

Assessment of Packaging Barriers to Management in Tanzania Maximum Efficiency of Food Supply Chain

Esther Kajula

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JAMK University of Applied Sciences

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Abstract <p>The study has been focusing on packaging barriers to maximum efficiency of food packaging in Tanzania. Food packaging aimed to protect, secure, sell, and keep products from the initial point to the point of consumption and prolong the shelf life of products.</p> <p>The specific objectives of this study are to identify the standard packaging techniques of food supply chain management, then analyze the barriers and challenges to effective food supply chain management and finally assess the proposed packaging solutions to effective food supply chain management in Tanzania. Most of the packaging materials have been reviewed in the literature and the way they are being used. Each kind of food packaging materials were also studied in various ways of their management. The case study approach was applied that involved both primary and secondary sources of data from Morogoro, Moshi and Dar es Salaam that were selected for the study. Data collecting tools were interviews, questionnaires, and observations.</p> <p>Findings identified the packaging materials that are usually being used by both customers, such as food suppliers and retailers, such as paper boxes, plastic boxes, corrugated boxes, poly bags, woven bags, jute gunny bags and others. Besides, some areas have been facing some barriers in packaging, such as transportation, primary packaging, secondary packaging, storage, general handling, and others. Lastly, customers recommended effective food supply management that will serve as bridges to effective supply chain management. This juncture could avoid food losses where packaging is essential and should be with high standard and the better packaging materials, the more it cost. To maximum efficiency of food supply chain in stipulated area the packaging should be defined to suit the purpose. Furthermore, all stakeholders should be involved and understand the whole packaging concept aspects are met.</p>		
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1. Introduction

This study aimed to focus on assessing packaging barriers to maximum efficiency of food supply chain management in Tanzania. The packaging is meant to protect, secure, sell, and keep products from the initial point to the point of consumption. Furthermore, it has the function of prolonging the shelf life of products. Packaging is an essential part of logistics and supply chain management since it adds efficiency in transportation, warehousing and general material handling.

As a developing country in the world, Tanzania is facing challenges on effective food supply chain management because the existing food packaging is overwhelmed with the limitation of rising demand of packages in the supply chain, techniques, and quality of packages itself. Most of the packaging has been made on cereals products like maize, rice and beans that have been processed locally. The focus of this study is aimed at the main food products that the most Tanzanian population has consumed.

Packaging has been among the essential factors in ensuring efficiency in the food supply system. According to the Food and Agriculture Organization of United Nations (FAO, 2014,1), the main purpose of packaging went back from significant losses from farm to consumers that are mainly attributed to poor handling, distribution, storage, and purchase or consumption behaviour. Whereby large quantity of resources that could otherwise be spent on more productive activities go into producing and transporting goods that only go to waste. Losses at almost every stage of the food chain may be reduced by using appropriate packaging. Packaging has been among the contributing factors that increase the efficiency of natural resources use and reduce the overall environmental impact of daily activities (Coelho et al., 2020,1-2). The solutions to achieve maximum efficiency in the food supply chain are to understand how the packaging of various organizations operate (Sohrabpour and Hellstrom, 2012,1). There have been various ways in which these organizations operate in processing their goods until they are supplied to the final consumers.

In order to ensure safety and quality, food packaging is essential in protecting food from environmental contamination and other influences (Han et al., 2018). Generally, packaging should always be aiming at containment, protection, communication, and convenience (Fawcett et al, 2014,38-48; Trung, 2020,17-21). Therefore, food packaging aims to maintain a cost-effective way for industry requirements and consumers, safety, and minimize environmental impact (Bugusu and Marsh, 2007,39). However, poor packaging results have been observed with some conditions: odours, shocks, dust, temperature, physical damage, light, microorganisms, and humidity.

Generally, efficiency is determined when considering the extent of achieving specific goals (Meta, 2017,1). The efficiency in food supply considers packaging materials as a more efficient option in reducing the impact of the volume of packaging materials and energy used while preventing production emissions. Thus, the study aims at assessing some packaging barriers to maximum efficiency of food chain management. Some challenging issues should be addressed to maintain aiming at improving food quality and safety, increase consumer trust and acceptance of new packaging technologies, and reduce the harmful impacts of packaging waste and food loss on the environment (Han et al., 2018). Currently, there is not enough information on the packaging barriers that affect the maximum efficiency of the food supply in Tanzania. This study is going to make an assessment of the whole process of food packaging in the supply chain management in Tanzania. Understanding food packaging in most developing countries is important to find the best ways of ensuring effective ways of maintaining standards. Therefore, this study will assess the whole process of food packaging in the supply chain management in Tanzania.

Despite the packaging materials' role as mentioned, the packaging materials also contribute to increased municipal waste after their uses after disposing of (Mditshwa and Opara, 2013,2629). The Impacts of disposing of the packaging wastes contribute to environmental pollution in different ways depending on the materials and securing the food system. Therefore, apart from various labelling details such as selling, promotion, and environmental protection, it has been proposed that should go together in the packaging designing (Trung, 2020,17,39-40). This is mainly accompanied by the materials used in packaging food products before they reach the final consumers.

1.2 Problem Statement and justification of the study

Although some developments in food packaging have been proceeding in Tanzania that contribute to ensuring food safety and quality, this study understands that there is nothing good without improvements. The efficiency of the food supply is much contributed by the packaging (Han et al., 2018). However, some barriers affect the efficiency of the food supply chain that are needed to be assessed in Tanzania. Their efficiency is very crucial to ensure the quality of goods throughout the supply chain. Therefore, there was a need to determine the barriers to Maximum Efficiency of Food Supply Chain Management in Tanzania by considering various factors.

It is observed that there is not enough continuous development in traditional packaging technology in developing countries. Currently, there is minimal effort that has been made to assess and develop a conventional technology or in as well as application of scientific knowledge in packaging amongst the developing

countries (FAO, 2014). These traditional technologies that are already existing need to be advanced by assessing their potentiality to meet customer demand. Though there are new technologies that have been imported into the packaging, care should be taken on their efficiency as well as their effects on the traditional methods of the developing world. Therefore, traditional and modern ways of preserving food should be assessed and recommended based on their efficiency. Also, through taking appropriate suggestions on the best ways of developing our traditional technologies.

Tanzania is among the developing countries where most of their economic developments depend on agriculture for and their people employment. Therefore, the significant food packaging in Tanzania will boost the development of the country in general. First, however, it is necessary to consider the growing importance of food packaging in Tanzania regarding quality and safety. According to (Mmari, 2015,80), some packaging barriers lead to consumers' dissatisfaction in Tanzania. Furthermore, there are inadequate packaging standards and knowledge of packaging technology (Nzumile & Taifa, 2020,40).

1.3 Significance of the Study and objectives

The researcher was expecting to develop further knowledge on the efficiency of food packaging technology in Tanzania and the entire developing world. Also, this study is will be valuable in developing and advancing food packaging technology, thereby increasing the efficiency of food supply logistics. Furthermore, the findings of the study will be beneficial to the stakeholders in the value chain of food products locally and worldwide.

Objectives of the study

The general objective of this study was to assess the Packaging Barriers to Maximum Efficiency of Food Supply Chain Management in Tanzania.

The specific objectives of this study were to:

- i. To Identify the common packaging techniques of Food Supply Chain Management in Tanzania
- ii. To analyze the barriers and challenges to effective food supply chain management in Tanzania
- iii. To assess the proposed packaging solutions to effective food supply chain management in Tanzania.

1.4 Research questions and Limitations of this study.

Research questions are considered as a significant part of any academic writing as they aimed to focus on a specified area of studies and objectives. The stipulated research questions strived to identify all packaging barriers to maximum efficiency of food supply chain management in Tanzania and analyze how they can be alleviated. This research aimed to offer the proposal and recommendations according to the study questioners' findings on how to overcome the topic. Besides, this Study aimed to gain knowledge and assess the packaging barriers to maximum food supply management in Tanzania. To focus on the research addressed, it is necessary to find solutions for the following question.

- i. How efficient is the food packaging techniques in supply chain management Tanzania?
- ii. What are the packaging barriers affecting efficiency of food supply management in Tanzania?
- iii. What are the effectives proposed food packaging in the supply chain in Tanzania?

Limitations of this research study.

This study focused more on Tanzanian main food products such as maize and maize products, rice and beans. Although there are many varieties of food products in Tanzania, but those are the mainly used country wide. The demand and circulation of those food is large and always affect the supply chain.

2. Background theory overview

This chapter aimed to gather various information from other studies related to packaging barriers in food supply chain management. Furthermore, Tanzania's existing packaging concept and supply chain was reviewed to widen this thesis study's knowledge. Scientific articles, books, and webpage base were used in this study.

2.1 Food supply management

The process of supply chain management involves supplier and customer integration. But among them, there are various integrating factors, mainly the logistics of that supply (Sulaiman et al., (2017,1). The better ways of discussing multiple supply chain management concepts and logistics are by asking and discussing specific practitioners such as operation managers (Emberson et al., 2006,1). This is by how the actors pursue their objectives, their scope of activities, and their supporters. In addition, the final consumers should be among the role players in this chain by participating in evaluating the materials being consumed. This will make significant contributions in the effective ways of ensuring innovations in technology and maintaining supply standards.

The supply chain is fulfilled when the three aspects are linked together: suppliers, logistics, and customers. Besides, supply chain and logistics are more borders in the business operation from product design to product utilization. Supply chain and logistics are sometimes used interchangeably though they are closely related to logistics is a subset of supply chain management. Logistics are among the processes involved in the supply chain, such as suppliers and customers. Logistics lies between the suppliers and customers up to the final consumer's Baker et al. (2014,3-5). It reached maximum attention when the industry started to demand an efficient system of handling materials in the supply chain by considering the minimization of costs at all levels and maintain maximum customer satisfaction (Chueneman, 2009).

According to Li (2014), supply chain management is defined as the integration of the strategic traditional business function and methods through the individual business company in the supply chain. Mainly for "improving the long-term performance of the individual companies and the supply chain as a whole" This is performed by well-coordinated and organized personnel that can perform their duties effectively at all levels of organizations. Moreover, explain logistics as Logistics management can be attained when all re-

sources associated managed, including information flow, material handling, production, packaging, inventory, transportation, warehousing, and often security. All these physical logistics need to meet the customer's requirements from the point of origin to consumption. Ideally, logistics management should involve customers, including final consumers, by assessing their satisfaction with their surrounding environment.

Furthermore, the Council of Logistics Management, currently known as Council of Supply Chain Management Professionals) referred to logistics management as "the process of planning, implementing, and controlling the efficient, effective flow of goods" (Li, 2014). In addition, Schueneman (2009) defined logistics as the movement of products from one point to another either from the firm or into the firm, which requires inbound management, materials, and distribution.

