Assessment of the Supply Chain and Factors Influencing Consumer Decisions to Purchase Bean-Based Processed Products in Lusaka Province of Zambia

BY

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DECLARATION

I, MAIMBO HABOOMBE, do hereby declare that this dissertation is my own work and all the materials used for this dissertation have been fully acknowledged. This dissertation has been submitted in partial fulfillment of the requirements for obtaining the Master's Degree in Agricultural Economics. I therefore declare that this dissertation is my original document and that it has never been submitted for the award of any academic qualification to any university.

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ABSTRACT

Global climate change, coupled with rapid population growth at a rate of 3.4%, is driving significant shifts in agricultural practices worldwide. Traditional crops are struggling to cope with the biotic and abiotic stresses imposed by climate change on plants. Recognizing the need for adaptive solutions, the Zambian government, through the Ministry of Agriculture (MoA), actively promotes the production of legume plants due to their benefits, such as enhancing soil aggregates, increasing soil water retention, and demonstrating robust adaptive capacities in adverse environments. Despite the advantages of legumes, many small-scale farmers engaged in their production neglect value addition, resulting in substantial postharvest losses. Acknowledging that minimizing these losses can enhance food availability, security, and environmental sustainability, the discourse on food loss and waste (FLW) avoidance has gained prominence globally. Efforts to combat global hunger and improve food security underscore the importance of engaging in agro-processing.

Agro-processing emerges as a pivotal strategy not only for minimizing postharvest losses but also for export diversification, as processed agricultural items hold greater value than raw materials. In Zambia, however, agro-processing remains underutilized, presenting numerous untapped opportunities within the sector. The insufficient information on value addition to common beans through processing results in their predominantly low-value sale in raw material form. Therefore, this study addressed the potential of bean-based processed products in the Zambian market. While prior research had primarily focused on increasing legume production, this study shifted attention to bean-based processed products on the Zambian market. Recognizing the dearth of information on these products, the study aimed to identify the challenges faced by supply chain participants and determine the factors influencing the consumption of bean-based processed products. The findings sought to enhance understanding of the market for these products and identify interventions necessary for the commercialization of the bean-based processing industry in Zambia.

The study, conducted through two surveys (a rapid market assessment and a household survey) in Lusaka province, Zambia, adopted a comprehensive research design, utilizing both descriptive and econometric methods for analysis. A total of 78 respondents were interviewed along supply chains during the rapid market assessment (13 processors, 3 importers, 13 Distributors and 49 on-spot

consumers) and 341 for the household survey. The key respondents for the rapid market assessment were key actors along the bean-based processed product supply chain while the person in charge of food purchases in a household was the target respondent for the household survey. The findings underscore the dominance of flour and pre-cooked relish in the bean processing industry, with the majority of processors/importers facing challenges in raw material acquisition.

Importantly, the study reveals that female influence significantly shapes food purchasing decisions within households, with eating habits, wealth index, and the work status of the household head emerging as critical factors influencing the consumption of bean-based processed products. The results carry implications for various stakeholders within Zambia's agricultural sector, providing insights that can guide farmers in aligning their production with consumer preferences, potentially leading to increased income and sustainability. Some of these implications are that businesses in the food industry should pay attention to female preferences in their marketing strategies and policy initiatives could focus on making nutritious food more affordable, potentially through subsidies or incentives that benefit lower-income households.

Key words: value, processed foods, bean-based processed products, consumer behavior, Rapid Market Analysis, supply chain actors

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DEDICATION

I dedicate this work to my Husband, Mr. Chipapa Matyola for always believing in me, and supporting me against all odds! I am highly indebted to your never-ending love and support. To my only son Waluse Matyola, thank you for your patience when I had to leave you to pursue my studies far away from home. You were only 2 years old, and I knew it was not going to be easy but here we are, reaching the end of this journey stronger than we started! I will always love you. To my Mother, Chilima Habuyani Haboombe, I will always be grateful for your love and prayers.

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ABBREVIATIONS

CFA:	Confirmatory Factor Analysis
CIAT:	Alliance Bioversity International
CSO:	Central Statistical Office
EFA:	Exploratory Factor Analysis
FAO:	Food and Agriculture Organization of the United Nations
IDOs:	International Development Organizations
MoA:	Ministry of Agriculture
PABRA:	The Pan-Africa Bean Research Alliance
PCA:	Principal Component Analysis
RMA:	Rapid Market analysis
UNZABREC:	The University of Zambia Biomedical Research Ethics Committee
VC:	Value Chain
WTO:	Willingness to pay
ZamStats:	Zambia Statistics Agency
ZARI:	Zambia Agriculture Research Institute
ZNFU:	Zambia National Farmers Union
SWOT:	Strengths, Weaknesses, Opportunities and Threats

CHAPTER ONE: INTRODUCTION

1.1 Background

Agro-processing is important for export diversification since agricultural processed items are more valuable than agricultural raw materials. Agro-processing in Zambia is still underutilized, and as a result, there are many prospects in the sector. A report published by FAO indicated that challenges such as a diminishing contribution of agriculture to GDP, enduring rural poverty, and constrained diversification, underscore the underdeveloped nature of agro-processing in Zambia (FAO, 2022). The agricultural sector industry generates goods that can be sold to other industries as intermediary inputs for processes of value addition hence it has the ability to boost the nation's economy (Mapulanga and Black, 2020).

Mapulanga and Black, (2020) in their study claim that the production of food, particularly processed food, cannot keep up with the demand of the growing population in Zambia, which results in high and rising food imports. Thus, the creation of processed foods represents a glaringly untapped prospect for industrial growth.

Global climate change coupled with rapid population growth (3.4% growth rate) is changing agricultural practices everywhere. Traditional and dominant crops are failing to cope with the biotic and abiotic stress that climate change is imposing on plants (Mulenga, Wineman and Sitko, 2017) . Some of these climate challenges affecting Zambian crops are as discussed below.

Erratic Rainfall Patterns*:* Most crops in Zambia are predominantly rainfed, relying heavily on timely and consistent rainfall (Arslan et al. 2015; Love et al. 2006; Schlenker and Lobell 2010: Siatwiinda *et al.,* 2021). Climate change has led to erratic rainfall patterns, with shorter rainy seasons, delayed onset, and uneven distribution of precipitation. These conditions not only reduce crop yields but also make it challenging for farmers to plan and execute planting activities effectively (Haggblade and Tembo, 2003).

Drought Vulnerability*:* Traditional , dominant (or primary) crops such as maize, are highly vulnerable to drought (Matchaya, Tadesse and Kuteya, 2022). Prolonged dry spells and water scarcity during critical growth stages can lead to crop failures and food shortages. This vulnerability is exacerbated as climate change intensifies the occurrence and severity of droughts.

Increased Pest and Disease Pressure: Climate change has altered the geographic distribution of pests and diseases, exposing traditional crops to new and more potent threats. Invasive species and the proliferation of crop-damaging pests can devastate harvests, resulting in economic losses and reduced food availability (Phiri *et al.*, 2013)

Soil Degradation*:* Altered precipitation patterns and prolonged droughts contribute to soil degradation, leading to reduced soil fertility and crop productivity (Mulenga, Wineman and Sitko, 2017). Traditional farming practices, which are prevalent in Zambia, may exacerbate this issue. Unsustainable land management practices, including deforestation and overgrazing, further degrade soils and limit the resilience of traditional crops (Wu and Mweemba, 2010).

Limited Crop Diversity: Traditional crops have been a staple of Zambian diets for centuries. However, their limited genetic diversity makes them less adaptable to changing environmental conditions. Climate change necessitates the exploration and integration of more climate-resilient crop varieties to ensure food security (Matchaya, Tadesse and Kuteya, 2022).

These stresses have been reducing crop yields (by 20% in Maize (Alfani *et al.*, 2019) at a time when yields need to increase to reach the demands of the growing population (Pereira, 2017) According to the Zambia Statistics Agency, (2022), the Zambian population has witnessed a substantial increase of 49.8% since the 2010 census, during which the total population was recorded as 13,092,666 people. By 2022, this figure had surged to 19,610,769 individuals (Zambia Statistics Agency, 2022). As part of the solution, there has been promotion of legume plants production in the recent past by the Zambian government through the Ministry of Agriculture (MoA) due to the many benefits such as improving soil aggregates, increasing soil water retention, and their strong adaptive capacity to adverse environments (Schwember, 2020). Furthermore, their robust adaptive capacity makes them an essential component of sustainable agricultural practices, as they empower local communities to cope with changing climatic patterns (Arslan *et al.*, 2015). The significance of legumes extends beyond their environmental impact; they are also integral to addressing nutritional deficiencies and ensuring food security. In 2016, the Food and Agriculture Organization (FAO) of the United Nations recognized the vital role of legumes and declared it as the International Year of Pulses with a theme, “Nutritious seeds for a sustainable future”. Legume plants have for long been pivotal in ensuring and guaranteeing food security, alleviating nutrition

deficiencies, reducing reliance on fertilizers and increasing resilience against climate change thereby empowering local communities.

Legumes are getting more attention outside of the scientific literature due to the varied roles they play in production and dietary requirements (Considine et al. 2017; Foyer et al. 2016), and also in the agricultural development strategies such as sustainable land management (SLM) practices and livelihood diversification strategies (Alfani *et al.*, 2019) built through private sector led consortiums through collaboration among producers, aggregators, processors and retailers . Private groups such as PROSPERO Limited have developed such strategies. These strategies have led to the production of high value products that reach both local and export markets. For example, PROSPERO Limited's 2021 Legumes initiative strategy focused on three value chains: soya beans, common beans, and groundnuts and pursued to support efforts to upgrade knowledge and skills around legume production in Zambia.

In Zambia, cultivation of legumes is quite common among smallholder farmers. Groundnuts are the second most cultivated crop among smallholder farmers after maize. It was observed that almost all households participate in cultivating various crops at a subsistence level. Specifically, 65% engage in the commercial cultivation of maize, and 45% cultivate groundnuts for commercial purposes. Nonetheless, the commercial cultivation of beans, cassava, and soya beans is practiced by fewer than 30% of the farmers (Kahenge, Muendo and Nhamo, 2019). These crops also form an important part of the Zambian diet daily.

Despite many benefits of legumes, most of the small-scale farmers involved in legume production are not engaged in adding value to their produce. For instance a study conducted by Siamabele (2019) on soya beans production in Zambia found that small scale farmers do not engage in value addition of soya beans and this was attributed to some challenges they face such as poorly developed agricultural advisory services, farmers' inability to access favorable output markets and lack of good infrastructure. Much of the produce is stored dry or frozen but these are ineffective against mold and insects already present in the grain before storage hence some of the produce is lost post-harvest (Manandhar, Milindi and Shah, 2018).

It has been observed that the population of Zambia consumes very little legume based processed products, particularly in peri-urban and rural areas. For example, just 30% of the soya beans grown in Eastern Province are kept at home and used mostly as seed (Lubungu, Burke, & Sitko, 2013;

Manandhar, Milindi and Shah, 2018) while the rest is sold. This is partially caused by an excessive reliance on maize as the primary staple diet and a lack of knowledge about the nutritional advantages of legume products (Muchemwa *et al.*, 2022).

End products in which the commonly grown legumes in the country are processed include peanut butter from ground nuts, cooking oil from soya beans, pre-cooked beans from common beans and animal feed from various legumes (Siamabele, 2019). Most common beans is sold cheaply in raw material form; little is known on the potential demand and production of value added bean products. Some of the potential products that can be made from beans are extruded or roasted snacks which are made from bean flours and these provide a wholesome snack alternative(Nicholson, 2013). Incorporating bean flours into pasta formulations enhances both protein and fiber content, altering the noodles structural properties (Stoin *et al.*, 2022). Bean-based beverages, exemplified by soy milk, demonstrate another avenue for bean processing (Rekha and Vijayalakshmi, 2013). Additionally, beans can be transformed into spreads or dips, offering nutritious alternatives Nair *et al.*, (2013) .The potential for market diversification due to the range of products underline the importance of a comprehensive study on consumer and agro-processing dynamics to provide this information and better comprehend factors influencing the consumption of these processed bean products.

While it is widely known that processing improves the economic value and enhances nutrition of farm food produce (Mhlanga, Mwila and Thierfelder, 2021), there is limited understanding of the challenges encountered by various actors in the supply chain and the factors influencing the consumption of processed products derived from beans. The consistent preference for unprocessed beans may be due to scarcity or lack of awareness regarding the availability of processed bean products. Recognizing the challenges faced by agro-processors is crucial for clarifying the current dynamics of availability and justifying the need for further investigation. Additionally, assessing whether the documented demand for processed bean products is low is important for assessing the demand side of the market. This study aims to elaborate the relationship between the challenges faced by agro-processors on the supply side and potential low demand, clarifying whether the low consumption of processed beans is attributed to supply-side factors, demand-side factors, or a combination of both. Such insights are important for developing effective strategies to encourage the adoption of processed bean products and improve the overall sustainability of the food system.

1.2 Statement of the problem

Legumes have potential to contribute to livelihoods, food and nutritional security of vulnerable rural households in Zambia. With the current threats posed by climate change such as land and environmental degradation which lead to an increase in poverty, hunger and food insecurity (Gogoi *et al.*, 2018), legumes will be a more suitable crop in the near future as most of the legume crops such as common beans are tolerant to such conditions (Muchemwa *et al.*, 2022). Legumes also contribute to food and nutritional security due to the high protein content compared to cereals. They also help in disease mitigation and weight management (Mullins and Arjmandi, 2021).

Much of the existing research has focused on agronomic aspects of legume crops, such as increasing output in the face of abiotic limitations in the field (Vadez *et al.*, 2008), the contribution of legumes as nitrogen fixing crops (Franco and De Faria, 1997) and development of new varieties through gene mutations and other techniques (Fratini *et al.*, 2014). However, literature has shown that increasing production does not necessarily result in increasing consumption (Schneider, 2002) thus agronomic improvements alone may not impact the nutrition status of consumers without considering the consumers consumption structure for the products.

There is a significant gap in the existing literature regarding the factors influencing consumer decisions to purchase bean-based processed products, particularly in the context of Lusaka Province, Zambia. Despite the growing interest in these products from the processors & policy makers and their potential impact on the local economy, there is a dearth of comprehensive research that addresses the specific attributes and challenges within the supply chain, as well as the broader factors shaping consumers' purchasing choices.

Some studies have also looked at the drivers of demand for the actual grain of beans (Sichilima, Mapemba and Tembo, 2016) but not the processed. Other studies have concentrated on the factors that affect demand of legume grain crops at producer node (Kormawa, Chianu and Manyong, 2002) and at consumer node (Sichilima, Mapemba and Tembo, 2016). The challenge with this approach is that it ignores the characteristics of the finished goods made from these grains (processed goods), which may be the driver of demand for specific grains at different nodes. It also fails to consider the possible influence of the challenges encountered by supply chain participants on the consumer's desire for bean grains and bean-based processed products. Yet,

little is known about the players in the legume processed products, supply networks and the characteristics that affect consumer purchasing and consumption behavior.

Thus, there is a dearth of information on bean-based processed products found on the Zambian market and the factors that influence purchase and consumption of these products. These findings would result in recommendations for developing effective agro-processing ventures that will not only increase incomes for all the actors, but also improve the nutritional status of the people thereby ensuring food security. The development of the agro-processing sector and production of products with desired consumer qualities depend on the knowledge provided by this information. Processed legumes are crucial because they are packed with nutrients that benefit children who are malnourished (Calder *et al.*, 2021).

This study therefore focused on identifying the processed products, challenges faced by actors and determine the factors that influence consumption of beans-based processed products. This information will enhance the understanding of the beans-based processed product market, as well as identifying relevant interventions required to commercialize the bean-based processing industry.

1.3 Research aim and objectives

- The general objective of this study is to identify bean-based processed products, challenges faced by suppliers and determine the factors that influence their purchase among consumers in urban and peri-urban areas.

1.3.1 Specific objectives

The specific objectives of the study are to:

1. Map the existing actors and products in the bean-based processed products market in Zambia.
2. Identify attributes of products desired by consumers of bean-based processed products.
3. Examine the challenges faced by actors along the supply chain of bean-based processed products.

4. Determine the factors that influence consumers' decisions to purchase bean-based processed products.

1.4 Rationale

According to the CSO (2011) report, the government of Zambia together with several International Development Organizations (IDOs) and the Zambia National Farmers Union (ZNFU) have been promoting the cultivation of legumes. It was reported that the crops offer huge potential income as they are high value and are currently produced in small quantities. Therefore, identification of factors that influence consumers purchasing and consumption will aid processors to increase production and hence buy these crops in large quantities from farmers (hence providing a ready market to smallholder farmers) and produce products that will meet consumer requirements.

According to a study done by Crush and Fayne, (2010), food security is emerging as one of the key development challenges for Africa in the 21st Century. This is seen by the large number of malnutrition in the rural, peri-urban and urban areas particularly in Zambia although bias towards the rural communities (Mukuka and Mofu, 2016). This could be because some legume grains are not consumed as grains among some individuals due to their un-preferred natural taste (soya beans, cowpeas) while others its due to the amount of energy required in preparation (common beans). Hence informing processors of the factors influencing consumption of these products will ensure production of legume products that will meet the needs of consumers. This will increase the consumption rate of legume processed products which in turn increases intake of nutrients in the products and reduces cases of malnutrition and food insecurity.

Previous studies have shown that agro-processing helps to improve access to nutrient-dense foods which lowers the levels of malnutrition in the countries, facilitates income and employment growth, improving the accessibility of basic needs among individuals, leads to increased food trade and foreign currency, boosts agricultural productivity, and ensures dependable market access as well as lower post-harvest losses. There is therefore need to determine the legume based processed value chains and the attributes of agro-processed foods that would improve the value chains.

The purpose of this study is to help businesses and marketers who rely on insights gained from consumer behavior research to develop effective marketing strategies, modify their products and services to customer needs, and make advertising campaigns that resonate with target audiences.

By understanding the complex processes behind consumer decision-making, businesses can better position themselves in the marketplace and build better relationships with their customers and this in turn will improve the quality of products produced, increase sales, increase incomes, increase consumption, improve nutrition, and reduce wastages because the products will be aligned to consumer desires.

CHAPTER TWO: LITERATURE REVIEW

This section reviews some of the available pieces of literature that is regarded significant to the study. First, a definition of key concepts is given. This is followed by a review of the empirical studies on demand for legumes and processed legume products. The last section gives the conclusion of the chapter.

2.1 Definition of key concepts

Value

Value must be regarded from the perspective of the consumer since value to the customer is what matters the most, and this is a crucial factor to consider. Value is a condition that influences people's behavior across all cultural boundaries and highlights the wants, demands, desires, and ultimate goals of the customer (Kumar and Rajeev, 2016). There is no comprehensive definition of value, and many have attempted to define it but failed. Value, according to (Porta, 1985) is "the amount buyers are willing to pay for what a firm delivers them." In this study, I adopt the definition of Value from the Food and Agriculture Organization (FAO) who defines value as production of new food products from raw materials (Neven, 2014).

Processed foods

Any food that has undergone some sort of modification during preparation is referred to as processed. Simple food processing methods include freezing, canning, baking, and drying (Amit *et al.*, 2017). Food processing in this study refers to the conversion of agricultural materials into food or the change from one kind of food to another. From home cooking to sophisticated industrial processes used to produce convenience foods, food processing encompasses a wide range of food preparation techniques.

Bean-based processed products

Bean-based processed products incorporate an assorted range of food items derived from legumes, mainly beans, which have undergone various processing techniques to make them fit for consumption. These processing techniques include canning, drying, milling, or packaging, among others (Valero, Carrasco and García-Gimeno, 2012). Commonly utilized bean crops for these

products include soy bean,, pigeon peas, cow peas (Chisomo, 2022) and groundnuts (Mukuka and Shipekesa, 2013). The attraction of bean-based processed products lies in their outstanding nutritional profile. Beans are naturally rich in essential nutrients, including protein, dietary fiber, vitamins, minerals and antioxidants (Mullins and Arjmandi, 2021). This nutrient concentration has rendered bean-based processed products as vital components of diets worldwide, contributing to health and nutrition (Mullins and Arjmandi, 2021).

In recent years, bean-based processed products have gathered significant attention, mainly within the context of the growing interest in plant-based and vegetarian diets. Health-conscious consumers are progressively seeking bean-based options as a means to increase their plant-based protein intake, reduce their dependence on meat, and enjoy associated health benefits (Pathiwada, 2023).

Consumer behavior

Consumer behavior, as defined by Schiffman and Kanuk, (2019)), refers to " the processes involved when individuals or groups select, purchase, use, or dispose of products, services, ideas, or experiences to satisfy needs and desires". This field of study explores the decision-making processes that individuals and groups undergo when choosing among numerous options in the marketplace. It investigates the numerous factors and influences that shape these choices, ranging from personal motivations and perceptions to external marketing strategies and societal norms.

Consumer behavior research is important to understanding how and why consumers make purchasing decisions. In this study, it involves the examination of what consumers buy, why they buy them and what makes the attributes or factors that make them buy it. The study of consumer behavior draws from disciplines such as psychology, sociology, economics, and marketing to shed light on the complex interplay of individual, interpersonal, and environmental factors influencing consumer choices.

Rapid market assessment

A **rapid market assessment** (RMA) is a rapid and short analysis of a specific market or business environment designed to swiftly gather essential insights. Typically employed in circumstances where time and resources are limited, RMAs are crucial in making informed decisions promptly

(Baker and Neto, 1988). They focus on key market features, such as size, trends, competition, and immediate opportunities or challenges (World Bank, 2007) often relying on existing data sources, secondary research, and expert opinions rather than extensive primary data collection (ACF International., 2013) RMAs may use a mix of qualitative and quantitative methods and can be iterative, permitting initial findings to guide further data collection and analysis as needed (World Health Organization, 2017). The main aim of an RMA is to make available actionable insights that can inform immediate decisions or actions (Food and Agriculture Organization, 2012) RMAs prove helpful in fast changing situations, such as market entry, crisis response, or resource allocation decisions, as they offer a practical and effective means to gather enough data and insights within tight timeframes.

Supply chain actors

These are also referred to as supply chain participants or stakeholders. They are the diverse entities and individuals that play important roles in the complex network responsible for producing, distributing, and delivering goods or services from suppliers to end consumers. These actors contribute diverse roles to the supply chain, cooperatively ensuring the seamless and efficient flow of products through its several stages (Hugos, 2018).

Producers or Manufacturers are responsible for making the actual products or services. They source raw materials and components, converting them into finished goods (Chopra and Meindl, 2020). Suppliers deliver the essential materials, components, or services to producers, serving as a key link in the supply chain (Jacobs and Chase, 2021). Distributors and Wholesalers act as intermediaries, taking possession of products from producers and enabling their distribution to retailers or other intermediaries (Langley *et al.*, 2019). Retailers serve as the final link before products reach end consumers, directly selling products through physical stores or online channels (Simchi-Levi, Kaminsky and Simchi-Levi, 2019). Customers, while not traditional supply chain actors, significantly affect demand, thus shaping the entire supply chain process (Christopher, 2016).

2.2.0 Agro-Processing: A global outlook of consumption of bean-based processed products

The food sector is facing an increasingly competitive and globalized market, and consumers are more demanding and more concerned about the quality and health benefits of products they

consume (Barrena, García and Sánchez, 2015). Consumption is among the drivers of food production, and exerts its influence on sustainability (Majili *et al.*, 2020). This study was carried out to verify and establish consumers' tendencies to consume legume products, which are becoming increasingly popular thanks to their nutritional value. Current changes in the economy of which some can be attributed to COVID 19 (such as changes in average incomes, increasing employment away from home) are causing changes in consumption and consumer behavior (Neuhofer and Lusk, 2022). Today's consumer is more aware of the health benefits of the food on the market (Román, Sánchez-Siles and Siegrist, 2017). Knowledge about the health benefits of products is disseminated by various media. Such tools as the internet allow us to gain knowledge about food products, but also enable their purchase (Barska and Wojciechowska-Solis, 2020), a method which is mostly used by consumers of large cities who want to have a wider choice of products (Barska and Wojciechowska-Solis, 2020).

For consumers in Europe, the health effects are perceived to be a big driver in the demand for legume-based products. According to Hamann, (2020), healthy lifestyle, which has been gaining popularity recently, has led to an increasing demand for products that can serve as, for example, meat replacements and contain a large nutritional value. In their study conducted in the United States of America, Mullins and Arjmandi (2021), noted a shift in consumer preferences for food products toward those with a plant origin. This could be attributed to any or a combination of health awareness, environmental concerns, ethical considerations, and the availability of appealing plant-based products which could have driven the shift in consumer preferences towards plant-based foods and a healthier lifestyle.

It should be noted that food inventors have shown a lot of interest in the gluten-free market segment of which legumes are one of the most affordable sources. This is due to the functionality that flours derived from legumes can contribute to gluten-free baking. The desire for gluten-free products is growing among consumers in the EU and the US, and this significant market trend will drive demand for legume-based flours made, for example, from beans, chickpeas, or lentils (Mecha *et al.*, 2021).

