of green packaging. Contrastingly, the technological factors have been found to have a positive effect on adoption of green packaging [1,2,24,38,41,42]. This agrees with the findings of Kajula [41] who explicate that food and beverage supply chain management should take measure on protecting the environment by applying innovation technology on sustainable packaging. In addition, Mohammad and Zakersalehi [34] elucidate that product label has a positive and significant relationship with consumer product choices. Consequently, government policies and corporate social responsibility (CSR) are key drivers in adopting green technologies. Technology adoption not only supports sustainability goals but also addresses cultural and consumer expectations which differ significantly across the globe. In this case, beverage firms adopting green packaging should align their strategies with varying local preferences while leveraging digital innovation to streamline processes and minimize supply chain cost.

5. Conclusions

This study aimed to assess the effect of external factors on adoption of green packaging. It used multiple linear regression model to test the interplay between the three firm's external factors (socio-economic factors, regulatory factors, and technological factors) and adoption of green packaging in beverage industries. Based on the study results, socio-economic factors, exerted influence on adoption of green packaging ($\beta = 0.471$; $p = 0.000$), implying that the consideration of social and economic conditions is vital in examining the adoption of green packaging. This confirms that consumers have become conscious of environmental awareness. In addition, high income and educated consumers are the major promoters of green packaging. The regulatory factors exerted influence on adoption of green packaging ($\beta = 0.139$; $p = 0.009$), indicating that green policies and regulations are important contributor to the adoption of green packaging. More specifically, the findings evidence that the government of Tanzania has effectively enforced green regulations. Furthermore, the study revealed that technological factors exerted insignificant influence on adoption of green packaging ($\beta = 0.179$; $p = 0.154$), suggesting that green technology has not effectively adopted in sustainable packaging. This implies that the current efforts to promote green technology are not adequate, therefore further actions are needed to overcome the barriers associated with the use of green technology. Among the three of the adapted PESTEL framework, socio-economic factors, by virtue of its highest beta coefficient of 0.471 is the key driver of the adoption of green packaging. The results of this study have important implications for beverage firms accentuating the need to prioritize external factors such as socio-economic factors, regulatory factors and technological factors in adoption of green packaging.

This study provides empirical evidence that adoption of green packaging to a large extent depends on the factors of the adapted PESTEL framework. The effective adoption of these practices improves beverage firms' social performance. To achieve the social performance, beverage firms should prioritize socio-economic status of consumers, abide to green policies and regulations, and invest in green technologies. In addition, monitoring and assessing the statistical significance of the effect of these external factors will enable beverage firms to reformulate their strategies and ensure sustained operational excellence over time. Based on the study objectives, findings and discussion thereof, this study concludes that socio-economic factors, regulatory factors, and technological factors positively affects adoption of green packaging. More specifically, socio-economic factors and regulatory factors significantly affects adoption of green packaging.

5.1. Implications for Research

5.1.1. Theoretical Contributions

This study contributes to the body of knowledge by providing literature that assists manufacturing firms for enhancing green supply chain management (GSCM) by testing a research model for the relationship between external factors and adoption of green packaging. The current study is ground-breaking in that it tests the research model in a relatively uncharted green packaging context. Though there are several studies on green packaging in other industries, the present study is unique in that it was directed towards the beverage industries. Evidence of similar previous empirical studies directed at the beverage firms in developing countries is currently rare. Moreover, the fact that all three external factors positively impacted the adoption of green packaging confirm the hypothesized relationships between external factors and adoption of green packaging.

The study is further novel in that it is anchored on the adapted PESTEL Framework applied in the beverage industry context, addressing an important existential research gap. Consequently, the study generates new and current knowledge which adds to the existing body of literature. The study is thus available as a source of literature to future researchers working in similar or related areas.

5.1.2. Practical Contributions

The study has several practical contributions. Firstly, it presents a research model that can be applied by logistics and supply chain professionals for effective adoption of green packaging. The model presented in Figure 1, integrates three external factors (socio-economic factors, regulatory factors, technological factors) and adoption of green packaging. Secondly, the study presents an opportunity for logistics and supply chain managers to apply the adapted PESTEL framework to exploit any advantageous opportunity while managing any potential threats. Specifically, the study suggests that attention should be directed to all three external factors (socio-economic factors, regulatory factors, and technological factors). Among these three external factors, greater attention should be directed to socio-economic factors, given that these are prominent factors that influence the social and economic environment of the market. Also, production managers should incorporate green packaging features in their packaging designs in order to cater for packaging market. Furthermore, practitioners should invest in their sustainable initiatives as the market is willing to pay for such investments. By linking the adapted PESTEL framework, logistics and supply chain managers should consider the factors influencing the target market and act accordingly. In so doing, their brands can gain consumer acceptance.