Also, FAO (2020) clarifies that logistics in food value chains involve different activities that include agricultural inputs, outputs, and agricultural services such as transportation, warehousing, procurement, packaging, and inventory management. These are the main activities considered when considering any logistic activities as infrastructures that will enable effective logistics. Any disruption among the activities will change the processes required to manage supply chain logistics. The food sector consists of various aspects to accomplish the supply chain. The ability to innovate in the food industry that needs much effort in packaging technology will add value to the supply chain.

2.2 Value supply chain of main food in Tanzania

Tanzania is one of the Sub Sahara Africa countries that are suffering from massive food loss. About 9,455,000 Tonnes of cereal are produced in Tanzania yearly. It is estimated that approximately 3,782,000 Tonnes, which are equal to 40% of food produced, is lost due to poor handling after harvesting and technology. Based on statistics, the food loss accounted for safety and quality also the income in general. After harvesting the crops, food loss shows that about 4 USD billion value of grain is lost annually. ("National Post-harvest Management strategy 2019-2029", 2019), 6-12).

Furthermore, about 30/40% per cent of food produced is ended to lost due to post harvested loss (PHL). Besides the food loss, it has reported that it has some side effect on the environment that hinders the utilization of production resources due to climate change. The food loss in post harvested classified into three categories such Qualitative loss due to some barriers that lead to food security—quantitative loss due to the infections of micro-organism, and transportation factor that led to physical weight reduction. Also, there is a loss of economic, which defined as monetary value due to insufficient food quality and quantity. Furthermore, it is reported that there are some direct losses occurred that happening to foodstuff spillage

from bags also some indirect loss due to less food quality. According to the research conducted in East and Southern part of Africa, about 13.5 per cent of grain produced is lost, whereas in Tanzania, the grain loss is estimated at 22 per cent due to post-harvest. The cereal loss in Tanzania mentioned into three types of crops; maize loss accounted for about 15.5 per cent, paddy, which is rice before processed, about 10.7 and Sorghum is about 12.5 per cent lost; besides, there also a paramount of fresh food about 18 and 32 per cent annually. The cumulation of the food lost for the selected crops in Tanzania due to the post harvested led to economic value loss, as shown in figure 1.

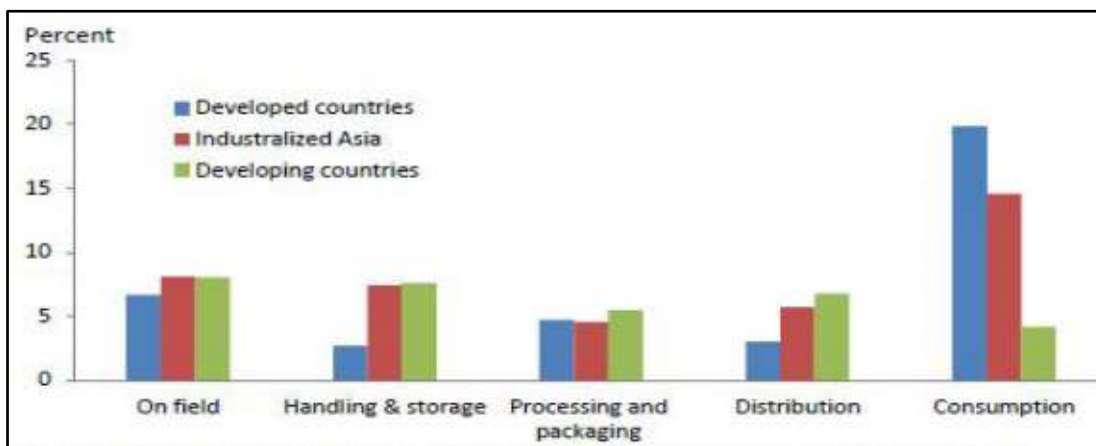


Figure 1. Illustrating the variation of the food loss along supply chain across countries

Massive food loss in the developing countries is happening in the early stage and middle stage of the food supply, while in the developed countries, the food loss is happening in the early stage of food supply and at the point of consumption. The understanding of this study all loss for somehow are related to the appropriate packaging. For example, table 1 displays the annual average economic loss for the major food crop in Tanzania below. Developing countries must take strategic actions in food packaging to eliminate food loss along the supply chain. ("National Postharvest Management strategy 2019-2029", 2019), 6-12).

Table 1, Displays the annual average economic loss for the major food crop in Tanzania. (mod. by author)

Crop	Average (000 Tonnes)		Average monetary Value in Tanzania shillings (Tshs.) million (000)	
	Production	Loss	Value saved	Value loss
Maize	6 046	937	3920	601
Rice	1780	180	2580	276
Sorghum	793	99	767	95

2.3 Food waste management

The term food loss and waste are interchangeable terminologies in which they share the same meaning at some point. The substantial food wastage may differ in the stages of losses in the supply chain for the developing and undeveloped countries. Food waste is happening in the food supply chain, but it has not been considered or accounted for in most cases, which means that food losses are inevitable. Still, observations are necessary to find appropriate measures for reducing these cases. The journey of food from the production to the consumers possess various supply chains. Interpretation of the food loss as "the quality of food lessened to consumers after harvested". Furthermore, food waste clarifies as "the consumption of inadequate food quality substantially either at the retail or final consumption location". Food loss associated with various stages such as handling, storage, transport, processing, and distribution, where's packaging plays a key role in food safety and quality. Refer the fig.7, as it illustrates various steps here food gets loss due to various reasons. (Kennard, 2019,2-3).

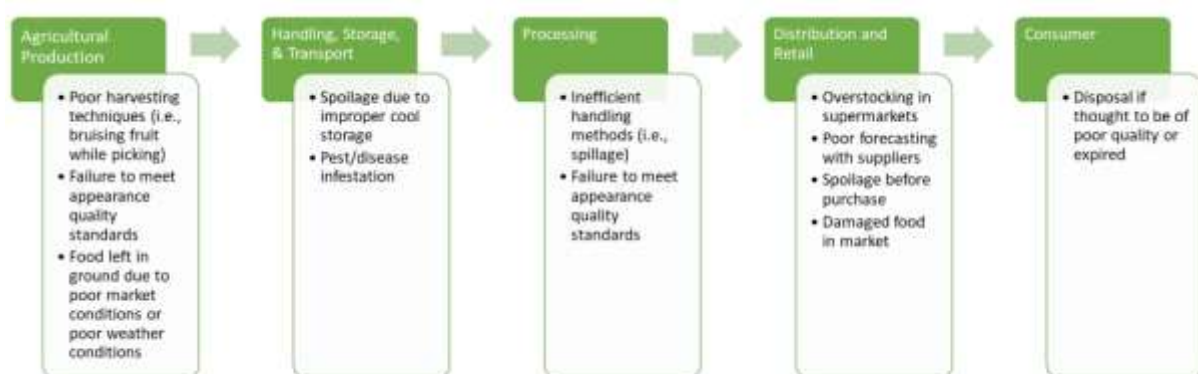


Figure 2: Displays the causes of food Loss and Waste in Food Supply Chain (Kennard, 2019,3).

Food loss is considered wasting, but there are losses in food quality due to various factors in the supply chain. These factors must also be considered, and there should be regularities in all stages of the supply chain to maintain the standards and consider waste minimization projects (Henningsson et al., 2001). Food waste is among the factors that affect the environment, social and economic sustainability. Therefore, it is necessary to take strictly target and measure to eradicate food waste in every stage of the supply chain. The effective measure and target in food supply chain and food waste management that aims to end hunger, improve food security and sustainable production by 2030 mentioned by Sustainable Development Goals (SDGs). To reach the goals in managing food waste, it is necessary to identify the main source of the

problem that hinders food waste elimination. Inadequate supply chain infrastructure, insufficient supply chain effort that not effectively focused on food loss and waste management, and weak collaboration across the value chain and ineffective regulations are among the things that require attention (Razafinirnamaharavo, 2021; Kennard, 2019,1-3).

2.4 Packaging

The packaging is meant for protecting, securing, selling, and keeping products from the initial point to the point of consumption. Also, Schueneman (2009) defined packaging as the process of protecting products from damage that are designed and tested. This is the method of avoiding damage or accidents on goods that have been produced against various agents such as temperature, humidity or vibrations. Furthermore, it has the function of prolonging the shelf life of products. Besides, it is an essential part of logistics and supply chain management since it adds efficiency in transportation, warehousing, informs and general material handling (Sohrabpour et al., 2012,1). Figure 3 displays the three major segments of the packaging system: primary, secondary, and tertiary or third in the order. The performance of the packaging method depends on the relationship between each component and its interactions. However, packaging is the most considered factor in the production of goods because it works in accordance with the value of products. Considering the value of the products in appearance, for example, the most takeaways in food packages are beverages, liquid-based such as water, milk, juice that are seen as natural as carried by different packaging materials (Kerry, 2009). Apart from the direct takeaway, packages have also been applied in other food ingredients such as oil, salts and spices. Figure 3 illustrates the main components of the packaging system.

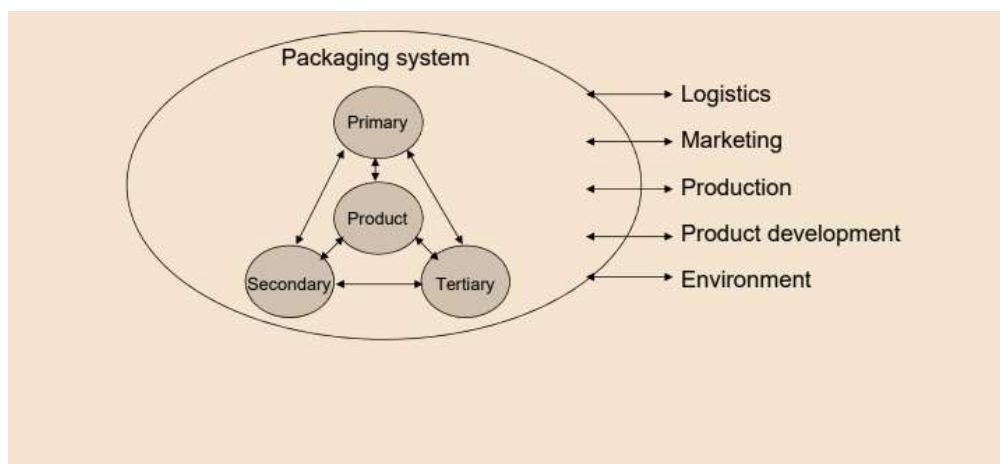


Figure 3. illustrates the main components of packaging system (Sohrabpour et al., 2012).

Further, Schueneman (2009) defined packaging as the process of protecting products from damage that are designed and tested. This is the method of avoiding damage or accident on goods that have been produced against various agents such as temperature, humidity, or vibrations.