Australian researchers noted favorable consumer views regarding legume products in a study conducted by Figueira *et al.*, (2019). They demonstrated in a sample that was representative of all

Australian consumers that legume products have a positive impact on health, lowering the risk of cardiac disorders (Crosland *et al.*, 2019). The potential for change in consumer behavior stems from the health element (Havemeier, Erickson and Slavin, 2017). As a result, affluent nations like the USA or Australia created educational initiatives that focused on schooling and thoughtful buying as well as diet planning and the development of culinary abilities (Lichtenstein, 2010). According to the U.S. Department of Health's recommendations, encouraging education, promoting good eating habits, and educating consumers about the needs of sustainable development can raise the consumption of legumes, which will have a positive impact on both the environment and diet.

In a study conducted among Iowa-based consumers in the United States, Palmer *et al.*, (2018) emphasized the significance of inexpensive legume products. The findings indicated that people living in poorer rural areas prefer to shop at chain supermarkets because the prices are generally lower there. Dietary sustainability includes not only nutritional and environmental considerations, but also socio-cultural and economic aspects. The findings of the study support the hypothesis of American scientists from Iowa, according to which a low price is a requirement for consumers to choose these goods in rural areas. In their study, Majili *et al.*, (2020) also emphasized the prevalence of legume products in underdeveloped rural areas.

2.2.1 Agro-Processing in Africa

The importance of agro-processing in Africa cannot be overelaborated, as it plays a key role in transforming the continent's agriculture sector and driving economic development. Quite a lot of key factors highlight the importance of agro-processing in Africa:

1. **Value Addition:** Agro-processing involves the conversion of raw agricultural products, such as fruits, vegetables, grains, and livestock, into value-added goods. Through processes like milling, canning, drying, and packaging, the inherent value of these agricultural commodities is significantly increased. This added value contributes to higher profit margins for both farmers and processors. A study conducted by Adejumo *et al.*, (2020) on post-harvest technology change in cassava processing found that use of improved post-harvest technologies (agro-processing) yield a greater net income compared to other types of post-harvest technologies, indicating its superior profitability. In this study, a choice

model was employed to investigate the factors that influenced the selection of post-harvest technologies in cassava starch processing. The study involved a sample of 570 processors located in the forest and guinea savanna zones of Nigeria. The study also evaluated the profitability of various post-harvest technologies within the study area, utilizing the budgetary technique. Furthermore, the impact of enhanced post-harvest technology on processors' revenue and output was analyzed using the average treatment effect model. The study identified several factors that significantly influenced the choice of post-harvest technologies, including the sex of the processor, processing experience, income level, cost of post-harvest technology, capacity of post-harvest technology, and access to credit, among others. Despite the higher initial cost associated with improved post-harvest technology, it was found to yield a greater net income compared to other types of post-harvest technologies, indicating its superior profitability. Additionally, the adoption of improved post-harvest technology had a positive and substantial impact on both output and income. These findings underscore the potential benefits of investing in enhanced post-harvest technologies for cassava starch processors and stakeholders, as it has the potential to increase income and overall welfare.

2. **Reduction of Post-Harvest Losses:** Postharvest loss can be redefined as the deterioration, encompassing both a reduction in quantity and a decline in the quality of food products, occurring in the interval between harvest and eventual consumption. One of the key constraints that hindered the improvement of food and nutritional security in Africa was the poor post-harvest management, which resulted in losses ranging from 14% to 36% of maize grains (Tefera, 2012). These losses exacerbated hunger and contributed to elevated food prices due to reduced market supply. Addressing the issue of post-harvest losses was deemed crucial in strategies aimed at increasing food availability without further burdening the natural environment. Solving the challenges associated with post-harvest management necessitated effective collaboration and linkages among various stakeholders, including research, extension services, agro-industry, marketing systems, and the creation of a supportive policy environment. Tefera, (2012) also examined the biological and socio-economic factors contributing to post-harvest losses in maize in Africa, considering their implications for climate change and food security, and proposed strategies to mitigate these losses among these being improvement of the agro-processing industry (Tefera, 2012).

3. **Employment Generation:** Aneani and Osei, (2011) conducted a study on Promoting agro-processing enterprises in Ghana. The main objective of this study was to evaluate the experiences of the CSIR-Food Research Institute in promoting agro-processing enterprises in Ghana and their influence on employment generation. Researchers used case studies and surveys to evaluate the growth and employment patterns within agro-processing enterprises. The findings proved that agro-processing initiatives led to increased employment opportunities in Ghana, mainly in the food processing sector. This study was carried out in various regions of Ghana.
4. **Export Potential:** The study conducted by David and Crentsil, (2013) had the main aim of examining the comparative advantage and competitiveness of Ethiopian coffee, with an emphasis on processed coffee products, in the international market. Using a combination of trade data analysis and market research methodologies, the researchers sought after evaluating the export potential of Ethiopian coffee and understanding the role of agro-processing in promoting its competitiveness globally. The analysis had its focus on coffee-producing regions in Ethiopia, evaluating trends in exports, consumer preferences, pricing strategies, and the market dynamics as a whole. The key results revealed that Ethiopian coffee, particularly in its processed forms, exhibited a comparative advantage and competitiveness in the international market. The value-added aspect of agro-processing emerged as a significant contributor to the accomplishment of Ethiopian coffee on the global stage. The study suggested further investments in agro-processing initiatives to preserve and increase the value-added aspect, strategic marketing ideas to highlight the exceptional features of Ethiopian coffee, and collective efforts between government agencies, coffee producers, and exporters to bear and increase the export potential of Ethiopian coffee.

2.3 Mapping agricultural value and supply chains

A value chain is a series of operations for a business engaged in a certain industry. Products move sequentially through each link in the chain's activities, gaining value at each one. The chain of activities adds more value to the products than the total value of the individual activities (porta, 1985).

A study was carried out by Jahari *et al.*, (2018) to assess how regional value chains in agro-processing could promote regional development, industrialization, and growth. The study examined the possibility for establishing greater regional ties between Tanzania and South Africa using the value chain from oilseeds to edible oils. The study's key conclusions revealed that high logistic costs constrained expanded commerce in processed goods. Developing the agro-processing industry necessitates creating related industrial competencies in addition to transportation, packaging, and quality requirements (Jahari *et al.*, 2018)

Branca *et al.*, (2021) carried out research on Malawi's cereal-legume value chain analysis using a thorough VC Map, a SWOT analysis, and a policy analysis. Smallholder engagement in VC comes with a variety of difficulties. The findings demonstrated that smallholder farmers frequently are unable to take advantage of lucrative market opportunities due to a lack of access to land, technology, and inputs, a lack of understanding of how markets operate, a lack of access to loans, and a general lack of extension services.

A study was carried out in Zambia to determine how common bean grain properties affect bean market pricing. It was suggested that traders and consumers should be considered by common bean breeders as significant actors whose expertise can have a useful impact on the development of the bean value chain (Sichilima, Mapemba and Tembo, 2016). It is important to note that the Zambian study's suggestions about the impact of common bean grain qualities on market pricing have not yet been fully implemented. According to the study's findings (Sichilima, Mapemba and Tembo, 2016), breeders should consider the opinions of both traders and consumers, acknowledging them as crucial parties with the potential to improve the bean value chain. Despite this insightful information, the implementation of these suggestions is still a work in progress, underscoring the continuous relevance and significance of this study in thoroughly investigating the variables influencing consumer preferences in the market for bean-based processed products.

According to Chopra and Meindl, (2020) any parties involved in directly or indirectly completing a consumer request are included in a supply chain. Along with the manufacturer and suppliers, the supply chain also consists of transporters, warehouses, retailers, and even the actual customers. The supply chain in every organization, such as a manufacturer, entails all activities involved in

receiving and completing a client request. New product creation, marketing, operations, distribution, financing, and customer support are just a few of these duties.

There are several supply chains in agriculture, and each has different challenges and opportunities. There are also several methods that researchers have used to identify these challenges and opportunities along supply chains. Chen *et al.*, (2021) did a study to determine the difficulties and opportunities in the food supply chains. Through a thematic analysis, the study sought to investigate how blockchain technologies are being adopted in the food supply chain. Desktop research was done, and information was gathered from online sources, including databases of academic papers and news articles (such as Factiva) (e.g. Web of Science). Following that, a qualitative theme analysis was done using Creswell's suggested research techniques. The study discovered fourteen first-order themes and five second-order themes in problems, seven first-order themes and two second-order themes in adoption processes, sixteen second-order themes, five third-order themes, and thirteen first-order themes in benefits.

In 2019, a qualitative study on Iran's "Challenges for Food Security and Safety" was carried out. The research methodology used a standard content analysis. The data collection process involved the triangulation approach, which combined participant observations, focus group talks with 17 managers, and semi-structured interviews with the business president. The company's key issues were recognized as the regulatory system, food safety risks, market volatility, conventional management and sanctions, culture, and market volatility (Sadati *et al.*, 2021).

2.4 Factors that influence consumption behaviors

It is vital to talk about the idea of customer preferences and willingness to pay for legume products based on the topic of legume production and products in Zambia. The examination of consumer preference for legume products stems from microeconomic theory and Lancaster's characteristics technique, where consumption utility is obtained indirectly from consumed items and directly from a well-defined collection of product properties (Lavoie, 2004).

According to neoclassical economic theory, customers' utility functions allow them to consistently rank many product alternatives and choose the one that will give them the greatest utility subject to a budget constraint. The preferences of the person are assumed to be reflexive, complete, transitive, continuous, and strongly monotonic under this premise. It also implies that consumers

are capable of processing information flawlessly and are competent enough to make judgments that are discriminating (Anderson *et al*., (1992) as cited by Owusu *et al.*, (2014). A consumer's demand for a product will reflect this utility maximization process such that any changes in the choice sets and/or budget constraint will result in reassessment of this demand decision. Because consumers are inherently different in their tastes and preferences, this optimal decision may be different among consumers with the same choice sets and budget. Based on this utility maximization process, demand refers to the quantity of a product or service that a consumer is willing and able to purchase at a given price, considering their individual tastes, preferences, and budget constraints. Consumers may, however, make choices that do not optimize their utility, which is accepted. This may be due to misperceptions about a product's features or inability to discount, market failures such as price structures that conceal the true costs of manufacturing for society, or restrictions in the market (Tiffin *et al*., 2006; Owusu *et al.*, 2014).

The theory of consumption and preference are interrelated in that consumers are rational beings hence are most likely going to purchase and consume products that reflect their preferences. Empirical evidence suggests that preferences can be affected by several factors relating to the consumer and his/her environment which in turn influence how choices are made. Consumer behavior concerns the lives of consumers and how the products and services they buy have an impact on their lives (Michael Solomon *et al.*, 2017). Aspects of consumer behavior that can be considered during analysis include demographics, psychographics, reference group, subcultures, market segmentation and many more (Michael Solomon *et al.*, 2017).

Sayin *et al.*, (2010) carried out one such study on the variables influencing household fish purchasing decisions. The study's goal was to identify the socioeconomic characteristics that influence fish consumption. The Heckman sample selection correction approach was used to survey 498 families in order to evaluate the effects on both individuals and households. The findings revealed that 36.6 percent of households, including those with poor incomes, middle-aged residents, and low reading levels, were replacing fish with chicken. But 78 percent of wealthy, educated, and older age groups who ate did not choose to replace their fish with chicken.

Some studies have been conducted on consumer preference of different legume products to identify factors that affect consumer preferences of legumes. One such study used information

from the Grain Legume Innovation Lab project, which performed a survey in 2015 on 844 respondents in the seven constituencies in Lusaka district. This study was on consumer preferences for common dry beans (Zulu, 2019). The survey's discrete choice experiment module's stated preference data were examined using a conditional logistic regression model. The findings showed that consumers' preferences for common dry beans are highly influenced by the color, cooking duration, and gravy quality of the beans. As an illustration, it was shown that customers strongly and significantly prefer the purple bean variety, which is followed by the mixed yellow bean variety. If someone were given a slow-cooking bean variety instead of a fast-cooking bean variety, their utility would decrease. Furthermore, if someone were given a bean type with a low gravy quality, their utility would decrease. Despite showing encouraging indicators, the coefficients for grain size were insignificant, indicating that a consumer does not place much importance on bean grain size. In terms of distributional assumptions, logistic regression assumes a logistic distribution for the error term, potentially limiting accuracy in representing the data with latent variables. Logistic regression should not be employed if there are less data than features because this could result in overfitting (Park, 2013).

Another study investigated how adding soy flour affected the nutritional value, consumer preferences, purchase intentions, and willingness to pay for fritters made with wheat. A consumer preference study on organoleptic qualities was conducted among 291 individuals (93 men, 198 women) in the Chipata, Katete, and Lundazi areas of Eastern Zambia to identify the approximate composition of both varieties of fritters. Ash, fat, amylose, crude fiber, and protein contents were considerably greater ($p < 0.05$) in the soy-fortified fritters compared to the unfortified fritters. The contents of soy-fortified fritters were significantly raised by 55.5%, 18.9%, 98%, and 30.6%, respectively, in terms of protein, crude fiber, amylose, and ash. The general preference between soy- and non-fortified fritters did not differ significantly ($p > 0.05$). Participants in Katete (38%) and Chipata (41%) were more likely to favor the soy-fortified fritters than the non-fortified ones. Also across the three sites, there was no discernible difference in intention to purchase for either type of fritter ($p > 0.05$) (Alamu, Popoola and Maziya-Dixon, 2018).

Examining the consumption trends of pulses in Zambia is vital for gaining complete insights into dietary habits. A research initiative led by Pele (2015), delved into the complex relationship between income dynamic forces and bean consumption patterns in the Zambian context. The main

aims of the study were to unravel the consequences of income variations on bean consumption, identify the income demographic most open to policy interventions, and draw evaluations between bean consumption and other food commodities. A robust statistical and econometric methodology was used by the researchers who accurately analyzed data derived from the 2010 Zambia Living Conditions Monitoring Survey. The results of the study discovered a noteworthy trend which is that Zambians allocate a relatively smaller portion of their food budget to beans. The findings strongly suggested that there exists a possible correlation between higher levels of education and income with an increased propensity for bean consumption. This implies that initiatives aimed at enhancing education and income levels may play a pivotal role in promoting bean consumption within the Zambian population. Such insights are vital for developing informed policies that aim to improve nutritional practices (such as improved consumption of processed products) and contribute to overall public health improvement.

In order to provide policymakers and chain actors with information about the best ways to address the problem of product consumption, Mfikwa and Kilima, (2014) conducted a study where they examined the factors that influence market participation and product consumption. For the purpose of determining the variables influencing the choice to take pulses and the volume consumed, a two-step model based on the double hurdle specification was used. The model's findings showed that household sizes and education levels of decision-makers in rural areas had a significant impact on their decision to consume pulses, while their level of education, household size, total household expenditure on food and non-food, and prices of pulses and meat all had an impact on how much they consumed. It was discovered that the major decision makers' sex, household size, and level of education all had a substantial impact on their choice to consume pulses whereas the primary variables that impacted the amount of consumption in urban regions were household size, age and education levels, and total household expenditure. In conclusion, the model demonstrated that market involvement for pulses was lower in rural than in urban areas. Nonetheless, the overall consumption was lower in urban areas than in rural areas, suggesting that urban areas had a better chance of growing their consumption. The challenge with the double huddle model is that it can only be used when the decision to participate is separate from the decision to consume (García, 2013). In this study, the dependent variable is the decision to purchase and consume a product. The study assumes that a household will purchase a particular product for the purpose of consuming it.

2.5 Factor Analysis

A common statistical method with applications in many disciplines, such as psychology, economics, and social sciences, is factor analysis. It is used to find latent variables that account for observed correlation patterns between various measured variables. Factor analysis is a useful approach for dimensionality reduction and pattern identification since it seeks to reduce data complexity while keeping crucial information (Gorsuch, 1983). The method makes the assumption that underlying unobservable factors influence the observed variables and aims to discover these factors based on the observed relationships (Thompson, 2004)

Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) are two types of factor analysis. EFA is used when researchers want to understand the underlying structure of the data without having prior notions about how the variables relate to one another. On the other hand, CFA is used by academics to verify whether their suggested model fits the data when they have precise theoretical expectations (Brown, 2015).

Finding hidden patterns, streamlining complicated datasets, and assisting in the comprehension of interrelationships between variables are all made possible by factor analysis. Researchers can learn more about the structure and underlying dimensions of the data by identifying latent factors that contribute to the observed correlations (Tabachnick and Fidell, 2007).

Therefore, factor analysis was employed in the study's investigation of consumers' perceptions towards bean-based processed products for the above-mentioned reasons.

2.6 Theoretical basis of the Principal Component Analysis (PCA) method

Principal Components Analysis (PCA) is a method used to derive a set of orthogonal linear combinations from a group of variables. These combinations are designed to effectively capture the shared information present in the variables. Instinctively, the initial principal component within a set of variables is the linear composite of all those variables that effectively encapsulates the most significant common information shared among them. The theoretical framework as described by Langyintuo, (2008) is as follows:

Let’s suppose I have a set of K variables, $a*1j$ to $a*Kj$, representing the ownership of K assets by each household j. Principal components start by specifying each variable normalized by its

mean and standard deviation. For example, $a_{1j} = (a^*_{1j} - a^*_1)/s^*_1$, where a^*_1 is the mean of a^*_{1j} across households and s^*_1 is its standard deviation. These selected variables are expressed as linear combinations of a set of underlying components for each household *j*:

$$\begin{aligned} a_{1j} &= v_{11}A_{1j} + v_{12}A_{2j} + \ldots + v_{1K}A_{Kj} \\ &\ldots \qquad\qquad \forall j = 1,\ldots,j \\ a_{K1j} &= v_{K1}A_{1j} + v_{K2}A_{2j} + \ldots + v_{KK}A_{Kj} \end{aligned} \tag{1}$$

where the *A*s are the components and the *v*s the coefficients on each component for each variable (and do not vary across households). The solution to the problem is indeterminate due to the fact that only the left-hand side of each line is observed. To overcome this indeterminacy, PCA identifies the linear combination of the variables with maximum variance, mostly the first principal component $A_{1j,}$ and then a second linear combination of the variables, orthogonal to the first, with maximal remaining variance, and so on. Theoretically the procedure solves the equations $(\mathbf{R} - \lambda\mathbf{I})\mathbf{v}_n = 0$ for λ_n and $\mathbf{v}_n$, where **R** is the matrix of correlations between the scaled variables (the *a*s) and $\mathbf{v}_n$ is the vector of coefficients on the *n*th component for each variable. Solving the equation yields the eigenvalues (or characteristic roots) of **R**, λn and their associated eigenvectors, $\mathbf{v}_n$. The final set of estimates is produced by scaling the $\mathbf{v}_n$s so the sum of their squares sums to the total variance.

To recover the "scoring factors" from the model, the system implied by equation 1 is inverted) yielding a set of estimates for each of the *K* principal components:

$$\begin{aligned} A_{1j} &= f_{11}a_{1j} + f_{12}a_{2j} + \ldots + f_{1K}a_{Kj} \\ &\ldots \qquad\qquad \forall j = 1,\ldots,j \\ A_{K1j} &= f_{K1}a_{1j} + f_{K2}a_{2j} + \ldots + f_{KK}a_{Kj} \end{aligned} \tag{2}$$

Therefore, the first principal component, expressed in terms of the original (un-normalized) variables, is an index for each household based on the expression:

$$A_{1j} = f_{11}(a^*_{1j} - a^*_1)/(s^*_1) + \ldots + f_{1K}(a^*_{Kj} - a^*_K)/(s^*_K) \quad (3)$$

The assigned weights are then used to construct an overall 'wealth index', applying the following formula:

$$W_j = \sum_{i=1}^{k} [b_i(a_{ji} - x_i)]/s_i \quad (4)$$

where: $\mathbf{W_j}$ is a standardized wealth index for each household; $\mathbf{b_i}$ represents the weights (scores) assigned to the (k) variables on the first principal component; $\mathbf{a_{ji}}$ is the value of each household on each of the k variables; $\mathbf{x_i}$ is the mean of each of the k variables; and $\mathbf{s_i}$ the standard deviations.

A negative index ($-W_j$) means that, relative to the communities' measure of wealth, the household is poorly endowed and hence worse-off while a positive figure (W_j) signifies that the household is well-off. A zero value, which is also the sample mean index, implies the household is neither well-off nor worse-off (Langyintuo, 2008).

2.7 Summary and conclusion

The literature reviewed has demonstrated that the landscape of agro-processing, with a particular focus on bean-based processed products, is diverse and dynamic. Exploring the definition of key concepts such as value and processed foods, the review underscores the critical role of consumer behavior in shaping preferences and decision-making processes. A rapid market assessment emerges as a valuable tool in swiftly navigating the complexities of the agro-processing

environment. Supply chain actors, from producers to end consumers, play integral roles in ensuring the efficient flow of goods.

A global outlook on agro-processing reveals a shifting consumer paradigm towards plant-based products, with a specific emphasis on the nutritional benefits of legume-based options. In the African context, agro-processing proves pivotal in transforming the agriculture sector, reducing post-harvest losses, generating employment, and unlocking export potential. The intricate mapping of agricultural value and supply chains highlights challenges and opportunities in various regions, emphasizing the importance of strategic competencies and considering diverse perspectives in shaping the bean value chain.

Consumer preferences and consumption patterns, influenced by factors such as bean variety, cooking time, and fortification, provide detailed insights into the intricacies of market dynamics. The theoretical and analytical framework draws from international studies, showcasing the relevance of models like the probit model and factor analysis in understanding the factors driving consumer choices and perceptions.

In conclusion, Chapter 2 navigates through a comprehensive range of topics, including global and African agro-processing perspectives, supply chain intricacies, and consumer behavior dynamics. The collective insights gleaned from the literature review set the stage for a profound understanding of the factors influencing bean-based processed product consumption and contribute to a broader comprehension of the agro-processing landscape.

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

3.0 Introduction

This chapter describes the research methodology employed to address the four objectives outlined in Chapter 1.3.1. The first three objectives are centered around understanding the existing products in the market and their distribution chains, extending to the markets frequented by the target consumers. For new products like locally processed legumes in Zambia, the presence and efficiency of distribution channels play a pivotal role in raising consumer awareness and influencing purchase decisions. The fourth objective in the study falls under the category of "Consumer Behavior and Decision-Making" as it aims to investigate the factors influencing consumer decisions regarding the product once it's available in the market.

This chapter begins by providing an overview of the study area, sampling techniques, data collection methods, and tools employed to achieve each objective. Additionally, the chapter offers an explanation of the econometric model used to achieve the objective of this study.

3.1 Description of the study area

The data used to achieve the four objectives was collected through two surveys carried out sequentially in Lusaka province, Zambia. Lusaka province is one of the ten provinces of Zambia and has six districts namely Chilanga, Chongwe, Kafue, Luangwa, Rufunsa and Lusaka districts The first survey (the Rapid Market Assessment) was conducted in Lusaka district while the second survey (household survey) covered Lusaka, Chongwe, and Kafue districts. In terms of geographical size, Lusaka is the smallest province in Zambia, with an area of **21,896 km^2**. As of 2022, Lusaka had a population of 3,079,964 and a density of 140.1 people per square kilometer, making it both the most populous and most densely inhabited province in Zambia (ZamStats, 2022). Lusaka province has the highest total number of households in the country at 687923. It is also one of the most urban provinces in Zambia with an urban population of 81.5% (ZamStats, 2022). Zimbabwe and Mozambique border the province; Lower Zambezi National Park is between them.

This area was selected because it gives a good representation of the actors involved in the legume-based processed products as most of the central markets are situated in the province. Major

processors also have their plants in the province and distribute to the rest of the country from this central position. The illiteracy rates in the three districts as of 2021, were 15.9% for Lusaka, 25.3% for Kafue and 36.7% for Chongwe. Higher illiteracy levels were among women due to early marriages, early pregnancies and traditional practices (Syakalima, 2010). Lusaka district has the highest population of 2204059 of the three districts selected and the highest population density of 5272.9 per square kilometer. This is followed by Kafue district with a population of 219574 and population density of 49.1 per square kilometer. Chongwe has a population of 313389 and a population density of 128.99 per square kilometer (ZamStats, 2022).

