EXPLORING THE IMPACT OF GREEN PACKAGING ON ENVIRONMENTAL SUSTAINABILITY :A CASE STUDY OF UGANDA

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A DISSERTATION SUBMITTED TO THE SCHOOL OF BUSINESS IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A DEGREE OF BACHELOR OF PROCUREMENT AND LOGISTICS MANAGEMENT OF UGANDA CHRISTIAN UNIVERSITY

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UGANDA CHRISTIAN UNIVERSITY

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DECLARATION

I, **SAULYN FAITH,** hereby declare that this dissertation entitled **"Exploring the Impact of Green Packaging on Environmental Sustainability"** is the result of my original work, is not plagiarised and has not been submitted for any other degree at Uganda Christian University or any other institution for any award. Credit has been given to all other writers' works that were used in any part of this research.

Date: 9th September, 2024. **Signed:** ……..

APPROVAL

This research report titled **"Exploring the Impact of Green Packaging on Environmental Sustainability"** has been submitted by **SAULYN FAITH** to the Faculty of Business and Administration in partial fulfilment of the requirements for the award of a Bachelor of Science in Procurement and Logistics Management of Uganda Christian University with my approval as a supervisor.

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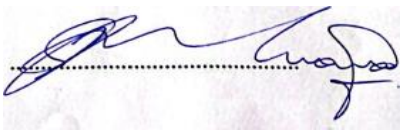

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To all I say God bless you abundantly

ABSTRACT

Green packaging can help an industry reduce its overall impact on the environment. This abstract considers the effect of green packaging strategies on environmental sustainability by way of three objectives: first, assessment of the strategy of packaging, second, analysis of consumer perceptions; and third, life cycle impacts.

Green packaging strategies are measured by the degree of adoption and effectiveness of ecofriendly materials such as biodegradable polymers and recycled paper. Strategies of green packaging will avoid multiplication of carbon footprint or depletion of any resource through any production process.

Basically, consumer perception and attitude to green packaging issues are very powerful drivers of market dynamics and consumer behaviour (Brown & Green, 2019; White, 2020). Consumers are increasingly concerned about sustainable packaging, and this affects brand loyalty and, subsequently, purchasing decisions.

Lastly, Johnson et al., in 2018, and Lee & Lee, in 2021, estimated the environmental impacts of sustainable packaging compared with traditional alternatives by using life cycle assessment. LCAs describe how much energy is used, how much GHG is emitted, and how much waste is generated along the cycle of packaging.

This abstract summarizes the findings to make a case for the transformative potential of green packaging in the achievement of environmental sustainability goals. The stakeholders may make use of empirical evidence to lead innovation, policy formulation, and consumer education in pursuit of a sustainable paradigm in packaging that would ensure a balance between economic viability and ecological stewardship.

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LIST OF ABBREVIATIONS AND ACCRONYMS

CO2	Carbon-dioxde
COMPASS	Cooperative Packaging Tool
DFE	Design For Environment
EOL	End Of Life
EPFA	Environmental Protection Forum Agency
FLW	Food Losses and Waste
H_1	Alternative Hypothesis
ISO	International Standards Organisation
LCA	Life Cycle Assessment
LDPE	Low-Density Polyethylene
LLDPE	Liner Low-Density Polyethylene
MJ/KG	Mega-joules per Kilogram
MS-Word	Microsoft-Word
NGO	Non-Governmental Organization
PIQUET	Packaging Impact Quick Evaluation Tool
SME	Small Medium Enterprise
TBL	Tripple Bottom Line
UN	United Nations
UNBS	Uganda National Bureau of Standards

1. Chapter One: Introduction

This chapter introduces the research topic by specifying the background context, the problem statement formed a basis for the formulation of objectives and, fitly, research questions. The chapter also states the significance of the research topic since the demand for packaging solutions that are safe for consumers and friendly to the environment is ever increasing daily.

1.1 Background of Study

Packaging forms a very integral part of our lives. It provides protection to the product from damage, helps in easy distribution, and also sometimes provides marketing (Auras & Susan, 2022). Conventionally, quality of the product and safety of the product are considered in a package. However, considering increasing sustainability issues, the environment has come as a significant factor in package development. Sustainable packaging balances the functionality of the package by considering environmental concerns. It is described as the package that is good for human beings, economically feasible, recycled, non-poisonous to the environment, as well as generating energy through renewable resources. Sustainable packaging also aids in reducing ecological footprints and resource conservation for businesses. It achieves this through waste minimization and distribution maximization.

Even though package protects the product and minimizes wastes during distribution, it also, as a characteristic can be a very serious ecological menace. There are two main types of environmental impact from packaging: Direct: These result directly from the production and disposal of the package itself and include energy use, associated pollution, and landfills. Indirect: These impacts result from associated food losses and waste (FLW) along with packaging. In fact, inadequate packaging can lead to the entry of oxygen, moisture, or microbes that can render food waste along the supply chain. FLW can be further divided into food loss at production and processing stages and food waste at the point of consumption.

The packaging industry is enormous, and its value is evaluated to be at $917 billion in 2019 (Smithers, 2019). Researchers postulate that this demand would grow even higher by 2024 at a compound annual growth rate of 2.8% to be at $1.05 trillion (Smithers, 2019). The growth is majorly caused by the fact that consumer spending

on packaged beverages is evolving, flexible packaging, and increased consumption of convenience features.

The environmental concerns have caused clear eco-tendencies into so-called "green packaging" as the very strategy that draws sustainability. Nevertheless, the real eco-effect of these solutions is still up for grabs. Latest investigations demonstrate a distinguished tendency of customer behaviour towards products with minimal packaging, recycling, reutilization, and composting as a consequence of sustainable packaging. A growing trend is flexible packaging, to enable ease for packaging, handling, storage as well as display for sales. These are in the form of bags, wrappers, pouches, and lids each with its unique protective characteristics.

The World Packaging Organisation approximates that by 2025, packaging production from the food sector alone will represent $400 billion in value (WPO, 2021). They advise two important trends towards this aim of sustainability. Recyclable Materials: Manufacturers and brands should innovate using materials that can be easily recycled. Refill Opportunities: Businesses should look for ways to engineer refillable products to avoid its use of disposable packaging (WPO, 2020).

Apart from these trends, the WPO also highlights eco-design, intelligent packaging, edible packaging, and graphic aesthetics as the new directions held out to be impacting sustainability through packaging innovations. Projecting forward to 2024 trends, to indicate there could be a role for automation and AI in enhancing efforts to secure packaging sustainability.

1.2Statement of Problem

The quest for environmental sustainability in packaging gives way to increased use of green packaging with claims to eco-friendly substitutions to conventional material. In most cases, though, the intended advantages of green packaging hardly occur, hence posing a great challenge to the realization of sustainability.

The Environmental Protection Forum Agency states that in 2015, containers and packaging were responsible for 77.9 million tons of municipal solid waste (Waste Advantage Magazine, 2021). Inadequate industrial composting infrastructure; thus, biodegradable plastics might not have degraded as assumed the inadequacy of the infrastructure in recycling or composting green packaging materials, thus leading to

its mismanagement and ending up in landfills. Packaging World 2021 A big challenge in recyclability of these material examples given include film made from laminated Stop and Shop bags that combined paper, foil, and plastic in a single film. Thus, the laminated film is difficult or nearly impossible to recycle, and its materials cannot be separated as the process is much costly and complicated Anthony 2021. Hagerman 2021. Again, the pricing of green packaging solutions is so high that most companies cannot afford to use them making the situation worse with conventional packaging materials. A 2021 study by Waste Advantage Magazine revealed that most consumers were not willing to pay more money for green products.

All this cumulatively makes green packaging lack influence drastically on environmental sustainability. The present study takes into account the above issues to find a gap between green packaging goals and its reality and to offer ways to bridge this gap.

Objective: To assess the overall impact green packaging/sustainable packaging strategies and materials exert on ecological sustainability.

1.3 Research Objectives

1.3.1 General Objective

The research aims at a comprehensive view of the green packaging concept and its impacts on the goals for environmental sustainability. The research studies current practices, challenges, and opportunities in the fullest manner possible, so it might come up with useful insights and practical recommendations for organizations moving to eco-friendly packaging practices in helping reduce their ecological footprints and toward a healthier planet. The research will also focus on increasing people's awareness of the need for environmental sustainability and how they can achieve it through green packaging.

1.3.2 Specific Objectives

To assess the different green packaging strategies used by different packaging and branding organizations.

To investigate consumer behaviour and perception towards green packaging.

To evaluate the life cycle impact of green packaging compared to traditional packaging.

1.4 Research Hypothesis

The study suggests a Research/ Alternative Hypothesis (H_1) which states the following:

H_1 1: There is a relationship between the effectiveness of various green packaging strategies and their ability to reduce environmental impact.

H_1 2: There is a positive relationship between consumer preference for eco-friendly materials and environmental sustainability.

H_1 3: There is a relationship between life cycle impact of green packing on environmental sustainability compared to traditional packing impact on environment.

1.5 Research Questions

What are the different green packaging strategies used by packaging and branding organizations?

How do consumers perceive and behave towards the evolution of green packaging?

What is the life cycle impact of green packaging compared to traditional packaging?