The new food industry is progressively keen on creating productive and imaginative solutions to ensure quality and appropriation supportability; one of the principal factors that impact such pivotal perspectives is the packaging. Because of their unconventional attributes, new food items require extraordinary administration, which accentuates quality, wellbeing and security. Besides, the limited time span of usability of such sorts of items, the requirement for a controlled temperature during shipping and capacity, the client interest for top quality and the low net revenues make new food dispersion a problematic movement that has been examined and investigated in writing from various aspects. (Battini et al., 2015,1).

2.5 Food Packaging materials

A healthy package considered purpose and layout play a remarkable function in prolonging the shelf life of food products and quality. An outstanding selection of food packaging materials and methods shall preserve food quality and desired freshness during its entire supply chain journey and storage. Apparently, paper and paperboard, metal, polymers (plastic materials), metals are the most used in food packaging. Nowadays, there are nanomaterials and compound of various packaging materials in each segment to employ the functionality of each material. The researchers are working continuously to develop packaging materials to meet environmental aspects and the effectiveness of packaging materials (Marsh & Bugusu, 2007,39). Packages for groceries usually come in various structures in light of specialized necessities all through its supply chain with respect to market aspects, for instance, branding, end-user info and related standards. The layers in direct contact with the food or refreshment are classified as "food contact materials". Refer figure 4 is displaying the global market share of mostly used packaging materials. ("Food Packaging Materials, Food Packaging Forum", 2021,1). Globally, paper and paperboard present more than 30% of packaging materials, followed by plastic materials and figure 5 present an example of food packaging with different materials. Foodstuffs usually are stored in various kind of packaging materials depending on the defined purpose. The aim is to ensure food quality and environmental and cost-effective aspects are met. Excellent packaging material is defined as the capability of the material to withstand barriers against temperature, moisture, dust and other foreign matter not to harm the desired products.

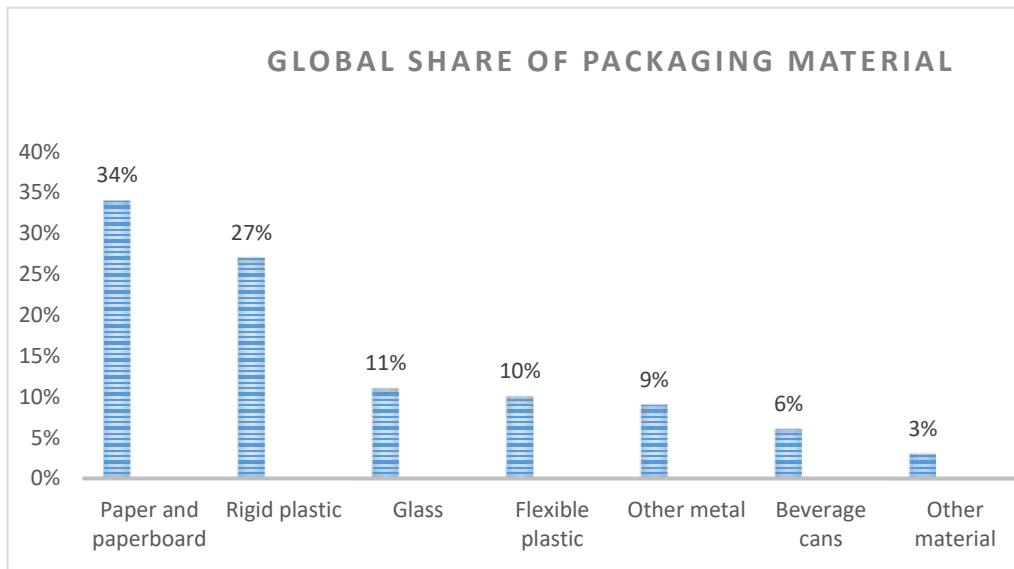


Figure 4. Illustrates the popular packaging food packaging materials (image by google).



Figure 5. "Food Packaging Materials Food Packaging Forum", 2021) Modified by Author.

Depending on the food type can be stored in different packaging materials; this more on the purpose of the package is used, what kind of food product it is. However, when talking about the food packaging materials

mentioned previously, they have all-important tasks to provide a reliable barrier between the food product and the outside environment.

Glass: These are materials that used for the long shelf life of food packaging. Most food packed in these materials are beverages, solid food, dry food, also used in medicine. Also, these are among the excellent materials that permanently leakproof oxygen, moisture, microorganisms, and pests; therefore, they can preserve food quality and safety. Due to the nature of the materials that nonchemical contains, the food packed is safer than the other materials in food contamination with material packed. The glass materials can be recyclable, and reusable somehow can save the environment. Having the advantage means it has some drawback in logistics, the glass packaging is heavyweight whereas it increases the transport costs and due to weight, also these materials is the one source of air pollution during production and transportation. (Marsh & Bugusu, 2007; Yarış & Sezgin, 2017,736-737; Kotonen, 2011,15).

Metal: Metal packaging materials are considered to have almost the same features in prolonging food products shelf and foodstuffs preservation. These packaging materials have a leak-proof of moisture, gases, odors, microorganisms, oxygen and light due to some additional chemical materials during the manufacturing process. These materials can protect the food from the outside environment, but the most important is the effective sealing process. Also, these are materials used for long run storage, and most food uses these packaging materials are beverages, solid food and dry food. These are rigid materials; therefore, it can withstand the physical movement is easy to transport and store; Besides, it has low shipping cost for the case of weight. Due to the cost of manufacturing, these materials mostly replaced with plastic. Also, it can be recycled and redesign other product from these materials. (Marsh & Bugusu, 2007; Yarış & Sezgin; Kotonen, 2011,16).

Paper and cardboard: These are two types of packaging materials used in food packaging. Paper are materials designed for the short period shelf life of food with flexible form, while cardboard is for the long shelf life of food packaging with a rigid structure that contains several layers to the material itself. The paper and cardboard materials to qualify for food packaging are made up of wood pulp, cellulose, and additive. In addition, some protective materials added to the paper and cardboard, such as wax, lessen the food contact to the material and increase food security. Most food that can be packed in these materials is dry food, liquid form, medicine and some sold food. The structure of the materials is easy to handle and storage and less transport costs in teams of volume and weight; also, these are eco-friendly. However, besides this material, it negatively impacts environmental impact since they are not completely food protected from air, moisture, and light. (Marsh & Bugusu, 2007; Yarış & Sezgin; Kotonen, 2011,16).

Plastic: Generally speaking, these food packaging materials has various advantage compared to three mentioned packaging materials (glass, paper & cardboard and metal). The materials have low cost in production and transportation due to its nature of less weight, also these materials can be structured in any desirable shape in production that promote sells somehow. Because most food packed with plastic is direct contact with materials it is necessary to take into consideration the knowledge of permeability and migration. Besides that, has these advantages compared to these three materials mentioned, plastic materials after recycling it is prohibited for food packaging. (Marsh & Bugusu, 2007; Yariş & Sezgin, 2017,736-737; Kotonen, 2011,15). Plastic materials or sometimes known as polymers in food packaging divided into various types that used for plastic polymers such as.

Polyethylene (PE); These materials are categorized into two types, high-density Polyethylene structured in the rigid form as box and trays. Also, low-density polyethene is structured in flexible and stretchable, such as film, boxes package, and wrapped papers. The materials are characterized with good moisture resistance, Higher melting point, better chemical resistance and the most food packed are highly oil, acid, salt or sugar content.

Polypropylene (PP): The material characterized with flexible and rigid properties with low density with higher melting point about 165 °C, this gives wider range of application in food packaging.

Polystyrene (PS); Clear and brittle crystal polystyrene are some of Polystyrene (PS)'s properties that can be found from three of polystyrene materials. They have relatively low gas and moisture barriers also with low melting points.

Polyvinyl chloride (PVC); is a rigid material that can withstand the physical movement not easy to break which safe the product itself and environment impact from food loss. Also, it has low oxygen proof absorbed that is suitable for oil packaging.

Polyethylene terephthalate (PET); These are materials mostly used in food packaging product, which is liquid form, it is a material that has high heat resistance. Figure 6 is showing the example of rice packed in plastics materials. The shelf life of these rice food packaging is defined as two years.



Figure 6. Jasmine royal rice packed in one of plastics materials. (google image.)

Referring to the role of packaging in the food supply chain, the significant material selection to the particular food packaging used is essential. Identifying the properties of the material in comparison based on the type of food distribution and storage ensures food security and safety. To have effective preservation in food, considering the kind of materials that can be used ensures technical suitability like shelf life and other environmental issues. Appropriate food packaging materials are described as one that possesses excellent mechanical properties against foreign forces and surrounding pressure, Antimicrobial functionality, barrier qualities such as gas, aroma and vapor barrier, thermal properties, optical properties and environmental aspects.

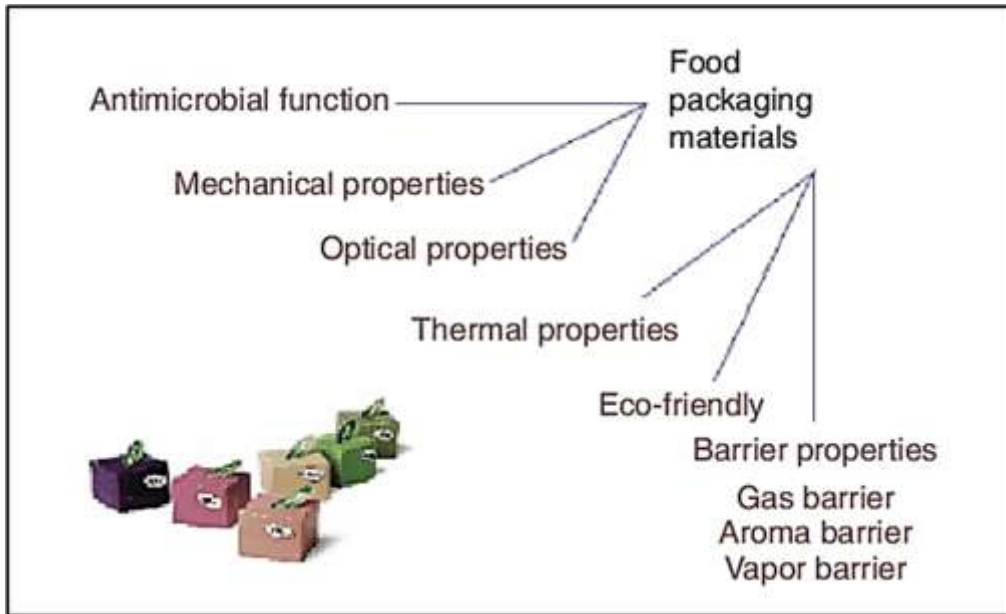


Figure 7. Display the aspects of good packaging materials (Keskin et al., 2017).

The usefulness of the food packaging materials in the supply to compare various properties and identify the advantages and disadvantages bring much awareness to food security and environmental protection, figure 8 displays.