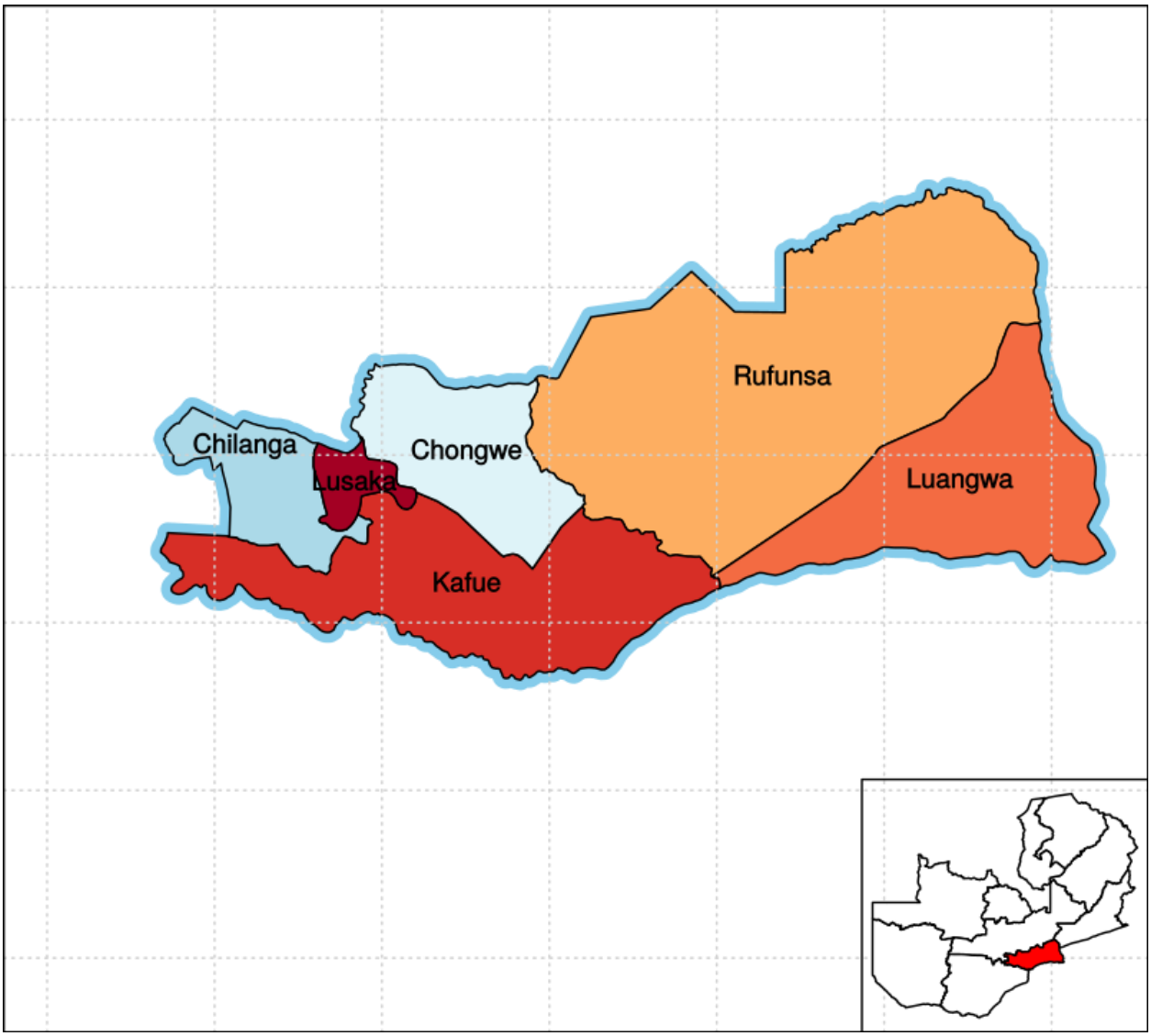

Figure 1: Map of Zambia's Lusaka province

Source: Wikipedia

3.1.1. Study area for the first survey: Rapid Market Assessment

Bean-based processed products are a new innovation and currently most prevalent in urban and peri-urban areas of Lusaka Province. The first survey in this study was the RMA, primarily conducted within Lusaka district. The survey covered a diverse selection of markets, including East Park Mall, Manda Hill Mall, Arcades, Kabwata Market, Olympia Market, Town Center, Libala Market, and Kamwala Market. These markets were specifically chosen because they housed shops and outlets where bean-based processed products were readily available. Mansa and Kasama districts were also added when one of the processors identified was found to be located in Mansa and supplying their products to Lusaka and Kasama. Hence Kasama on-spot consumers of the product were also interviewed.

3.1.2 Study area for the second survey: Household Survey

The second survey, which focused on consumer behavior and decision-making, extended its scope to encompass three districts: Lusaka, Chongwe, and Kafue. The selection of these three districts was driven by the presence of the main supermarket chain, "Choppies," in each location, which served as the primary retail outlet for locally produced bean-based processed products, as identified during the RMA. While Lusaka district has been previously described, the characteristics of the other two districts are described below.

Chongwe is a peri-urban community in the province of Lusaka. It is little over 40 kilometers from Lusaka and is occasionally referred to as rural Lusaka. Even though the city has recently grown because of a growing urban-rural migration from Lusaka, it is still predominantly an agricultural settlement. Even though a variety of food crops are grown, maize is the main staple in most families. In addition to the fact that it is a cash crop, the government also subsidizes maize production by providing input subsidies and a market for the produce (Chongo, 2022). On the north bank of the Kafue River, which bears its name, is the district of Kafue. It serves as the southern entrance to the central plateau of Zambia, which is home to Lusaka and the mining communities of Kabwe and the Copperbelt. It's situated on T2 Road (Great North Road). The area's traditional industries include farming and fishing, and a commercial farming region stretches 35km

north-west of the town along the Kafue Flats' edge. Fish farming is the only activity permitted for commercial fishing of any size. Kafue has a higher proportion of manufacturing industries. Kafue Estates, an industrial area with housing and services, is in the Town. It also has a larger rural population compared to urban areas.

The second phase of this study was not carried out in other provinces due to financial constraints. As for the first phase of this study, some phone interviews were conducted to capture actors who were situated out of Lusaka province.

3.2.0 Design and implementation of the first survey: Rapid Market Assessment.

In this study, descriptive and exploratory design and primary research methods were used. The RMA sample size was not scientifically determined due to the nature of the research. The selection of individuals to interview was based on the consumers purchase of any beans-based processed products in the stores. The data was collected in the month of August 2022 in Lusaka district.

3.2.1 Study Overview

The primary objective of the RMA activity was to thoroughly assess the legume-based processed foods market and acquire important insights into consumer behaviors and preferences. Given the relatively recent introduction of these products into the selected markets, I used a multifaceted approach for data collection. The sample size for this part of the study was not scientifically determined due to the nature of the study. The RMA initiative included the identification of market locations, collection of available legume-based processed products, and the tracing of products preparing for market entry. To achieve this, virtual consultations were conducted with processors, thereby smoothing the mapping of existing processed bean-based food items, their distribution networks, and their specific target consumer demographics. The study included both locally produced and imported bean products to provide an all-inclusive perspective on consumer preferences. This collaborative endeavor was executed in partnership with the Zambia Agriculture Research Institute (ZARI).

3.2.2 Data Collection Methods

In pursuit of the first three study objectives, a thorough data collection was carried out, primarily by conducting on-site visits to selected market outlets. These outlets were chosen through a randomized selection process of identifying the k^{th} (5^{th}) outlet from the starting point, guaranteeing an unbiased representation. During these field visits, the focus included a thorough examination of product offerings, price assessments, and analysis of consumer purchasing patterns. Furthermore, the study diligently compiled information regarding the relevant processors and distributors affiliated with these products.

Following the market analysis, structured interviews were conducted with the identified processors and distributors. These interviews served as a vital avenue for in-depth inquiries into their product portfolios, supply chain dynamics, and the characteristics of traders involved in the resale of their products. Alongside, insights into imported legume products and the respective importing entities were compiled through data accessed from the Zambia Bureau of Standards.

The study adopted a strategic "snowball" sampling approach to identify and survey key players in the distribution chain. This method initiated with the primary contacts, including processors and importers, who then nominated additional stakeholders within their distribution networks. Moreover, systematic sampling was used when faced with a large pool of potential participants particularly with the on-spot consumer. In this case, interviews were conducted with every 5^{th} consumer who purchased any of the bean-based processed products in the selected outlets. These measures were employed to ensure thorough representation and accuracy of the findings in this study. A total of 13 processors, 49 consumers, 13 distributors and 3 importers were identified.

Recognizing the potential for some legume-based food products to still be in the evolving stage, there was an active collaboration with private processors to acquire understandings into the characteristics of these emerging products.

Purposive sampling was also used to identify the On- Spot consumers. The researcher, while visiting distributors and processors identified the k^{th} (3^{rd}) consumer who purchased the legume based processed products and conducted On-spot interviews. Other on-spot consumers were interviewed in restaurants or communities once they were seen purchasing or consuming any of the legume based processed products.

The study's reliance on revealed preferences means that it focused on analyzing the actual purchase behavior of respondents rather than solely relying on their awareness levels. This approach allows the study to gain insights into consumer preferences and actual purchasing patterns for the bean-based processed products, even if the awareness levels for some specific products are low. The assumption of the study is that a household purchases these products for the purpose of consuming them.

By adopting the combined probit model and analyzing revealed preferences, the study aimed to understand the factors influencing a household's decision to purchase a processed bean product for consumption, considering the overall consumption behavior of respondents rather than focusing on individual products with low awareness rates. Although a detailed analysis of consumption decisions for individual bean-based products using a multivariate probit could have offered more profound insights, the observations on product utilization were insufficient to facilitate any significant analysis.

3.3 Design and Implementation of the second survey: Household Survey

3.3.1 Research Design

To achieve this objective, a cross-sectional research design was employed. Cross-sectional research allows for the collection of data from a diverse sample of households in Lusaka Province, including the districts of Chongwe, Kafue, and Lusaka, at a single point in time. This design was chosen for its efficiency in capturing a snapshot of the current consumer behaviors and preferences related to bean-based processed products. This section describes how the second survey was planned, conducted, and executed, offering critical insights into the survey's integrity and validity.

3.3.2 Conceptual Framework

This study conceptualized the consumer's choice to buy legume-based processed products as a construct shaped by demographic attributes, consumer beliefs and attitudes towards processed foods, and their surrounding food environments as depicted in figure 2. The consumer's journey

typically initiates with awareness of the product's existence, followed by a conscious decision to make a purchase upon acquiring this knowledge.

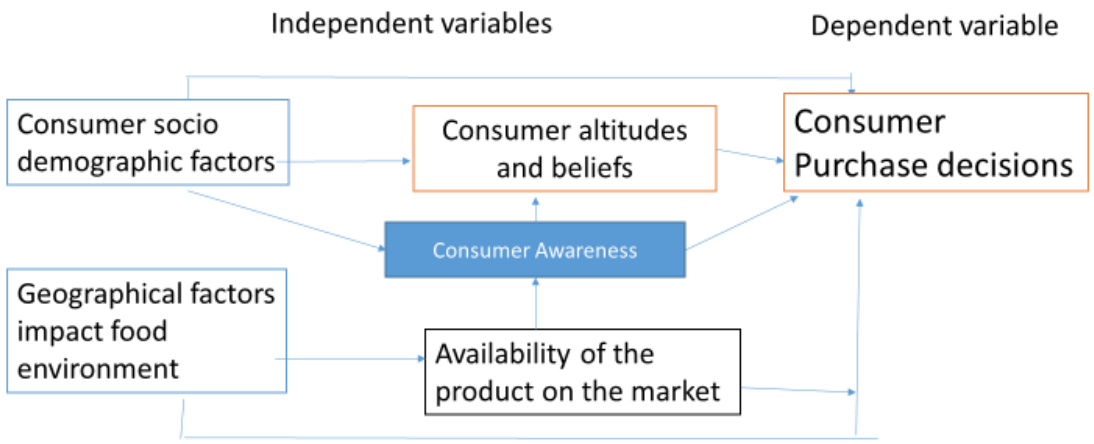

Figure 2: Conceptual framework
Source: author's survey

The relevance of the above variables in the Zambian context are due to their potential impact on consumer decisions regarding the purchase and consumption of bean-based processed products. Here's a justification for their relevance:

Socio-demographic variables:

1. **Age of household head:** Age can significantly affect dietary preferences. Diverse age groups may have varying levels of awareness and interest in bean-based products. Younger consumers, for example, might be more open to trying new products, while older individuals may have established dietary habits.
2. **Gender of household head:** Gender can influence food choices and cooking practices. In Zambia, traditional gender roles often dictate cooking responsibilities, which can influence

the inclusion of bean-based products in meals. Studying gender differences can reveal insights into consumption patterns.

3. **Marital Status of household head:** The size and composition of households can vary based on marital status. This can influence the quantity and type of food purchased. Married individuals may have different nutritional priorities compared to single individuals or those in other marital arrangements.

4. **Size of Household:** The number of people in a household affects the quantity of food required. Larger households may have higher demand for affordable and nutritious food options like bean-based products.

Consumer attitudes and beliefs

5. **Education Level of household head:** Education plays a critical role in shaping consumer preferences and behaviors. In Zambia, differences in education levels can influence how consumers perceive the nutritional value and benefits of bean-based processed products. Those with higher education might be more informed about these products and their health benefits, affecting their purchasing decisions.

6. **Monthly Income:** Income levels are a critical factor of food choices. In Zambia, income differences can influence access to and affordability of bean-based processed products. Low-income households may prioritize cost-effective and nutritious food options.

7. **Employment Status of household head:** Employment status affects income and, thus, the ability to afford certain food products. Employment status can also influence time availability for meal preparation, potentially affecting the choice of convenient processed products.

8. **Dietary Habits:** Dietary habits are fundamental to understanding consumer preferences. Zambian dietary habits may vary by region and cultural practices, impacting the acceptance and integration of bean-based products into local diets.

9. **Food Safety, Smell, Taste, and Quality:** These factors directly relate to consumer perceptions of the appeal and safety of bean-based products. Concerns about food safety, for instance, may deter consumers from purchasing certain products.

Geographical factors impact food environment

10. **Accessibility and Price of bean-based processed products:** These variables are particularly appropriate in a country like Zambia, where access to different food products can vary by region and urban-rural divide. Prices of food items, including bean-based products, can influence purchasing decisions.

In summary, these variables cover a comprehensive set of factors that can jointly influence consumer choices regarding bean-based processed products in Zambia. Their addition in the study allows for a holistic understanding of the dynamics affecting consumer behavior in this context.

3.3.3 Sample Size Determination

To determine the sample size, the study used a basic random sampling without replacement method derived from the work done by Horvitzt and Thompson, (2023), It is important to note that both sampling and non-sampling mistakes can alter the estimates from a sample survey. Adequate resources were available to conduct a survey with a sample size determined (as below), by the anticipated sampling error.

When a survey relies on a limited sample of units rather than speaking with every eligible unit, it makes sampling errors, which are representative errors. The sample size and the variety of the sampling units have an impact on sampling errors. The total of all ideal sample sizes over all domains for which the required degree of precision (or margin of error) is met is the intended sample size. Given that the sample size (n) is relatively small, and the target population (N) is big, the net sample size when calculating a proportion using a basic random sampling without replacement is given by;

$$n_i = \frac{z_{\frac{\alpha}{2}}^2 \left(\hat{p}(1-\hat{p})\right)}{\varepsilon^2}, \qquad (1)$$

where n_i is the sample size (number of individuals interviews), $\hat{p}$ is the adoption rate estimated from prior studies, z is the standard normal statistic for a two-sided test at 95 percent confidence (probability of type I error, $\alpha = 0.05$), and ε is the margin of error or precision. The study assumed that a precession of 5 percent is satisfactory at domain level, where the domain is defined by the

district (there are 3 districts) and the desired urban stratification. Thus, there is a total of 3 unique reporting domains for this study.

Equation (1) provides the ideal sample size for each individual, assuming 100% coverage. Equation (1) is modified as follows to take into consideration the inevitable individual and household non-response and to describe sample size as the total number of households to be chosen:

$$n_h = \frac{n_i}{R_i \text{ x } R_h \text{ x } d}, \qquad (2)$$

where R_i is individual-level response rate per household, R_h is the household-level response rate, and d is the number of individuals of interest per household (children or adults in this case).

However, while Equation (2) is appropriate for simple random sampling (SRS), it is insufficient for the proposed two-stage randomized cluster design. Following Kish (1965), I adjust for the complex design using the design effect:

$$n_h = Deff \text{ x } \frac{n_i}{R_i \text{ x } R_h \text{ x } d}. \qquad (3)$$

Deff is the design effect, given as

$$Deff = 1 + (b - 1) \text{ x } \rho, \qquad (4)$$

where *b* is the cluster take (or number of individuals to be interviewed per cluster), and ρ is the intra-cluster correlation coefficient (ICCC). As is typical of many national surveys, the ZamStats's standard enumeration areas (SEAs) were used as the study's clusters. The final sample size determined was 341. This sample size was divided according to percentage share of population in the three districts and according to percentage share of urban-and peri-urban population within each district to avoid biasness in the data collected. Therefore, the study had 36 optimal clusters. The expected response rate was 95% and 50% adoption rate. The probability of type 1 error used was at 0.05 and probability of type 2 error at 0.1.

3.3.4 Sampling Procedure for the Household survey

A two-stage sampling design was used in the household survey, with standard enumeration areas (SEAs) as primary sampling units or clusters, and households as the secondary sampling units. The sampling frame for the first stage was obtained from the Zambia Statistics Agency (ZamStats) and was based on the 2022 census of population and housing. Based on SEA maps, also obtained from ZamStats, a list of SEAs within supermarket catchment areas was developed. The list was further stratified identifying each SEA as being either urban or peri urban. Within each stratum, sample SEAs were then selected using simple random sampling (SRS). At the second stage of sampling, systematic sampling was used to select the sample households within each selected SEA. A sampling interval was determined by assuming a cluster size of 133 as indicated by experts from ZamStats. To ensure that the sample is random, enumerators started from the center and went into different directions for the identification of households to interview. This systematic approach ensured that households were selected in a manner that reduced potential bias and provided a representative sample.

The sample size for this study was determined scientifically (as shown in 3.3.5) to ensure its representativeness. The total sample size consisted of 341 households. This sample size was arrived at based on power calculations, assuming 95 percent confidence level, 80 percent power and a 1.1 design effect. The distribution of this sample across the three districts (Chongwe, Kafue, and Lusaka) was based on the percentage share of the population in each district. Chongwe had the largest share at 46.7%, Kafue at 32.7%, and Lusaka at 20.6%. Therefore, 156 households were randomly selected from Chongwe, 110 from Kafue, and 75 from Lusaka Central.

3.3.5 Data Collection

Data collection was carried out between the months of February and March 2023 through individual interviews with the key respondents, namely the household heads responsible for food purchases within their respective households. The household survey was done by administering structured questionnaires in form of Computer Assisted Personal Interviews (CAPI). The questionnaire consisted of seven modules, each addressing different aspects of the study objectives.

Module A was dedicated to obtaining essential information regarding household identification and characteristics, while module B focused on assessing access to infrastructure. Module C investigated aspects related to household well-being and dwelling conditions, while module D was dedicated to the investigation of food consumption patterns. Module E probed respondents' knowledge of locally produced bean-based processed products, while module F examined the consumption patterns of these products. Lastly, module G was dedicated to capturing valuable insights into consumer perceptions and attitudes towards locally produced bean-based processed products.

The primary target respondent for this survey was the household head, provided they were responsible for all food purchases within the household. In cases where the household head was unavailable, a spouse or another member actively engaged in decision-making pertaining to household food purchases was interviewed as a suitable alternative.

3.3.7. Ethical Considerations

Ethical considerations were paramount throughout the research process. Informed consent was obtained from all participants, and their confidentiality and privacy were rigorously upheld. The study received ethical approval from the University of Zambia Biomedical Research Ethics Committee (UNZABREC), ensuring compliance with ethical research standards.

3.3.8 Management of potential conflicts of interest

The management of potential conflicts of interest in research is crucial to upholding the objectivity and integrity of scientific investigations. In this study, a multifaceted approach was employed to effectively navigate and mitigate conflicts of interest. Firstly, transparency was prioritized through the open acknowledgment of any potential conflicts related to the study and these were submitted to the University of Zambia biomedical research ethics committee for reveal. This proactive disclosure allowed stakeholders to identify and assess biases that might arise from financial interests or personal relationships, demonstrating a commitment to unbiased knowledge pursuit.

Independent oversight, provided by third-party organizations (ZARI) free from conflicts of interest, played a vital role in scrutinizing the research process and ensuring its impartiality. Additionally, the university's reliance on ethics review boards, which assess research proposals for

potential conflicts, and the proactive seeking of approval from these boards before conducting the study, further underscored the commitment to ethical considerations and conflict management.

Furthermore, data transparency was deemed fundamental to conflict management. The research team enhanced transparency by making research data and methodologies accessible to other scholars for scrutiny, allowing the broader scientific community to evaluate the validity of the study's findings and identify potential biases. Seeking expert consultation from external professionals without conflicts of interest provided impartial perspectives, guidance on research design, and ensured the study's objectivity and credibility. Finally, a commitment to including a declaration of conflicts of interest in publications or reports was emphasized, providing readers with information to gauge the impact of conflicts on the study's findings and reinforcing the overall dedication to research integrity.

3.4 Data Analysis

To analyze the data, a combination of analysis methods was used. The method of data analysis chosen was based on the study objective.

3.4.1. Objective 1, 2 & 3: Product Identification and supply chain Actor Analysis

The content and thematic analysis approaches were used to achieve the first, second and third objectives which are to identify the existing bean-based processed products on the Zambian market and identify attributes of products desired and challenges faced along the supply chain. Newspaper marketers utilized content analysis for the first time in the 1940s; they simply tallied references to various topics to determine what interests a given readership (Jamieson, 2016). Because it involves counting, this type of qualitative data analysis has been dubbed "quasi-quantitative," yet it is qualitative in the sense that it uses text and aims to understand what is significant to individuals. It is a deductive technique to data analysis, meaning the researcher seeks for evidence to support his preconceived notions about what he is looking for in the data. Then the thematic approach was applied by using the 5 step process of qualitative data analysis by Jamieson, (2016) shown in figure 4.

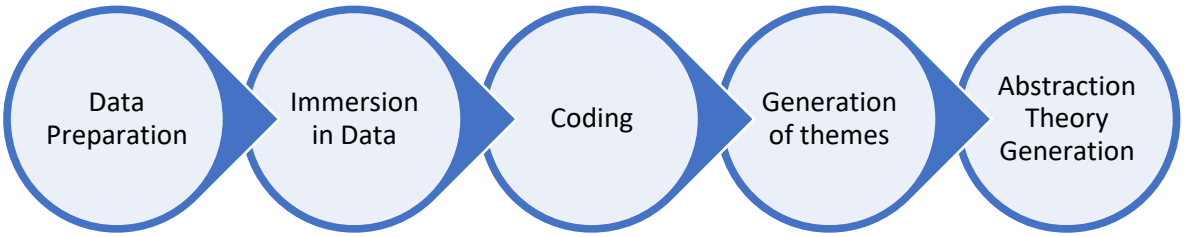

Figure 3: Thematic approach
Source: Jamieson, (2016)

The data analysis in this part of the study was performed using Microsoft Excel. The initial stage of the analysis involved a descriptive examination to gain a fundamental understanding of the respondents' demographic characteristics. This entailed calculating basic statistics such as the average age of respondents and common household sizes.

Subsequently, a frequency analysis was conducted to quantify the occurrence of specific variables within the dataset. This enabled the determination of the gender distribution among respondents and actors involved in the bean product supply chain, providing insights into gender-related aspects of the study.

The study also delved into the distribution and supply chain, identifying the various actors involved and their roles in the process of delivering bean products to consumers. This facilitated a comprehensive understanding of how these products traverse the supply chain.

Furthermore, an investigation into consumer perspectives on bean-based products was carried out, seeking to discern the attributes that held significance for them. For instance, the study aimed to ascertain whether consumers prioritized factors such as product price or taste.

Lastly, the study examined the challenges encountered by different actors within the distribution network. This examination shed light on the obstacles faced by those striving to make these products available to consumers.

3.4.2. Objective 4: Consumer Decision-Making Survey; data analysis

Both descriptive and econometric methods were used to analyze the data in the household survey. A probit model was used to identify factors that influence purchase and consumption of the bean-based processed products. Frequencies and descriptions were used to summarize the data and the results have been presented in tables and graphs. The analysis was conducted using STATA and was initiated with a comprehensive exploration of demographic characteristics, employing frequencies to examine variables such as gender, age, marital status of the household head, and household size.

Furthermore, an analysis of education levels was carried out, providing valuable insights into the educational backgrounds of the respondents. The study also delved into consumer behavior, including product identification and awareness levels, using frequencies to quantify responses.

To gauge consumer preferences, attribute ratings on a 5-point scale were analyzed, employing descriptive statistics to capture these insights comprehensively. Additionally, an economic analysis was conducted, offering valuable insights into the economic aspects of consumer decision-making.

In this study, Principal Component Analysis (PCA) was employed as a robust statistical tool to streamline the extensive data collected under the "Household Wellbeing" category. PCA enabled the reduction of multiple variables associated with household wellbeing into a more manageable and interpretable index. Specifically, the derived Wealth Index encapsulated various aspects of household wellbeing, including income, assets, and other relevant variables. This approach allowed for a concise representation of the multifaceted dimensions of household economic status, enabling the exploration of its role in influencing consumer decisions regarding bean-based processed products.

Furthermore, Factor Analysis was applied to condense and elucidate the intricate data encompassing consumer attitudes and beliefs towards bean-based processed products. By utilizing Factor Analysis, the study identified underlying factors or latent constructs that influence

consumer behavior and decision-making processes. This method not only reduced data complexity but also facilitated a more insightful examination of consumer perspectives. The study specifically investigated the factors driving consumer preferences, perceptions, and the motivations behind their choices regarding bean-based processed products. Factor Analysis served as a valuable analytical tool to uncover the hidden dimensions that contribute to consumers' attitudes and beliefs, thereby enriching the understanding of their decision-making processes in the context of this study.

Appropriate statistical techniques were used to assess the relationships between different variables and consumer decisions. The probit model was used, and this allowed the analysis of marginal effects, providing an understanding of how various factors influence the decision to purchase bean-based processed products. The probit model was used because the dependent variable is a binary response variable and a probit is a binary response model (Wooldridge, 2004).