1.6 Scope of Study

1.6.1 Content Scope

The study will focus on the impact of green packaging practices on environmental sustainability in the packaging industry, specifically in the food packaging industry. The study area will include the evaluation of packaging lifecycle, incorporation of sustainability in packaging design, green packaging materials—biodegradable and compostable, and consumer behaviour and orientation towards packaging.

1.6.2 Geographical Scope

The study was conducted in Uganda, the East African landlocked country that borders to the north of South Sudan, to the east of Kenya, to the south of Tanzania and Rwanda, and to the west of the Democratic Republic of Congo. Uganda lies in latitude 1.3733° N and longitude 32.2903° E. The GPS coordinates indicate that the African state is located in the northern and eastern hemispheres.

1.6.3 Theoretical Scope

The study shall be guided by several theories but most especially the Triple Bottom Line developed by John Elkington focusing on all the triple sustainability pillars, that is the economic, social and environmental impacts of packaging practices for a holistic approach to sustainability.

1.6.4 Time Scope

The research was done over the course of four months, and it shall centre around the present situation of the impacts of green packaging measures towards environmental sustainability between the year 2010 to date.

1.7 Rationale/Justification of the Study

The empirical validity of green/sustainable packaging has been questioned by many researches across many countries with regard to the changing dynamics of packaging practices and strategies across the world and the rising global concern for sustainability. Thus, this paper attempts to contribute to filling this wide empirical knowledge gap with the testing of general hypotheses, such as the sustainability hypothesis and triple bottom line hypothesis, by an examination of packaging materials' impacts on the environment.

1.8 Significance of the Study

The study is significant to different stakeholders who include the organizations, the policymakers, and the society at large. According to a report by the Consequently, the significance of the study encompasses the;

1.8.1 Practitioners (organizations)

This will significantly inform various organizations interested in attaining green packaging and ensure that they achieve a lower environmental impact with better sustainability performance. Work conducted in 2021 by Teresa D researched that some of the recent innovations including, life cycle assessment packaging, packaging understanding concerning products and user requirements, and use of bio composite materials to help organizations preserve the environment and materials (Teresa De Pilli, n.d).

1.8.2 Policy makers

The research findings will emphasize the need for policies to nurture and incentivize the uptake of green packaging practices as one way of ensuring sustainability in environment conservation at large. However, for example, a study undertaken in the

year 2019 expresses such sentiments, that policy Instruments, including carbon pricing and eco-labels, can trigger an uptake of more sustainable logistics practices and lower the related environmental impact (Pauer et al., 2019).

1.8.3 Fellow scholars

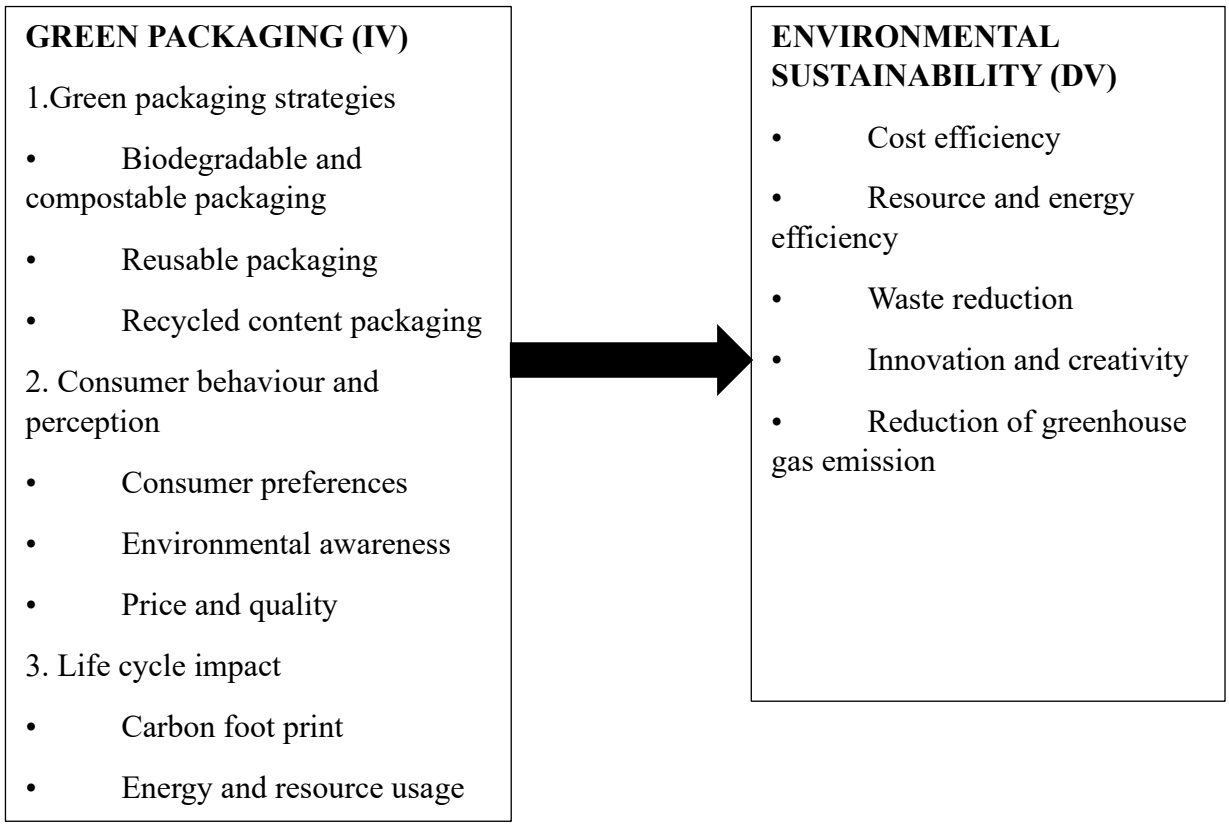
The study will therefore add to the existing body of knowledge by investigating the relationship between green packaging and environmental sustainability. In this way, it expands the knowledge of sustainable practices for the packaging industry, such as recyclable materials, life cycle assessment of packaging material, and reseal options, among others. Informed by the findings and methods developed from this research, future studies will be better placed to open new lines of inquiry and, through replication in other settings, to progress frameworks of theory to respond to new set of new challenges and opportunities arising from packaging.

That this research would provide the needed impetus for effecting positive change and engendering sustainable practices towards the attainment of the broader goal of environmental sustainability in packaging operations is the major significance of this study.

1.9 Framework of the Study

1.9.1 The Conceptual Framework

The conceptual framework shows the connection between the independent variable green packaging and the dependent variable environmental sustainability, directly and indirectly, through mediating and moderating variables.



Conceptual Framework

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1.9.2 Theoretical framework

This section tries to bring out the fundamental theories that are instrumental in any discussion within the context of this study concerning the relationship between green packaging and environmental sustainability. The various theories identified herein serve to bring out the impact of practices in green packaging on the environmental sustainability aspects of policies on a circular economy or the principles therein.

- LCA – technique to estimate environmental impacts of a product process or service at all phases of its life cycle
- Theory of consumer behaviours is the factors that tend to influence the attitude of and suspicion in consumer towards a product and Packaging.
- Triple Bottom Line: This theory, created by John Elkington via his book "Cannibals with Forks," assesses the performance of a company from not only a financial perspective but also through environmental and social dimensions in relation to its packaging practices. It encourages every business to consider a holistic approach to sustainability by balancing between economic prosperity, environmental responsibility, and social justice. Businesses, able to integrate the three bottom lines, would strive towards sustainable development goals, create long-term value, and help lead toward a sustainable future and a fairly just society.

2.0 Chapter Two: Literature review

2.1 Introduction:

Under this study framework, this chapter serves to provide us with information that enables us to further explore the literature under the topics lengthily, as well as in the use of the research objectives (Steenis and others, 2018; Su and others, 2021). Packaging was already an essential part of product distribution and a strategy for promotion; it is today, one of the biggest reasons for environmental concerns (Santos, 2017). Now that manufacturers and customers are becoming more ecologically concerned, it has become an urgency of increasing drive towards the use of sustainable or "green" packaging solutions (Martinho et al., 2015).

2.2 Research Objective 1: Assessing the different green packaging strategies used by different packaging and branding organizations

The use of green packaging techniques is fast becoming the norm instead of the exception for any business that needs to make a mark in today's marketplace, which is extremely competitive and sensitive to the ecologically sound customer. For this reason, eco-packaging is a tool that, according to research of Kimes, 75% of the consumers state, ecologically pretentious operations would influence their buying. Companies like Procter and Gamble, Unilever, and Nestle have taken a series of the green packaging techniques to make it easy for their burden on nature. One of the commonly used approaches is the adoption of bioplastics, which are plastics generated in the production of renewable resources, like starch acquired from potato, corn or sugarcane. Bioplastics may replace conventional plastics used in packaging, and according to Kumar et al. 2010, it is estimated to emit 70% lesser greenhouse gases. Coca-Cola, for instance created a bioplastic bottle from plant materials.