Packaging material	Packaging material properties comparison				Advantages	Disadvantages
	Performance		Application	Disposability properties		
	Barrier performance	Mechanical strength				
Glass	Permanently leakage proof of oxygen, moisture, odours, microorganism pest and liquid form.	Brittle materials in the form of rigid that withstand the stacking of the product without damaging the products contained.	Beverages and food personal care items pharmaceutical products	Good	Highly preserve food quality and safety, Excellent material for long shelf products, 100 % recyclable material without quality effecton. Re-	Due to its nature of the material, it quickly breaks during distribution and handling.
Metal	Metal packaging possesses strong mechanical strength, impervious to moisture and gases resistance, light, smells, bacterias and shatterproof against foreign matters. form excellent tamper-evident containers Available in tubes, drums and pails, Aerosol containers, cups and closures.	Rigid materials that withstand physical movement without damaging the food product.	Beverages, solid food, dry food and Suitable for primary and secondary packaging. @	Good	Highly preserve food quality and safety, Suitable for a long life food preservation, recyclable and reused material. Re usable	To some extent is not safe materials due to the tendency of chemical reaction from the air, which quickly gets corrosion. Metal packaging is relatively heavy and costly.
Paperboard	Poor leakage proof of oxygen, moisture, microorganism and pest	Dry material that not compatible with wet condition.	Suitable for solid food, dry food and also used for medicine. Suitable for almost all types of food that require short shelflife.	Possess good disposable properties	Excellent convertibility properties. Relatively affordable compared to other packaging materials. Suitable for food products that require short shelflife. Eco-friendly material.	Not 100% percent food protection from physical constrain, one source of air .
Plastics	They are good in moisture and gas protection	It is in form of Rigid and flexible, Can withstand the wet and dry condition	Beverages, solid food, dry food and also used for medicine	Possess poor disposable properties.	Suitable for the short life food preservation, excellent space utilization during storage and transportation. Re usable.	Most of them are the source of pollution due to the tendency of degradability , recyclability and produced in non-renewable materials, bad heat resistance

Figure 8. Illustrates the summary properties of packaging materials.

2.6 Food packaging

It's not possible to imagine food without packaging! Whether it is the small scale to large scale food supply chain. The fresh food or dry food as processed by small farmers to massive producers. Food packaging is everywhere, as it aims to comply with food safety effectiveness, quality prolonging the shelf life of food itself, and add value in logistics and supply chain (Emblem & Emblem, 2012). Considering the quality of the food lessened during handling or storage time. Furthermore, (Robertson, 2017) mentioned food shelf life can be controlled by considering the packaging's properties and environmental aspects during distribution and storage and the product's distinctive, including formulation and processing parameters. Refer figure 9, one is demonstrating the global consumer of packaging industry 2009, food products packaging dominates large share compared with other products.

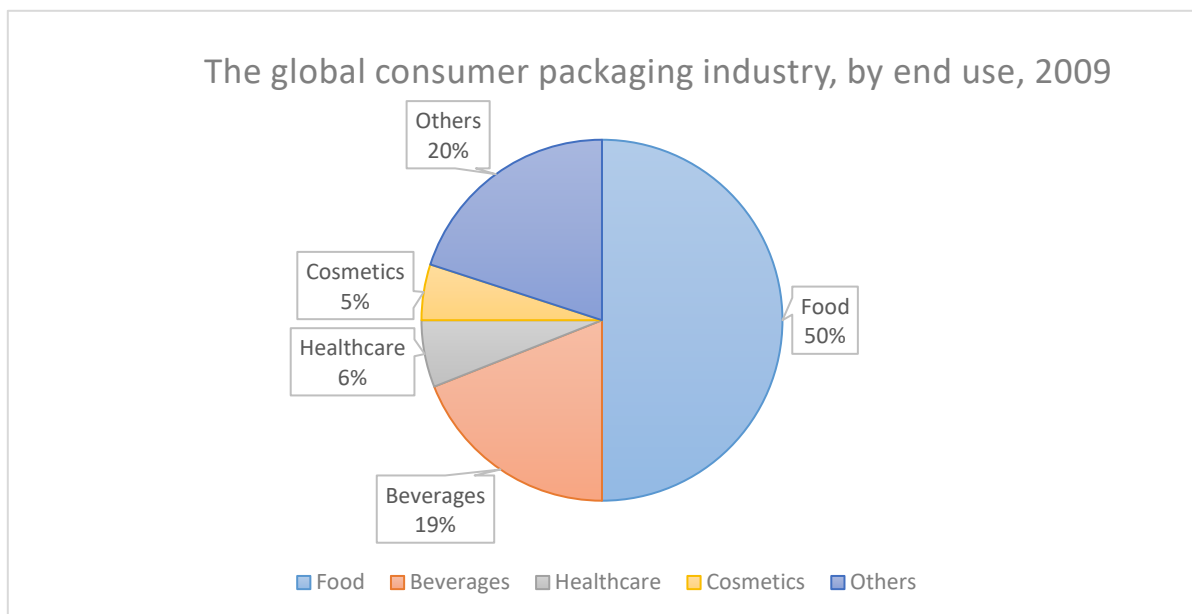


Figure 9. demonstrates the global consumer packaging industry 2009 (FAO ,2014,4). (figure modified by author).

2.7 Food Packaging Techniques

Globally, the industry of food packaging has been growing, thereby contributing in reducing food losses and ensuring food safety and enhancing global food trade, which is a key to the economic development of different economies. Food packaging is being observed in the food chain from the farm, processing, and distribution to all sectors. Moreover, the development in the technology of packaging in the food chain will ensure improved food quality and safety; they will not leave behind the developing countries, mostly small producers, by enhancing access to the market and the sustainability of the food chain. Furthermore, this growth in production among the developing countries has brought changes in packaging amongst various organizations.

Food loss depends on the food group, at what stage along the chain and the factors that lead to its spoilage and consider if that kind of spoilage may be avoided by various means. Considering the group of food, environmental factors, and manufacturing level will help in designing the appropriate way of packaging that will eliminate or reduce food wastage. Therefore, the type of products from the traditional markets to modern markets are needed to increase the quality of their products if they are to maintain a sustainable chain. Furthermore, the agricultural sector as a dependent economy in most underdeveloped countries and packaging technologies has been very slowly adopted, contributing to low exports. It is found out that developing nations engage substantially in agricultural foods like cereals, roots and tubers, oilseeds and pulses (including nuts), fruits and vegetables (including bananas), animal products (milk, eggs, meat), as well as fish, that make 60–80% to the world total production FAO, (2014). This is a great potential in the world market that needs to be reached with the new packaging technology in the whole food chain.

The Ministry of Economic Affairs of the Kingdom of Netherlands (2015) reported that horticultural products such as vegetables and fruits in Tanzania, the regions of southern and north-north-western highlands, are the main production areas. Also, tropical fruits such as oranges and pineapples are concentrated in the coastal zones and in the highlands. The bulk of fresh food, for example, vegetables and fruits, are produced locally and sold through intermediaries to wholesalers. These regional and urban markets highly need packaging technology of preservation and management in the supply chain. These are the freshest foods whose technology of preservation and packaging is needed to observe together with management.

2.8 Food Packaging Barriers

Food loss as one of the packaging barriers needs to be identified within the food chain from production, post-harvest, distribution, processing, wholesale, retail, and consumption. Therefore, the local food processing introduces new packing technology for products from developing countries, including most of Africa, on the world market, increasing attention to customer requirements in industrialized countries (FAO, 2014). Besides, storage, post-harvest handling and logistics reported by the Ministry of Economic Affairs of the Kingdom of Netherlands (2015), that are not well developed for example, in the Tanzanian horticultural sector that has impacted high post-harvest losses and reduced product quality, large opportunities exist to supply storage, packaging and handling technology.

Some external barriers have been observed as poor infrastructure, unfavourable regulations, competitive pressures among stakeholders, consumer behaviour and needs, stakeholder relationships, and inferior technology. Also, internal barriers to packaging are inadequate expertise, poor infrastructure and technology with the government management support, poor business models and financial resource regulations (FAO, 2014). Ekbohm (2016) identified financial resources as the first external factor mainly because they determine the amount and quality of raw material to be included that may be utilized in the food processing. Also, financial resources normally determine what kind of technology for processing and packaging is afforded, which in turn determines whether the firm is eligible for registration and certification or not.

However, the packaging materials have been debated as the contributing factor in ensuring an efficient food product supply. Packaging materials used and how they are being packed food industry during handling, storing, and distributing fresh and processed food products. The whole food chain from the farm to the consumer needs to be considered (Mditshwa and Opara, 2013). These materials are also the major contributing factors in the loss of food quality. Food products mostly depend on packaging materials, such as plastic, glass, paper and cardboard, metal or wood.

2.9 Role of packaging in food supply chain

Packaging has significant and diverse roles in supply chain management. Packaging plays remarkable roles to ensure the products maintains the desired quality and effectiveness throughout the supply chain. Besides, it helps waste lessening and recycling. (Sohrabpour et al., 2012). The packaging as a key aspect in the supply chain, mainly for protecting, preserving, containment, convenience and information provider, and environmental responsibility to the final user/customer. (Kuusipalo, 2008). The safe product obtained

through the supply chain, which depends on various packaging elements associated. Moreover, packaging plays a significant role in cost-effective solutions for social and environmental impact during the supply chain (The packaging supply chain, 2012). Logistics and supply chain companies are putting notable efforts to ensure that supply chain and logistics aspects are achieved. Packaging is considered as a potential tool to mitigate the effective logistics and supply chain. (Tambe et al., 2016)

Packaging Policies and Legal instruments

Trade policies and regulations have been observed as necessary to achieve efficient packaging in the value chain. In areas of handling and disposing of large quantities of packaging and after utilizing the food contents, constantly has been among the factors contributing to poor handling of wastes in securing food supply depending on the packaging materials involved (Mditshwa and Opara, 2013). Apart from the food wastes, there is familiarity in “Reduce, Reuse and Recycle” (Irshad and Rajaran, 2016). These methods have been used as possible options for many years to describe waste controlling. However, some people do not realize that this phrase represents a hierarchy of activities, starting with the most beneficial and moving to the least attractive. Besides, most developing countries have not been observed to have strong and effective regulatory authorities to maintain the packaging standards (FAO, 2014). Apart from that, there have also witnessed some variations and frequent policy changes among the developing countries. Therefore, the developing nations must share their technology and expertise in enabling effective packaging technology through trading together.

There is also an unequal distribution of resources and enough support among the actors in the food chain. (Brunori and Galli, 2013) One of the strategies for short food supply chains SFSCs is to improve the flexibility of the family farms by the support of consumers, local communities, and civil society organizations. To overcome the packaging barriers, one of the important solutions is cooperation among the producers to work in partnership rather than become rivals or competing (Fawcett et al., 2014). Therefore, there is a need to ally partners to cooperate rather than willingly competing to overcome food packaging challenges.