3.4.2.1. Principal Component

In this study, Principal Component Analysis (PCA) was employed to derive a comprehensive wealth index, a precursor for subsequent analysis using a probit model. The wealth index serves as a consolidated measure, combining various economic indicators such as income, assets, and housing conditions into a single, representative metric. PCA was chosen to extract the underlying structure of these variables, providing a comprehensive perspective on household wealth. The tool that was used to implement PCA was STATA. The analytical process started with the selection of appropriate economic indicators, ensuring a holistic representation of household wealth. The indicators selected were falling under the following categories: income-related variables, housing and dwelling conditions, asset ownership, education and occupation, health-related variables, demographic variables, food security, utilities and services, geographic variables and expenditure. Then the data was standardized for the sake of comparability.

PCA was then applied to identify principal components capturing the maximum variance in the original dataset (as shown in appendix 6). Eigenvalues and eigenvectors were scrutinized to guide the selection of principal components, and weights were assigned based on their significance in explaining wealth variance. The resulting wealth index, synthesizing the essence of household wealth was constructed.

This wealth index, derived through PCA, later played a key role in informing the probit model. By including this measure into the model, the study anticipated gaining a more detailed understanding of the relationships between household wealth and the decision to purchase bean based processed products for consumption. The PCA-derived wealth index served as a key instrument in unraveling the socioeconomic dynamics at play.

3.4.3. Empirical estimation of the decision to purchase and consume bean-based processed products.

The dependent variable, denoted as Y, served as the cornerstone of the analysis. It was coded as '1' to signify a positive decision to purchase and consume these products and '0' to indicate otherwise, creating a binary outcome variable. A probit model (being a binary response model) was used to analyze the factors that influence purchase and consumption of bean-based processed products in urban and peri-urban areas.

In a binary response model, interest lies primarily in the response probability;

$$p(y = 1|x) = p(y = 1|x_1, x_2, , , , , , x_k)$$

where $\boldsymbol{x}$ denotes the full set of explanatory variables, y is the decision to purchase and consume a bean based processed product. To avoid the linear programming model limitations such as the assumption of normality and homoscedasticity, the study considered a class of binary response models of the form;

$$p(y = 1|x) = G(\beta_0 + \beta_1 x_1 \ldots\ldots \beta_k x_k)$$

where G is a function taking on values strictly between zero and one: $0 < G(z) < 1$, for all real numbers z. This ensures that the estimated response probabilities are strictly between zero and one. G is the standard normal cumulative distribution function (cdf), which is expressed as an integral:

$$G(z) = \varphi(z) \equiv \int_{-\infty}^{z} \varphi(v)\, dv$$

where $\varphi(z)$ is the standard normal density. The G function is an increasing function, and its choice ensures that the model is strictly between zero and one for all values of the parameters and the x_i.

The vector ***x*** contains various demographic characteristics such as education, age, marital status, and perceptions that affect decision making among consumers such as dietary, prices, accessibility and food habits. Age was measured as a continuous variable and the average age across the respondents was computed, offering insights into the average age of those making these consumption decisions at household level. Marital status was categorized as, '0' representing single individuals '1' indicating married ones, ‘2’ indicating divorced ones and ‘3’ indicating widowed ones shedding light on the influence of marital status. Household size was quantified as an average, providing a glimpse into the typical number of individuals residing in the households of the participants. Education was categorized as '0' reflecting no formal education and '1' signified having attained primary education, ‘2’ signified having attained secondary education and ‘3’ signified having attained tertiary education, giving more insight into the impact of education on these decisions.

. Consumer attitudes and beliefs toward bean-based processed products were measured on a scale, with higher values reflecting stronger positive attitudes and beliefs. Additionally, attributes like smell, taste, and other product features were evaluated using a 5-point scale, with '1' indicating "very poor" and '5' denoting "very good." These scales permitted the gauging consumer perceptions of these attributes accurately.

Overall, the measurement of these variables enabled comprehensive analysis of the intricate web of factors that shape consumers' decisions when it comes to bean-based processed products, with a particular focus on the impact of demographics, dietary habits, attitudes, and product attributes.

CHAPTER FOUR: RESULTS AND DISCUSSION

This chapter presents and discusses the findings of the study organized by objective.

The results of the RMA are presented in 4.1 while 4.2 summarizes the finding of the household survey.

4.1. Rapid Market Analysis Results: Existing actors and products in the bean-based processed products market in Zambia.

In this subsection, results from a rapid market assessment to identify actors, bean-based products available on the market and their distribution chain is presented and discussed. Table 1 gives the demographic characteristics of the respondents by actor and by district. In total, 13 respondents across all districts described themselves as "Processors," 49 respondents as "On-spot Consumers," 13 respondents as "Distributors," and 3 respondents as "Importers." There was a total of 78 respondents across the three districts.

4.1.1 Demographic Characteristics

Table 1: Summery of respondents by District

Respondent Category	Lusaka District	Mansa District	Kasama District	Total
Processors	12	1	0	13
On-spot Consumers	30	0	19	49
Distributors	13	0	0	13
Importers	03	0	0	03
Total	**58**	**01**	**19**	**78**

Source: Author's own survey

According to the Rapid Market survey results, respondent involvement varied between districts. All responders, including processors, on-the-spot consumers, distributors, and importers, were most numerous in the Lusaka District. In contrast to Mansa District, which had just one respondent who identified as a Processor, Kasama District had a considerable participation of On-the-Spot Consumers. These differences in the distribution of respondents by district offer perceptions into

the geographic diversity of market participants and their functions within the surveyed market for the specified bean-based processed goods.

4.1.2 Supply chain of bean-based processed products

Figure 4 shows the identified supply chain of bean-based processed products on the Zambian market. The supply chain identified follows a multi-stage journey, beginning with cultivation and spanning through various processing and distribution channels. The process initiates at the farm level, where beans are cultivated and harvested. Subsequently, the harvested beans are transported to a processing plant where they undergo cleaning, roasting, and grinding to prepare the foundational ingredients. From the processing plant, the processed bean material is directed to manufacturers who play a pivotal role in mixing ingredients, forming distinct products, and packaging them for retail.

Following the manufacturing stage, the products enter the distribution phase, where they are supplied to distributors responsible for managing the logistics of product movement. Depending on the distribution model, products may be sent directly from the manufacturer to wholesalers or retailers, and in some instances, directly to consumers. Concurrently, a parallel distribution channel may involve the transfer of products from distributors to wholesalers and retailers before reaching the end consumer.

The final stage involves the consumer, where the bean-based processed products are purchased and consumed. Some products may follow a more direct route from the distributor or manufacturer to the consumer, bypassing the wholesale and retail levels. This multi-tiered supply chain structure provides flexibility and accommodates diverse distribution strategies, allowing for both direct-to-consumer and traditional distribution models.

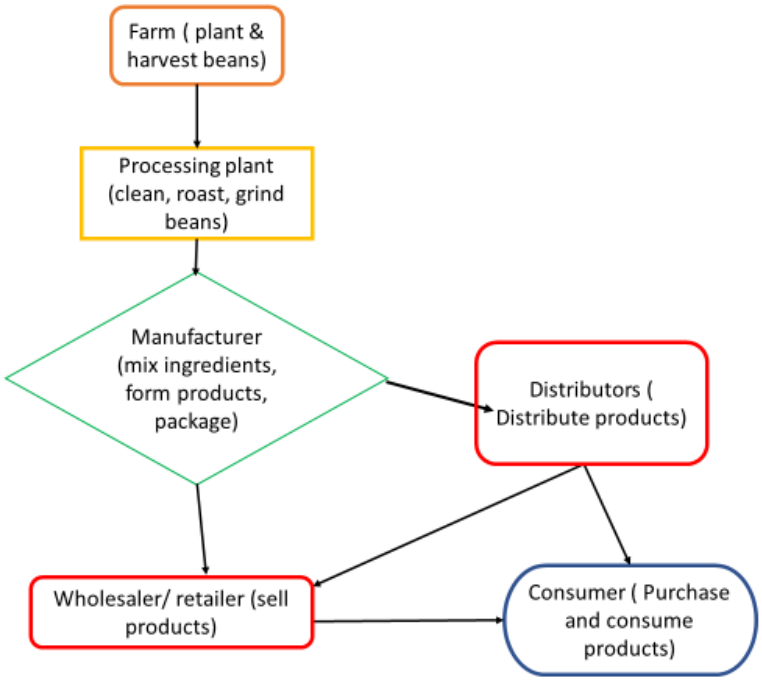

Figure 4:Supply chain of bean-based processed products
Source: Authors own survey

4.1.3 Supply chain actors of bean-based processed products by gender

a) **Actors in the supply chain of bean-based processed products.** Figure 5 illustrates the various actors identified during the rapid market analysis positioned along the supply chain of bean-based processed products. These actors include processors/importers, distributors, wholesalers, retailers, and, ultimately, consumers as the end users of the products.

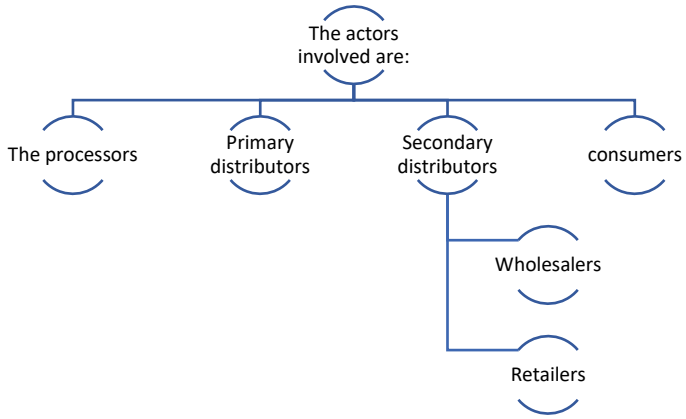

Figure 5: supply chain actors of bean-based processed products
Source: Authors' own survey

When disaggregated by gender in figure 6, the results showed that males dominated the chain as there were 76.9% males among the processors, 61.54% males among the distributors and all the importers interviewed were male. On the other hand, more females (51.1%) were interviewed as on-spot consumers showing that food purchasing is mostly done by women. When considering all respondent categories collectively (Processors, On-spot Consumers, Distributors, and Importers), the gender distribution across all categories combined reflects that 47.44% were male, and 52.56% were female.

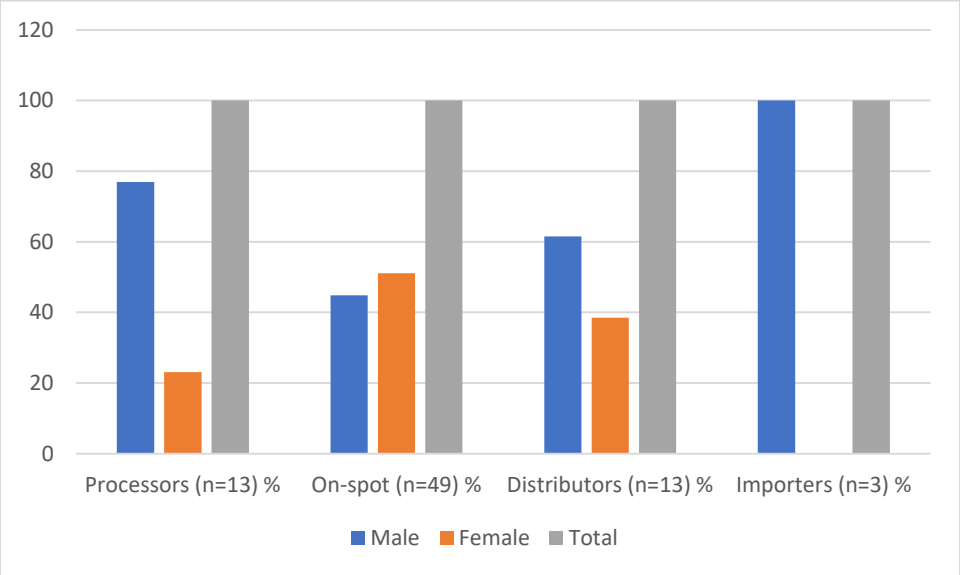

Figure 6: Actors of bean based processed products by Gender.
Source: Author's survey

These results therefore indicate that the gender distribution among respondents varies across different categories within the market for bean-based processed products. Among Processors, males have a significantly higher representation while on the On-spot Consumers category there is a relatively balanced gender distribution. Distributors have a majority of male participants, while the Importers category is entirely represented by males, with no female participation. These disparities can have extensive implications for the industry. Research has shown that gender diversity in the workplace can lead to improved decision-making (Wagner, 2011) and enhanced creativity and innovation (Woolley *et al.*, 2010). Therefore, the gender disparities observed might unintentionally limit the industry's adaptability and competitiveness, especially in sectors dominated by one gender.

The observed gender disparities may also be influenced by societal and cultural factors. Eagly and Wood, (1999) suggest that gender stereotypes can significantly impact career choices and opportunities.

The gender distribution data highlights the importance of considering diversity and inclusion within the industry. Addressing gender imbalances and striving for a more equitable representation of genders can contribute to a more innovative, adaptive, and competitive industry, ultimately benefiting both the industry and its workforce.

In relation to the existence of these actors (processors, distributors and importers), the results showed that most of these started operations between 2000 and 2021. In terms of location, most of the processors are in urban areas where there is good road network and are less congested. Hence the results show that the bean processing industry is new and still developing.

Upon examination to ascertain the presence of labels and their corresponding details, it was observed that all products identified in the market followed the comprehensive labeling practices. These labels included crucial information such as the date of manufacturing, the identities of the processor and distributor, the expiry date, a detailed breakdown of ingredients, precise protein content specification, and clear instructions for product preparation.

These labels act as an important source of knowledge that enables people to choose and consume items with confidence. The composition, nutritional value, potential allergies, and expiration date of a product are all vital information that may be found on transparent, precise labels. People can regulate their food choices, health considerations, and allergic reactions as a result (Nayga, 1999). Additionally, labeling is essential for protecting food safety since it helps consumers avoid consuming expired or subpar products (Drexler *et al.*, 2018). By making it possible to identify genuine and reliable items, it also helps to protect consumers as consumers tend to trust the experts who put this information (Rupprecht *et al.*, 2020). The significance of thorough labeling procedures is further underlined by product differentiation, regulatory compliance, and raising nutritional awareness. These labels improve customer confidence, increase transparency, and enable people to make better and more educated food decisions.

4.1.4 Bean-based processed products on the market

The dominant products in the bean processing industry are products in the form of flour and pre-cooked relish. In the flour category, the results showed that some processors produced bean flour while pre-cooked frozen beans, pre-cooked dehydrated beans, pre-cooked hydrated beans, sorted dry bean grains and baked beans were the products identified under the relish category.

4.1.5 Bean based product attributes identified as important to consumers

Figure 7 shows the percentage attributes of products that consumers (N=49) indicated have an influence in the decision to purchase a bean-based processed product.

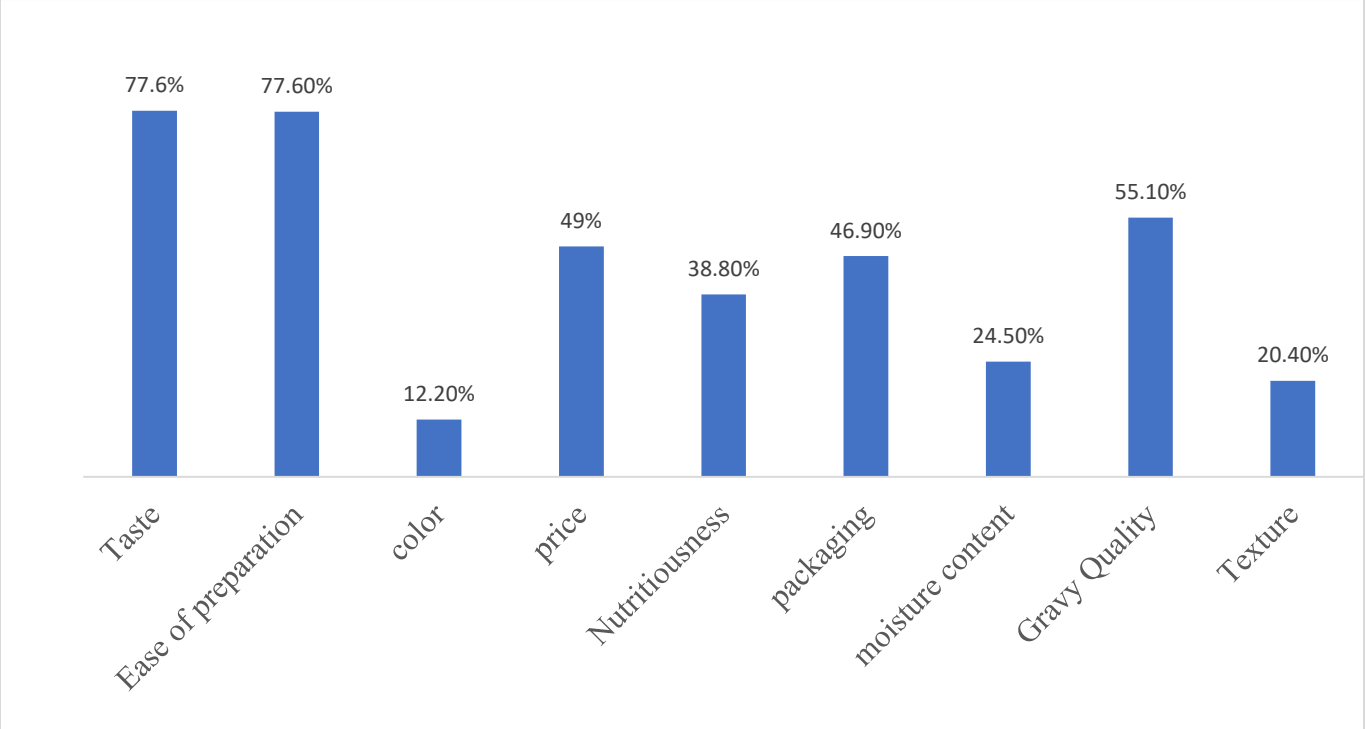

Figure 7: Identified attributes of bean-based processed products.
Source: Authors' own survey

Taste and ease of preparation are one of the most important factors for consumers, both at 77.6%. Price holds significant importance for 49% of consumers, while attributes related to product quality and health, such as gravy quality (55.1%), packaging (46.9%), and nutritious (38.8%), are also valued. Consumers give less weight to visual characteristics like color (12.2%) and texture (20.4%), although 24.5% mention moisture content. When choosing these products, people generally give priority to flavor, convenience, price, and quality qualities.

4.1.6 Challenges faced by actors along the supply chain of bean-based processed products.

This subsection gives the challenges faced by the actors along the supply chain of bean-based processed products. The challenges are discussed by actors involved.

4.1.6.1 Challenges faced by processors/importers

Figure 8 shows that 81.3% of processors/importers face challenges in obtaining raw materials, highlighting the importance of a reliable and accessible supply of quality raw materials to the processing industry. This considerable proportion of respondents encountering difficulties in raw material procurement shows a bottleneck in the production chain. The continuous availability of high-quality raw materials is important for the smooth functioning of processing activities. The challenges reported suggest that issues related to the cost, quality, or availability of procuring beans can directly impact the operational efficiency and sustainability of processors/importers.

The vast majority of respondents (62.55%) said that they struggle with high energy expenditures, especially electricity rates. Bean-based products must be processed using energy-consuming machinery, and rising power prices may affect their overall production costs.

A majority of those surveyed (56.3%) also indicated that the high costs of packaging materials and the procedures needed to package items made from beans present difficulties for them. This may involve the cost of eco-friendly or specialty packaging alternatives as well as the requirement for effective packaging equipment.

Nearly half of those surveyed (43.75%) cited the absence of suitable machinery for processing products made from beans as a challenge. This could include equipment for product cleaning, sorting, grinding, or packaging. A challenge with inadequate finance or capital was brought up by about 18.8% of the respondents. This may limit the amount of money that processors have available to spend on operational growth, modernization, and research & development. Only 12.55 percent of respondents said that low production quantities are a problem for them. This shows that some processors encounter difficulties in generating enough bean-based goods to satisfy consumer demand. 12.5% of respondents also mentioned costs associated with compliance as a challenge. Processing companies may incur additional costs in order to comply with legal regulations and industry standards.

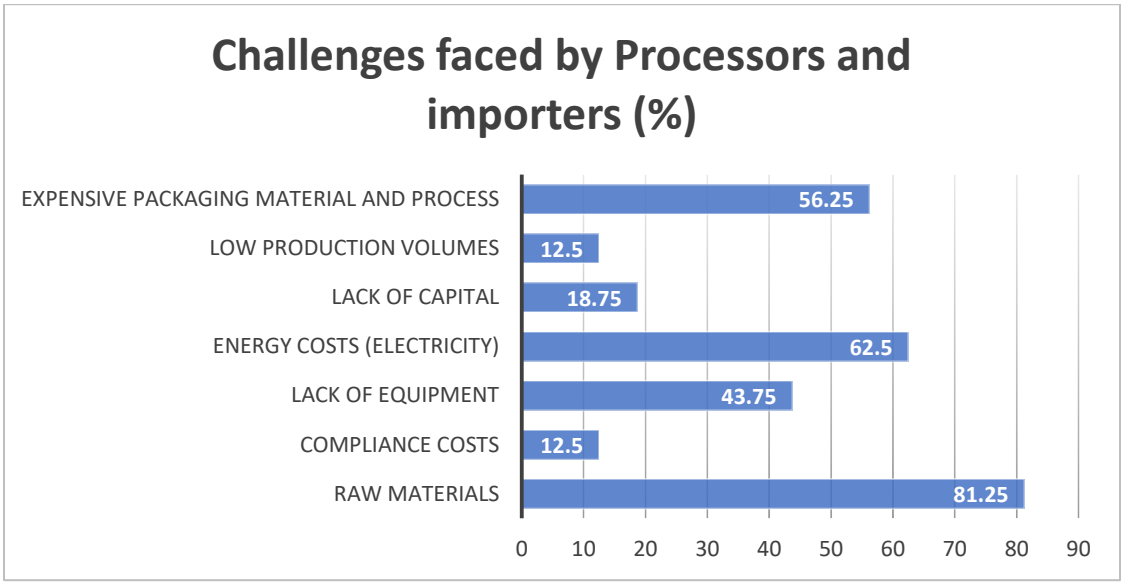

Figure 5: Challenges faced by processors and importers of bean-based processed products. Source: Authors' own survey

4.1.6.2 Challenges faced by Distributors

Figure 9 shows the two types of channels of distribution used in the bean-based processed product industry i.e. Wholesalers and Retailers.

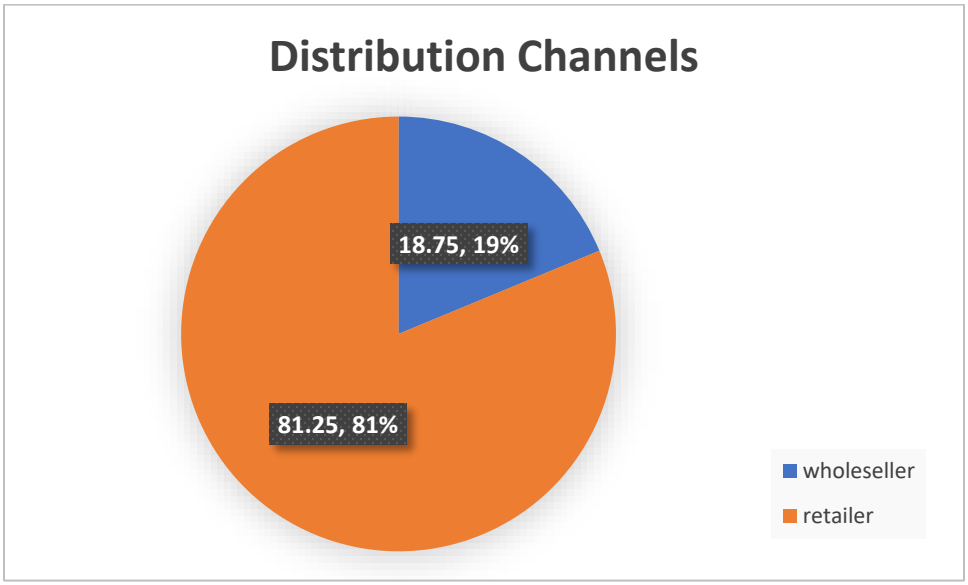

Figure 6: Distribution Channels of bean-based processed products. Source: Authors' own survey

Wholesalers (primary) are companies that buy goods in bulk from producers or manufacturers and then resell them to retailers in smaller quantities. By serving as a middleman between manufacturers and retailers, they facilitate the distribution process. On the other hand, retailers (secondary) serve as the customer's last point of purchase. They acquire goods from wholesalers or producers directly and sell them to clients through physical stores.

Figure 9 indicates that a larger portion of the bean-based processed products are distributed directly to retailers, indicating a strong presence of retail channels in the distribution of these products. Figure 9 also shows that 19% of the bean-based processed products are distributed through wholesalers, while the remaining 81% are allocated to retailers.