Other plans include utilizing "naked" or "bare" products, those with scarce or totally absent packages. This cuts down both the amounts of wastes produced, and the resultant carbon emissions realized in production and while conveying the packages to the intended locations. Prominent organizations such as L'Oréal and Unilever have created "naked" product lines with up to 90% reduced packaging material. Other green packaging strategies researched by organizations included recycled or

biodegradable material, source reduction in packaging waste, and designing for recyclability or re-use (Martinho et al., 2015).

Such strategies would ameliorate the environmental impacts of consumer goods and raise circularity. For instance, one study on different strategies of green packaging by firms unearthed that "the most common green packaging practices were using recycled materials, reducing packaging size/weight, and using renewable materials" (Martinho et al., 2015). This implies companies are searching for packaging solutions that are influential at the natural lifecycle of products. Other green packaging methods are re-usable packaging, refillable containers, and recycled materials. In particular case, Heineken's Draught Keg system is re-usable and reduces up to 90% of the waste generated by a beer packaging (Heineken, n. d). Opponents argue that some green packing practices might not be feasible or sustainable for the long term. For example, based on Akenhead et al. (2017), though companies have the chance and capability to brag about their environmental awareness, in reality, the footprint left on the environment is minimal due to the complexity introduced into the supply chain and manufacturing processes.

Conclusion: Green packaging strategies could be considered as one of the important tools of corporate social responsibility. However, effectiveness and sustainability of such strategies need to be evaluated critically for their compatibility with environment goals.

2.3 Research Objective 2: Investigating consumer behaviour and perception towards green packaging

Consumer behaviour and perception towards green packaging has been studied sufficiently in the recent years. This was supported by Grinstein and Levy in 2011 who concluded that consumers are more likely to prefer the green package when they perceive the brand as credible and environmentally friendly.

According to Chang et al., in considering how the process of green packaging works, a number of factors come into play that impact the behaviour of the consumer: the nature of the product, claims being made in marketing, and social norms. For

example, research by Kwak et al. (2018) revealed that despite the fact that biodegradable packaging is believed by consumers to be of environmental benefit, they prefer products that are provided in such. Other research indicates that cultural beliefs and other individual differences always influence consumer attitude towards green packaging Mao et al. (2018). For example, Li et al. (2016) found that, compared to Western consumers, Chinese customers paid more attention to environmental issues when evaluating green packaging.

Additionally, the perception of green packaging significantly influences customer loyalty and repurchase intention as well (Gao et al., 2017). According to a study by Kim et al. (2016), customers are likely to repurchase if they perceive the environmental initiatives taken by a brand as proper. However, several studies suggest that, according to Ketelsen et al., consumers give more precedence to other product attributes, like price and quality, over green packaging while making purchase decisions. Furthermore, it seems that there is a gap between the attitude expressed and purchasing behaviour manifested by consumers, as this might be because although some would show a preferential attitude for green packaging in their minds, they do not end up making the right choice in terms of purchase. According to one study, the variables of influence by consumers on sustainable packaging include "demographics, behaviour and attitudes, environmental awareness, and satisfaction with packaging features" (Martinho et al., 2015).

Conducted additional research in the Philippines on the purchasing practice of green marketing adopted by students' products; hence, "Consumers believe that it is not only the government and business that will take care of environmental protection but also individual responsibility" and " consumers' past experience on green products affect their purchase intention" (Santos, 2017).

The performance of green packaging in relation to consumer behaviour and perception is thus multifactorial. Companies need to appreciate these factors to be able to effectively communicate their efforts in regard to the environment, hence creating brand loyalty.

Key features that are of interest to the consumer, such as biodegradability and recyclability, influence consumer perception and behaviour. Such decisions can be effectively guided by eco-labels and good design relating to packaging design, aesthetics, the transparency of information, etc. Different consumer segments respond differently to green packaging, with demographic factors playing an important role in influencing purchase decisions Segmentation of Consumers Based on Their Response to Green Marketing, 2016).

2.4 Research Objective 3: Evaluating the life cycle impact of green packaging compared to traditional packaging.

The product or process life cycle assessment is one of the most widely used tools to evaluate the impact upon the environment due to products or processes, right from raw material extraction to the final disposal or recycling stage. It is one of the most popular tools companies and researchers use to determine the environmental impact of packaging during its life cycle.

In other words, it quantifies the environmental burdens from a product, assessing the energy and material being used up and the wastes and emissions released over the whole life cycle of a product. LCAs sum the total contribution packaging has to important critical environment and climate-related impacts (Hartman, 2012), and as well evaluates varying intensities of the environmental impact of products/packaging from the stage of production to consumers (Lingle, 2021), which contains a great deal of inputs and outputs around the processes (Eco-Enclose, 2021).

The earliest version of the LCA was introduced in the food and beverage sector during the 1960s when manufacturers examined product choices, particularly raw materials (Andrieu, 2021). As sustainability becomes more widespread, implementing the LCA process for industries in manufacturing has been spurred on to curtail the generation of solids wastes.

Aided by inventions of frameworks, tools, and standards to guide implementation, such as the International Organization for Standardization, one ISO 14040 and ISO 14044 that provides the general framework, and the minimum standards for

implementation of LCA. This has been further encouraged by Even more LCA tools such as The Comparative Packaging Tool and Packaging Impact Quick Evaluation Tool are being exceedingly used by researchers and companies. More so, LCA assessment approaches have played in executing LCA; these are;

i. **Cradle to grave:** complete assessment from creation to disposal.
ii. **Cradle to factory gate:** This evaluates the product/packaging from the extraction stage of raw materials through the production channels. Siracusa et al, 2014
iii. **Gate-to-gate:** This looks at the particular impacts at a given stage in life. Wassenaar, 2020.

Continuously referring to the Tripple Bottom Line framework for driving sustainability, a sustainability assessment framework considering "temporal changes and interrelations between the product and its system environment and vice versa" proves that LCA's must maximize the environmental and social performance of economic activities" (Verghese et al, 2012).

A number of studies have compared the life cycle impacts of conventional versus green packing materials using life cycle assessment (LCA) techniques. For example, Cherubini et al. 2017 found that although bioplastic bags generated fewer greenhouse gases during the manufacture than the conventional packaging, a smaller carbon footprint was registered for the normal plastic bags for the whole life cycle.

Zhang et al. (2020) compared the LCA results of three different types of bioplastic films used in food packaging to the manufacture of regular PET film, reporting that the bioplastic film had lower acidification and global warming potentials compared to PET film.

But, among several studies on this issue and varying results, it is observed that the production processes and the waste management practices may differentiate in the entire line of supply chain operations. For instance, a study conducted by Lee et al., 2020, showed that in most cases, bioplastic bags demonstrate lower carbon emissions compared to conventional plastic bags during the production phase, but

they tend to emit higher carbon during the disposal phase due to increased energy consumption during the degradation process.

Finally, LCA results indicate that green packaging can have less environment effect compared to traditional packaging materials in their entire life cycle. On the other hand, although the potential for significant environmental benefits, the performance of a LCA of packaging also faces challenges, which include data availability and great variability in assessment methods. On the other hand, challenges are inviting alternatives for innovation and policy support to enhance environmental performance, relative to packaging, as proposed by Methodological Challenges on the Life Cycle Assessment of Packaging" (2012).

In conclusion, it therefore is clear that the contribution of sustainable packaging to promoting ecosystems and environment sustainability is broad and massive.
In the application of life cycle, principles of Eco-design, a triple-bottom-line approach, adapting to circular principles, and consideration of the action's ecological footprint, several gains will be realized in mitigation of ecological pressure that is tied to packaging.
Only by embracing such "holistic" approaches can waste generation and resource consumption be minimized, and a more sustainable, robust global economy be built. Engaging the business community, governments, and consumers has started our journey toward making these sudden, enormous changes toward a healthy and sustainable planet permanent.

3.0 Chapter Three: Methodology

3.1 Research Design

The research methodology was premised on a combination of both the qualitative research approach, mostly with the Case Study technique, and the quantitative approach looking at statistical analysis, carbon footprint analysis, and life cycle analysis to evaluate the collected time series data over the years particularly from 2010 to the present.

It is the framework that will facilitate this research to quantify the relationships between sustainable (green) packaging and Uganda's sustainability in general to achieve the objectives of this research.

Research design is the blueprint undertaken using lots of elements of a research form structure, to connect the parts coherently and logically, in such a manner that the plan implemented successfully takes care of the problem at hand. It is an outline of action for data gathering, measurement, and the analysis.

Note that the design of the study is, to a great extent, informed by the research problem. Thereafter, the study shall further collect data and analyze it using the qualitative and quantitative methods to research techniques on time-series data from 2010 to date.

3.2 Area of Study

The study area focused on Environmental Sustainability. In the developing/growing economy like Uganda, environmental sustainability is still a developing/growing concept, though especially in the fields of packaging, for instance food packaging, medicine packaging, and cosmetics packaging.

This study showed how green/sustainable packaging, through awareness-raising on sustainable growth elasticity, is key in the greening of Uganda in its packaging practices.

3.3 Data and Source

The study uses primary and secondary data sources, secondary data includes books, journals, literature reviews and reviewed articles. Data gathered by some other person but not the researcher for some other reason not related to the present study area work is known as secondary data. Some secondary data also include details about sustainable practices of packaging and the methodologies, consumer perceptions, and packaging life cycle assessment.