The Tanzanian government has established various procedures of food packaging whereby no one shall be allowed to manufacture or import food into the country without being registered at the Tanzania Food and drugs authority (URT, 2012). This includes the registration during the establishment of any business, including the change of packaging materials that are subjected to fees. But changes such as change in name and address of a person, name and address of the manufacturer (except physical address), food packaging unit, shape, size, colour shall not be subject to payment of fees.

The Tanzanian Food, Drugs and Cosmetics Act, 2003 stipulates also on Section 92.-41, that “No person shall, in the course of a business operated by him, sell or supply or have in his possession for purposes of selling or supplying any product regulated under this Act in a container or package which is not labelled in accordance with the regulations made under, section 122.” It further states that no person shall pack a product regulated under this Act in a container or package, altering the efficacy, safety, quality, or nutritional value of such a product under section 94. (1).

3. Research methods

The study intended to use a case study approach that will involve both primary and secondary sources of data. Interviews were the mostly used due to being common and flexible way of asking people based on their own opinions and experienced (Moriarty, 2011). The researcher used fifteen interviews from five companies that are dealing with food supply and logistics to the final consumers. These interviews depended on the companies and the information may differ according to a particular company. For example, there are different internal company organizations and also the titles of the informants (Sandberg, 2017).

3.1 layout plan process Thesis

This thesis study process's diagrammatic plan aimed to enable the reader to follow up on the key areas and idea behind this study. The main steps were demonstrated, as the figure10 reveals.

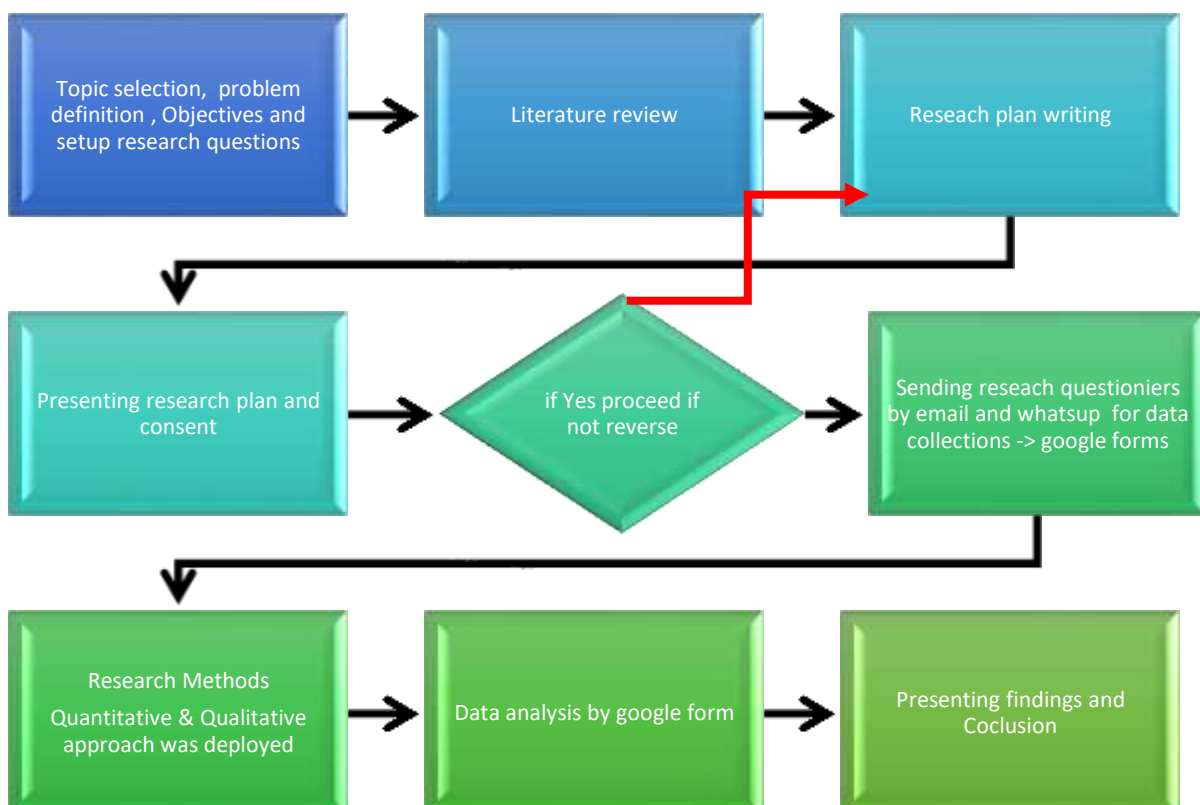


Figure 10. Display the structure of thesis process.

3.2 The study area

The study was conducted in Tanzania urban areas. This is because most of food processing industries are operating. Therefore, a random selection of three urban areas was chosen to represent other areas. More description of the study areas was made during and after the time of data collection. Therefore, the study have covered Dar es Salaam, Morogoro and Moshi that were randomly selected, where food processing industries are situated to reveal food packaging.

3.3 Research design

According to Dehdashti and Elahi (2011) there are three main types of research designs namely exploratory, conclusive and performance- monitoring research. After studying both methods exploratory design was the preferable for this study since it seeks to identify problems on the food packaging barriers through gathering information so as to formulate alternative solutions.

There was a need to have a research design in order to simplify and coordinate some ideas in a meaningful manner. From the basic knowledge from other sources, Harwell (2011) also pointed main three research methodologies namely qualitative, quantitative and the mixed methods with their roles where they may be applied to help in designing and organize ideas. After considering both types of research methods, this study is expected to focus on the mixed method mainly because of the tools of data collection that will be used. Also, this approach that will involve both primary and secondary sources of data. Interviews will be the most common and flexible way of asking people based on their own opinions and experienced (Moriarty, 2011).

3.4 Sampling techniques

The study employed a simple random sampling for obtaining consumers and purposive sampling techniques from food processing and packaging authorities to generate the required data. Random sampling applied to 60 households for the purpose of obtaining data from consumers. Households were divided in different strata based on gender (Allan *et al.*, 2004). Purposive sampling employed to gather data from food processing and supply company officials who were key informants and who increased the reliability of data. (Elam *et al.*, 2003).

3.5 Data collection tools

The researcher used fifteen interviews to five companies from each region selected that are dealing with food supply and logistics to the final consumers. Interviews were expected to be used in this thesis because they gave a room for respondents to give their own opinions and experiences and are the most common and flexible ways. (Moriarty, 2011). Hence, there were 15 interviews that depended on the companies and the information may differ according to a particular company. For example, there are different internal company organizations and the titles of the informants (Sandberg, 2017). For all these interviews were face to face and online that promised for confidentiality. For the case of face-to-face interviews and questionnaires were later being entered from hard copy to google forms. The study conducted 50 questionnaires to final consumers and 25 interviews to the customers of production companies. These tools were prepared based on literature that have been reviewed and the objectives of this study which meant to answer the research questions.

Therefore, apart from interviews, the study applied questionnaires to final consumers on assessing the packaging barriers to the food products they buy directly from final suppliers. Both open and closed ended questions were be used to collect information in order to get detailed information (Dawson, 2002). There were 60 questionnaires prepared but 50 respondents were able to answer.

Furthermore, during the use of interviews and questionnaires as mentioned, observations were going on since are the most straightforward methods of data collection that are more economical, simplest, quickest and most accurate way of gathering data (Babin and Zikmund, 2013). This method was expected to provide detailed records of what people actually do on the field during an event of collecting data so as to make relevant information. This method helped to see the environment where things are taking place in order to increase understanding of the situation hence it is subjected to checks and control of the research (Kothari, 2003).

3.6 Data analysis and presentation

Analysis of data is the management by taking raw data from various tools to make summaries (Allan *et al.*, 2004). In this study, data were analyzed both quantitatively and qualitatively as obtained from the field.

Therefore, quantitative raw numerical data was coded systematically by the researcher and analyzed by using the google form app. The resulting summaries were, thereafter, in tables, charts and graphs in form of percentages and numbers.

4. Findings and Discussion

This chapter is based on research findings that have been divided into three major parts. The first section analyzes the usual food packaging in the study area. The second section discusses the efficiency of food packaging techniques in the study area from the processing through the whole food chain, including suppliers to the final customers. This dealt with all the barriers observed as the contributing factors to efficient food packaging. The third section covers customers and suppliers' observations on effective food packaging techniques that are favorable to efficient food supply management.

Research questionnaires

The online and physical survey was used for data collection to understand and analyze the assessment of food packaging barriers to maximize the supply chain in Tanzania. The google app was the most suitable for the online survey because it is easily accessible, free of charge and highly compatible with all devices and ideal for any professionals. Furthermore, the physical survey was applied in which the paper of questionnaires was printed, and targeted people were able to fill it. Even though the online survey was used, it was necessary to be done face by face according to the nature of the survey study area. Three types of survey were created to insight the problem. Firstly, was the study for the company dealing with food distribution in the study area. About twenty-two (22) questionnaires were designed purposely to assess the type of food packaging and the effectiveness in operation. Secondly were the questionnaires for the semi- customer which are suppliers buying the product from the company and selling to the final customers. About thirteen (13) questionnaires were designed to assess the barriers hindering the effective food distribution from the packaging and some issues related to packaging standards and environmental aspects. Also, the third was for the final customers, which is the end-users of the products; about seventeen (17) questionnaires were designed to assess the awareness of the packaging materials, standards from the food packaging materials and the importance of packaging the product that they are buying. It was necessary to include all these three groups in assessing the food packaging barriers to maximize the efficiency in the supply chain and find the truth of this study.

4.1 Characteristics of the sampled population

Socioeconomic factors have been shown to impact food packaging where random sampling for final customers targeted 50 respondents. These respondents were sampled at Morogoro, Moshi and Dar es Salaam urban areas. Figure 11 and table 2 shows this study was able to meet a total of 51 responses of the final consumers from households who were contacted both online bases using google forms link through emails and WhatsApp and physically. Therefore, the sampled population for final consumers was able to obtain 51 household heads. Among the foods that are mostly consumed by most of Tanzanians are cereals, bites, vegetables, ground nuts and bananas.

Apart from that, the study was able to interview 24 customers who were also suppliers. The target was 25 customers from producers (Figure 11). These customers were all buying food products from producers, including supermarket and mini- supermarkets, open markets, and retail shops. Similarly, some suppliers were distributing products to these buying centers were included in this category. However, there was the category of food processing industries and entrepreneurs who are the primary source of food processing and packaging before supply. The target was to interview 15 food processing companies and entrepreneurs. This study was able to interview all 15 food processing companies and entrepreneurs. Table 2, present the summary of questionnaires what was targeted, sent and achieved. In general, the study managed to achieve 90 % in total, which describes the validity of this study research.