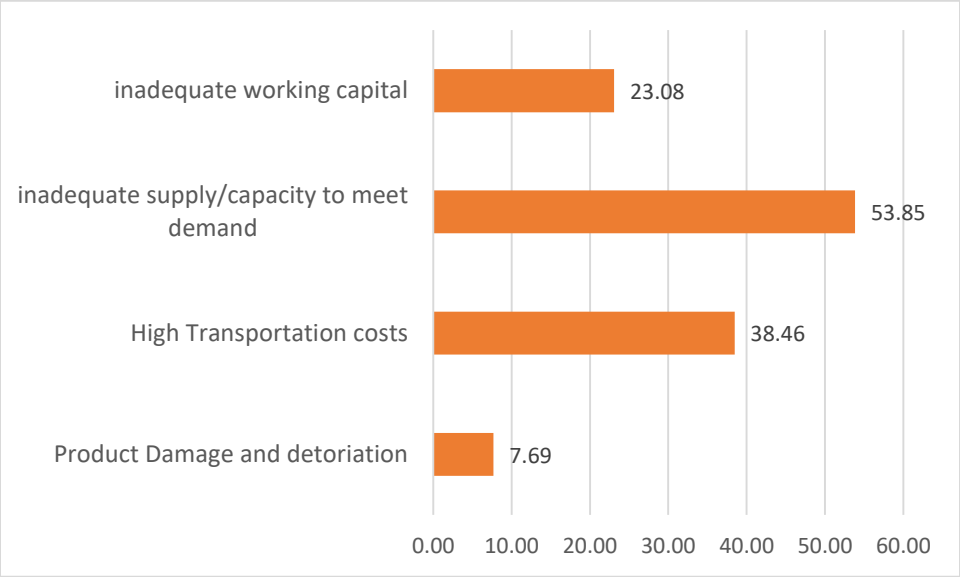

Figure 7: Challenges faced by Distributors of bean-based processed products.
Source: Authors' own survey

Distributors of bean-based processed products encounter multifaceted challenges, as revealed by survey responses in figure 10. The foremost concern, identified by 53.8% of respondents, is the inadequacy of supply or capacity to meet demand, indicating a widespread struggle to fulfill market needs. Concurrently, 23.08% of distributors face challenges related to inadequate working capital, emphasizing financial constraints that may impede operational efficiency and growth. High transportation costs, reported by 38.46% of respondents, emerge as a significant hurdle impacting the overall cost structure and competitiveness of distributors. Although a relatively smaller percentage (7.69%), the distributors struggling with product damage and deterioration

underscore the importance of maintaining product quality throughout the distribution process. From the results shown in figure 10, the challenges are elaborated below:

1. **Product damage and deterioration**: Processed beans can be susceptible to elements including moisture, temperature, and handling. In order to prevent product damage and deterioration during transportation, distributors rely on Processors to ensure proper packaging and storage (Uebersax and Siddiq, 2012). One of the respondents indicated that exposure to moisture or extremely high or low temperatures can have an impact on the products' quality, flavor, or texture. It was also reported by another respondent that utilizing proper handling techniques and packing materials can reduce the likelihood of product damage during transportation and preserve product integrity.
2. **High transportation costs**: Because of their fragility, processed items made from beans may need special handling during shipment. To prevent damage, one of the respondents indicated that "these products may require specialist handling, refrigerated transportation, or cautious stacking". Distributors may incur greater transportation costs because of such customized transportation. High gasoline prices have increased the cost of transporting these products, which has forced distributors to pass these expenses on to customers by raising the cost of the products.
3. **Inadequate supply/capacity to meet demand**: One of the distributors interviewed indicated that "distributors must maintain a balance between their inventory levels and changing demand. Planning for supply and capacity needs to be adequate if stockouts or overstocking are to be avoided. Maintaining an ideal supply to satisfy consumer demands can be difficult due to variables such as seasonal variations in demand, supplier dependability, and unanticipated market developments".
4. **Inadequate working capital**: Distributors need working capital (money) to buy, and store processed goods made from beans, pay for transportation, and handle other operational expenditures. The distributor's capacity to respond to market demands, maintain adequate inventories, or invest in expansion possibilities may be hampered by insufficient working cash.

4.1.6.3 Challenges faced by consumers

On-spot consumers interviewed through consumer intercept interviews (on-site interviews) indicated the following as some of the challenges they face with some bean-based processed products:

1. **A lack of market information:** Consumer sentiments consistently pointed to concerns about the "Lack of Market Information" surrounding bean-based processed products. Participants expressed difficulties in obtaining detailed information about nutritional content, origin, and benefits of these products. One participant noted, "I find it hard to get information on the nutritional content and origin of these products. It makes me hesitant to try new ones." Another participant emphasized the need for clarity, stating, "There's a lack of clarity about the benefits compared to traditional products. I wish there were more educational resources." The poor awareness of the numerous brands, product possibilities, nutritional value, sourcing, production processes, or certifications is one example of this market ignorance. Without sufficient knowledge, it can be difficult for customers to make rational judgments about the things they buy, such as selecting healthier options or comprehending the ethical and environmental ramifications of their selections.

2. **High prices**: Another prominent theme that emerged was the perception of "High Prices" associated with bean-based processed products. Consumers articulated concerns about the affordability of these healthier alternatives, often viewing them as a luxury rather than a regular dietary option. Economic considerations and comparisons with traditional alternatives played a significant role in shaping consumer opinions about the pricing of these products. A participant expressed this concern, saying, "I feel like I'm paying a premium just because it's labeled as 'healthy.' It’s like it is a luxury to buy it." Consumers who are on a limited budget may find it difficult to afford processed foods made from beans. The price of these goods is influenced by elements such as production costs, packaging, distribution, and brand positioning. Organic or healthier options are typically more expensive than standard options, making it difficult for customers to afford them (Drexler *et al.*, 2018).

3. **Small packages**: discussions on "Small Packages" highlighted considerations related to the size of bean-based processed product packaging. Consumers found the current packaging sizes to be small, leading to concerns about increased expenses and inconvenience. Preferences were expressed for larger package options, particularly for staple items, indicating a desire for more

flexibility in product sizes. A consumer remarked, "The packages are so small that I end up buying multiple, and it feels expensive." The majority of processed foods made from beans are sold in small package sizes, which may be restrictive for some consumers, particularly those with bigger households or particular consumption needs. Smaller packages would encourage more frequent purchases, which would raise costs and produce more packaging waste.

4.2 Household Survey Results: Determine the factors that influence consumers' decisions to purchase bean-based processed products.

4.2.1 Demographic Characteristics of Respondents

In this study, 60% (206) of the respondents were from peri-urban areas and 40% (135) were from urban areas. The demographic characteristics of the respondents are presented in Table 2. The characteristics considered were gender, age, marital status, employment status and size of household members.

Table 2: Socio-demographic Characteristics of Household heads

Characteristic	Category (N=341)	Value
Gender of household head	Male	26.1%
	female	73.9%
Age of household head	Average	40.89 years
Marital status of household head	Single	17.69%
	Married	63.95%
	Divorced	8.84%
	widowed	9.52%
Education level of household head	None	3.52%
	Primary	19.35%
	Secondary	41.94%
	Tertiary	35.19%
Household size	Range	4 to 8 members
	Average	6 members
Employment status of household head	Salaried (full time)	32.65%
	Salaried (part-time)	6.8%
	Self-employed (full-time)	18.71%
	Self-employed (part-time)	15.99%
	Unemployed	25.85%
	Insensitive households	97.28%

Gluten sensitivity of a household	Sensitive households	2.72%
Dietary status of a household	Has special diet individual (s)	2.38%
	Has no special diet individual(s)	97.62%
Amount of money spent on food purchases a month (ZMW)	Minimum	<500
	Mean	2138
	Maximum	>5000
Dinner frequency variable	Never	45.58%
	Seldom (a few times in a year)	25.17%
	Often (a few times in a month)	4.425
	Frequent (once or more times a week)	3.06%
	Daily	21.77%

Source: Own survey data (2023)

The findings from the analysis (as shown in Table 2) highlight a notable trend wherein a significant majority (73.9%) of food purchasing decisions within households are predominantly influenced by females. Table 2 also revealed that the average age of household heads responsible for food purchasing decisions stands at 40.89 years, indicating a predominant presence of individuals in their early forties overseeing these choices. Married household heads constitute a substantial portion, accounting for 63.95%, indicating a prevalent association between marital status and the role of decision-making in food purchases.

Further insights into the household dynamics reveal that widowed individuals represent the smallest proportion, underscoring their relatively lower prevalence among the sampled households. An analysis of household size showed that households in this sample had a range of 4 to 8 individuals in each household with an average of 6 household members. Examining the occupational landscape, the data illustrates that 38.12% of household heads responsible for food purchases hold salaried jobs, while self-employment is represented by 34.02%, and unemployment accounts for 27.86%. These findings highlight the diverse spectrum of work statuses among the household heads, showcasing a significant presence of self-employment indicative of entrepreneurial activities, alongside a notable proportion facing unemployment challenges.

The respondents were asked to indicate their education level ranging from primary school, secondary school, tertiary and no formal education. Significant information can be gleaned from the distribution of respondents' educational backgrounds. An overwhelming majority of the sample

(about 77.48%) has formal education beyond the first grade, indicating that most of the household heads in this sample had obtained formal education. Notably, a sizeable fraction within the sample has attained formal education, as shown by the significant 41.94% of respondents who have completed their secondary education. Additionally, a notable 35.19% of respondents had attended a college or university to further their education, highlighting the existence of a substantial group with advanced academic credentials.

However, it is important to note that a small percentage of respondents (about 3.52%) claimed to have no formal education. This may be due to limitations that are economic, cultural, or regional in nature, highlighting the variety of educational backgrounds represented in the sample. The top educated group, which included 35.19% of respondents with university degrees, is known for its discerning inspection and purchases that are carefully considered in light of demands and expected satisfaction. The respondents' breadth of educational backgrounds was crucial in gathering a wide variety of viewpoints and opinions, enhancing the study with observations from people with various levels of education.

The survey results also show that 97.28% of the interviewed households are insensitive to gluten, while 2.72% exhibit gluten sensitivity. In terms of dietary status, 97.62% of households have no individuals with special dietary needs, whereas 2.38% report having members with specific dietary requirements. The household survey reveals interesting insights into the spending habits and dinner frequency of the surveyed households. The amount of money spent on food purchases per month ranges from less than 500 ZMW (Zambian Kwacha) as the minimum to over 5000 ZMW as the maximum, with a mean expenditure of 2138 ZMW. This suggests a notable variation in food spending patterns among the surveyed households. In terms of dinner frequency, the majority of households report eating dinner daily, accounting for 21.77%. Conversely, 45.58% of households claim to never have dinner, indicating a significant proportion that abstains from this meal. Additionally, 25.17% dine seldom, a few times in a year, while 4.425% do so often, and 3.06% have frequent dinners, occurring once or more times a week. These findings offer a comprehensive understanding of both economic and dietary behaviors within the surveyed population, providing valuable information for further analysis.

4.3 Discussion of findings

This section includes a summary of the study's findings, followed by an analysis and in-depth discussion of them.

4.3.1 Bean-based processed products purchased by sampled households

Table 3: Bean-based processed products on the Zambian market

S/N	Product	Origin of the producer
1	Tinned/canned beans	Local/ foreign
2	Pre-cooked dehydrated beans	Local
3	Pre-cooked hydrated beans	Local/ foreign
4	Pre-cooked Frozen	Local
5	Bean-flour	Local
6	Bean porridge	Local

Source: Own survey data (2023)

Canned beans are cooked beans that have been processed, packaged, and sealed in a can or tin. They are typically ready to eat (or use in recipes) without the need for additional cooking. They are a convenient and time-saving choice for including beans in various dishes. Depending on where the manufacturer is from (country of origin), these tinned or canned beans are classified to be either domestically produced or imported. Customers can purchase this item in supermarkets and smaller retail establishments, commonly referred to as "Tuntemba" stores.

Pre-cooked dehydrated beans are beans that have been cooked, dehydrated, and then packaged for convenience. These beans are processed to decrease their cooking time significantly compared to dried beans that need long soaking and cooking periods. Pre-cooked dehydrated beans are a suitable alternative for people who want to fix bean dishes more quickly. Currently, this product is only sold straight from the processor and in some supermarkets.

Pre-cooked hydrated beans are beans that have already been cooked and then hydrated. They are fully cooked and then packaged in a liquid medium. These beans are completely hydrated and ready to eat straight from the can or container without any additional cooking. They are a suitable and time-saving option for adding beans to recipes or meals. The findings in this study demonstrate

that producers may be either domestic or of foreign origin and that consumers can find these products in supermarkets.

Pre-cooked frozen beans are beans that have already been cooked and then frozen to maintain freshness and extend shelf life. These are produced locally and are sold in both supermarkets and a variety of mom-and-pop shops. Additionally, some homes cook their own frozen beans. On the other hand, a finely ground version of beans called bean flour provides a gluten-free option for a gluten sensitive individual. The product is produced and sourced locally. At the time of this survey, the only way to get this product was through the processor because it was still not widely available in chain supermarkets. However, some smaller retailers do sell bean flour.

4.3.2 Awareness of beans-based processed products by area

Below is a figure showing the awareness levels by respondents for bean-based processed products on the market by area.

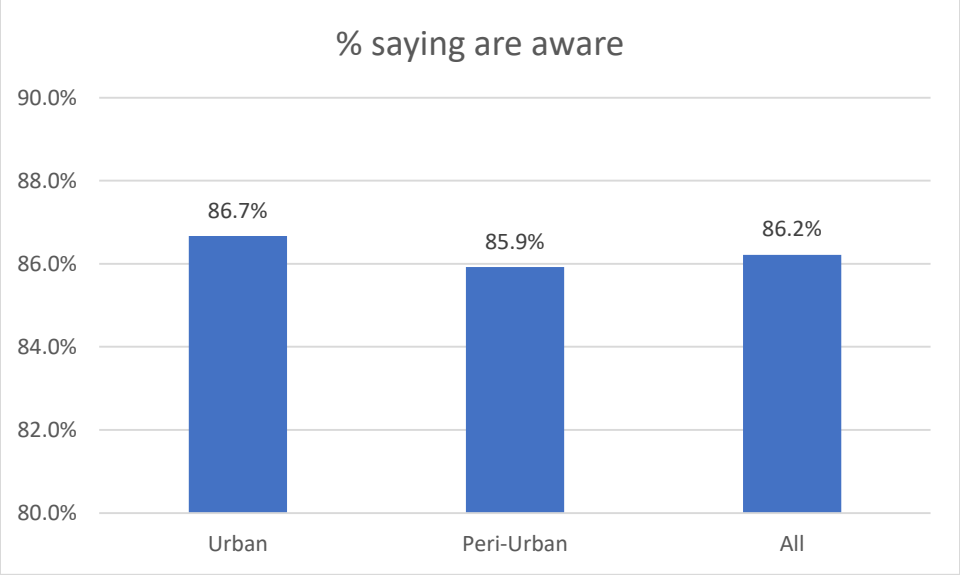

Figure 8: Awareness of bean-based processed products by area
Source: Authors' own survey

The above figure shows that about 86.7% of respondents in the urban areas are aware of processed bean-based products. This suggests that the vast majority of urban residents are aware of these products. Around 85.9% of respondents in the peri-urban area are aware of processed bean-based goods. A sizable section of the peri-urban population is likewise familiar with these products, just like in the urban areas. When all respondents are considered, independent of their area, about

86.2% of them are aware of bean-based processed items. This demonstrates a high degree of awareness across all respondents to the study.

The data gathered on awareness holds important implications for marketing and promotion strategies. With a remarkable overall awareness rate of 86.2% in both urban and peri-urban areas, it's evident that these products have made a significant impact in the target markets. The balanced awareness percentages highlight that both urban and peri-urban areas are informed or have a similar degree of knowledge about these products (Martin, 2011).

4.3.3 Awareness of bean-based processed products by product in urban and peri urban areas

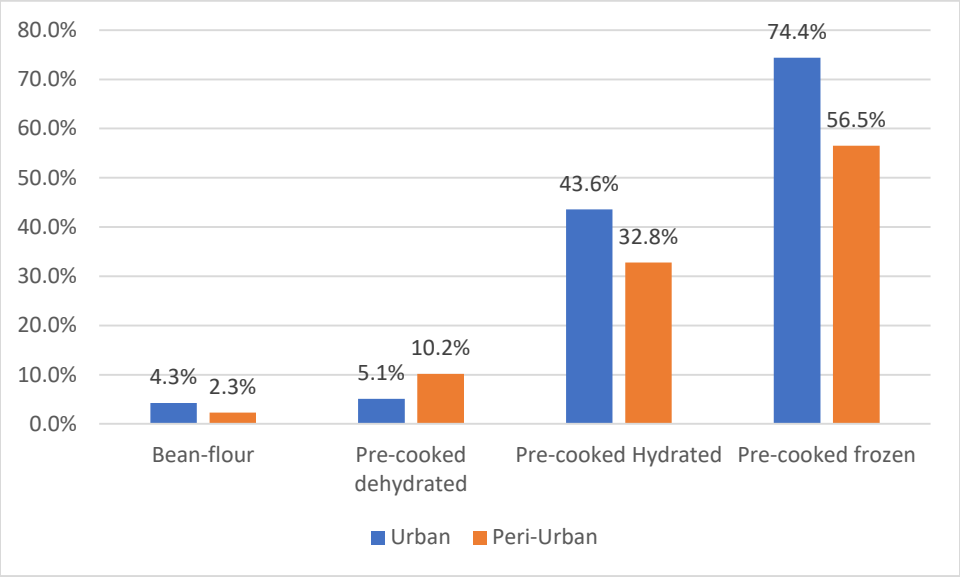

Figure 9: Awareness of bean-based processed products by product.
Source: Authors' own survey

Based on the survey results, the bar chart above shows the percentages or proportions of respondents who are aware of each type of processed bean product in urban and peri-urban areas.

The bar graph demonstrates that whereas 2.3% of respondents in peri-urban areas are aware of bean flour, 4.3% of respondents in urban areas are. This suggests that respondents in both urban and peri-urban areas had a generally low level of awareness about bean flour. The low awareness percentages for bean flour in both urban (4.3%) and peri-urban (2.3%) areas suggest that this product category requires considerable marketing efforts to intensify visibility (Martin, 2011). Marketing strategies for bean flour should prioritize education and awareness-building campaigns.

The campaigns should consider highlighting its nutritional benefits, flexibility in cooking, and potential to cater to specific dietary needs.

Results show that 10.2% of respondents in peri-urban areas and 5.1% of respondents in urban areas are both aware of dehydrated beans. When compared to respondents in urban areas, peri-urban respondents are slightly more aware of dehydrated beans. Given this difference in awareness between urban and peri-urban areas, actors need to use segment-specific marketing strategies that target the higher-awareness market while vigorously promoting awareness in urban areas (Martin, 2011).

The study revealed that both in urban (43.6%) and peri-urban (42.8%) locations, a sizable majority of respondents are aware of hydrated beans. Among responders in both regions, awareness of hydrated beans is comparatively high. This means that actors can leverage the high awareness levels by concentrating on differentiation and value propositions to uphold and potentially increase market share in urban areas.

According to the bar graph, respondents in urban regions are more knowledgeable about frozen beans (74.4%) than those in peri-urban areas (56.5%). Despite the differences, respondents in both regions are generally familiar with frozen beans. With strong awareness, marketing efforts should move towards encouraging usage times, convenience, and the unique benefits of pre-cooked frozen beans (Kotler *et al.*, 2018).

However, due to the low awareness rates for pre-cooked dehydrated beans and bean flour, the study did not have enough observations (sample size) to run a separate probit model for each of these products. In other words, there were not enough respondents who were aware of these products to provide a sufficient sample size for a reliable analysis.

Instead, the study adopted a combined probit model where the dependent variable, denoted as "y," is equal to 1 if respondents purchased and consumed any of the bean-based processed products and 0 otherwise. By combining the data for all the bean-based processed products, the study was able to aggregate the observations and obtain a larger sample size, increasing the statistical power for the analysis. The aggregated observations showed that 58.16% of the respondents had purchased at least one of these bean-based processed products. Urban and peri-urban areas were defined based on the ZamStats standards.

4.3.4 Household rating of Attributes

Table 4 presents attribute ratings provided by consumers for various bean-based processed products. The attributes are rated on a scale of 1 to 5, where 1 represents "Very poor" and 5 represents "Very good." Interpretation of these ratings is presented after table 4.

Table 4: Rating of Attributes by consumers

Rate the attribute on a scale of 1 to 5: *(1=Very poor; 2=Poor 3=Fair 4=Good 5=Very good)*					
	Bean flour	Pre-cooked dehydrated beans	Pre-cooked hydrated	Pre-cooked Frozen	Overall score
1.Taste	5.0	4.1	4.3	3.4	4.2
2.Aroma	5.0	4.0	4.3	3.5	4.2
3.Easy to prepare	5.0	4.14	4.6	4.4	4.5
4.Quick to cook	5.0	4.1	4.6	4.4	4.5
5.Well packaged	1.0	3.9	4.7	3.8	3.2
6.Longer shelf life	5.0	3.9	4.5	3.9	4.3
7.Filling	4.0	4.3	4.5	3.7	4.1
8.Does not require sugar	5.0	4.0	4.3	4.0	4.3
9.Requires little amount to make a meal	5.0	3.8	4.2	3.7	4.2
10.Clean free of grit	5.0	4.1	4.6	4.2	4.5
11.Smooth Texture when cooked	4.0	3.6	4.2	3.6	3.9
12.Color when cooked	5.0	4.1	4.5	3.8	4.4
1 has thick gravy	1.0	4.0	4.5	3.7	3.3
14.Diversified in terms of food groups	5.0	4.1	4.2	3.7	4.3
15.Nutritious	5.0	4.1	4.4	3.7	4.3
16.Affordable	1.0	4.3	3.9	4.1	3.3
17 Portion (size) of packaging	5.0	4.0	3.9	3.8	4.2
Overall average score	4.2	4	4.1	3.6	4.0

Source: Authors' own survey

Bean Flour: Bean flour received excellent ratings from consumers for its flavor, scent, ease of preparation, speed of cooking, extended shelf life, need for little quantity to produce a meal, cleanliness and lack of grit, color when cooked, variety in terms of food categories, and nutritional value. These attributes were perceived as its strengths. However, it received lower ratings for being well packaged and affordable, indicating that these are the potential areas for improvement The

product received the lowest rating for having thick gravy because the flour does not come with any gravy.

Pre-cooked dehydrated beans: Customers highly rated the flavor, aroma, simplicity of preparation, and speed of cooking of pre-cooked dehydrated beans. Additionally, it received high ratings for having a longer shelf life, being filling, not requiring sugar, and cooking with a clean free of grit attribute hence these attributes were seen as its strengths. It was given a significantly lower score, nonetheless, because of the cooked version's smooth texture suggesting room for enhancement in the texture aspect. Although consumers judged it to be less diverse in terms of dietary groups and serving sizes, they did love its color when cooked. The product had a poor score for requiring a small amount to make a meal, which may point to a potential issue with how people perceive its quantities.

Pre-cooked hydrated: The assessment of "Pre-cooked Dehydrated Beans" presents a generally positive consumer perception across various attributes. Notably, the product excels in attributes such as taste, aroma, ease of preparation, and quick cooking, receiving scores of 4.1, 4.0, 4.14, and 4.1, respectively. Additionally, it scores well in terms of being well packaged (3.9) and having a longer shelf life (3.9). Consumers also appreciate the filling nature of the product, with a score of 4.3. The product further meets expectations in attributes related to cleanliness, texture when cooked, color when cooked, and nutritional value, receiving scores ranging from 3.6 to 4.1. However, the product falls short in terms of affordability, with a score of 4.3, indicating a lower level of satisfaction in this aspect. The portion size of the packaging receives a moderate rating of 4.0. Overall, "Pre-cooked Dehydrated Beans" demonstrates positive consumer sentiment, with areas of strength in taste, convenience, and nutritional value, while affordability remains a potential area for improvement.

Finally, **Pre-cooked frozen:** The evaluation of "Pre-cooked Frozen" reveals a mixed reception across various attributes. Consumers express moderate satisfaction with the product's taste, aroma, and packaging, receiving scores of 3.4 and 3.5, and 3.8, respectively. The convenience of preparation and quick cooking are notable strengths, earning the product a higher satisfaction level with scores of 4.4. However, "Pre-cooked Frozen" lags in terms of filling, with a score of 3.7, indicating a comparatively lower level of satisfaction in this aspect. While it boasts a longer shelf life (3.9), the product demonstrates variability in consumer perceptions of attributes such as

cleanliness, texture, color, gravy thickness, diversification, nutrition, and affordability. Notably, the portion size of the packaging receives a moderate rating of 3.8.

The overall scores for the evaluated attributes of different bean-based processed products range from 3.6 to 4.2 on a scale of 1 to 5. The attributes include taste, aroma, ease of preparation, quick cooking, packaging, shelf life, filling, sugar requirement, portion size, and nutritional value. Pre-cooked hydrated beans received the highest overall score of 4.1, indicating a favorable perception across the assessed attributes. On the other hand, pre-cooked frozen beans obtained the lowest overall score of 3.6, suggesting a comparatively lower satisfaction level. The results suggest that, on average, the surveyed individuals perceive these bean-based products positively, with variations in preference among different product types.