Primary data, this refers to the facts gathered especially for this research. The essential features of primary data are that the researchers make direct contact with the respondents, and specially designed research tools exist to inform the respondent's answers. A structured Online Survey Questionnaire was developed for the primary source to source for customers' information, opinions and perceptions as for their expectations of Green Packaging as a driver of sustainability.

3.4 Research Population

To allow for ease and convenience in data collection, a population of 200 consumers was researched in terms of education background. The population for the case of the research constituted of consumers from all walks of education and specializations. There was no restriction as to the kind of population to be selected based on demographics, factors of location. This was aimed at receiving the population and the customer perception of the various functions related to the packaging.

3.5 Sampling Technique

To reach to a sample size, the research utilized the **GEOPOLL's** sampling technique with the help of ***survey monkey sample size calculator***. This tool simplifies the calculation of the sample size with the help of;

- **Population size (200);** Population refers to the total number of people in the group one is trying to study.
- **Margin of error;** A percentage that tells you how much you can expect your survey results to reflect the views of the overall population. The smaller the margin of error, the closer you are to having the exact answer at a given confidence level.
- **Sampling confidence level;** A percentage that reveals how confident you can be that the population would select an answer within a certain range.

$$\text{Sample} = \frac{z^2 \times p(1-p)/e^2}{1 + (z^2 \times p(1-p) / e^2 N)}$$

N, population size

e, margin of error

z, number of standard deviations a given proportion is away from the mean (got from the z-score table).

Using the above information, a population of 200, confidence level of 80%, a z-score of 1.28 (got from the z-score table using a confidence level of 80%) and a margin of error 0.05%, by inserting the figures in the formula, we obtain **a sample size of 91.**

In this study of 91, Convenience random sampling was used by utilizing structured questionnaires, gathered from online databases with the help of surveys and interviews carried out collecting data concerned about consumers' perceptions and behaviour towards green and sustainable packaging.
Convenience sampling is a form of non-probability sampling in which study participants are selected based on their availability.
This method saves the researcher a lot of time and a great deal of money, as other sampling methods are also very involving.

3.7 Data collection methods and instruments

The research applies many combinations of data collection techniques concerning both the instruments used in collecting secondary and primary data.
Most of the secondary data will comprise online databases of the existing data that is the statistical databases, academic databases, UBOS reports, newspaper articles, and grey literature (theses, reports and dissertation) that is whereby one to analyze the data that has earlier been collected by the many scholars and the researchers on the sustainable packaging.

This method is of an advantage in that it interrogates the research questions with large-scale datasets and resource saving. Moreover, interviews, observational research, and consumer surveys based on structured questionnaires helped in making consumers' perceptions, preferences, and practices visible regarding green packaging. The questions entailed attitudes to recycling and waste minimization and whether they have an idea of what green packaging is and what positive packaging means in relation to making conscious shopping decisions regarding the family. Online surveys were created using google forms, survey monkey, and other pressing online survey sites, which helped the researcher in collecting overhead and considerable varieties of data.

3.8 Data Analysis

Data analysis is the process of examining, cleaning, transforming, and modelling data to discover useful information, conclusions, and recommendations to answer questions, test hypotheses, and solve problems. By using these integrated techniques of data analysis, this study is intended to come out with a wholistic approach regarding the impact of sustainable packaging on businesses and strategies to inform improved package operations.

3.8.1 Secondary Data Analysis

The datasets were tested for correlation and regression analyses by making use of statistical data analysis. This secondary data was also subjected to data visualization and meta-analysis, a procedure that includes the combination of the findings of several studies.

Correlation Analysis: It is, according to Gandhi and Porter (2022/2009), "the study examining relationships between two or more variables to find out, on one hand, whether a relationship exists, and on the other just how strong the rate of change in one variable can be predicted from the other.".

Regression analysis: A statistical method that describes the relationship between the dependent variable (the result) and one or more independent variables (the predictors) to develop the equation for the relationship between two or more continuous variables 2019's Akbari et al.

As supported by Dijk et al. (2018), in this way, regression analysis can help to determine the relationship between the factors causing the given environmental impact, for instance, waste generation, and carbon footprint besides the design characteristics for packaging. This is given even more significance for sustainable packaging, in that the associated businesses can reduce their environmental impact and enhance the design resulting from this impact (Li et al., 2019).

Data visualization: The process by which data is represented graphically to effectively communicate insights and trends. Sustainable packaging data visualization can help discover patterns, find correlations and outliers of big datasets about resource use, packaging waste, and environmental effect. Patel et al. (2020) further indicated that well-presented data visualization can display the transparency benefits needed from the data and suggest where waste could be reduced, supply

chain efficiencies could be improved, and areas for innovative sustainable packaging could be accomplished.

Meta-analysis: The use of statistical methods for combining results from different studies or analyses in order to determine something that has relevance to bigger populations or phenomena (Zhang et al., 2020). In sustainable packaging, meta-analyses can help aggregate findings across the diversity of hundreds of independent studies of environmental impacts associated with different materials or packaging designs. This is important in informing policy decisions and guiding industry investments through synthesizing existing knowledge and identifying best practices (Li et al., 2020).

3.8.2 Primary Data Analysis

Descriptive statistics (means, medians and modes), content analysis, correlation analysis (relationships and patterns) and factor analysis were employed for the primary data analysis.

Descriptive analysis: This is a statistical method of summarizing and describing the main characteristics of a dataset. Often, it uses measures like means, medians, and frequencies. Kim, et al. (2020) argue that in sustainable packaging, it could be deployed for a very brief overview of the present state of generation of packaging wastes, resource consumption, and environmental impact.

Content analysis: A technique in the qualitative research course of action where documents, photographs, or any other form of written communication can be researched to establish patterns, themes, or trends (Wang et al, 2019). In the domain of sustainable packaging, content analysis might involve examining industry reports, consumer surveys, or marketing materials with regards to understanding the attitudes towards sustainable packaging or perception of environmental impact (Kumar et al, 2019).

Factor analysis: A statistical technique that simplifies a large number of variables into a smaller set of underlying factors that account for most of the variations in the data (Kim et al., 2020). In sustainable packaging, it can help identify the critical drivers of environment impact or consumer behaviour in packaging choice (Li et al. 2020).

3.9 Ethical considerations

The considered ethical implications to ensure that it is responsible, respectful, and minimizes harm to individuals, society and the environment are;

Anonymity and Privacy: Identity of the respondents and other related information were not released, to keep the anonymity and secrecy of the respondents' personality.

Informed consent and volunteerism: An explanation of the purpose and implications of getting the research done was carried out for the participants. Accordingly, they consciously decided with their own free will on whether or not they would participate in the study.

Objectivity and bias: The study did not make an effort to prop up personal biases and support some agendas thereby finding results as objective and reflective of the green packaging's impact on environmental sustainability.

The dissertation has applied the APA 7 reference style to enable proper crediting of other writers' works used in parts of this research. Correspondingly, the communication related to this research has been carried out in the most honest and transparent manner possible.

3.10 Validity and Reliability

Validity and reliability are crucial concepts that assess the accuracy and trustworthiness of research findings. Explained are some of the ways in which the concepts will be used in the study.

3.10.1 Validity

Validity refers to the extent to which a research study accurately measures what it intends to measure. The following are some of the considerations the research applied so as to increase validity:

Multiple data sources: As previously mentioned, the study examines primary and secondary data sources with the aid of surveys, interviews, and observations in order to maximize validity.

Reporting limitation: In order to propose directions for future research, the study identifies potential limits during the entire process.

3.10.2 Reliability

This is the consistency stability and repeatability of results over time and across different contexts. This means that if the study were to be repeated, similar results are likely to be obtained. The following are some of the considerations the research applied so as to increase reliability:

Pilot testing: This involved testing out with small samples to obtain information before conducting the main study. This helped the researcher predict possible outcomes of the actual study.

Transparency: Openly stating the research design, methods and findings to enable easy evaluation and comparison of the study by others.

3.11 Limitations/Methodological constraints

It is essential to acknowledge the limitations of a research study, as they can affect the generalizability and applicability of findings. Here are some of the limitations that were encountered during this study:

Data quality: Data quality issues arose from incomplete or inaccurate responses, which affected the overall validity of the results.

Measurement bias: Some measurement tools and instruments were biased and focused on single factors ignoring general factors which influenced findings.

Time and resource constraints: The study was unable to capture all relevant time frames or longitudinal effects, thus, limiting the scope of the study's conclusions.

Social desirability bias: Some respondents gave information basing on their general knowledge and what they think the researcher wants to hear rather than actual experience with packaging, limiting expected validity of information.

3.12 Conclusions

It is crucial to consider ethical considerations, ensure validity and reliability, acknowledge limitations, and be mindful of methodological constraints. By doing so, you can increase credibility and usefulness of the research findings, ultimately contributing to a better understanding of the topic.

4.0 Chapter Four: Data analysis, presentation and findings

4.1 Introduction

This chapter explains the findings and results as found from the research that explores the effect of the green packaging on environmental sustainability. It will consider, with a wish to determine the green packaging strategies by different companies within the scope, their consumers' preferences and perceptions over the green packaging and the effect that this way of packaging has on the environment considering the Life Cycle Assessment (LCA). The research utilized a mixed method to combine quantitative and qualitative methodologies. The consumer questionnaire survey was adopted, which was complemented using the secondary research conducted on green packaging practices adopted by firms and corresponding LCA studies.