5.2. Limitations and Directions for Future Research

Despite the useful insights provided by this study, it is important to note several limitations. Firstly, the study mainly focussed on few selected beverage firms in Dar es Salaam city. Thus, caution should be exercised when generalising the empirical results of the study to other environments that were excluded from the study. Secondly, measures used in the research instrument for this study were adapted from previous studies and were originally developed for other purposes. Thirdly, the study was based on the quantitative research design, which relies on numerical data and does not collect in-depth or qualitative explanations for the observations made. Mixed methods research design could be employed in subsequent studies to circumvent the weaknesses of using a single method. Fourthly, the study used a cross-sectional research strategy since the data were collected at a single point in time. The primary limitation of the cross-sectional study is that the predictor variable and response variable are simultaneously assessed, making it difficult to determine if one factor caused the other. However, the cross-sectional study design was employed since it is less expensive and time-consuming than the longitudinal study research strategy. Future studies should use longitudinal research strategy to compare results over time. Furthermore, the study was limited to beverage firms; non-beverage firms (e.g. food, clothing companies) in the manufacturing sector were excluded. Though the findings disclose useful insights, the deep understanding of the effect of external factors adoption of green packaging is lacking. Therefore, in order to get down to the nitty-gritty of the effect of external factors on adoption of green packaging, it is suggested to conduct a comprehensive study involving all manufacturing companies in Tanzania. Furthermore, a similar study can be conducted using the triple bottom line approach to assess firm's performance based on financial, social, and environmental perspectives.

REFERENCES

[1] Isa, S.M. & Yao, P.X. 2013. Investigating the preference for green packaging in consumer product choices: A choice-based conjoint approach. *Business Management Dynamics*, 3(2): 84-96.

[2] Mahmoud, M.A., Tsetse, E.K.K., Tulasi, E.E. & Muddey, D.K. 2022. Green packaging, environmental awareness, willingness to pay and consumers' purchase decisions. *Sustainability*, 14: 16091.

[3] Wang, Z., Mathiyazhagan, K., Xu, L. & Diabat, A. 2016. A decision making trial and evaluation laboratory approach to analyze the barriers to green supply chain management adoption in a food packaging company. *Journal of Cleaner Production*, 117: 19-28.

[4] Zhang, G. & Zhao, Z. 2012. Green packaging management of logistics enterprises. *Physics Procedia*, 24 (Part B): 900-905.

[5] Doan, T.M.H. & Nguyen, B.T. 2024. Promoting the use of sustainable packaging in urban areas: A regulatory policy contribution. *Journal of Governance & Regulation*, 13(4): 27-34.

[6] Agyeman, C.M. 2014. Consumers' buying behavior towards sustainable products: An exploratory study. *International Journal of Management Research and Business Strategy*, 3(1): 188-197.

[7] Joyasinghe, J.A.S.C. 2022. The influence of green packaging, green attitude on green behavioural intentions of consumers: Evidence from Sri Lanka. *Colombo Journal of Multi-disciplinary Research*, 6(2).

[8] Boz, Z., Korhonen, V. & Sand, C.K. 2020. Consumer considerations for the implementation of sustainable packaging: A review. *Sustainability*, 12(6): 2192.

[9] Popovic, I., Bossink, B.A. & Van Der Sijde, P.C. 2019. Factors influencing consumers' decision to purchase food in environmentally friendly packaging: What do we know and where do we go from here? *Sustainability*, 11(24): 7197.

[10] Singh, G. & Pandey, N. 2018. The determinants of green

packaging that influence buyers' willingness to pay a price premium. *Australas, Mark*, 26: 221-230.

[11] Imbambi, O.S. & Kinoti, M. 2018. Consumer buying behaviour and adoption of sustainable products in large supermarkets in Nairobi City Kenya. *Global Journal of Economics and Business*, 4(2): 269-279.

[12] Aguilar, F.1967. Scanning of business environment. California: Macmillan Publishing.

[13] Yasin, T.R.; Anna, Z.; Utama, G.L. 2024. Unpacking Indonesia's energy transition through a PESTEL analysis, for achieving Sustainable Development Goals. In *E3S Web of Conferences*, 495: 01007.

[14] de la Rosa, C.B.; Bolaños, B.C.; Echeverría, H.C.; Padilla, R.C.; Ruilova, G.S. 2019. PESTEL analysis with neutrosophic cognitive maps to determine the factors that affect rural sustainability. Case Study of the South-Eastern plain of the province of Pinar del Rio. *Neutrosophic Sets Systems*, 27: 218–227.

[15] Song, J.; Sun, Y.; Jin, L. 2017. PESTEL analysis of the development of the waste-to-energy incineration industry in China. *Renewable and Sustainable Energy Reviews*, 80: 276–289.

[16] Torkelis, A., Dvarionienė, J. & Denafas, G. 2024. The factors influencing the recycling of plastic and composite packaging waste. *Sustainability*, 16 (21): 9515.