4.3.5 Probit model results

Table 5: Probit model results

Variables (y=decision to purchase bean based processed products)	Coefficients	Marginal effects
Age of household head	-0.00852	-0.0023312
	(0.00807)	(0.00219)
Sex dummy of household head (1= male, 0= otherwise)	-0.166	-0.0454747
	(0.222)	(0.0607)
Household size	0.0334	0.0091392
	(0.0460)	(0. .0125)
Marital status of household head (in relation to single)		
Married	-0.100	-0.0274754
	(0.267)	(0. .0729)
Divorced	0.00397	0.0010866
	(0.396)	(0. .1084)
Widowed	0.263	0.0719724
	(0.411)	(0. 1120)
Education level of the household head (in relation to Tertiary)		
No education	0.211	0.0508691
	(0.331)	(0. 1386)
Primary level	0.158	0.0577407
	(0.252)	(0. 0903)
Secondary level	0.186	0.0433585
	(0.507)	(0. .0687)
Employment status of the household head (in relation to salaried on full-time basis)		
Salaried (Part-time)	0.105	0.028726
	(0.375)	(0. 1025)

Self-employed (Full-time)	0.409	0.1119356
	(0.294)	(0. 0796)
Self-employed (Part-time)	-0.142	-0.0388554
	(0.284)	(0. 0776)
Unemployed	-0.512*	-0.1401725*
	(0.262)	(0. 0704)
Distance to the nearest supermarket (Km)	0.0162	0.0044452
	(0.0220)	(0. 0060)
Distance to the nearest bank (Km)	-0.0818*	-0.0223928*
	(0.0420)	(0. 0113)
Households with no special diet (1= has no special diet, 0=otherwise)	0.612*	0.1673827*
	(0.596)	(0. 1620)
Gluten sensitive households (1= is gluten sensitive, 0= otherwise)	-1.901**	-0.5201708**
	(0.858)	(0. 2293)
Amount of money spent on food purchases a month (ZMW)	0.410*	0.1123261*
	(0.218)	(0. 0582)
Dinner frequency variable (in relation to never have dinner)		
Dinner2 (Seldom-a few times)	-0.130	-0.0356942
	(0.276)	(0. 0754)
Dinner3 (often-few times in a month)	-0.910**	-0.2490542**
	(0.443)	(0. 1187)
Dinner4 (frequent-once or more a week)	-0.191	-0.0523855
	(0.545)	(0. 1491)
Dinner5 (Daily)	0.908***	0.2485003***
	(0.322)	(0. 0844)
Wealth index	0.266***	0.0728945***
	(0.0838)	(0. 0217)
Constant	-0.881	
	(0.788)	
Goodness of Fit LR chi2(31)		109.83***
Pseudo R-square		0.2787
Joint Test for Factor Scores (Chi-square (8)		33.27***
Observations		290

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The probit model results shown in Table 5 offer valuable insights into the factors influencing consumer decisions regarding the purchase of bean-based processed products. Among the significant variables, households with unemployed heads exhibit a lower likelihood of purchasing these products compared to the households that have salaried heads on full time basis.

Additionally, wealthier households are more inclined to buy bean-based processed items, reflecting the impact of increased purchasing power. The absence of special dietary constraints also emerges as a key factor, with households without dietary restrictions significantly more likely to choose these products. Conversely, gluten-sensitive households exhibit a lower likelihood of purchasing bean-based processed items, underlining the influence of dietary considerations on consumer choices. Furthermore, specific preferences captured by the F-test on the factor scores positively impact the decision to buy these products. Higher food expenditure and frequent dinner consumption, particularly daily dinners, are associated with an increased likelihood of purchasing bean-based processed goods, highlighting the role of spending patterns and meal habits in shaping consumer behavior.

These findings collectively underscore the multifaceted nature of consumer choices in the context of bean-based processed products. Economic factors, dietary considerations, and specific preferences all play integral roles, demonstrating the intricate interplay of various elements that contribute to consumer decision-making.

Several variables in the probit model did not exhibit statistical significance in influencing consumer decisions regarding the purchase of bean-based processed products. The age of the household head, gender, household size, marital status, education level, and proximity to the nearest supermarket or bank were found to be non-significant factors. These results suggest that these demographic and contextual variables may not play a discernible role in shaping consumer preferences for bean-based processed goods in the studied context.

4.3.6 Discussion of Probit Model Results

The findings discussed here illustrate the variables that affect consumers' decisions to buy and consume processed goods made from beans. The independent variables are different sociodemographic traits, attitudes toward bean-based processed items (expressed by factor scores), and other pertinent aspects. The dependent variable (y) represents the choice to buy and consume these products. Along with the coefficients (effect sizes), Table 5 also includes their related standard errors.

In understanding consumption decisions, several important variables, including income, age, education level, employment status, consumer perceptions, eating habits, dietary behavior, and distance, contribute to the complexity of consumer choices.

The Probit model results in Table 5 reveal that the employment status of the household head significantly influences decisions to buy and consume processed goods made from beans, aligning with the findings of a prior study (French *et al.*, 2019). Compared to being salaried on a full-time basis, the results show that at 10% significant level being unemployed has a negative and statistically significant effect (-0.512) on the likelihood of purchasing these products. This implies that households with unemployed heads are less likely to opt for bean-based processed products. Employed household heads may possess greater disposable income, enabling them to make choices aligned with health and convenience (Drewnowski and Almiron-Roig, 2010).

The findings also demonstrate that dietary requirements have an impact on whether bean-based processed foods are purchased and consumed in a household. At 10% level of significance, the variable reflecting households without special diets has a highly significant coefficient. This suggests that households without particular dietary constraints are more likely to purchase and eat processed foods made from beans. These results align with findings from a previous study, emphasizing the observed association between dietary considerations and the likelihood of purchasing and consuming products (Oster, 2018).

Notably, the age of the household head, sex dummy, household size, marital status, and education level do not exhibit statistically significant effects on consumption decisions. These findings may differ from some aspects of the existing literature, which may have highlighted these variables as influential in certain contexts (Singh and Verma, 2017). However, these results align with a study conducted by Khare, (2015), which similarly found non-significant effects of these demographic factors on consumption decisions.

In the probit model results, the variable "Gluten-sensitive households" refers to households where members are sensitive to gluten. The coefficient for this variable is -1.901, and it is statistically significant at 5% significance level. The negative coefficient suggests that households with gluten sensitivity are less likely to decide to purchase bean-based processed products. In other words, the presence of gluten sensitivity is associated with a decreased likelihood of choosing bean-based processed items. This suggests that households with gluten-sensitive members may be less inclined

to opt for bean-based processed products, possibly due to the probability of some bean-based processed items having gluten or becoming cross-contaminated with gluten during processing. The highly significant negative correlation suggests that gluten-sensitive families are less likely to buy and eat bean-based processed products which aligns with the findings by (Oster, 2018) who found that individuals with special diets such as diabetic individuals are mindful of their choices when it comes to food purchases hence maybe less likely to purchase processed products.

The significant effect of dietary factors is evident through the "Household with no special diet" and "Gluten sensitive households" variables. The positive coefficient for the former highlights the appeal of bean-based processed products to households without specific dietary limitations, aligning with the usefulness and health benefits of beans (Messina, Melina and Mangels, 2003). On the other hand, the negative coefficient for "Gluten sensitive households" highlights the importance of offering gluten-free alternatives in product groups to cater to specific dietary needs (Ciclitira, king and Fraser, 2015).

Additionally, an F-test was conducted on the scores to determine a collective significance of all the eight factors. The p-value obtained (0.0001) is less than the 1% significance level hence the null hypothesis was rejected. This simply means that at least one of the factor scores has a statistically significant effect on the decision to purchase and consume bean-based processed products. The F-test thus implies that there is evidence to support the joint relevance of the component scores in describing the variability in the dependent variable. Collectively, the factors identified by the factor analysis are impacting people's choices about the consumption of processed products (food) made from beans. This result indicates that the joint effect of these factors is statistically significant implying that, collectively, these factors have a substantial impact on the perception of products in this study.

The statistically significant joint impact of perceptual factors on product perception in this study aligns with findings from prior research by Osman et. al,. (2010) who found that online purchasing behavior of undergraduate students is highly influenced by the perceptions that they have for the product and the altitude towards the online site. This highlights the importance of these factors in shaping consumer perceptions across different contexts.

The amount of money spent on food (monthly) also shows a significant positive coefficient at 10% significance level. Households that allocate a large amount of money to food purchases monthly

are more likely to purchase and consume bean-based processed products. This result is in line with a study conducted by Drewnowski and Almiron-Roig, (2010) who concluded that families with higher disposable income may be better able to allocate more money towards food purchases and hence afford a wide range of food items, including processed goods made from beans. These households also may spend a bigger percentage of their income on food. As a result, these households may be more likely to experiment with various food choices, including ready-to-eat items like bean-based products. In marketing strategies, this finding highlights the importance of emphasizing the cost-effectiveness and nutritional benefits of bean-based processed products, especially when targeting consumers who allocate a large portion of their income to food expenditures. Emphasizing the affordability and value proposition of these products can resonate with households seeking high-quality, budget-friendly food options.

The dinner variable represents the eating habits of households in terms of meal frequencies at home. The frequency (ranging from never to daily) is a dummy variable and have varying coefficients. Dinner 2 and dinner 4 (seldom to frequent) are not statistically significant, suggesting they may not be a significant factor in the decision to purchase and consume bean-based products in comparison to those who never have dinner. Dinner5 (daily) on the other hand has a highly positive coefficient, indicating a strong positive association with the purchase and consumption of bean-based processed products while dinner 3 has a negative coefficient indicating that households having dinner often, a few times in a month, are significantly less likely to opt for bean-based products compared to those who never have dinner. The coefficients are highly statistically significant at 5% significance level. Bean-based processed products are rich in protein, fiber, and essential nutrients, making them an attractive option for households seeking dietary diversity and nutritional benefits (Lachat *et al.*, 2012). The coefficients for different dinner frequencies tell valuable insights into meal habits. For instance, the positive coefficient for "Dinner5 (Daily)" shows a strong association with daily dinner consumption and the likelihood of purchasing these products, potentially reflecting the convenience of including beans into daily meals (Thompson, *et al.*, 2017).

The dependent variables' positive relationship with the wealth index suggests that wealthier households are more likely to buy and consume processed goods made from beans. Greater purchasing power and access to a wider variety of food options may come with greater affluence. Households with greater wealth have more purchasing power and may thus afford a wider range

of food options. Bean-based processed foods, such as canned beans or pre-cooked beans alternatives provide a filling and affordable source of protein that is compatible with a variety of dietary preferences (Darmon and Drewnowski, 2015). A study done by Smith et al., (2013) found that wealthier households often prioritize health and nutrition. This makes them seek out foods that contribute to a balanced and healthy diet. Bean-based processed products are recognized for their nutritional value, including being rich in dietary fiber, vitamins, and minerals, making them attractive choices for health-conscious (Smith, Ng and Popkin, 2013). Therefore, the positive coefficient for the "Wealth Index" variable suggests that households with higher wealth indices are more persuaded to purchase bean-based processed products, reflecting the potential correlation between economic well-being and food choices (Fosu-Mensah, Vlek and MacCarthy, 2012).

Other sociodemographic factors, such as age, sex, household size, marital status, and educational attainment, did not show statistically significant correlations with consumer behavior in this study. Nevertheless, the negative coefficient for the "Age of Household Head" variable suggests that older household heads are less likely to purchase and consume bean-based processed products. This finding aligns with previous research on generational differences in food preferences (Popkin, Adair and Ng, 2012). Additionally, the negative coefficient for the "Sex of Household Head" variable points to possible gender-related factors impacting consumption decisions, justifying further exploration (Wagner, 2011).

4.3.7 Marginal Effects

This study used marginal effects for the purpose of providing a comprehensible and actionable understanding of the impact of independent variables on the decision to purchase and consume bean-based processed products by households within the probit model. By quantifying the change in the probability or value of the dependent variable resulting from a one-unit change in each independent variable while holding other factors constant, marginal effects offer valuable insights for informed decision-making, policy formulation, and accurate communication of results (Cameron and Trivedi, 2013). This technique aids in assessing variable importance, identifying key drivers of outcomes, and facilitating comparative analyses across different factors. Marginal effects analysis enhances the interpretability and practical applicability of complex statistical models, ultimately contributing to evidence-based decision-making and rigorous research conclusions (Cameron and Trivedi, 2013).

As can be seen from the Table 5, a one-unit increase in the employment status of the household head (such as moving from unemployed to being employed) is associated with a 0.1402 increase in the likelihood of purchasing and consuming bean-based processed products. This effect is statistically significant at the 10% level. In other words, households with an employed head are substantially more likely to engage in this consumption behavior.

A one-unit decrease in the distance to the nearest bank is linked to a 0.0224 decrease in the likelihood of purchasing and consuming bean-based processed products. This effect is statistically significant at the 10% level. Households closer to banks are less likely to make such consumption decisions. However, according to theory, individuals living closer to a bank might have better access to financial resources, which could lead to increased purchasing power and, consequently, a higher likelihood of purchasing and consuming bean-based processed products. This aligns with the notion that improved access to financial services positively influences consumer behavior and expenditure patterns (Sarma, 2008).

The financial habits among the sampled households may explain the found negative coefficient for "Distance to the Nearest Bank". It's conceivable that a sizable portion of these households chooses alternate saving methods rather than keeping their money in banks. The main goal for those who use financial services may be concentrated on saving money. Therefore, households living further away from banks might devote a bigger percentage of their resources to urgent spending, such as buying food. Families living close to banks, on the other hand, might be more likely to emphasize saving, leaving less money available for food purchases. Essentially, the negative coefficient might illustrate the interaction between geographic distance, financial choices, and the resulting distribution of resources between savings and consumption. According to research on the effects of financial inclusion on spending dynamics, this perspective emphasizes the significance of financial behaviors and access to banking services in influencing consumer spending patterns (Beck and De la Torre, 2006; Demirguc-Kunt and Klapper, 2012).

Households without a special diet have a 0.337 higher likelihood of purchasing and consuming bean-based processed products compared to households with special diets. This effect is statistically significant at the 10% level. Households without dietary restrictions are notably more inclined to consume these products.

Gluten-sensitive households have a 0.5271 lower likelihood of purchasing and consuming bean-based processed products. This effect is statistically significant at the 10% level. Households with gluten sensitivities are substantially less likely to choose these products due to the reasons given in the earlier analysis.

A one-unit increase in the amount of money spent on food purchases in a month is associated with an 0.1123 increase in the likelihood of purchasing and consuming bean-based processed products. This effect is statistically significant at the 10% level. Households allocating a larger share of their income to food expenditures are more likely to opt for these products.

Households with a daily dinner routine have a 0.2485 higher likelihood of purchasing and consuming bean-based processed products compared to those who never take dinner. This effect is highly statistically significant at the 1% significance level. Daily dinner habits strongly correlate with a preference for these purchase and consumption patterns.

A one-unit increase in the wealth index is associated with a 0.0729 increase in the likelihood of purchasing and consuming bean-based processed products. This effect is highly statistically significant at the 1% significance level. Higher economic well-being is strongly linked to an elevated likelihood of engaging in this purchase and consumption behavior.

These interpretations provide a comprehensive understanding of the level of significance, direction of correlation, and the meaningful impact of each significant variable on the likelihood of purchasing and consuming bean-based processed products.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter summarizes the study's goals and key findings after giving a concise summary of its results. It also presents potential recommendations based on the main findings. The chapter concludes by highlighting prospective directions for further research that are closely related to the topic of this study.

5.2 Conclusions

The dissertation concludes by listing a variety of bean-based processed products identified during the Rapid Market Assessment and Household survey. These products include frozen beans, bean porridge, pre-cooked hydrated beans, pre-cooked dehydrated beans, bean flour, and canned beans with attributes like taste and ease of preparation ranking high among consumer priorities. These products' makers come from both domestic and foreign sources. The study also lists other places where consumers can find these products, such as supermarkets and neighborhood retail stores. The findings are useful for stakeholders in the food business, decision-makers, and academics looking at consumer behavior and dietary preferences because they offer insightful information about the range and accessibility of bean-based food products on the market.

It can also be concluded that there are gender variations among actors along the supply chain of bean-based processed products. Males dominated the processing chain, while on-the-spot consumers exhibited a relatively balanced gender distribution. Processors and distributors, mostly located in urban areas, started operations between 2000 and 2021, indicating a new and developing industry. These gender-based variations provide insights into the role of gender in different aspects of the market. The differences in gender distribution suggest potential variations in involvement, roles, and preferences among different respondent categories, which can further influence consumer behavior and market dynamics related to bean-based processed products. Understanding these gender-specific patterns can be valuable for developing targeted marketing strategies and addressing specific needs within the market.

Challenges faced by processors/importers included difficulties in obtaining raw materials, high electricity expenditures, packaging costs, machinery inadequacy, and financial constraints.

Distribution challenges involved product damage, high transportation costs, inadequate supply, and insufficient working capital. Consumers faced challenges such as a lack of market information, high prices, and small package sizes. Awareness of bean-based products varied, with marketing efforts recommended for less-known products like bean flour.

Furthermore, the study findings shed important light on the complex variables affecting households' decisions about the purchase and consumption of processed bean products. A number of important factors have emerged as the primary motivators of these spending patterns. Notably, there is a positive correlation between the frequency of such purchases and the employment status of the household head, suggesting that families with employed heads are more likely to purchase these products. The absence of particular dietary requirements and the distance to the closest bank, on the other hand, show negative relationships, indicating that households with dietary restrictions and those further from banks are less likely to make such purchase decisions. Additionally, the impact of socio-demographic characteristics, such as wealth index and education level, emphasizes the complex interplay between economic position and consumer preferences. It was also observed as evidenced by variables like "Dinner5 (Daily)," the effects of particular eating habits have a substantial impact on molding these purchasing patterns.

The study's findings have reflective implications for various stakeholders within Zambia's agricultural sector. Firstly, the identified factors influencing consumer decisions to purchase and consume bean-based processed products have direct implications for farmers and producers. Understanding consumer preferences, particularly regarding factors such as affordability, nutritional value, and specific dietary needs, can guide farmers in crop planning and variation. This knowledge empowers them to align their production with market demands, possibly leading to increased income and sustainability.

Additionally, the study's insights hold significance for legislators and governmental bodies involved in influencing agricultural and economic policies. For instance, identifying the positive association between employment status and the likelihood of purchasing bean-based products advocates that policies promoting employment and economic stability can indirectly contribute to increased consumption. Legislators can leverage these findings to plan targeted interventions that support both employment generation and the promotion of locally produced nutritious food options.

The private sector, including retailers, food processors, and distributors, can benefit from a better understanding of consumer preferences. For example, the finding that households allocating a large amount of money to food purchases are more likely to choose bean-based products offers valuable market intelligence. It shows an opportunity for businesses to tailor advertising approaches and product offerings to appeal to this segment of the consumer base, possibly fostering business growth and market share.

Furthermore, non-governmental organizations (NGOs) and development agencies focusing on food security and nutrition can use these results to plan targeted programs. For example, understanding the factors that make bean-based products attractive to certain demographics, such as larger households or those without special dietary requirements, can advise the development of nutrition interventions that resonate with these groups.

5.3 **Recommendations**

This study's recommendations encourage processors to diversity product packaging sizes to suit diverse consumer budgets. Additionally, stakeholders should work together to develop methods that make it easier for consumers to get these items, supporting greater acceptance and encouraging better consumption options.

Marketers (including processors) are encouraged to refine their strategies by aligning them with identified consumer preferences for bean-based products. Importance should be placed on highlighting the affordability, nutritional benefits, and convenience of these products. This may require the development of targeted advertising campaigns that precisely communicate these key attributes. Furthermore, marketers can explore packaging innovations to improve the appearance and shelf life of bean-based products. Partnerships with retailers can also be helpful in increasing the visibility of these products within the market. Additionally, involvement in consumer education initiatives is paramount. Marketers should actively work in partnership with health professionals and nutritionists to impart knowledge about the health benefits linked with consumption of bean-based products. Circulating this information through various channels, including social media platforms, will increase consumer awareness and understanding, eventually fostering a positive perception of bean-based products in the market.

Policymakers are urged to develop policies aimed at incentivizing farmers to diversify their crop production, with a specific focus on cultivating good bean varieties that will provide good raw materials. This can be attained by providing targeted financial incentives, educational opportunities, and necessary resources to farmers. Such policies are expected to not only contribute to the economic growth of the agricultural sector but also to improved nutrition. Furthermore, policymakers should consider supporting initiatives that promote employment, particularly within the agriculture sector. Identifying the correlation between employment status and the likelihood of purchasing bean-based products, actions aimed at job creation not only address concerns related to unemployment but also stimulate local demand for domestically processed products.

5.4 **Future Research**

Research customer views, preferences, and barriers regarding processed bean products in-depth. Examine elements like flavor, texture, cultural acceptability, and alleged health advantages. This study can serve as a roadmap for the creation of focused marketing campaigns that clearly convey the nutritive benefits, adaptability, and culinary allure of these items. Investigating cutting-edge branding, marketing, and packaging strategies that connect with various consumer categories can have a big impact on consumer choice and market penetration.

In addition, examine how supply chains for processed goods made from beans might be optimized, paying particular attention to how to boost productivity, save prices, and guarantee availability. Examine the viability of constructing neighborhood or regional processing and distribution hubs to facilitate the movement of products from manufacturing facilities to retail locations. Assess logistics and technology options that can increase these products' shelf lives while reducing waste and preserving freshness. To enhance access to raw materials, processing facilities, and market outlets, particularly in underserved or rural locations, there is need to research the possibility of joint projects such as public-private partnerships.

5.4.1 Specific research questions and areas of inquiry:

Customer Views, Preferences, and Barriers:

1. Flavor and Texture:

- What is the perception of flavor and texture in different processed bean products among consumer segments, and how does this perception impact their choices when making purchases?

2. Cultural Acceptability:
    - What cultural factors influence the acceptability of processed bean products in different regions, and how can marketing strategies be tailored to address cultural preferences?
3. Branding and Packaging:
    - What impact does inventive branding and packaging have on consumer perception and decision-making regarding processed bean products?

Public-Private Partnerships:

4. Infrastructure Gaps:
    - What is the impact of public-private partnerships on addressing infrastructure gaps in underserved or rural areas, and how do these efforts contribute to enhancing access to raw materials, processing facilities, and market outlets for bean-based products?
5. Connectivity Improvement:
    - In what ways can combined initiatives between public and private entities improve connectivity between production centers and market outlets, particularly in regions with limited access?

REFFERENCES

ACF International. (2013) *Guidelines for Conducting a Rapid Market Assessment*. Action Against Hunger International.

Adejumo, O., Okoruwa, V., Abass, A. and Salman, K., (2020) 'Post-harvest technology change in cassava processing: A choice paradigm', *Scientific African*, 7, p. e00276. Available at: https://doi.org/10.1016/j.sciaf.2020.e00276.

Alamu, E.O., Popoola, I. and Maziya-Dixon, B. (2018) 'Effect of soybean (*Glycine max* (L.) Merr.) flour inclusion on the nutritional properties and consumer preference of fritters for improved household nutrition', *Food Science & Nutrition*, 6(7), pp. 1811–1816. Available at: https://doi.org/10.1002/fsn3.751.

Alfani, F., Arslan, A., McCarthy, N., Cavatassi, R. and Sitko, N.J., (2019)*Climate-change vulnerability in rural Zambia the impact of an El Niño-induced shock on income and productivity*. Rome: Food and Agriculture Organization of the United Nations.

Amit, S.K., Uddin, M.M., Rahman, R., Islam, S.R. and Khan, M.S., (2017)'A review on mechanisms and commercial aspects of food preservation and processing', *Agriculture & Food Security*, 6(1), p. 51. Available at: https://doi.org/10.1186/s40066-017-0130-8.

Aneani, F. and Osei, R.D. (2011) 'Promoting agro-processing enterprises in Ghana: Experience of the CSIR-food Research Institute.', *African Journal of Agricultural Research*, 6(18), pp. 4277–4287.

Arslan, A., McCarthy, N., Lipper, L., Asfaw, S., Cattaneo, A. and Kokwe, M., (2015) 'Climate Smart Agriculture? Assessing the Adaptation Implications in Zambia', *Journal of Agricultural Economics*, 66(3), pp. 753–780. Available at: https://doi.org/10.1111/1477-9552.12107.

Baker, G.A. and Neto, J.D.S. (1988) 'The rapid market assessment (RMA) of new products', *Agribusiness*, 4(5), pp. 467–473. Available at: https://doi.org/10.1002/1520-6297(198809)4:5<467::AID-AGR2720040506>3.0.CO;2-6.

Barrena, R., García, T. and Sánchez, M. (2015) 'Analysis of personal and cultural values as key determinants of novel food acceptance. Application to an ethnic product', *Appetite*, 87, pp. 205–214. Available at: https://doi.org/10.1016/j.appet.2014.12.210.

Barska, A. and Wojciechowska-Solis, J. (2020) 'E-Consumers and Local Food Products: A Perspective for Developing Online Shopping for Local Goods in Poland', *Sustainability*, 12(12), p. 4958. Available at: https://doi.org/10.3390/su12124958.

Beck, T. and De la Torre, A. (2006) *The basic analytics of access to financial services. The World Bank Research Observer*.

Branca, G., Cacchiarelli, L., D'amico, V., Dakishoni, L., Lupafya, E., Magalasi, M., Perelli, C. and Sorrentino, A., (2021) 'Cereal-Legume Value Chain Analysis: A Case of Smallholder Production in Selected Areas of Malawi', *Agriculture*, 11(12), p. 1217. Available at: https://doi.org/10.3390/agriculture11121217.

Brown, T.A. (2015) 'Comfirmatory factor Analysis for applied research. 2nd ED'. Guilford Press.

Calder, N., Walsh, K., Olupot-Olupot, P., Ssenyondo, T., Muhindo, R., Mpoya, A., Brignardello, J., Wang, X., McKay, E., Morrison, D. and Holmes, E., (2021)'Modifying gut integrity and microbiome in children with severe acute malnutrition using legume-based feeds (MIMBLE): A pilot trial', *Cell Reports Medicine*, 2(5), p. 100280. Available at: https://doi.org/10.1016/j.xcrm.2021.100280.