4.2 Identification and assessment of Green Packaging Strategies adopted by companies

The purpose of this first objective is to investigate the green packaging strategies that companies are adopting in response to the growing demand for sustainable practices on their desks. Different approaches taken in the quest for sustainable packaging across various different industries increase insight into current trends and hence may guide many forward.

As the world progresses to embrace sustainability, Ugandan packaging and branding organizations have not been left behind in adopting green packaging strategies. Among them is the reduction of environmental pollution, meeting consumer demand for sustainable practices, establishing good reputation for brands, and compliance with the national and international environmental regulation policies. It is in this light that this assessment foresees the projection of such an analysis of the green packaging initiatives in Uganda with a keen interest in the food, medicine, and textile industries.

Literature Review, this includes a review of existing available literature; analysis of new studies and reports on packaging sustainability, case studies; an in-depth review of selected companies reputed to have instituted the sustainability of packaging, even to the enumeration of industry surveys; mail shots to packaging companies to highlight trends and practices.

4.2.1 Results and Analysis: Case study of the trend setters

1. The use of bio-degradable material

The business would follow suit as Uganda's secondary and tertiary organizations which also have started contributing to the reduction of their carbon footprints by using biodegradable products for packaging its materials. Secondary research evidence has these firms as constituting to 10%-15% of Uganda's packaging industry.

Green Packaging Uganda: Companies such as Eco-packing, Oribags, Crane Paper, and Prime Concepts Packaging handle the manufacturing of biodegradable packaging materials from natural materials, including cassava starch. They aim to offer support to the food packaging industry by changing the status quo on conventional polythene. Their offers for bagging come with products that decompose on exposure to the elements in the surroundings, making a reduction of up to 80% of the waste in land refill sites (Nangoli, 2022).

ARUORA: This is a company manufacturing sustainable packaging solutions. Aruora uses locally sourced natural fibres and biodegradable plastics to cater to industries in food takeaway services. Their focus on using materials with minimal carbon footprints reflects the shift towards sustainable practices in the food industry as reported by Mawanda, 2023.

2. Recyclable Packaging

Many companies are now turning to the use of recyclable materials, especially in beverage and food industries.

Uganda Breweries: This is one of the biggest companies in the beverage sector that shows a good adherence to the commitment of sustainability through the use of recycled glass bottles for its products. Initiatives like the "Returnable Bottle Scheme" are indicative of a company focusing on reducing waste, reducing the use of new raw materials, and setting a circular economy in the beverages sector. It is expected that, in general, the "Returnable Bottle Scheme" will be recycling and reusing up to 40% of its bottles.

DOVE FOODS: Dove Foods has also positioned itself to wrap its products having the capacity to use such resources as carton and plastics in 60% of its total packaging, which is a 30% increment as compared to the past years when only 30% of its entire packaging was having the ability to use the recyclable packaging and, according to Wanyama, this, therefore, makes it able to be recycled.

This integrates on the supply chain efficiency, while packaging waste responsible for environmental issues also have become so prevalent in the food processing industry. Wanyama, S., 2023.

3. Minimalist packaging

This design philosophy lowers material content and maintains the core protection of the product.

Nile Special: The famous Ugandan beer has left its use of chaotic graphics on new labels to incorporate minimalist designs. The label for Nile Special has reduced plastic and simplified graphics so that it would be recognizable to keep the brand recognized in the marketplace. It also allows for less material in total production, which aligns with global trends in a move towards more sustainable packaging. Owiny (2023) presents that the material of packaging per unit has been reduced by 20%, leading to a reduction in waste and lowering the use of resources.

Novaroma: Known for selling essential oils and fragrances, Novaroma has resorted to a minimalist approach to its packaging; instead of plastic, it uses simple glass containers. The switch to glass containers eliminates about 50% of the plastic that was formaly utilized, thereby making a firm stand on sustainability. The fact that the company has put an emphasis on aesthetics joined with sustainability proves how minimalist design can appeal to the 'green' conscious and yet make the brand premium in presentation (Kisakye, 2023).

4. Returnable Packaging Systems

This strategy upholds the closed loop of material use and substantially cuts down on waste generated due to packaging.

Coca-Cola Beverages Uganda: By outlaying a strong returnable glass bottle program, Coca-Cola is actually calling on the consumers to bring the bottles back post-utilization so that they can be cleaned and reused. This will save on resources and further save on required energy but also engage the community in the recycling processes hence, a 35% return rate of bottles, a high rate of engagement with their customers. The commitment to sustainable packing has reduced the new production demand for glass products by about 30% on their end (Akena, 2022).

Bottlers and Juiceries: Local bottlers and juiceries, such as Teju Juice report a 25% increase in bottle returns due to incentives and community programs., also use

returnable bottles as part of their focus on sustainability. They offer consumers incentives to return used bottles so that they will not be disposed of but will be reused. Such has contributed to expanding community participation in recycling efforts (Kisakye, 2023).

5. Educational Initiatives

They are investing on outreach and education; that will take place in order to inform the public about the importance of sustainability and responsible use of packaging.

Uganda Conservation Foundation: long-term impacts are intervention through direct communication with around 5,000 participants each year; the awareness raised about green packaging has increased by about 20% in the targeted communities, and workshops are held for businesses and the public. The campaign focus is on ecological impacts through packaging waste and hence encourages businesses to go greener. Through such campaigns, the populations are sensitized on the importance of recycling and proper utilization, making society aware in handling sustainable life. (Okwong, 2023).

Unilever Uganda: For instance, with 'Clean Up Uganda' campaigns, Unilever had community engagements on the appreciations of proper waste disposal and interventions in recycling. In these community recycling initiatives, Unilever has sensitized over 10,000 persons, and community recycling has increased by 15%, showing an overall sustainability view by the company (Muwanga, 2021).

4.3 Assessing customer view, perception and attitude towards packaging.

The study's second objective was to understand consumer preferences and attitudes toward sustainable packaging. The information was solicited through a regimented online questionnaire using Google Forms Survey Tool, which collects information about the consumers' demographics, levels of awareness concerning sustainable packaging, and their perceptions about the different types of packaging. The survey data will be analyzed with the software tools provided by Microsoft into statistical analysis, auto-generated from Google forms(https://docs.google.com/forms/d/e/1FAIpQLScbhykSxMhd1OZXn_Uv80oonZPRGWrX-bqK4-ev4X-WH-n7bg/viewform?usp=sf_link), and use appropriate descriptive statistics based on the survey responses, inferential statistics like correlation

analysis, through which relationships between variables are adjudged to find whether findings are significant in nature.

General information, as featured in the results of the survey, includes demographics, preferences, experiences, perceptions, and behavioural changes with respect to packaging or rather sustainable packaging. The details of some elucidations and interpretations of each section presented below would result from the implication of the findings.

4.3.1 Section 1: Demographics

The demographic profile of the respondents holds a lot of significance since it would help in interpreting the responses and behaviours of the respondents.

Age Distribution:

The vast majority of 87% come from the age group between 19 and 39 years, meaning that the segment that was interviewed is overwhelmingly young adults, typically much more attuned to ecological issues and definitely more likely to include sustainability in the set of purchase criteria.

The 6% of the identified respondents below the age of 18 represent minor inputs from this age segment, while the 7% of respondents equal to or over the age of 40 may represent totally different profiles and experiences in packaging use and functionality.

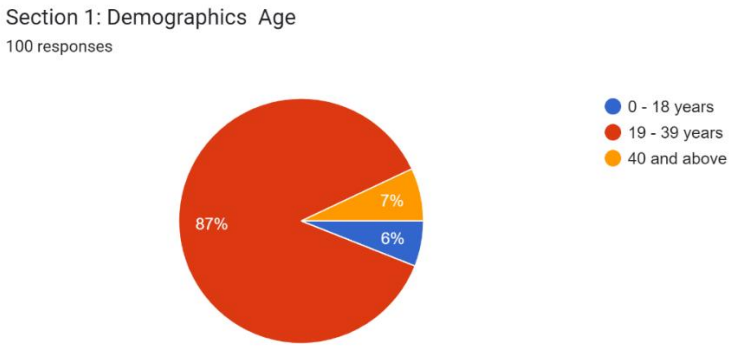

Figure 1: Age Distribution Chart

Source: *Author's Illustration on Ms Excel*

Gender Distribution:

The demographic is very slightly male-dominant, 55% male and 41% female, a factor that can play its part in attitude towards packaging choices since gender differences contribute to differences in consumer behaviours. And the fact only 4% of reflected

respondents withhold their details on gender demonstrates privacy although to a paltry yet a significant extent.