Table 2, Presents questionnaires summary.

	Sent	Received	Target	Achieved
Semi-structured Interview for a Company (Suppliers)	30	24	25	96.0%
Semi-structured Interview for the Customers (Retailers)	25	15	20	75.0%
Questionnaire for Final Consumers (End users)	60	51	55	92.7%
Total	115	90	100	90.0%

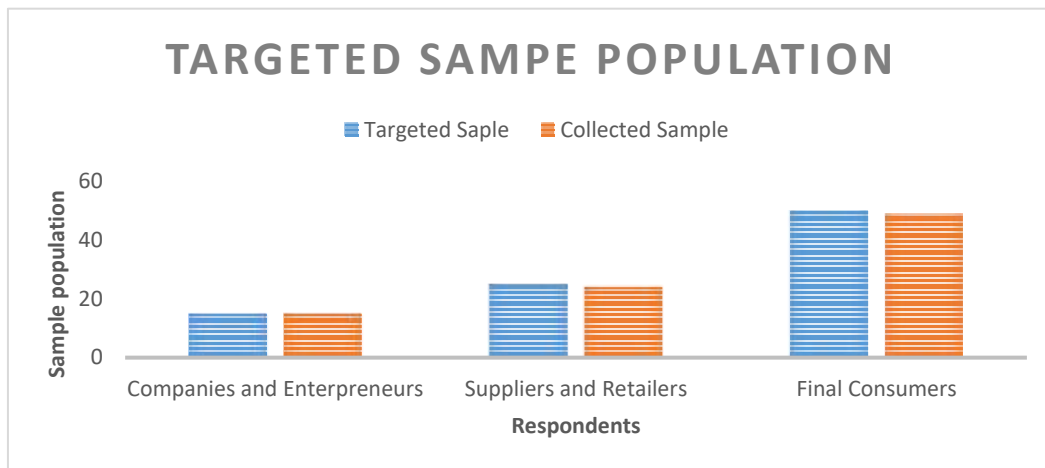


Figure 11. Displays the sample population

The average age of the sampled population also for those below 40 years was 10.5 %, 41 up to 50 years were 37.5 %, 51 to 60 years were 43 % and those above 60 years of age where 9 % average family size was six people.

Customers who buy food through vendor were 4 % and for those on foot were 68.5 % which is the usual way for most households. Those using motorbikes were 10.3 percent while a cart is being used by 7.2 % and personal cars were 10 %. Also, the usual areas for food shopping show 50.2 % buy from open markets, while 20.3 % buy from mini or supermarkets while 29.5 % usually buy from shops and kiosks.

Customers who were asked on the use of the food packaging materials after use whereby 48.8 % reuse those materials for other purposes. However, 38 % of food customers dispose of the packaging materials after using them, and 4.2 % recycle. This shows that the technology for recycling packaging materials in Tanzania is not much developed compared to other means. The social-economic characteristics of final consumers are summarized in table 3 based on gender, age, means of transport, shopping place, and recyclability of packaging materials.

Table 3, Social economic characteristics of final consumers

Variable	Percentage
Respondent by Gender (%)	
Male	29.2
Female	70.8
Average household members	6
Age of respondent (%)	
<40	10.5
41-50	37.5
51-60	43
>60	09
Usual Means of Transport for shopping (%)	
Vendor	4
On Foot	68.5
Motor Bike	10.3
Cart	7.2
Car	10
Usual areas for food shopping (%)	
Open market	50.2
Mini/Super Market	20.3
Shops/Kiosk	29.5
After use of Packaging Materials	15.05
Re use	48.8
Dispose	38
Recycle	4.2

The sampled companies who were producers use various packaging materials, as shown in Figure 12 below. Two companies use paper board boxes as their packaging materials in the food supply chain, while 5 companies use plastic packages, and three companies utilize corrugated boxes. Most companies use poly bags as food packaging materials, which has been observed as the major packaging materials used. These materials were of different qualities with different grades, such as grade one with high quality to grade three with low quality. This was followed with woven bags which are usually used as food packaging materials amongst food processing in Morogoro and Dar Es Salaam with jute gunny bags traditionally used in the processing areas from farmers.

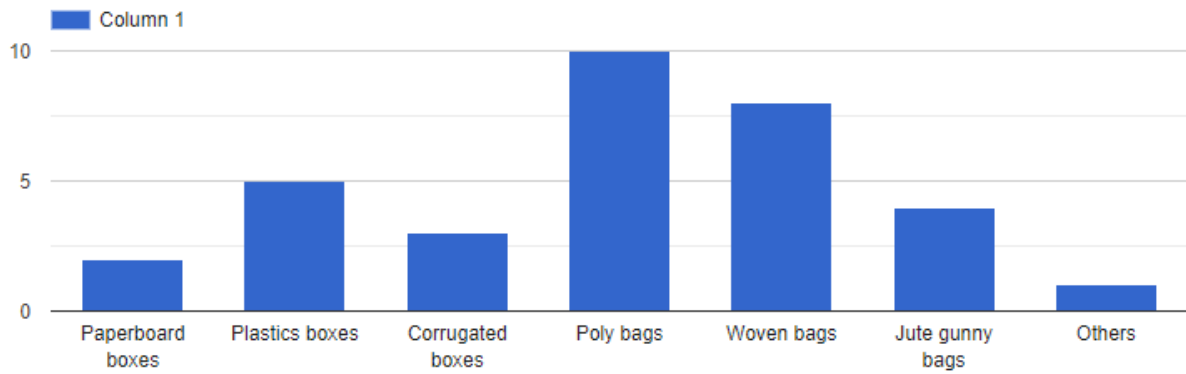


Figure 12. packaging materials used by Food Producers

For the case of the final consumers, the study shows 30 respondents buy the foods that are packaged by the use of plastic materials, as shown in figure 13 below. All in all, Plastic materials are preferably used in Tanzania as in developing countries due to the material durability, cost-effectiveness, high flexibility and means of transport and storage (Opara, 2020). This is followed by paper and paper board that were 27 respondents.

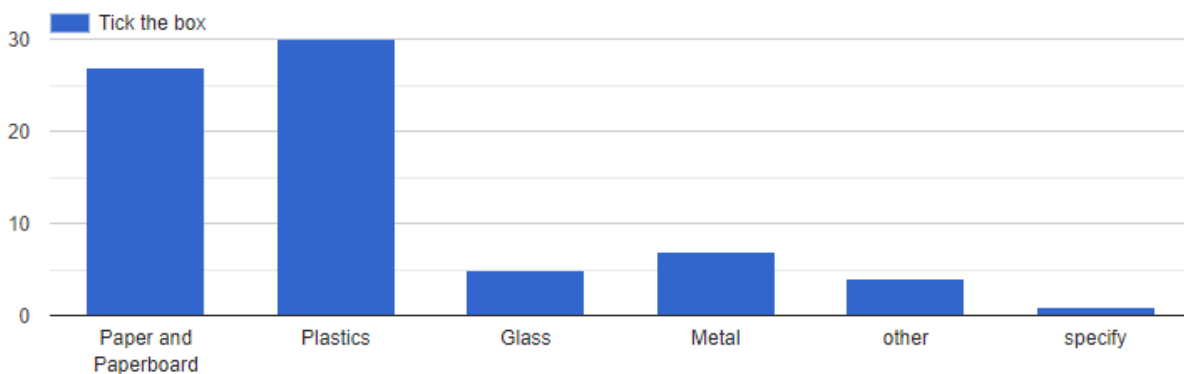


Figure 13. Food Packaging materials bought by final consumers

Apart from that, 98% of customers recognized packaging as the most essential factor to be considered in food processing to maintain quality, as shown in figure 14. In comparison, the remaining 2% didn't recognize the importance of food packaging. This is the possible reason most food producers consider food packaging before they supply it to their customers.

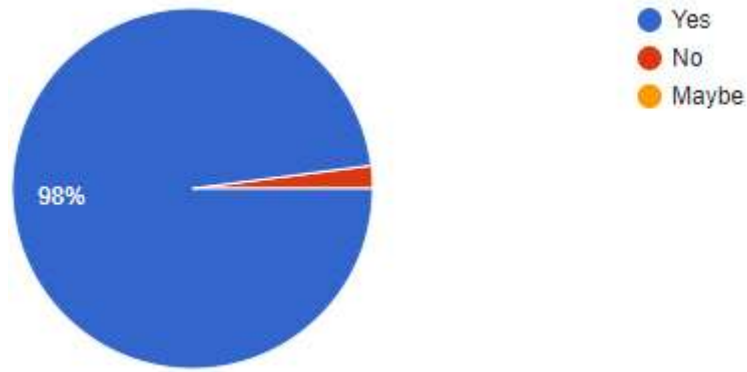


Figure 14. Customers views on the importance of Quality food packaging.

Both Suppliers, Semi structure customers, and final customers were asked general questions related to packaging quality issues or claims. The findings reveal that they acknowledge packaging as a significant factor in the maximum efficiency of the food supply chain in Tanzania. Refer to figure 15 for more demonstrations.

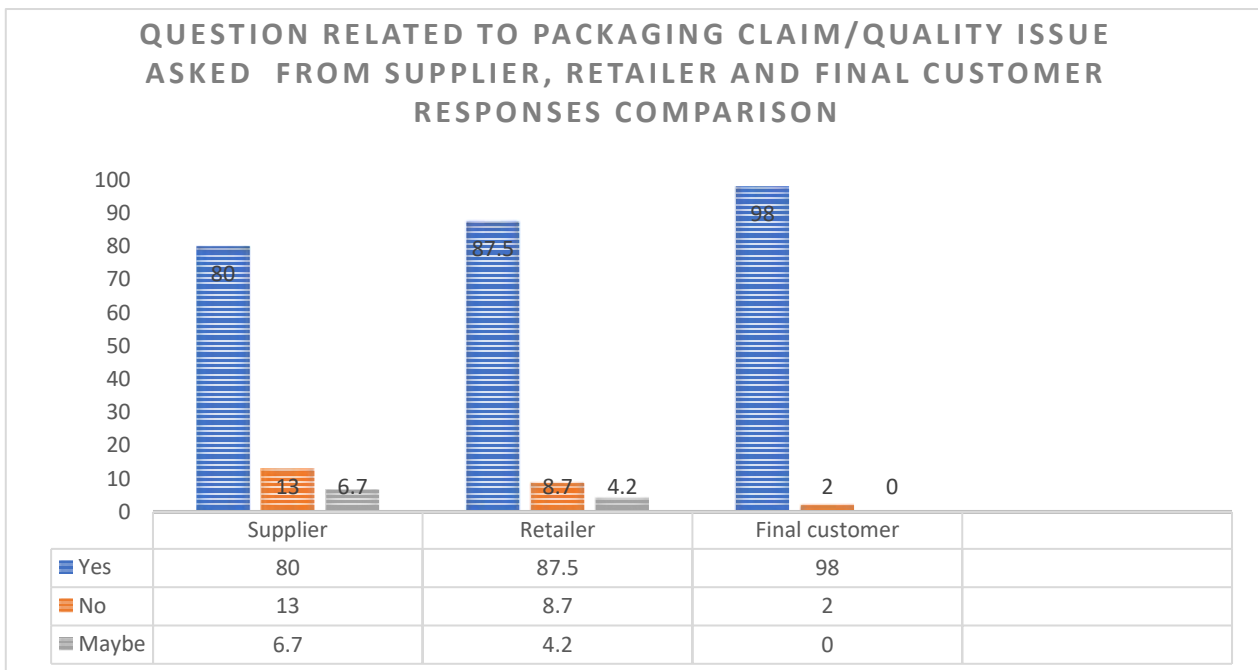


Figure 15. Stakeholders experience packaging issues.