Cameron, A.C. and Trivedi, P.K. (2013) 'Regression Analysis of Count Data', *Cambridge University press*, 53.

Chen, S., Liu, X., Yan, J., Hu, G. and Shi, Y., (2021)'Processes, benefits, and challenges for adoption of blockchain technologies in food supply chains: a thematic analysis', *Information Systems and e-Business Management*, 19(3), pp. 909–935. Available at: https://doi.org/10.1007/s10257-020-00467-3.

Chisomo, M.D. (2022) 'Comparative evaluation of the effect of boiling and autoclaving of legume grains on tannin concentration', *Magna Scientia Advanced Biology and Pharmacy*, 7(1), pp. 009–017. Available at: https://doi.org/10.30574/msabp.2022.7.1.0080.

Chongo, M. (2022) 'Promoting Nutrition in Chongwe Food System Lab', *Promoting Nutrition in Chongwe Food System Lab*. Available at: https://healthyfoodafrica.eu/blog/promoting-nutrition-in-chongwe-fsl/#:~:text=Food%20System%20Lab-,Promoting%20Nutrition%20in%20Chongwe%20Food%20System%20Lab,-June%2028th%2C%202022.

Chopra, S. and Meindl, P. (2020) *Supply Chain Management: Strategy, Planning, and Operation*. 7th edn. Pearson.

Christopher, M. (2016) *Logistics & Supply Chain Management*. 5th edn. Pearson.

Ciclitira, P.J., king, A.L. and Fraser, J.S. (2015) 'AGA technical review on celiac sprue', *Gastroenterology*, 120(6), pp. 1526–1540. Available at: https://doi.org/10.1053/gast.2001.24056.

Crosland, P., Ananthapavan, J., Davison, J., Lambert, M. and Carter, R., (2019)'The health burden of preventable disease in Australia: a systematic review', *Australian and New Zealand Journal of Public Health*, 43(2), pp. 163–170. Available at: https://doi.org/10.1111/1753-6405.12882.

Crush, J. and Fayne, B. (2010) *The invisible crisis: urban food security in Southern Africa*. Cape Town: AFSUN.

Darmon, N. and Drewnowski, A. (2015) 'Contribution of food prices and diet cost to socioeconomic disparities in diet quality and health: a systematic review and analysis', *Nutrition Reviews*, 73(10), pp. 643–660. Available at: https://doi.org/10.1093/nutrit/nuv027.

David, B. and Crentsil, C. (2013) 'Competitiveness and Determinants of Coffee Exports, Producer Price and Production for Ethiopia', 1, pp. 51–56.

Demirguc-Kunt, A. and Klapper, L. (2012) 'Measuring Financial Inclusion:The global findex database', *World bank policy research working paper*, p. 6025.

Drewnowski, A. and Almiron-Roig, E. (2010) 'Human perceptions and preferences for fat-rich foods.', in *Human perceptions and preferences for fat-rich foods. In Montmayeur J.P., le Coutre J. (Eds.), Fat Detection: Taste, Texture, and Post Ingestive Effects*. CRC Press/Taylor & Francis., pp. 265–290.

Drexler, D., Fiala, J., Havlíčková, A., Potůčková, A. and Souček, M., (2018)'The Effect of Organic Food Labels on Consumer Attention', *Journal of Food Products Marketing*, 24(4), pp. 441–455. Available at: https://doi.org/10.1080/10454446.2017.1311815.

Eagly, A.H. and Wood, W. (1999) 'The origins of sex differences in human behavior: Evolved dispositions versus social roles.', *American Psychologist*, 54(6), pp. 408–423. Available at: https://doi.org/10.1037/0003-066X.54.6.408.

FAO (2022) *Food Systems Profile - Zambia*. FAO; European Union ; CIRAD; Available at: https://doi.org/10.4060/cb8716en.

Figueira, N., Curtain, F., Beck, E. and Grafenauer, S., (2019) 'Consumer Understanding and Culinary Use of Legumes in Australia', p. 16.

Food and Agriculture Organization (2012) *Rapid Market Appraisal: A Manual for Trainers and Field Officers.* FAO.

Fosu-Mensah, B.Y., Vlek, P.L.G. and MacCarthy, D.S. (2012) 'Farmers' perception and adaptation to climate change: a case study of Sekyedumase district in Ghana', *Environment, Development and Sustainability*, 14(4), pp. 495–505. Available at: https://doi.org/10.1007/s10668-012-9339-7.

Franco, A.A. and De Faria, S.M. (1997) 'The contribution of N2-fixing tree legumes to land reclamation and sustainability in the tropics', *Soil Biology and Biochemistry*, 29(5–6), pp. 897–903. Available at: https://doi.org/10.1016/S0038-0717(96)00229-5.

Fratini, R.M., Pérez de la Vega, M. and Ruiz Sánchez, M.L., (2014) 'Lentil', in *Broadening the Genetic Base of Grain Legumes*. New Delhi: Springer India, pp. 115–147. Available at: https://doi.org/10.1007/978-81-322-2023-7_6.

French, S.A., Tangney, C.C., Crane, M.M., Wang, Y. and Appelhans, B.M., (2019)'Nutrition quality of food purchases varies by household income: the SHopper study', *BMC Public Health*, 19(1), p. 231. Available at: https://doi.org/10.1186/s12889-019-6546-2.

García, B. (2013) 'Implementation of a Double-Hurdle Model', *The Stata Journal: Promoting communications on statistics and Stata*, 13(4), pp. 776–794. Available at: https://doi.org/10.1177/1536867X1301300406.

Gogoi, N., Baruah, K.K. and Meena, R.S., (2018)'Grain Legumes: Impact on Soil Health and Agroecosystem', in R.S. Meena et al. (eds) *Legumes for Soil Health and Sustainable Management*. Singapore: Springer Singapore, pp. 511–539. Available at: https://doi.org/10.1007/978-981-13-0253-4_16.

Gorsuch, R.L. (1983) *Factor Analysis*. 2nd edn. Hillsdale, NJ: Lawrence Erlbaum Associates.

Haggblade, S. and Tembo, G. (2003) 'Conservation Farming in Zambia', *Intl Food Policy Res Inst* [Preprint].

Havemeier, S., Erickson, J. and Slavin, J. (2017) 'Dietary guidance for pulses: the challenge and opportunity to be part of both the vegetable and protein food groups: Dietary guidance for pulses', *Annals of the New York Academy of Sciences*, 1392(1), pp. 58–66. Available at: https://doi.org/10.1111/nyas.13308.

Horvitzt, D.G. and Thompson, D.J. (2023) 'A Generalization of Sampling Without Replacement From a Finite Universe'.

https://scholar.ufs.ac.za:8080/bitstream/handle/11660/854/Owusu-SekyereE.pdf?sequence=1&isAllowed=y *et al.* (2017) *Consumer Behavior: A European Perspective*. Third. Prentice Hall.

Hugos, M.H. (2018) *Essentials of Supply Chain Management*. 4th edn. Wiley.

Jacobs, F.R. and Chase, R.B. (2021) *Operations and Supply Chain Management*. 16th edn. McGraw-Hill Education.

Jahari, C., Kilama, B., Dube, S. and Paremoer, T., (2018)'Growth and Development of the Oilseeds-Edible-Oils Value Chain in Tanzania and South Africa', *SSRN Electronic Journal* [Preprint]. Available at: https://doi.org/10.2139/ssrn.3115940.

Jamieson, S. (2016) 'Analyze qualitative data', *Education for Primary Care*, pp. 1–5. Available at: https://doi.org/10.1080/14739879.2016.1217430.

Kahenge, Z., Muendo, K. and Nhamo, N. (2019) 'Factors Influencing Crop Commercialization Among Soybeans Smallholder Farmers in Chipata District, Eastern Zambia', *Journal of Agriculture, Science and Technology*, 19(1), pp. 13–31.

Khare, A. (2015) 'Antecedents to green buying behavior: a study on consumers in an emerging economy', *Marketing Intelligence & Planning*, 33(3), pp. 309–329. Available at: https://doi.org/10.1108/MIP-05-2014-0083.

Kormawa, P.M., Chianu, J.N. and Manyong, V.M. (2002) 'Cowpea demand and supply patterns in West Africa: the case of Nigeria; Challenges and opportunities for enhancing sustainable cowpea production', *IITA Ibadan*, pp. 375–386.

Kotler, P., Armstrong, G., Harris, G. and Piercy, N., (2017) *Principles of marketing: Seventh European edition*. 7th edn. Pearson.

Kumar, D. and Rajeev, P.V. (2016) 'Value chain: a conceptual framework', *International journal of engineering and management sciences*, 7(1), pp. 74–77.

Lachat, C., Nago, E., Verstraeten, R., Roberfroid, D., Van Camp, J. and Kolsteren, P., (2012)'Eating out of home and its association with dietary intake: a systematic review of the evidence: Eating out and diet', *Obesity Reviews*, 13(4), pp. 329–346. Available at: https://doi.org/10.1111/j.1467-789X.2011.00953.x.

Langley, C.J. , Coyle, J.J., Novack, R.A. and Gibson, B.J. (2019) *Supply Chain Management: A Logistics Perspective*. 10th edn. Cengage Learning.

Langyintuo, A., S. (2008) 'Computing Household Wealth Indices Using Principal Components Analysis Method'. Harare, Zimbabwe, CIMMYT.

Lavoie, M. (2004) 'Post Keynesian consumer theory: Potential synergies with consumer research and economic psychology', *Journal of Economic Psychology*, 25(5), pp. 639–649. Available at: https://doi.org/10.1016/j.joep.2003.02.001.

Lichtenstein, A.H. (2010) 'Bring Back Home Economics Education', *JAMA*, 303(18), p. 1857. Available at: https://doi.org/10.1001/jama.2010.592.

Majili, Z.S., Nyaruhucha, C., Kulwa, K., Mutabazi, K., Rybak, C. and Sieber, S., (2020)'Preferences and Consumption of Pigeon Peas among Rural Households as Determinants for Developing Diversified Products for Sustainable Health', *Sustainability*, 12(15), p. 6130. Available at: https://doi.org/10.3390/su12156130.

Manandhar, A., Milindi, P. and Shah, A. (2018) 'An Overview of the Post-Harvest Grain Storage Practices of Smallholder Farmers in Developing Countries', *Agriculture*, 8(4), p. 57. Available at: https://doi.org/10.3390/agriculture8040057.

Mapulanga, W. and Black, A. (2020) 'The potential of the agro-processing industry for industrialization in Zambia (Master's thesis, Faculty of Commerce)'. Available at: https://open.uct.ac.za/handle/11427/32835.

Martin, G. (2011) 'The Importance Of Marketing Segmentation', *American Journal of Business Education (AJBE)*, 4(6), pp. 15–18. Available at: https://doi.org/10.19030/ajbe.v4i6.4359.

Matchaya, G.C., Tadesse, G. and Kuteya, A.N. (2022) 'Rainfall shocks and crop productivity in Zambia: Implication for agricultural water risk management', *Agricultural Water Management*, 269, p. 107648. Available at: https://doi.org/10.1016/j.agwat.2022.107648.

Messina, V., Melina, V. and Mangels, A.R. (2003) 'A new food guide for North American vegetarians', *Canadian Journal of Dietetic Practice and Research*, 64(2), pp. 82-86. Available at: https://dcjournal.ca/doi/abs/10.3148/64.2.2003.82.

Mfikwa, A.E. and Kilima, F.T.M. (2014) 'Factors Influencing the Consumption of Pulses in Rural and urban areas', *Tanzania Journal of Agricultural Sciences*, 13(2), pp. 59–74. Available at: https://www.ajol.info/index.php/tjags/article/view/130187.

Mhlanga, B., Mwila, M. and Thierfelder, C. (2021) 'Improved nutrition and resilience will make conservation agriculture more attractive for Zambian smallholder farmers', *Renewable Agriculture and Food Systems*, 36(5), pp. 443–456. Available at: https://doi.org/10.1017/S1742170521000028.

Muchemwa, N. Ben, M., Siyunda, A. and Munyinda, K., (2022)'Climate Smart Crop: Evaluation of Selected Mutant Cowpea Genotypes for Yield, Earliness and Ground Cover in Eastern Zambia', *Medicon Agriculture & Environmental Sciences*, 3, pp. 33–41.

Mukuka, R.M. and Mofu, M. (2016) 'The Status of Hunger and Malnutrition in Zambia: A Review of Methods and Indicators', p. 34. Available at: https://www.academia.edu/download/77769174/IAPRI_TP5.pdf.

Mukuka, R.M. and Shipekesa, A.M. (2013) 'Value Chain Analysis of the Groundnuts Sector in the Eastern Province of Zambia', *Michigan State University, Department of Agricultural, Food, and Resource Economics.* [Preprint]. Available at: https://econpapers.repec.org/paper/agsmidcwp/171869.htm.

Mulenga, B.P., Wineman, A. and Sitko, N.J. (2017) 'Climate Trends and Farmers' Perceptions of Climate Change in Zambia', *Environmental Management*, 59(2), pp. 291–306. Available at: https://doi.org/10.1007/s00267-016-0780-5.

Mullins, A.P. and Arjmandi, B.H. (2021) 'Health Benefits of Plant-Based Nutrition: Focus on Beans in Cardiometabolic Diseases', *Nutrients*, 13(2), p. 519. Available at: https://doi.org/10.3390/nu13020519.

Nair, R.M., Yang, R.Y., Easdown, W.J., Thavarajah, D., Thavarajah, P., Hughes, J.D.A. and Keatinge, J.D.H., (2013)'Biofortification of mungbean (*Vigna radiata*) as a whole food to enhance human health: Biofortification of mungbean to enhance human health', *Journal of the Science of Food and Agriculture*, 93(8), pp. 1805–1813. Available at: https://doi.org/10.1002/jsfa.6110.

Nayga, R. (1999) 'Toward an understanding of consumers' perceptions of food labels', *The International Food and Agribusiness Management Review*, 2(1), pp. 29–45. Available at: https://doi.org/10.1016/S1096-7508(99)00011-7.

Neuhofer, Z.T. and Lusk, J.L. (2022) 'Most plant-based meat alternative buyers also buy meat: an analysis of household demographics, habit formation, and buying behavior among meat alternative buyers', *Scientific Reports*, 12(1), p. 13062. Available at: https://doi.org/10.1038/s41598-022-16996-5.

Neven, D. (2014) *Developing sustainable food value chains: guiding principles*. Rome: FAO.

Nicholson, T. (2013) 'Addition of Micronized Black Bean (Phaseolus Vulgaris) Flour Improves Sensory Qualities of Low Fat Beef Burgers', *University of Manitoba (Canada)* [Preprint].

Osman, S., Yin-Fah, B.C. and Choo, B.H. (2010) 'Undergraduates and Online Purchasing Behavior', *Asian Social Science*, 6(10), p. p133. Available at: https://doi.org/10.5539/ass.v6n10p133.

Oster, E. (2018) 'Diabetes and Diet: Purchasing Behavior Change in Response to Health Information', *American Economic Journal: Applied Economics*, 10(4), pp. 308–348. Available at: https://doi.org/10.1257/app.20160232.

Owusu-Sekyere, E., 2014. *Consumer preferences and willingness to pay for beef attributes in Ghana* (Doctoral dissertation, University of the Free State)'. Available at: https://scholar.ufs.ac.za:8080/bitstream/handle/11660/854/Owusu-SekyereE.pdf?sequence=1&isAllowed=y.

Palmer, S.M., Winham, D.M., Oberhauser, A.M. and Litchfield, R.E.,(2018) 'Socio-Ecological Barriers to Dry Grain Pulse Consumption among Low-Income Women: A Mixed Methods Approach', *Nutrients*, 10(8), p. 1108. Available at: https://doi.org/10.3390/nu10081108.

Park, H.-A. (2013) 'An Introduction to Logistic Regression: From Basic Concepts to Interpretation with Particular Attention to Nursing Domain', *Journal of Korean Academy of Nursing*, 43(2), p. 154. Available at: https://doi.org/10.4040/jkan.2013.43.2.154.

Pathiwada, G. (2023) 'Low glycemic index foods: A way to enhance healthy lifestyle and disease management'.

Pele, W.K. (2015) 'Income and bean consumption patterns in Zambia (Doctoral dissertation, Kansas State University)'.

Pereira, L.S. (2017) 'Water, Agriculture and Food: Challenges and Issues', *Water Resources Management*, 31(10), pp. 2985–2999. Available at: https://doi.org/10.1007/s11269-017-1664-z.

Phiri, J.S., Moonga, E., Mwangase, O. and Chipeta, G., (2013) 'Adaptation of Zambian agriculture to climate change-a comprehensive review of the utilization of the agro-ecological regions', *Climate Change, Agriculture and Agro-Eco Regions of Zambia. Zambia Academy of Sciences Lusaka*, pp. 4–30.

Popkin, B.M., Adair, L.S. and Ng, S.W. (2012) 'Global nutrition transition and the pandemic of obesity in developing countries', *Nutrition Reviews*, 70(1), pp. 3–21. Available at: https://doi.org/10.1111/j.1753-4887.2011.00456.x.

porta, V.C.M. (1985) 'What Is Value Chain', *E-Commer*, pp. 1–13.

Rekha, C.R. and Vijayalakshmi, G. (2013) 'Influence of processing parameters on the quality of soycurd (tofu)', *Journal of Food Science and Technology*, 50(1), pp. 176–180. Available at: https://doi.org/10.1007/s13197-011-0245-z.

Román, S., Sánchez-Siles, L.M. and Siegrist, M. (2017) 'The importance of food naturalness for consumers: Results of a systematic review', *Trends in Food Science & Technology*, 67, pp. 44–57. Available at: https://doi.org/10.1016/j.tifs.2017.06.010.

Rupprecht, C.D., Fujiyoshi, L., McGreevy, S.R. and Tayasu, I., (2020)'Trust me? Consumer trust in expert information on food product labels', *Food and Chemical Toxicology*, 137, p. 111170. Available at: https://doi.org/10.1016/j.fct.2020.111170.

Sadati, A.K., Nayedar, M., Zartash, L. and Falakodin, Z., (2021)'Challenges for food security and safety: a qualitative study in an agriculture supply chain company in Iran', *Agriculture & Food Security*, 10(1), p. 41. Available at: https://doi.org/10.1186/s40066-021-00304-x.

Sarma, M. (2008) 'Index of Financial Inclusion (No. 215)', *Working paper* .

Sayin, C. Mencet, M.N., Karaman, S. and Tascioglu, Y. (2010) 'Analysis of Factors Affecting Fish Purchasing Decisions of the Household: Antalya District Case', *Journal of Animal and Veterinary Advances*, 9(12), pp. 1689–1695. Available at: https://doi.org/10.3923/javaa.2010.1689.1695.

Schiffman, L., G. and Kanuk, L.L. (2019) *Consumer Behavior*. 11th ed. Pearson.

Schneider, A.V.C. (2002) 'Overview of the market and consumption of pulses in Europe', *British Journal of Nutrition*, 88(S3), pp. 243–250. Available at: https://doi.org/10.1079/BJN2002713.

Schwember, A.R. (2020) 'Stimulating Legume Production for a More Sustainable and Nutritious Agriculture', *American Journal of Biomedical Science & Research*, 8(6), pp. 521–523. Available at: https://doi.org/10.34297/AJBSR.2020.08.001331.

Siamabele, B. (2019) 'Soya Beans Production in Zambia: Opportunities and Challenges', *American Journal of Agricultural and Biological Sciences*, 14(1), pp. 55–60. Available at: https://doi.org/10.3844/ajabssp.2019.55.60.

Siatwiinda, S.M., Supit, I., van Hove, B., Yerokun, O., Ros, G.H. and de Vries, W., (2021)'Climate change impacts on rainfed maize yields in Zambia under conventional and optimized crop management', *Climatic Change*, 167(3–4), p. 39. Available at: https://doi.org/10.1007/s10584-021-03191-0.

Sichilima, T., Mapemba, L. and Tembo, G. (2016) 'Drivers of Dry Common Beans Trade in Lusaka, Zambia: A Trader's Perspective', *Sustainable Agriculture Research*, 5(2), p. 15. Available at: https://doi.org/10.5539/sar.v5n2p15.

Simchi-Levi, D., Kaminsky, P. and Simchi-Levi, E. (2019) *Designing and Managing the Supply Chain: Concepts, Strategies, and Case Studies*. 4th edn. McGraw-Hill Education.

Singh, A. and Verma, P. (2017) 'Factors influencing Indian consumers' actual buying behavior towards organic food products', *Journal of Cleaner Production*, 167, pp. 473–483. Available at: https://doi.org/10.1016/j.jclepro.2017.08.106.

Smith, L.P., Ng, S.W. and Popkin, B.M. (2013) 'Trends in US home food preparation and consumption: analysis of national nutrition surveys and time use studies from 1965–1966 to 2007–2008', *Nutrition Journal*, 12(1), p. 45. Available at: https://doi.org/10.1186/1475-2891-12-45.

Stoin, D., Vîrsta, D.L., Robert, R., Bicu, O.M., Jianu, C., Velciov, A.B. and Poiană, M.A., (2022)'Quality evaluation of noodles based on black bean flour and wheat flour', *Journal of Agroalimentary Processes and Technologies*, 28(4).

Syakalima, D. (2010) *SECOND REPORT OF THE COMMITTEE ON EDUCATION, SCIENCE AND TECHNOLOGY FOR THE FOURTH SESSION OF THE TENTH NATIONAL ASSEMBLY APPOINTED ON 24 SEPTEMBER 2009*. 2. Lusaka: National Assembly, p. 6. Available at: https://www.parliament.gov.zm/sites/default/files/documents/committee_reports/SECOND%20REPORT%20FOR%20%20EDUCATION.pdf.

Tabachnick, B.G. and Fidell (2007) *Using Multivariate Statistics*. 5th edn. Pearson.

Tefera, T. (2012) 'Post-harvest losses in African maize in the face of increasing food shortage', *Food Security*, 4(2), pp. 267–277. Available at: https://doi.org/10.1007/s12571-012-0182-3.

Thompson, B. (2004) *Exploratory and confirmatory factor analysis: Understanding concepts and applications.* Washington, DC: American Psychological Association.

Thompson, F.E., Subar, A.F., Smith, A.F., Midthune, D., Radimer, K.L., Kahle, L.L. and Kipnis, V., (2017)'Fruit and vegetable assessment: Performance of 2 new short instruments and a food frequency questionnaire'. Journal of the American Dietetic Association. Available at: 107(10), 1557-1568.

Uebersax, M.A. and Siddiq, M. (2012) 'Postharvest Storage Quality, Packaging and Distribution of Dry Beans', in M. Siddiq and M.A. Uebersax (eds) *Dry Beans and Pulses Production, Processing and Nutrition*. 1st edn. Wiley, pp. 75–100. Available at: https://doi.org/10.1002/9781118448298.ch4.

Vadez, V., Rao, S., Kholova, J., Krishnamurthy, L., Kashiwagi, J., Ratnakumar, P., Sharma, K.K., Bhatnagar-Mathur, P. and Basu, P.S., (2008) 'Root research for drought tolerance in legumes: Quo vadis?', *Journal of Food Legumes*, 21(2), pp. 77-85.

Valero, A., Carrasco, E. and García-Gimeno, R. (2012) *Principles and Methodologies for the Determination of Shelf-Life in Foods*. INTECH Open Access Publisher.

Wagner, H.M. (2011) 'The Bottom Line: Corporate Performance and Gender Diversity in the C-Suite (2004-2008)', *SSRN Electronic Journal* [Preprint]. Available at: https://doi.org/10.2139/ssrn.1980371.

wooldridge, jeffrey (2004)*) - Introductory Econometrics*. 2nd edn. Wooldridge.

Woolley, A.W. *et al.* (2010) 'Evidence for a Collective Intelligence Factor in the Performance of Human Groups', *Science*, 330(6004), pp. 686–688. Available at: https://doi.org/10.1126/science.1193147.

World Bank (2007) *Guidelines for Conducting a Rapid Market Assessment*. World Bank.

World Health Organization (2017) *Rapid Market Assessment for Health Products: Guidance for Rapid Sourcing and Supply of Health Products*. WHO.

Wu, H. and Mweemba, L. (2010) 'Environmental self-efficacy, attitude and behavior among small scale farmers in Zambia', *Environment, Development and Sustainability*, 12(5), pp. 727–744. Available at: https://doi.org/10.1007/s10668-009-9221-4.

Zambia Statistics Agency (2022) *Census of population and housing-preliminary*.

ZamStats (2022) '2022-Census-of-Population-and-Housing-Preliminary'. Zambia Statistics Agency (ZamStats).

Zulu, M. (2019) 'Consumer preferences for common dry beans in Lusaka, Zambia (Doctoral dissertation, The University of Zambia).'

APPENDICES

Appendix 1:

CHECKLIST: LEGUME BASED PROCESSED PRODUCT—ON-SPOT CONSUMERS

A. IDENTIFYING VARIABLES **Respondent** ID

……

A1. Date of interaction (dd/mm/yyyy)

A2. Start time (hrs: mins) ….. : …

Geographical areas of residence:

A3. Region ……District of operation [add codes]

A13. …… [Add codes]

A6. City or Village …… [Add codes]

A7. Recorder's name [names will be added coded]

A9. Name of the respondent (consumer) …….