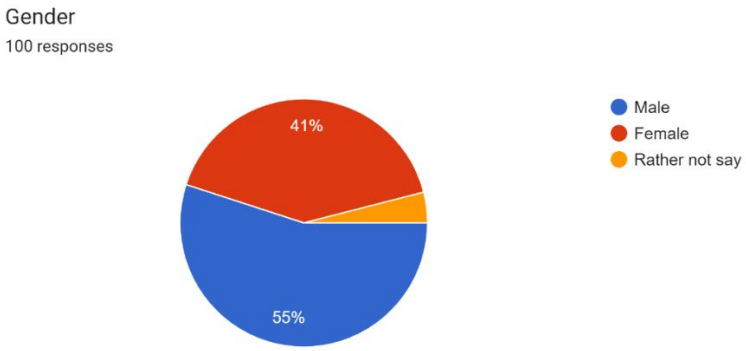

Figure 2: Gender Distribution Chart

Source: *Author's Illustration on Ms Excel*

Education and Occupation:

With 62.5%-degree holders, it could be implied that the sample group is relatively highly educated, which may likely be related with increased consciousness and concern on sustainable packaging practices. The sample also has a smaller number of students (50%), which draws in interest on issues at present, especially environmental issues, which concerns most of the younger workforce entering the industry.

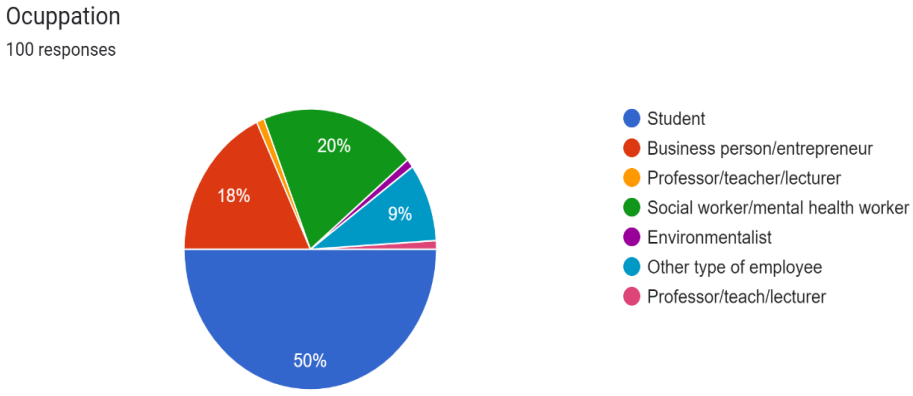

Figure 3: Occupation Chart

Source: *Author's Illustration on Ms Excel*

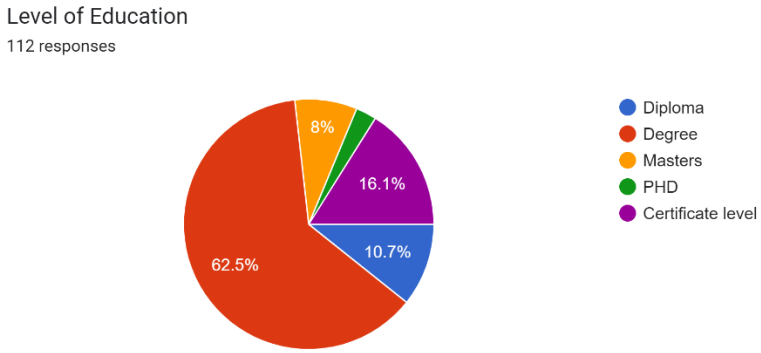

Figure 4: Level of Education Chart

Source: *Author's Illustration on Ms Excel*

4.3.2 Section 2: Packaging Preferences

There is a high preference for "paper packaging" among specification in packaging materials, recording 57.1% due to the recent awareness about environment issues. The reason why 37.4% of consumers rated "sustainable packaging" as "very important" could be attributed to the fact that paper is arguably way better than plastic in terms of the environment-friendly in packaging material.

As such, the high percentage (78%) will think logically since packaging will play an open lead to conclusion unless it is a representative of the current trend of sustainability.

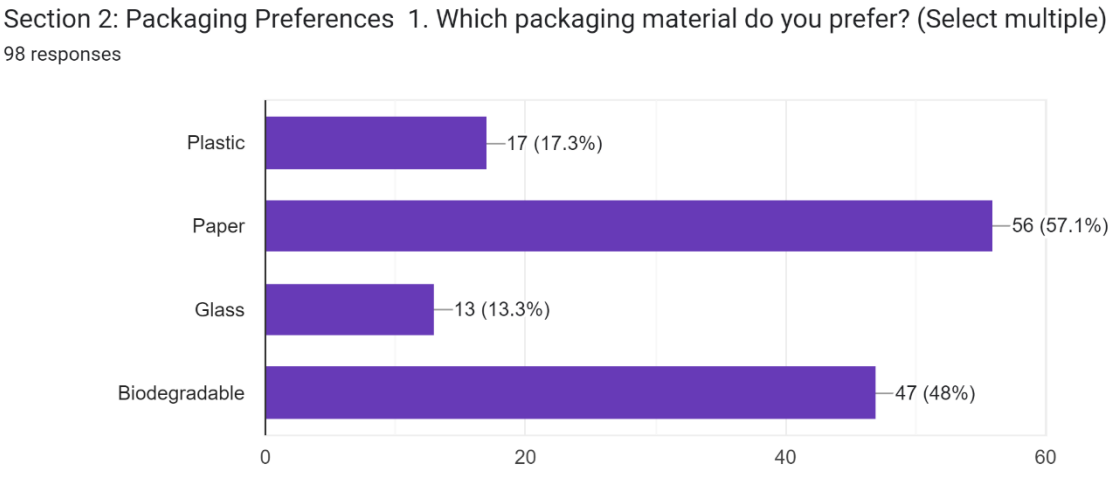

Figure 5: Packaging preference graph

Source: *Author's Design on Ms Excel*

4.3.3 Section 3: Sustainable Packaging

As complemented above, where views on packaging are concerned, the research of the approach of the respondents to sustainable packages also provides an overhead into the enunciations of consumer expectations and values. Therefore, here, the report is that there is a broad-based understanding of sustainable packaging based on aspects accentuated, which are:

- Is Ecologically Sound and ensures zero or no impact on nature.
- Use of recyclable, biodegradable, and reusable materials.
- Consideration for entire lifecycle impacts and reduced pollution.
- Importance of durability and functionality without harming the environment.

A vast majority, at 76.8%, believe that sustainable packaging "reduces waste"; this reflects very good consumer support for practices related to environmental issues.

Additionally, majority of the respondents (54%) presented their preference for reusable bags/containers which demonstrates a push towards sustainability. Other actions such as use of minimal packaging, avoiding single use packaging and recycling practices are being implemented amongst most consumers as illustrated below.

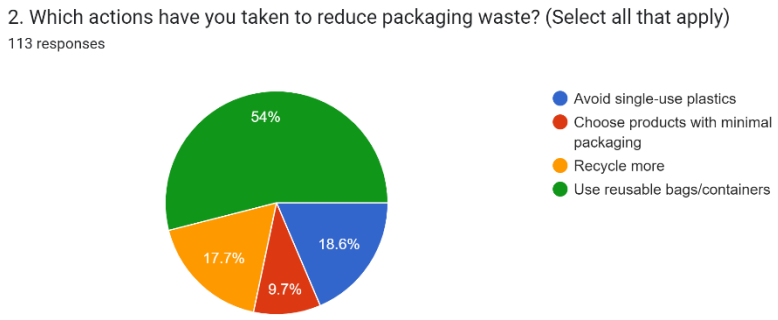

Figure 6: Actions for waste reduction

Source: *Author's Design on Ms Excel*

The overwhelming readiness (74%) to pay an additional cost on packaging that can be termed sustainable marks a market potential for those brands that spend on green materials that allows consumers to pay a premium above the packaging in the name of the environment and its sustainability.

4.3.4 Section 4: Packaging Features

The focus on critical features of packaging for consumers highlights:

Eco-friendliness (49%) being their most important favourite feature reinforces the emerging trend where consumers wish for products meeting their needs, and equally support their ecologically friendly beliefs. The variation in importance placed on packaging to influence purchase choices certainly will guide and be of help to producers and other marketers offer a more personalized approach to packaging, to meet customer needs and requirements.

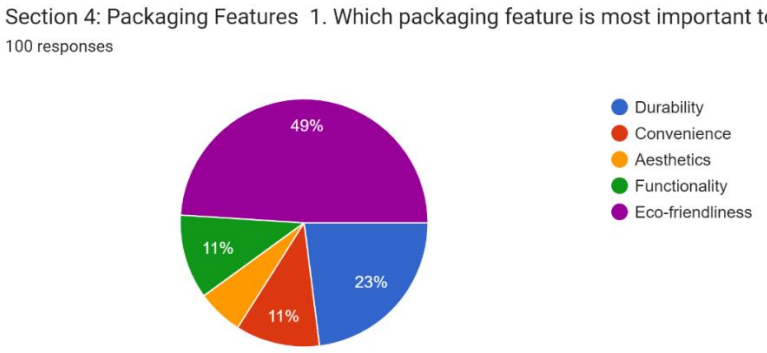

Figure 7: Packaging features chart

Source: *Author's Figure in Ms Excel*

4.3.5 Section 5: Experience with Sustainable Packaging

A vast majority (79%) have used products that feature sustainable packaging illustrating that such products have a significant footprint in the market, and customers are also familiar with them. Good usability experience that is associated with reusability is indicative of being considered as a positive reason for sustainable packaging as well, therefore solidifying the idea that sustainability definitely increases usability if designed correctly.