[17] Turkyilmaz, A.; Guney, M.; Karaca, F.; Bagdatkyzy, Z.; Sandybayeva, A.; Sirenova, G. 2019. A comprehensive construction and demolition waste management model using PESTEL and 3R for construction companies operating in central Asia. *Sustainability*, 11: 1593.

[18] Ho, J. K. K. 2014. Formulation of a Systemic PEST Analysis for Strategic Analysis. *European Academic Research*, 2 (5): 6478-6492.

[19] Yuksel I. 2012. Developing a Multi-Criteria Decision-Making Model for PESTEL Analysis. *International Journal of Business and Management*, 7 (24), 52-66.

[20] Collins J. R. 2012. Is there a better way to analyse the business environment? [MBA Dissertation Report, Henley Business School, University of Reading].

[21] Matović, I.M. & Arsić, L. 2020. Ecological dimension of PESTEL analysis in small enterprises in the Republic of Serbia. *Recycling and Sustainable Development*, 13: 63-71.

[22] Puglieri, F.N., Salvador, R., Romero-Hernandez, O., Filho, E.E., Piekarski, C.M., de Francisco, A.C. & Ometto, A.R. 2022. Strategic planning oriented to circular business models: A decision framework to promote sustainable development. *Business Strategy and the Environment*, 31(7): 3254-3273.

[23] Polat, O. & Güngör, A. 2024. From analysis to action with PESTEL insights into Izmir's sustainable urban logistics plan. IGI global scientific publishing.

[24] Gasde, J., Woidasky, J., Moesslein, J., & Lang-Koetz, C. 2021. Plastics Recycling with Tracer-Based-Sorting: Challenges of a Potential Radical Technology. *Sustainability*, 13(1): 258.

[25] Kongseecha, S., Lilavanichakul, A. & Sane, A. 2023. Carbon footprint analysis of post-consumer recycled PET value chain of different plastic collection regions. *Journal of Food Science and Agricultural Technology (JFAT)*, 7(1): 1-7.

[26] Khan, A.U. 2020. Green packaging factors that affect millennials brand preference towards fruit juice in the Indian market [Master's dissertation. Dublin, National College of Ireland].

[27] Kumar, S., Kalyani, V., Babu, P., & Mathew, R. 2024. The effect of sustainable packaging on consumer attitudes in the beverages industry. *International Journal of Central Banking*, 20(1): 759-770.

[28] Wandosell, G., Parra-Meroño, M.C., Alcayde, A. & Baños, R. 2021. Green packaging from consumer and business perspectives. *Sustainability*, 13(3): 1356.

[29] Rizos, V., Behrens, A., Van der Gaast, W., Hofman, E., Ioannou, A., Kafyeke, T. & Topi, C. 2016. Implementation of circular economy business models by small and medium-sized enterprises (SMEs): Barriers and enablers. *Sustainability*, 8(11): 1212.

[30] Moorthy, K., Kamarudin, A.A, Xin, L., Hui, L.M., Way, L.T., Fang, P.S. & Carmen, W. 2021. Green packaging purchase behaviour: A study on Malaysian consumers. *Environment, Development and Sustainability*, 23: 15391 – 15412.

[31] Su, D.N., Duong, T.H, Dinh, M.T.T., Nguyen-Phuoc, D.Q. & Johnson, L.W. 2021. Behaviour towards shipping at retailers practicing sustainable grocery packaging: The influences of intra-personal and retailer-based contextual factors. *Journal of Cleaner Production*, 279: 123683.

[32] Fu, W. & Liang, B.C. 2018. How millennials personality traits influence their eco-fashion purchase behaviour. *Athens Journal of Business and Economics*, 1(2): 1-14.

[33] Pālsson, H. & Molina-Besch, K. 2016. A supply chain perspective on green packaging development: Theory versus practice. *Packaging Technology and Science: An International Journal*, 29(1): 45-63 – 461.

[34] Mohammad, Z. & Zakersalehi, A. 2012. Consumers' attitude and purchasing intention toward green packaged foods: A Malaysian perspective. *International Conference on Economics Marketing and Management*, Singapore.

[35] Koutsimanis, G., Getter, K., Behe, B., Harte, J. & Almenar, E. 2012. Influences of packaging attributes on consumer purchase decisions for fresh produce. *Appetite*, 59: 270-280.

[36] James, F. & Kurian, E. 2021. Sustainable packaging: A study on consumer perception on sustainable packaging options in e-commerce industry. *Natural Volatiles & Essential Oils*, 8(5): 10547-10559.

[37] Yang, X., Dai, X. & Bin, H. 2024. The dynamics of rewards and penalties: Government impact on green packaging adoption in logistics. *Sustainability*, 16(11): 4835.