Furthermore, the market situation of food producers was observed to be is good. In contrast, others were moderate but challenge to compete with the foreign supplier due to packaging quality; sometimes, marketing is challenging due to the unavailability of raw materials. These limitations and industry barriers, such as creativity, innovations and sustainability consciousness, are taking off in developing countries (FAO, 2014).

As mentioned before, we are small scale suppliers facing massive competition from big and external suppliers. For others, the market is good, but they cannot deliver to their best due to various constraints, including quality of and grade of packages but mostly supply within the surrounding region and have customers who come directly to their stores. Other producers have the market inside and outside the country, especially Eastern Africa, which has made it good externally.

4.2 The common packaging techniques of Food Supply Chain Management

After looking at the packaging materials usually being used, customers such as food suppliers and retailers were asked about their satisfaction with food packaging. Most of them were satisfied at the average, while few were strongly satisfied or weakly satisfied. This indicates that there is a mid-satisfaction in food packaging technology in Tanzania. However, the technology is on the way to progressing to achieve a more advanced packaging technology.

Among the food processors interviewed on their packaging materials were paper boxes, plastic boxes, corrugated boxes, poly bags, woven bags, jute gunny bags, and others. Polybags have been observed as the main packaging materials used because they are inexpensive with low weight in food processing and packaging, followed by woven bags that could possibly be due to their low price and availability. Other materials such as plastic boxes, jute gunny bags, corrugated boxes and paper board boxes were among others that are being used based on their material quality and price. Refer figure 16.

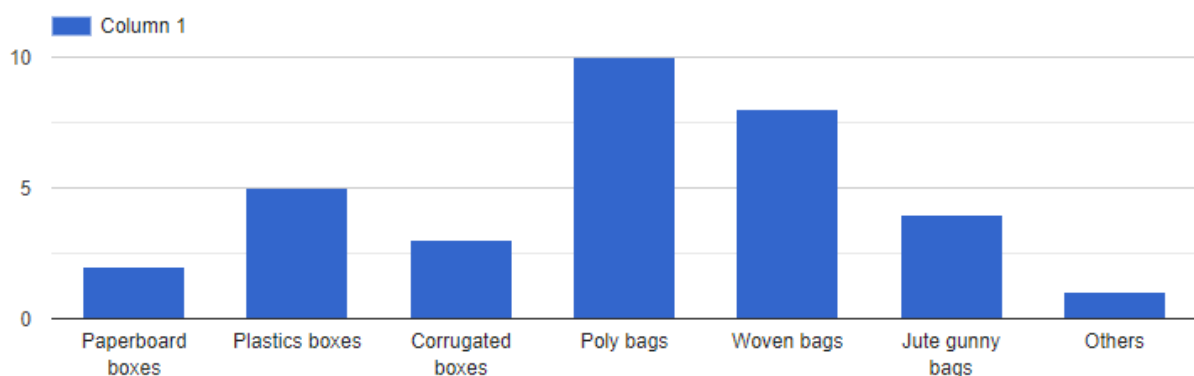


Figure 16. Food packaging materials that are mostly used

Based on the experience of the packaging materials observed, customers and food processors have experienced some cases due to their quality. About 26 percent have experienced food losses due to poor packaging through breaking down during transportation, others during collection from the farms during

harvests, handling, processing, storage and shipping and they have stated that may be during the packaging form industries.

About 80 percent of food processors are also receiving claims from customers especially regarding to food packaging. These claims have been received with recommendations on the appropriate ways of packaging. Some of the suggested measures were by always try to improve but in most cases the price and availability is the issue for remote area and small supplier chain, create/introduce type of packaging which will be suit for the food (strong type of package). Also they have always tried to ask their package suppliers to do their best, proper sealing of packaging product.

Moreover, processors always try to ask their package suppliers to deliver quality packaging and the price of packages should be minimized and improve the quality of their packaging bags. However, all the necessary activities can be followed like quality packaging materials, transportation and delivery. But the effective transportation and delivery including the handling of the packaging should be taken with care. This can be enabled by demanding quality packaging suppliers who are knowledgeable about relevant or right packaging materials for the given product and being given enough information regarding the product and the materials used in packaging.

Therefore, most of processors were able to continue to improving their way until they make sure their products are in a good condition. Also by using good brand colour, proper sealing, emphasis on material used by the material producer and layout their needs to packages manufactures. Also due to claims of high prices for quality packaging materials they recommended the packaging materials to be cheap and easily available. Also the handling of their products, by making sure they buy good quality packaging materials as well as applying advanced technology, information and skilled labour.

4.3 The barriers and challenges to effective food supply chain management in Tanzania

Customers were asked if they experience any packaging challenges when they buy food. At least 52 percent of respondents have been experiencing challenges in packaging, and 31 percent have not experienced packaging challenges that have resulted in food loss and losing the quality, while 17 percent are not sure. Figure 17 present the responses as achieved.

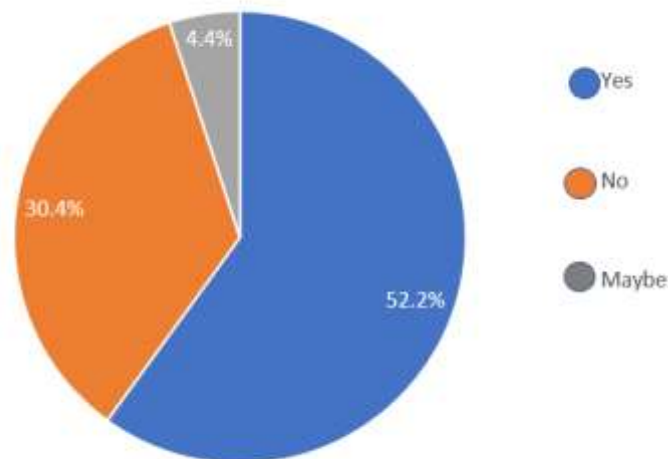


Figure 17. Customers experience on food packaging challenges

The areas facing packaging challenges are transportation, primary packaging, secondary packaging, storage, general handling, and others. For example, figure 11 shows that there are more cases of packaging barriers during primary packaging from the food processors where the experience of food loss and quality occurs. This has been observed followed by transportation from the farms and during supply followed by storage and general handling, which is generally every stage of the supply chain.

Close relationships with customers help to bridge the gap and understand their demand to work on them (Fawcett et al., 2008). Hence, food producers receive customer claims about food loss and money as poor packaging affects the quality of our products and loss and cost. Also, it can limit the products from reaching many customers. Also, they recognise poor packaging results to rotten simply because of poor sealing, becomes easily torn because of insufficient material used. Therefore, effective packaging meant for protection, preserving, providing info, and as a silent salesman if one of those is missing affects the products. Hence, loss of revenues, loss of quality, loss of material and can create waste.

Improper post technologies that are still being used in developing countries and poor infrastructures have been the contributing factors to food losses (Mditshwa and Opara, 2013). Though many food producers could not really estimate food loss in this study because it depends on transport and the season, they admitted to experiencing much loss, but now at least a tiny amount is being lost. They also understand that food packaging helps maintain quality and avoid contamination, and packaging materials with low quality and transport may lead to food loss. Hence, packaging maintains food quality and safety apart from poor handling is for customers themselves.

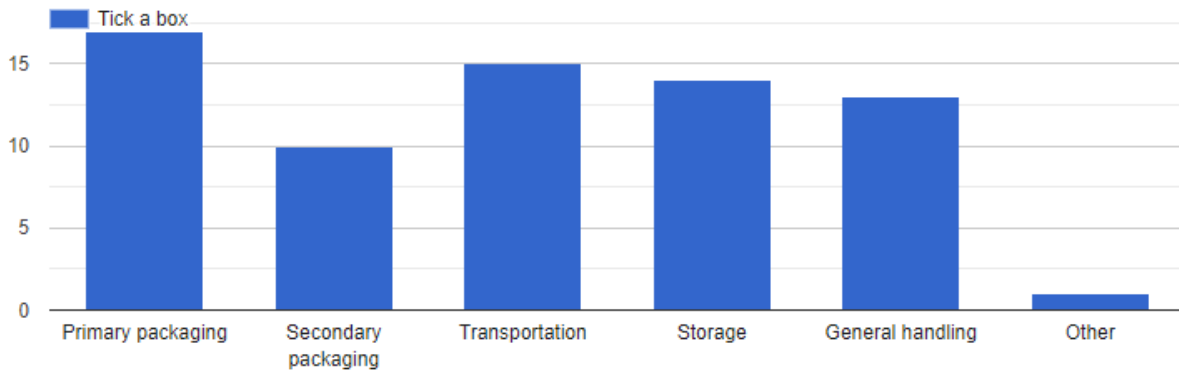


Figure 18. Present the areas that contribute to inadequate food quality.

On the other hand, food processors face some challenges that were mainly related to administrative, social and technological, making them difficult to have sustainable packaging suppliers in their areas such as enough processing and business skills and facilities such as quality packaging materials, transport, and marketing. The other challenges that were captured were inadequate facilities caused by climatical change temperature leading to plastic material deformation and food loss during processing. In addition, the study observed that there had been improper sealing of packaging due to inferior technology. Furthermore, customers understand the use of hand sewing machine is leading to packaging leakage and damages. Therefore, advanced technology should be used to lessen these kinds of defects. Customers are not much aware of the necessity of packaging.

Usually, competition has also been observed from foreign to home markets (FAO, 2014). There were other challenges from food producers which were mainly related to marketing. The more giant suppliers always have their own packaging. Those who depend on purchasing packaging materials were small scale producers, In which during preparation up to complete type of package was observed to increase the value of products. Basing on most people, they need the cheapest thing once the price is the high customer they will run away most of them do not compare service receive only based on the most affordable price. The other challenge for small producers experiences other customers considering price instead of the quality of packaging materials. There are other producers who do not have much competition mainly because they do not have much competition due to the few producers of the product. In contrast, others are carried by their popularity compared with other similar products.