4.3.6 Section 6: Perceptions

This nearly three-quarters acceptance that companies who are using sustainable packaging are more responsible shows that in the consumer's mind, the issue of corporate accountability is almost identical in it being or not being sustainable. This is a potent way that companies can use this among their strategies and tactics to build consumer brand loyalty and more substantial customer relationships.

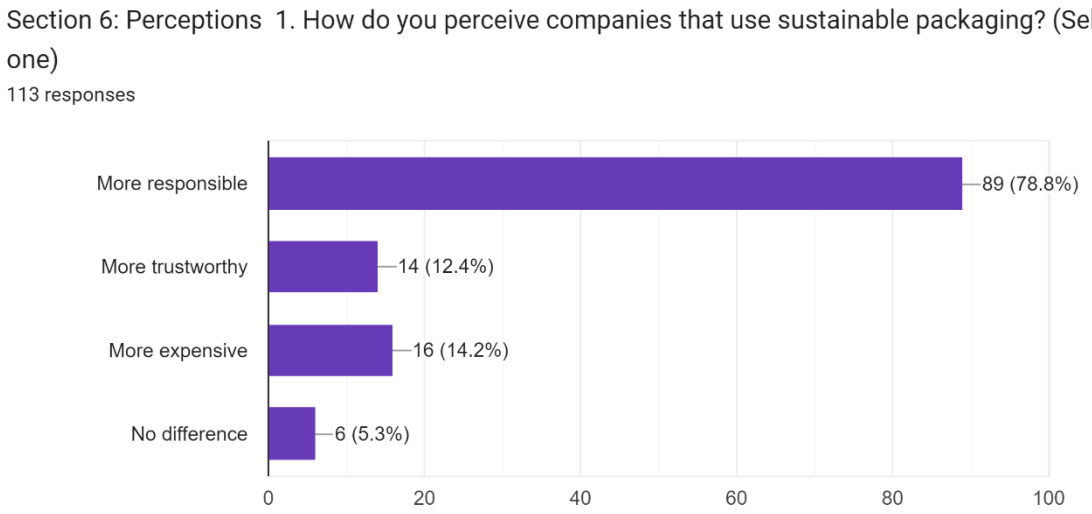

Figure 8: Perception graph

Source: *Author's Figure in Ms Excel*

The Confidence Factor 94% would refer brands that are seen as having a serious commitment to the good of the environment through sustainable packaging. That in itself is one significant finding, and usually, corporations are happy to be able to differentiate themselves in any way in a competitive marketplace.

4.3.7 Section 7: Behaviour Change

An intent to use re-useable bags and a willingness to purchase with minimum packaging products reveals the trend of more sustainable consumer behaviour.

Environmental reasons score higher (68%) compared to Health reasons and Cost reasons, meaning that ecological considerations are the top priorities for the consumers.

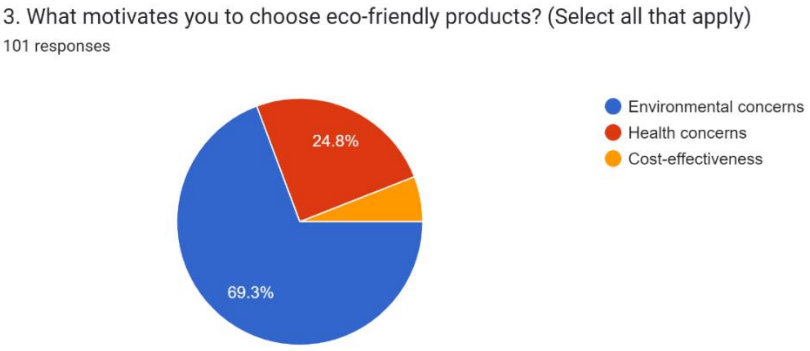

Figure 9: Motivation to use eco-friendly products

Source: *Author's Figure in Ms Excel*

4.3.7 Section 8: Open-End Questions

Qualitative information such as open-end comments will help neutrally understand consumer reactions:

Likes/Dislikes: Though the convenience of these packing materials is well-liked, their environmental cons point out the need for some development within this area of packing.

Suggestions: Since the majority call for more decomposable materials, it indicates their wish to have brands being innovative in their choice of materials, ensuring packages being environmentally friendly.

General Awareness: Increase in awareness and stronger regulations signal that the responsibility towards sustainability is in the hands of all collectively – consumers, producers, and policymakers rather than only one party.

It is this survey that underlines a sort of general trend in consumers a propensity to incline to more sustainable modes of packaging, thus making the urge paramount for businesses to fit into the dynamics. The data showed that people are ready to pay the extra amount, but they also strongly preferred brands that promoted responsible acts toward the environment—not a small change in consumer dynamics. Therefore, brands that wish to do well in this landscape must calibrate their products and message with sustainability principles if they are to capture this growing demand in the market.

4.4 LCA Green Packaging Vs LCA Traditional Packaging in Uganda

The third objective of this research seeks to analyze the Life Cycle impact of Green Packaging versus the Life Cycle impact of traditional packaging in Uganda to determine their overall environmental impact and establish empirical data based on case studies. Interest has consequently been generated at the intersection of the growing importance of sustainability, worldwide, with the packaging life cycle impacts as well. This paper assesses the impacts of green materials in packaging, mainly focusing on biodegradables and recyclables, on life cycles compared with that of traditional packaging, plastic and polythene, in a Ugandan perspective. Businesses and policymakers must understand these impacts, for the choices made will determine how much environmental footprints are to be reduced.

4.4.1 Comparative Analysis of Life Cycle Impacts

1. Raw Material Extraction

Traditional Packaging: Fossil fuels are major components of conventional packaging, particularly those made with plastics. The techniques involved in the extraction of raw materials in obtaining crude oil result in enormous amounts of greenhouse gas (GHG) emissions. Indeed, making polyethylene, one of the major plastics in use, produces some considerable amount of CO2 responsible for climate change (Kisakye, 2023).

Green Packaging: Green packaging materials are usually derived from such things as biodegradable plastics and paper, which come from renewable resources. For example, Oribags and Eco-Packaging of Uganda produce biodegradable bags out of cassava starch, with a lower impact on raw material concerning the environment compared to petroleum-based plastics. These materials consume less energy in extraction and also contribute to agricultural sustainability (Nangoli, 2022).

2. Manufacturing Process

Traditional Packaging: Energy-intensive traditional packaging manufacturing processes lead to high emission levels. Local industries dealing with traditional plastic manufacture are prone to huge wastes and high emissions, as per the findings by the Uganda National Bureau of Standards, due to the inefficient technologies that produce their products (UNBS, 2023).

Green Packaging: Green packaging often requires considerably lower energy consumption during the manufacturing process. To illustrate this, manufacturers, under the brand Dove Foods, have resorted to forms of processing that rely on renewable sources of energy, as a result, reducing CO2 emissions. In addition, most components of biodegradable materials often have low energy levels compared to most of the conventional plastics and therefore considered the most viable, when sustainable packaging is considered (Wanyama, 2023).

3. Transportation and Distribution

Traditional Packaging: Emission-related events during the transportation stage are higher for traditional packaging due to the weight and volume of plastic products. The deplorable state of infrastructure in Uganda can worsen the accumulative carbon footprint for these heavy materials shifting across the nation (Kisaka, 2021).

Green Packaging: Green packaging products in a biodegradable lightweight bag can lessen the usage of energy used during transportation. From this, Coca-Cola Beverages Uganda moved to light glass bottles that save on the fuel costs needed to distribute its products, hence reducing emissions per unit transported. The company reports that it works with sustainability consultants to conduct LCAs within the context of its broader sustainability reporting framework and models the entire lifecycle of packaging using proprietary software—from raw material extraction to end-of-life disposal.

Only the active involvement of communities and stakeholders will make it easier to collect wastes, thereby facilitating improvement in recycling and return rates, which are factored into LCA calculations. The strong keeping of a database, therefore, implies the tracking of environmental impacts of the packaging material life cycle.

4. The use phase

Traditional Packaging: In traditional packaging, the use phase falls into a single-use culture. To exemplify, the single-use plastics come in waves of huge quantities, and after using them, people dispose them off in the environment. This behaviour turns out to be a significant problem in the urban and rural environments in Uganda. For instance, it is estimated to be 3–10 times the equivalent GHG emissions are emitted into the atmosphere during the life cycle from a plastic bag produced from equivalent weight (Okwong, 2023).

Green packaging: For example, green packaging is defined as packaging that uses returnable or reusable systems, such as the Uganda Breweries' returnable glass bottle system, which substantially reduces the use of the packaging to single use. There is also less disposal involved with the returnable glass bottle strategy because studies show that a lot of the disposal of packaging comes from discarding things that can be reused or recycled further (Kisaka, 2021). Uganda Breweries pays third-party consultants to undertake LCAs in their packaging because they are likely to be more objective.

In addition, they carry out primary data collection through field studies and cooperation with local waste management companies to estimate the packaging's end-of-life (EOL) conditions in order to draw out strategies based on LCA results,

and therefore reduce environmental load with an enhancement of return and recycling rates.