[38] White, G.R.T., Wang, X. & Li, D.2015. Inter-organizational green packaging design: A case study of influencing factors and constraints in the automotive supply chain. *International Journal of Production Research*. 53(21): 6551-6566.

[39] Dharmadhikari, S. 2012. Eco-friendly packaging in supply chain. *IUP Journal of Supply Chain Management*, 9(2):7.

[40] Agyabeng-Mensah, Y., Afum, E., & Ahenkorah, E. 2020. Exploring financial performance and green logistics management practices: examining the mediating influences of

market, environmental and social performances. *Journal of CleanerProduction*, *258*: 120613.

[41] Kajula, E. 2021. Assessment of packaging barriers to maximum efficiency of food chain management in Tanzania. [Online]. Available: https://www.theseus.fi (Accessed on June 01, 2025).

[42] Huang, J. 2017. Sustainable development of green paper packaging. *Environment and Pollution*, 6(2): 1-5.

[43] Ahmed, J. & Varshney, S. 2011. Polylactides chemistry property and green packaging technology. *Taylor and Francis*, 37-38.

[44] Saunders, M., Lewis, P. and Thornhill, A. 2013. Research methods for business students. 6th ed. Pearson.

[45] Myamba, B.M., Shatta, D. and Massami, E. (2024). Benchmarking supply chain collaboration dimensions with insights from resource-based theories: a key to manufacturing competitiveness. *Brazilian Journal of Operations and Production Management*, 21(4): e20242221.

[46] Myamba, B.M. and Nguni, W.S. (2022). Aligning the risk hedging strategy with supplier collaboration and manufacturing competitiveness: a resource-based and contingency approach. *International Journal of Productivity and Performance Management*, 72(6): 1740-1770.

[47] Susanti, A., Soemitro, R. A. A., Suprayitno, H., & Ratnasari, V. (2019). Searching the appropriate minimum sample size calculation method for commuter train passenger travel behavior survey. *Journal of Infrastructure & Facility Asset Management*, 1(1).

[48] Kumar, R. 2011. Research methodology: A step-by-step guide for beginners, 3rd ed. SAGE Publications Ltd.

[49] Wu, T. Wu, Y.C.J., Chen, Y.J. & Goh, M. 2014. Aligning supply chain strategy with corporate environmental strategy: A contingency approach. *International Journal of Production Economics*, 147: 220-229.

[50] Rahimnia, F. and Keyvanipoor, S.2014. Analysis of BSC perspectives as related to the alignment of environmental uncertainty and supply chain strategy. *Benchmarking: An International Journal*, 21(6): 903-916.

[51] Henseler, J., Hubona, G. and Ray, P.A. 2016. Using PLS path modeling in new technology research: Updated guidelines. *Industrial Management and Data Systems*, 116(1): 2-20.

[52] Hair, J.F. 2014. A primer on partial least squares structural equation modeling (PLS-SEM). SAGE Publications Inc.

[53] Raja, C., Ramachandran, M., Nanjundan, P., & Rajamanickam, J. 2023. Industrial Engineering Using IBM SPSS Statistics. *Journal on Electronic and Automation Engineering*, 2(3).

[54] Massami, A.B., Massami, E.P. & Ngongi, W. 2024. Assessment of the port resource constraints contributing to ship clearance delays: A case of Dar es Salaam seaport. *International Journal of Research Publication and Reviews*, 5(10): 3562-3572.

[55] Wou, D. 2021. The impact of comprehensive quality management and organizational resilience on financial performance in the maritime administration of a local port. *Applied Innovations in Industrial Management*, 1(1): 49-62.

[56] Gunawan, F., Ali, M.M. & Nugroho, A. 2019. Analysis of the effects of perceived ease of use and perceived usefulness on consumer attitude and their impacts on purchase decision on PT TOKOpedia in Jabodetabek. *European Journal of Business and Management Research*, 4(5): 1-6.

[57] Aghdam, F.B., Alamdari, Z.D., Nadrian, H., Jafarabadi, M.A. & Dehahanzadeh, R. 2019. Personal, social, and environmental factors associated with the behaviour of plastic bag use among urban residents: A study with socioecological approach. *International Journal of Preventive Medicine*, 10(1).

[58] Beleya, P., Khim, L.S. & Wei, E.K.J. 2019. Factors influencing green procurement adoption in food and beverage SME. *Innovative Journal of Business and Management*, 8(5): 84-94.

[59] Thatte, A.A., and Rao, S.S. 2013. Impact of SCM practices of a firm on supply chain responsiveness and competitive advantage of a firm. *Journal of Applied Business Research*, 29(2): 499-530.

Copyright © 2025 The Author(s). Published by Scientific & Academic Publishing
This work is licensed under the Creative Commons Attribution International License (CC BY). http://creativecommons.org/licenses/by/4.0/