4.4 Packaging solutions to effective food supply chain management in Tanzania.

Customers were also asked to recommend on effective food supply management. According to Fawcett et al., (2008) discussed these as bridges to effective supply chain management and could avoid food losses whereby packaging is essential and should be with high standard and the better packaging materials, the more it cost. These ways of dealing with the challenges differ among producers depending on their working environment. However, the products need to reach the final destination with proper conditions, such as easy availability of packaging materials and loans to producers. Also, packaging should not be sold to consumers when buying food products. Instead, seller should provide them for free as part of the service to customers.

Apart from that, the packaging materials recommended must be reasonable so that each manufacture can afford. Likewise, suppliers should have a variety of packages to suit different circumstances & locality. There were other recommendations from customers who were also suppliers who commented that the government should encourage packaging and trying best to ensure goods are packed well. This is because large companies have good packaging, but micro suppliers don't. Therefore, they should be encouraged to improve. Similarly, there should be a strong and stable policy that not frequently changing in a short time. FAO (2014) identified lack of incentives and support to grow technologically were also observed as challenges to sustainable and upgraded technology.

Further, lousy food packaging should be discarded, and good ones should be supplied reasonably. They must contain all the necessary information concerning the material used to make it avoid any risks. Customer's awareness should be encouraged in various packaging areas, such as restricting the use of plastic bags by stakeholders & government to promote of environmentally friendly packaging material and provision of suitable packaging materials, proper sealing, and friendly to the environment.

On the side of processing, there is an improvement. Still, in most cases, the price and availability are the issues for remote area, and a small supplier chain was observed to create or introduce a type of packaging which will suit the food (strong kind of package). Besides, processors always are trying to ask their package supplier to do their best but for them is to have proper sealing of packaging product. All these efforts are meant to protect the product, attract the customer, give information regarding the product.

Further, through having more up to date knowledge and technology on packaging materials that conserve the environment, the government should continue trying hard to push. Still, the challenge is for micro suppliers that have been observed to experience more challenges. Some food processors recommended more advanced packaging materials and are ready to be educated more on quality packaging. Likewise, Fawcett

et al., (2008) show that managers recommended frequent training and other support that should be provided in order to improve their productivity.

Also, over packaging should be avoided throughout the supply chain. The findings from this study underscore the importance of packaging and packaging design for fulfilling the many functions related to logistics and marketing of food products, but also technological advancement is needed to consider hygienic awareness.

Nothing is good without developing, as the world has witnessed some historical changes and reforms from ancient times (Opara, 2020). Still, there should be big room for improvement in the packaging sector and production of enough raw materials by having good environmental policies and being enforced by the government. Correspondingly, the government should promote and encourage more packaging industries in Tanzania and good storage and reasonable farming procedures in agricultural food production. In addition, the service providers should attend seminars and training on customer service.

Among the quality assurance that has been certifying in Tanzania have been involving most food producers. These certifications are mainly from Tanzania Revenue Authority (TRA), Tanzania Bureau of Standards (TBS), Tanzania Food and Drugs Authority (TFDA). In addition, other producers have been given seminars and training on food safety and production from those authorities and the Small Industries Development Organization (SIDO). Similarly, to maintain production and packaging standards, food producers received claims and opinions from their customers on how they can keep their standards.

5. Conclusion

Regarding some observations of this study that have been seen as barriers to maximum efficiency of food supply chain management in Tanzania, there is progress in improvements that needs more advanced technology. Correspondingly, there is support from the government that is required in order to continue. These efforts will enable quality food products that will be competitive to regional and international levels. Also, there is not enough resources such as electricity, raw materials and market that need to be considered to increase the efficiency in production and supply chain in general; there is no reliable electricity, raw materials and demands that need to be considered in order for producers to increase efficiency in production and supply.

Apart from that, customer's views should be among the priorities in ensuring quality products through the whole food supply chain from the harvest until the final consumers; Government should put much effort into ensuring the effectiveness of food packaging and supply chain are properly met. Furthermore, continuous improvement is required in the packaging industry with advanced technology and packaging knowledge understanding the benefits and effects of food packaging in the whole supply chain. This will enable further chances for improvement in production and technology. Also, packaging should continue to meet customers demand depending on their requirements and uses.

5.1 Recommendations

Due to the tradition of producers who face challenges and barriers in their food production and packaging, there is a need to consider reliable supply chain services that involve means of transportation and quality packaging. Additionally, the affordable price that meets the standard of food packaging materials and facilities will increase the food quality and safety in the supply chain in Tanzania. Not only that also customers have been looking for affordable prices from producers.

This could be achieved through the quality of packaging material that informative and that suits secondary and primary packages and reliable transportation. This will avoid food losses and spoilage during the processing with more advanced technology. Besides, packages should consider environmental protection since most observed materials are not environmentally friendly and should be reusable and recyclable.

On top of the packaging materials, there is still a need for a growing technology in recycling packaging materials used for food products. In addition, the treatment of wastes in Tanzania compared to other studies has been observed as a challenging issue due to lack of knowledge and inadequate investment in that sector. Furthermore, the researcher recommends more study is needed in this area. Due to little research in food packaging and supply chain in Tanzania, Africa has blessed weather for food production. This will bring more information that creates awareness on food loss and waste due to food packaging.

All stakeholders should be engaged within the food supply chain to ensure the aspects of food packaging and the value chain are met.

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Questionnaires

APPENDIX 1:

Semi-structured Interview for a Company

Name of the Company _____ Date _____

Your role at the company _____

Dear Sir/Madam,

Basic Questions

1. What is the general view on packaging sector in your company?
2. What kinds of packaging are you using in your company?
3. Do you experience product loss due to improper packaging?
4. In your opinion, what do you think must be done to increase efficiency on food supply chain?
5. What measures do you think are appropriate an effective food packaging?
6. Are there any problems (Administrative, Social, Technological) facing effectiveness in food packaging in your company? If yes, what are they?
7. Do you experience any kind of competition on your products? What are those competitions?
8. Are the daily packaging materials available? When they are not enough what is your concern about this problem?
9. What kind of certifications do you have so far? Do you see any importance of having a certification from those authorities? Explain.
10. Do you receive any comments from your customers regarding to packaging on your product? What are they and in what extent?
11. What are your opinions on the effective ways of packaging materials that are being used?
12. What is the market situation of your internal and external supply based on your packaging technology?
13. What measures are you taking in order to ensure there is an effective packaging system?

14. What kind of infrastructure do you use from processing until supplying? What is the standard of the infrastructures?
15. Do you think poor packaging has any effect to the supply chain of your products?
16. Do you recognize any efforts made in order to improve your packaging materials?
17. Are there any challenges that have not been identified in your company that you would like to address? Mention them.
18. In your own view, what measures are needed to ensure that there is efficient Food Supply Chain Management?
19. How does packaging affect your food supply, what are total volume of food you supply is lost along supply chain?
20. By estimation through improving packaging how much food will be save?
21. Can I contact you in case I need more information?
22. Is there anything more you would like to say or ask?

Thank you very much for your cooperation!

APPENDIX 2:

Semi-structured Interview for the Customers

Name of the Customer(optional) _____ Chain level _____ Date _____

Dear Sir/Madam,

Dear Sir/Madam,

This interview is a part of the research regarding the Assessment of Packaging Barriers to Maximum Efficiency of Food Supply Chain Management in Tanzania. The researcher is from the JAMK University of Applied Sciences. Thanks a lot, in advance for accepting me to present my questioners and conversations regarding this matter. Could you please be so kind as to provide your cooperation to obtain relevantly and all possible, reliable information about the problem under scrutiny?

Basic Questions

1. What is the general food products supply/usage at business area?
2. Are you satisfied with packaging from the products you purchased?
3. Do you experience any quality issue related to packaging?
4. In your opinion, what do you think must be done in packaging to increase efficiency?
5. What efforts do you make to maintain the food quality you purchase?
6. Is there any charging for the packaging services? If yes, what is the charge used?
7. Are there any challenges (Administrative, Social, Technological) facing quality of food products supply? If yes, what are they?
8. What areas do you think can contribute to poor food quality?
9. What are your opinions on packaging pricing for effective food packaging measures and how should it be carried out?
10. Do you recognize the efforts made in order to ensure packaging is environmentally friendly? If yes, what are they?
11. In your own view, what has been done and has to be done to ensure that there is efficient food packaging and sustainability in Tanzania?
12. Can I contact you in case I need more information?
13. Is there anything more you would like to say or to ask?

APPENDIX 3:

Questionnaire for Final Consumers

This questionnaire is part of the research work namely, Assessment of Packaging Barriers to Maximum Efficiency of Food Supply Chain Management in Tanzania. The study is carried out by the researcher from JAMK University of Applied Sciences. The researcher is delighted to have your opinions about investigate the problem.

Name of the Village _____ Date _____ Name _____ (optional) Age _____
(Years) Sex _____ Education _____ Occupation _____

Answer the following questions as instructed

1. What are the packaging materials used for food products purchased at your home and the minimum quantity? Put a tick (a) Plastic []____ (b) Glass [] _____(c) Paper Board [] ____ (d) Wood [] ____
(c) Metal [] _____(e) Other(s) Specify _____
2. Do you think food packaging is important to maintain the quality of food? (a) Yes [] (b) No []
3. Are you aware of food loss through packaging? (a) Yes [] (b) No []
4. How many are you in your household? _____. Who is usually responsible for purchasing food (a) Male household [] (b) Female household [] (c) Boy(s) [] (d) Girl(s) []
5. What is the average daily expenditure of the family? _____ Tshs
6. Do you always read the details of food packages? (a) Yes [] (b) No []
7. Do you (a) Re-use [] (b) Recycle [] (c) Dispose [] (d) Others
the packaging materials?
8. What details do you mostly read in food packages? (a) Ingredients [] (b) Expiry date [] (c) Packaging materials [] (d) Disposing [] (h) Others. Specify _____
9. Are there any cases of e diseases caused by food poisoning in your household? (a) Yes [] (b) No []
10. Which packed food products do you buy most? _____, _____, _____

11. What are the most types of food does your household consume per daily? _____
12. What means do you use to buy food and bring home (a) Car ____ (b) Motor bike ____ (c) Cart ____ (d) On foot ____ (e) Vendors _____ (e) Other(s) Specify _____
13. Where do you buy food products? Put a Tick. (a) Market [] (b) Super market (c) Shops [] (d) Kiosk [] (e) Others _____ (specify)
14. Mention any other packaging solutions that will increase efficiency in supply chain management
a. _____ (b) _____ (c) _____
15. Are satisfied with the quality packaging from the food products you are buying?
16. Can I contact you in case I need more information?
17. Is there anything more you would like to say or to ask?

Thank you for your consideration and cooperation.