5. End-of-Life (EOL) Disposal

Traditional Packaging: Traditional plastics decay in hundreds to thousands of years, as evidenced by several academic studies that have continued to show their presence in landfills and other natural environments. Uganda's case is even worse because it does not have workable waste collection, management, and recycling systems. Over 90% of plastic waste is reportedly being taken to landfills and littering (Nangoli, 2022).

Green Packaging: The End-of-Life impact of the green packaging is way more positive. Biodegradable and compostable alternatives biodegrade naturally through microbial activity, thus releasing their nutrients to the earth. Through organizations, such a Green Packaging Uganda better environmental gains are ensured through enhancing of composting sites and handling of materials of the kind (Muwanga, 2021).

LCA at Green Packaging Uganda is performed in the manner that complies with the ISO 14040 and with analytical steps namely goal and scope definition of an LCA, inventory analysis, impact assessment, and interpretation of the results.

4.4.2 Quantitative Results and Comparative Data

The LCA for five kinds of sustainable packaging versus traditional packaging has been enumerated, including the outline of metrics such as carbon footprints, energy and waste reduction assessment. These confirm the existing literature, with the presupposition that sustainable packaging has lower impact than the various options in traditional packaging. However, it also poses challenges to improve the sustainability of solutions in view of both production efficiencies and end-of-life disposal for green packaging.

Carbon Footprint: Studies show that bio-degradable plastics can result in less than <50% carbon footprint in comparison to traditional plastics over the entire life cycle (Wanyama, 2023). Basically, a comparative study shows that for 1 tonne of traditional plastic, about 6 tonnes of CO2 emissions are released, whereas biodegradable options could result in about 3 tonnes in similar conditions (Kisakye, 2023).

Energy Physical Consumption: During the lifecycle of standard packaging, the Energy Physical consumption can be around 3-4 times higher than that of biodegradable alternatives.

The manufacturing of conventionally built plastics normally takes around 17 MJ/kg, which can be under 10 MJ/kg inside of biodegradable materials (UNBS, 2023).

Waste Decomposition Rates: Classical plastic waste may take centuries to decompose, versus biodegradable plastics and paper-based products that may in the decomposition period of as short a period as 6 months provided all the right conditions are present (Nangoli, 2022).

5.0 Chapter Five: Summary of findings and conclusions

5.1 Discussion and summary of findings.

The survey results confirm the opinion of the current literature the role consumer awareness and environmental concern plays in the development of preferences towards sustainable packaging. A high percentage of consumers claiming to have a preference for sustainable packaging also suggests market demand which firms can benefit.

Consumer Tendencies: The strong preference for the recyclability and biodegradability aspects indicates that one has to deal with the very critical attributes that the packaging strategies should deal with to align with the broader preferences towards the environment and consumer expectations.

Influence of Age and Income: Such pronounced divergence of attitudes across age and income also implies that the marketing strategy will have to be distinctive for differentiating between demographic sections. Younger consumers are more likely to respond to the sustainable message in marketing campaigns, whereas for incoming constituents, the value constructed around the sustainable set will also be an issue.

Educational Opportunities: Since the percentage of those aware beforehand of some sustainable packaging solution is very low, there is a large window within which consumer education can fill with specific campaigns. The latter can include information programs aimed at filling consumers with demand for the advantages and availability of this sustainable packaging.

In general, more positive attitudes to the idea are evident, and a change is achievable through greater attention and knowledge. Companies that are looking to apply sustainability on their own business should take these consumer understandings in designing best feasible packaging approach for the company to serve the target audience and to bring benefit to the environment.

Packaging strategies that adopt this innovation hint at a rising wave in which companies espouse sustainability not only to fulfill the dictums of the regulators but to actually step forward to adopt it as part of their brand identity. The two case studies under this review equally bring out the importance of the attitude of integration of sustainability in the core business strategy and not as a side initiative.

Companies that invest in sustainability do much more than make a positive social and environmental impact; they also stand out in highly competitive markets, building higher customer retention and acquiring new consumers.
The trend of green packaging in Uganda is a pointer to the rising commitment of organizations in addressing environmentally sustainable development. Businesses in the food industry, through the pharmaceutical sector and the textile industries, device newer approaches to sustainability, biodegradable materials, recyclable packaging, minimalist designs, returnable systems, and educational initiatives. But for these efforts to bear fruits, the issues of cost, infrastructure, and consumer orientation need to be resolved. Business, governmental, and NGO follow-up is essential for an empowered environment, and increasing the options of sustainable packaging eventually works well for local people and mother earth in general.

The life cycle impact of Uganda's green packaging compared with the traditional packaging shows a number of remarkable benefits. On the whole, green packaging will result in a lower carbon footprint, lesser energy usage, and better outcomes for disposal. CO2 emissions reduction, energy savings, and waste disposal benefits are the general positive impacts of adopting green packaging. However, consumer awareness, waste management infrastructure, and, most of all, the exact cost implications for businesses are still major challenges.

Life Cycle Assessment in Uganda is a great step toward both understanding and reduction in environmental impacts. Companies such as Green Packaging Uganda, Dove Foods, Uganda Breweries, and Coca-Cola Beverages Uganda have taken a lead in this application, and practical use of these assessments is to promote green practices. Systematic evaluations of leading options for environmentally friendly packaging assist in the reduction of the carbon footprints, resource efficiency improvements, and the construction of a circular economy.

Through the repetitive emphasis of LCA in their operations, Ugandan businesses can develop more sustainable packaging solutions not in isolation from others in the global market, but also in correspondence with the current demand for environmentally sensitive practice approaches from the consumer and stakeholder.

Joint efforts between the government, businesses, and civil society ensure the full realization of the potential gains from green packaging practices. Uganda will prevent and attain a sustainable packaging future where economic growth is brought closer to compatibility with the environment through infrastructure investment and fostering best practices.

5.2 Implications and Recommendations

Consumer Education: Companies and agencies in Uganda should major in increased awareness campaigns with regard to consumer education on sustainable packaging solutions that are likely to increase market acceptance in demand.

Improvement of LCA Methodologies: Future LCA studies should be more inclusive of the diversity of packaging types and account for local situations and practices regarding waste and consumer recycling considerations to arrive at more relevant results.

Incentivization for Green Innovations: Policies to incent the policy for Ugandan firms to adopt green packaging, like a subsidy on biodegradable material or tax credit on the one which uses an effectively run recycling program.

Engaging Community Efforts: Community-based participation in closed-loop creation and further advocacy of the same would cumulatively decrease waste and encourage recycling among consumers of products in Uganda.

5.3 Challenges Facing Green Packaging Adoption

While progress is made, other challenges are being faced, some of which will be discussed below:

Cost Implication: Naturally, the cost of product packaging in more biodegradable ways statistically shows an increase in the cost and depressed returns to a class of business enterprises. This class of businesses often seems unable to absorb the additional costs of making a transition to sustainable packaging, leading to hesitation and delay in adopting sustainable packaging solutions (Wiley, 2023).

Lack of Infrastructure: To execute working green packaging strategies, there must be a well-established recycling infrastructure. Unfortunately, most of the communities in Uganda lack proper collection, sorting, and processing systems for collection of recyclable material; hence, businesses find it tough to run a recycling program (Nangoli, 2022).

Consumer Knowledge: The benefits of green packaging are not understood by many consumers; thus, sustainable products are not highly sought after. Without mass education campaigns on the part of the consumers, the manufacturers will not have much motivation to invest in environmentally friendly materials.

The challenges, however, in adopting green packaging are several, despite all the opportunities it presents as a way forward into better alignment with consumer preferences and contributing positively toward environmental sustainability. Such challenges include higher and increasing development and sourcing costs of eco-friendly materials, limited availability of sustainable alternatives, a robust infrastructure structure for recycling and waste management, and the complexity involved in consumer education on the advantages and end-of-life management of green packaging. In addition, there may be pressure to maintain business competitiveness regarding price and performance, making the shift to sustainability even more challenging. In view of this, stakeholders all along the value chain from manufacturers and retailers through to policy makers should combine in active cooperation to find innovative investment ways into improved materials and processes and consumer awareness. Only by overcoming these challenges will it be possible to achieve the best from green packaging and to establish a much more sustainable future.

5.4 Areas for Future Research

Longitudinal Studies about Consumer Behaviour: The dynamism in the preferences that the consumers in Uganda are developing towards sustainable packaging will make for extensively interesting research and each of these studies should monitor how socio-economic factors influence each of these changes.

Broader Scope of LCA Studies: Wide LCA studies covering wide areas of sustainable packaging solutions in the domain of the specter of different industries of Uganda would probably provide more relevant information on these environmental impacts.

International Comparisons: How cultural differences at geographical levels matter in drawing consumer attitudes toward sustainable packaging in Uganda will rely on such research.

Impact of Policy Change: Future studies should assess how emerging regulations and policies might facilitate or impede the adoption of sustainable packaging practices within Ugandan industries.

By addressing these recommendations and research areas, stakeholders can navigate and respond adeptly to the evolving landscape of green packaging in Uganda, ultimately promoting environmental sustainability more effectively.

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APPENDIX

APPENDIX A: ORIBAGS PACKAGES

APPENDIX B: RECYCLABLE PAPER PACKAGING

APPENDIX C: TYPES OF PACKAGING

APPENDIX D: SUSTAINABLE PACKAGING FEATURES