A10. Mobile number of the respondent: -

A11. Sex of the respondent [1] Male [2] Female

A12. Age of the respondent …… [Add codes]

Module B: PRODUCTION CONSUMPTION

B1. How often in a month do you purchase legume based processed products?

1 = never; 2 = 1-2 times (rarely); 3 = 3-4 times (weekly basis); 4 = daily

B2. What type of legume based processed products do you purchase, please list all

B3. Which legume based processed products do you purchase the most frequently?

MODULE C: CONSUMER PREFERENCE FOR LEGUME PROCESSED PRODUCT QUALITY ATTRIBUTES (Enumerator please read: I will now ask you questions about the [legume name] that you purchased the most frequently.

C1. What is the main legume used in the production of [product]? 1=bean, 2=cowpea, 3=groundnut, 4=soya bean

C2. What are other crops added in the production of [product]? 1=bean, 2=cowpea, 3=groundnut, 4=soya bean

C3. What is the package size of [legume name] based processed product mostly purchased?

C4. How much, on average, do you pay for [product] per specified package in C3 above?

C5. How long have you been buying [product]**?**

C6: What do you like about [product]? [Allow multiple choice]

C7. How would you describe the product in terms of its attributes? (Enumerator: record exact words the respondent says to describe the product)

C8: What changes, if any, would you recommend to improve [Product]? [Must provide at most three potential changes.]

C9a. If such an improved product was supplied on the market, what would change in your current product consumption practices?

C9b. Explain why [Please help us to understand your answer [please write as much as possible]

Codes for C2 & C3:

1.Tasty; 2.good aroma; 3.Easy to prepare; 4.Quick to cook; 5.Well packaged; 6.Longer shelf life; 7.Filling; 8.Does not require sugar; 9.Requires little amount to make a meal; 10.Clean free of grit; 11.Smooth Texture when cooked; 12.Colour when cooked; 14.Diversified in terms of food groups; 15.Nutritious; 17 Portion (size) of packaging; 18 OTHERS (SPECIFY)

D1: Can you please tell us who in your household consume legume based processed product?

Codes: *1= Children between 6-23 months; 2= children 2-5 years; 3= children and teenagers 6-14 years; 4=women of reproductive age (15-49 years); 5=Boys 15-19; 6=adult women (50-*

64 years); 7=Adult men (20-64 years); 8= elderly (above 65 years); 9=All household members combined;

D2: what challenges if any do you face in accessing these products?

Appendix 2

CHECKLIST: LEGUME BASED PROCESSED PRODUCT—DISTRIBUTORS

A. IDENTIFYING VARIABLES Distributor ID ……

A1. Date of interaction (dd/mm/yyyy) | | | | | | | | |

A2. Start time (hrs: mins) ….. : …

Geographical areas of location:

A3. Region ……District of operation [add codes]

A13. Sub-County …… [add codes]

A6. City Center /Village …… [add codes]

A7. Recorder's name [names will be added as codes]

A8. Team leader's name [name will be added as codes]

A9. Type of the distributor [large scale wholesaler, small scale wholesaler or retailer]

A10. Name of respondent ……

A10. Mobile number of the respondent: -

A11. Sex of respondent [1] Male [2] Female

A12. Designated role of the respondent in the legume bean-based processed product business ……

Module B: Business history and current practices

B1: In which year did this business start selling legume based processed product?

B2: How many legume based processed product in total does your business deal with?

B3: What are the main suppliers for the legume based products sold in your business? Please list all suppliers starting with the most important one.

B4: What are your distribution channels? [Wholesale/Retail] Please list all distribution channels starting with the most important one.

B5: How many full-time employees does the company have now?

B6: How many temporary employees does the company have now?

B7: How many temporary employees does the company have during peak periods?

B8. What is the annual volume of each of legume based processed product (mentioned in Bi.1) are sold by your company?

Module C: Current legume-based processed product

C1: Please list the different legume based processed products that your company handled starting with the most important one in terms of volume.1=bean based processed, 2= cowpea based processed, 3=g/nut based processed, 4=soybean-based (allow multiple questions)

C2.For each legume based product distributed by this company, make observations and take notes on the following: [Guideline: It is useful to interact with actor on product descriptors to ascertain the information as well as use it as an entry point to dig deeper into other attributes that consumers like or dislike and reasons for their preferences].

From whom does your company purchase this product?

What is the dominant package size (kg)……

Selling price for dominant package size…….

Is label of all ingredients included?

Nutritional information

Manufacturing and expiry dates

Name of manufacturer

Safety precautions?

Who are the main buyers for this product?

Where are the buyers located?

Ask and record product attributes that are liked by customers of [product name]

What are the challenges, if any, your company faces when distributing this product (e.g., lack of volume, lack of information on consumer preferences etc.)? (Enumerators: Please discuss with the respondent).

What are the product attributes that your customers wish to have improvement [help us understand your answer]

What one change would you recommend to improve this product? [Must provide a restricted number of potential changes.]

If such a product was supplied on the market, what would change in your business?

Please help us to understand your answer [please write as much as possible]

Module D: Type of consumers that buy the products

D1. Do you sell to buyers who purchase for own consumption? If yes ask D2, If no, stop the interview

D2. Ask the type of the main consumers of the [product] [record exactly what the respondent says]

D3: Examine sale packages sizes, and ask the type of consumers that prefer which package size and why? (This will help us understand more about the type of consumers]

D3: ask the main target consumers of the product within a household

D4: What motivates consumer buying decision? [Price, Size, Packaging, label]

D4: Make observation and describe the site with respect to:

D4.1: the type of road network, physical organization and surrounding community activities

D4.2: flow of people and traffic,

D4.3 shopper demographics, their interactions and conversations

Appendix 3

CHECKLIST: LEGUME BASED PROCESSED PRODUCT—IMPORTERS

A. IDENTIFYING VARIABLES

Processor ID ……

A1. Date of interaction (dd/mm/yyyy) | | | | | | | | |

A2. Start time (hrs: mins) ….. : …

Geographical areas of location:

A3. Region ……District of operation [add codes]

A13. Sub-County…… [Add codes]

A6. Urban Center or Village …… [Add codes]

A7. Recorder's name [names will be added as codes]

A8. Team leader's name [names will be added as codes]

A9. Name of the processor's Company name [provided with codes]

A10. Name of person (respondent) ……..……

A10. Mobile number of the respondent: -

A11. Sex of respondent [1] Male [2] Female

A12. Designated role of the respondent in the processing company

Module B: Company (importing/business) history

B1: In which year did this company begin importing the legume based processed product (s)?

B2: How many full-time employees does the company have now?

B3: How many temporary employees does the company have now?

B4: How many temporary employees does the company have during peak periods?

B5: What was the volume of legume based processed product imported in 2021?

Module C: attributes of current legume-based processed product

C1. List all the different legume processed products imported by this company,

C2**. For each product**, record (Guideline; if any of the information is missing, record n/a):

a. The list of legumes used in the imported product (in a decreasing order starting with the main legume 1 =bean, 2= cowpea, 3=g/nut, 4=Soya beans (allow multiple questions)
b. Price
c. Color,
d. Label all ingredients
e. Nutritional Composition
f. Name of manufacturer
g. Date of manufacturing and expiry
h. Size of package
i. Source of origin (i.e. where it is made)
j. Monthly sales for the product in terms of volume
k. Monthly sales for the product in terms of value.
l. Annual sales for the product in terms of volume
m. Annual sales for the product in terms of value.
n. What are the product properties liked by consumers and reasons for preferences? This is to help us understand your answer [please write as much as possible]
o. What are the future improvement plans do you have for this product, if any?
p. What are the challenges, if any, your company faces when importing this product (e.g., inconsistent quality, lack of volume, price fluctuations, etc.)? Please discuss.
q. Record size of stock of product currently in the facility

Module D: product marketing

D1. Who are the main buyers of the [product] your company imports. Please list all the buyers, starting with the most important one.

D2. **For each buyer**, ask

What is the share of imported products that is sold this buyer?

Where is this buyer located?

D3. Please help us understand the geographical areas of concentration for the utilization of your products. [add district].

D4: Ask for records to identify names and location of small-scale wholesalers and retailers for next sampling [verify with the importer to fill any gaps]

D: Make observations on the facility

D: size of stock for each imported product [record].

D5: Are there competitors in this sector? [Yes/No]

D6: If yes to D5, who are the main competitors?

D97: What problems is this sector experiencing?

Appendix 4

CHECKLIST: LEGUME BASED PROCESSED PRODUCT—PROCESSORS

A. IDENTIFYING VARIABLES

Processor/importer ID ……

A1. Date of interaction (dd/mm/yyyy) | | | | | | | | |

A2. Start time (hrs: mins) ….. : …

Geographical areas of location:

A3. Region ……District of operation [add codes]

A13. Sub-County…… [Add codes]

A6. Urban Center or Village …… [Add codes]

A7. Recorder's name [names will be added as codes]

A8. Team leader's name [names will be added as codes]

A9. Name of the processor's/importer Company name [provided with codes]

A10. Name of person (respondent) ……..……

A10. Mobile number of the respondent: -

A11. Sex of respondent [1] Male [2] Female

A12. Designated role of the respondent in the processing company

Module B: Company (processing/business) history

B1: In which year did this company begin producing the legume based processed products?

B2: How many full-time employees does the company have now?

B3. What is your peak period? (code using quarters)

B3: How many temporary employees does the company have now?

B4: How many temporary employees does the company involve during peak periods?

B5: What is the annual production/stock volume?

B6. What are the raw materials are used in the production of [product]

B7. For [product], where do raw materials come from [1. Locally in this country, 2. Imported]

B8. Are there any other raw materials used?

Module C: attributes of current legume-based processed product

C1. List all the different legume processed products produced by this company/processor.
In which year did the company start producing this product?

C2**. For each product**, record:

a. The list of legumes used in the production of [product] starting with the main legume 1=bean, 2= cowpea, 3=g/nut, 4=Soya beans (allow multiple questions)
b. Other foods the company includes in the [product]?
c. Price
d. Color,
e. Label on ingredients,
f. Preparation direction
g. Date of manufacturing and expiry
h. Size of package
i. Nutritional Composition
j. Monthly sales for the product in terms of volume.
k. Monthly sales for the product in terms of value
l. Annual sales for the product in terms of volume.
m. Annual sales for the product in terms of value
n. What are the product properties liked by consumers and reasons for preferences? This is to help us understand your answer [please write as much as possible]
o. What are the challenges, if any, your business faces with the processing of this legume-based processed product? (for example, uncertain supply of inputs, lack of information on consumer preferences, etc.) Please discuss
p. What are the future improvement plans do you have for this product, if any?

Module D: product marketing

D1. Who are the main buyers of the legume based processed products produced [add codes]
Where are those buyers located?

D2. Please help us understand the geographical areas of concentration for the utilization of your products [add district codes].

D3: Ask for records to identify names and location of small-scale wholesalers and retailers for next sampling [verify with the processor to fill any gaps]

D4: Make observations on the processing facility

D5size of stock for each product record].

D5: Are there competitors in this sector? [Yes/No]

D6: If yes to D5, who are the main competitors?

D7: What problems is this sector experiencing?

Appendix 5

HOUSEHOLD SURVEY QUESTIONNAIRE

Name of enumerator (to be coded)

Province (automatically Lusaka)

City/town: (to be coded; 1=Lusaka, 2=Chongwe, 3=Kafue)

Constituency (to be coded)

Ward (to be coded)

Enumerator area (to be coded)

Interview date: (automatic entry)

Interview location: (1=Home, 2=Work, 3= church, 4=other (specify)

INTRODUCTION BY ENUMERATOR:

The purpose of this survey is to collect data to help us develop better understanding of how people make food choices, and the role beans/ bean-based processed products play in their food options. I would also like to know what factors influence consumption decisions of bean-based processed products. Your responses will help inform researchers on how plant breeders and the upstream production chain should make decisions to enhance the nutrition status of consumers. All your answers are confidential and will only be used in ways that do not allow any trace back to you, ensuring your anonymity.

Your selection to participate in this survey was purely random and you are under no obligation to participate. However, your participation will be extremely helpful for the research objective. There is no penalty for your refusal to participate.

- Do you consent to participate in this survey: (yes/no)

If the respondent agrees to participant in the survey, proceed to Module A, with the following introduction.
E.2 You have consented to participate in this survey. Before we start with the survey, do you have any questions or is there anything, which I have said that you would like further clarification? (provide entry for the question)
{Wait for respondent response. Answer any questions respondent may have. Upon satisfying the respondent, continue with interview}

E.3 May I proceed with interviewing you and/or your spouse (if available and willing)?

MODULE A (HOUSEHOLD ROASTER)

A0: Are you the person in charge of making decisions on food purchasing? (1= Yes 0= No)

If not, may I please talk to the person in charge of food purchases.

A1a What is your Name?

A1b what is the age of the respondent?

A2. What is the Gender of the respondent?

A3. Phone number of the respondent

A4. Are you the household head (or spouse)? (1= household head, 2= spouse 3= No

A4a. If not, may I ask for permission from the household head (or spouse to interview you?

A4b. Phone number of household head (or spouse)

A4c. What is the Gender of the Household head? (if not the respondent)

A4d. What is the Age of the household head?

If permission is given, proceed with the interview. Otherwise, thank the respondent and end the interview

A5 How many people, including yourself, live permanently in this household?

A6. For all household members under 18 years, please indicate the number in each of the following age categories.

1=Under 5 Years…… 2= 5-12 Years……. 3= 13-17 Years…… 4= 18- 44…. 5= 45 and above

A7. Which of the following best describes the marital status of the household head?

1=Single/Never Married…….2=Married 3=Cohabiting……4=Divorced 5=Separated……..6=Widowed

A8. What is the highest level of education current or completed by the household head?

1=None……2=Primary……. 3=Secondary……4=. College/University

A9. Please select the employment type that best describes the household head.

1=Salaried (Full-time) …2=.Salaried (Part-time)…..3=Self-employed (Full-time)…..4=Self-employed (Part-time)….5=Unemployed

A10. If you indicated being married/cohabiting, could you please indicate which of the following best describes the spouse's situation?

1=Salaried (Full-time) ….2=Salaried (Part-time) ….3=Self-employed (Full-time)….4=Self-employed (Part-time)….5=Unemployed

Module B: Knowledge of Bean-based processed products

(Enumerator: Start by asking

B0: Are you aware of any beans-based processed products 1=yes, 0= No

If yes Which ones, are you aware of? Specify

if no, skip to D8 and D9

B1. Enumerator: Now ask the questions in the table below to ***understand whether the household has been exposed to the legume based processed products (allow multiple response)***

List of the bean-based processed products: codes below 1. *Bean flour* 2. *Pre-cooked dehydrated* 3. *Pre-cooked hydrated* 4. *Pre-cooked frozen*	B1a. Have you heard about the following products/flour? *1=Yes, 0= No* *If no skip to D8*	*B1b. If Yes to B1a mention the source of information (for each product)* *Code A:*	*B1c. If Yes to B1a have you ever seen these products 1=Yes, 0= No*	*B15d. If **NO** to B1c What could be the reason for not seeing these products Code B*	B1e If yes to B1c. Where did you first see them? Code C	*B1f. If Yes to **B1c.** Have you ever **TASTED the product[name]*** *1=Yes, 0= No*	B5g. If you have tasted the product, what do you think/ feel about it Code D.
5. *Baked Beans*							
Bean flour							
Pre-cooked dehydrated beans							
Pre-cooked hydrated beans							
Pre-cooked frozen beans							
baked beans							

Code A: 1=Friend 2=Family member 3=Village health team 4=Trader 5=processor (specify)6=Health center 7=door to door activation 8=Church activation 9=Market activation 10=Posters 11=Television 12= Radio 13=Newspapers 14=Internet, 777=Others (specify) Allow multiple response.

Code B: 1=They are not readily available 2=They are sold to a specific group of people 3=I have not just been interested in them 777=Other specify.

C*ode C: 1=Mom and Pop shop 2= Health Center 3= Supermarket 4= VHT 5=Promotion campaigns 6= friend 7= Neighbors home 8= Church 777= other specify*

Code D: *1=It is tasty 2=It is filling 3=its nutritious 4=It gives energy 5=It increases weight gain 6= I don't like the smell 7= it has too much gasses 777=other (specify)*

If no skip to D8

B5h . Has the household ever purchased any of the bean-based processed products for consumption? YES/NO

1) If yes, ask which ones were purchased and consumed at home (allow multiple response)?*Bean flour; 2) Pre-cooked dehydrated; 3) Pre-cooked hydrated and 4) Pre-cooked frozen 5= canned/baked beans 6= other (specify)*
2) if No (Skip C3) do you consume any of these products? 1=*Bean flour; 2) Pre-cooked dehydrated; 3) Pre-cooked hydrated and 4) Pre-cooked frozen 5= canned/baked beans 6= other (specify)*

B2. I would like to know your Knowledge about the benefits and motivation for consumption of bean based processed products (*only bring products that they are aware of)*

Bean-based product	B2a. Are you aware about the benefits of consuming the products 1= yes, 0= no	B2b. If yes, what are the benefits of consuming product [name] when you compare it to un-processed beans grains) **Code F**
Bean flour		
pre- cooked dehydrated beans		
Pre-cooked hydrated beans		
Pre-cooked frozen beans		
Baked beans		

Code F: 1=They are nutritious 2=They are healthy 3=They cook fast 4=They are filling 5=do not know, 6= they have an increased shelf life 7= more tasty 8= Clean free of grit *777=Other specify*

B3. CONSUMERS EXPERIENCE ON THE PRODUCT ATTRIBUTES (only bring products they have consumed)

B3.1. For products you have consumed, I would like to know how you evaluate them based on your experience.

Select one product to assess at a time☮1= *Bean flour 2= Pre-cooked dehydrated 3= Pre-cooked hydrated 4= pre-cooked frozen 5 = Baked beans*		
Attribute	**It's importance on a scale of 1 to 5** *(1=not at all 2= less important 3= 50-50 4=important 5= very important) (this question should be asked simultaneously with the attribute question)*	**Rate the attribute on a scale of 1 to 5**: *(1=Very poor; 2=Poor 3=Fair 4=Good 5=Very good)*
Product [name] it should be for each products		
B3.1a	**B3.1b**	**B3.1c**
1.Taste		
2.Aroma		
3.Easy to prepare		
4.Quick to cook		
5.Well packaged		
6.Longer shelf life		

7.Filling		
8.Does not require sugar		
9.Requires little amount to make a meal		
10.Clean free of grit		
11.Smooth Texture when cooked		
12.Color when cooked		
1 has thick gravy		
14.Diversified in terms of food groups		
15.Nutritious		
16.Affordable		
17 Portion (size) of packaging		

MODULE C: CONSUMPTION AND PURCHASE OF BEAN-BASED PROCESSED PRODUCTS

For the rest of our conversation, I am going to focus on your household's consumption of beans and bean-based processed products.

C2. How frequently does your household consume each of the following bean-based processed products? (Response codes below)		
	Variety/Product	**Frequency Code**
C1.1	Bean flour	
C1.2	Baked beans / canned beans	
C1.3	Pre-cooked dehydrated beans	
C1.4	Pre-cooked Frozen beans	
C1.5	Pre-cooked hydrated beans	
C1.6	Other processed bean products (Specify below)	

Frequency	Never	Less than once per month	Once per month	Once every two weeks	Once or more per week
Code	0	1	2	3	4

TIP: If the frequency of the variety or product is NEVER (i.e., frequency=0), then you may skip food product option in the subsequent tables (Program restriction so that the skipping is automatic)

C3. Over the past 30 days, please estimate your expenditure on bean products purchased or consumed in your household. (in local currency)		
Variety	**Product**	Expenditure
C2.1	Bean Flour	
C2.2	Baked / canned beans	
C2.3	Pre-cooked dehydrated beans	
C2.4	Pre-cooked hydrated Beans	
C2.5	Pre-cooked frozen beans	
C2.5	Other processed bean products	

C1. For each bean based processed product, Please indicate your source of product. Select the source used most often for each product.							
Product/Variety		**Prepared at home**	**Gift**	**Donations from Church, NGOs, Gov't**	**Open Market**	**Supermarket**	**Other specify**
C3.1	Bean flour						
C3.2	Baked/ Canned Beans						
C3.3	Pre-cooked dehydrated beans						
C3.4	Pre-cooked Hydrated Beans						

C3.5	Pre-cooked frozen Beans						
C3.6	Other processed beans-based processed (Specify)						

C4. Please indicate the typical utilization of the different types of beans and bean products in your household meals Select all that apply.

Product/Variety		**Main Dish**	**Side Dish**	**Complement to Main dish (soup/stew)**	Ingredient	Snack	Other specify
C4.1	Bean flour						
C4.2	Baked/ Canned Beans						
C4.3	Pre-cooked dehydrated beans						
C4.4	Pre-cooked hydrated Beans						
C4.5	Pre-cooked frozen Beans						
C4.6	Other processed beans (Specify)						

(Enumerator" tell the respondent that you would like to get properties of the products that influence his/her purchasing and/consumption decisions.

C6. Please indicate which of the following factors influence your decision to purchase any of the bean products you consume. Select all that apply.										
Product	Variety	Cooking time	Gravy Quality	color	Moisture Content	taste	Package Size	Price of product	other (specify)	non
C5.1	Bean flour									
C5.2	Baked/canned beans									
C5.3	Pre-cooked dehydrated beans									

C5.4	Pre-cooked hydrated beans									
C5.5	Pre-cooked frozen beans									
C5.6	Other processed beans-based processed products									

C5. Please indicate which of the following food groups you would pair with beans and bean products in your household (allow multiple response.

Food Group		**Yes**	**No**
C6.1	Cereal (maize, rice, millet, sorghum, etc.)		
C6.2	Cereal products (bread, etc.)		
C6.3	Roots and Tubers (cassava, sweet potato,		
C6.4	Irish potato, yams, etc.)		
C6.5	Groundnuts		
C6.6	Meat (beef, chicken, pork, etc.)		
C6.7	Fish (fresh, dry, tinned, etc.)		
C6.8	Wheat Flour		

Module D: History about product consumption:

The questions below should be asked to those people that have consumed the bean based processed products and are intended to understand the adoption dynamics.

product type	**D.1**. In which month and year did the household start consuming: Month 0= can't remember	**D.2.** Where did you access the first product consumed? **Code H**	**D.3.** What was the quantity accessed for the first time? 1= Quantity (Kgs, grams,	**D.4.** What was the unit of measurement? 1= grams *2=kg,* *3=Meda* *4=BP*	**D.5.** Means of acquiring the first product consumed *(0=Given for free; 1=Bought* *2= prepared it at home)*	**D6.** If purchased how much did you buy it in ZMW**.**

	1= month __Year __ (*4 digits*)		meda, tin, etc.) 0= can't remember	*5= gallon* *6= cup* *7=tin*	*If not bought, skip D6*		
						Amount	*Unit*
beanflour							
Pre-cooked dehydrated beans							
Pre-cooked hydrated beans							
Pre-cooked frozen beans							

Code H: 1= *From a supermarket 2=From a local market/ shop3=From sample provided by processor during market shows 4= From hospital 5= From sample provided by marketing agent 6= Can't remember 777=Other specify*

D.7. I would like to find out the Group of people within the household that consume the product

Flour	D7a. What groups of people (in your household) consumed this product for the first time? ***Code I***	D7b. What was their reaction after consuming this product? **Code J**
Bean flour		
Pre-cooked dehydrated beans		
Pre-cooked hydrated beans		
Pre-cooked frozen beans		

Code I*: 1=Children 0-23 months; 2=Children 2-5yrs; 3=Women of reproductive age 15-49 yrs.; 4=elderly; 5=only adults; 6=mixed ages of children; 7 = Everybody, 777=other category (specify*

Code J: *1=They requested for more servings 2= They suggested that the product be substituted for dry beans (wheat flour for the bean flour) 3=They suggested that the new product be substituted for other products 777= Other specify*

D7c Since your household started consuming bean based products, what would you say have been advantages/disadvantages compared to if you were consuming dry unprocessed beans?(only pick the products that they consume and A respondent should be allowed multiple response.)

Advantages	*Select*	*Disadvantages*	*Select*
1= reduced electricity bills		*1= it is too expensive*	
2= reduced time required in preparation		*2= packages are too small*	
3= increased consumption volumes		*3= it has an expiry date hence can't buy in bulk*	
4= tastes better		*4= it bulges when kept for some time on the shelf*	
5= makes better baked goods in terms of texture		*5= has additives/chemicals which may not be healthy*	
6= flour is lighter		*6= not available in nearby shops*	
7= requires less spices because it has a good taste		*7= only found in big supermarkets which are far from homesteads*	
8= does not require sorting before cooking		*8= they are not suitable for our diet*	
9= it is always available in supermarkets *10. None*		*9= takes too much storage space (Fridge/etc.)* *10. None*	

Skip to Module E for those who consume beans-based processed products

Enumerator: Question D8 & D9 are follow up questions for households that do not consume bean based processed products. The following few questions are for those who do not currently consume any beans-based processed products in their households **D8. Why don't you eat beans-based processed products? (Select all that apply).**	**Check**

Reason	
D1011 It is an inferior food product in my community (e.g., only poor people eat beans)	
D1022 Health reasons (allergies, stomach aches)	
D1033 Religion, faith or cultural taboo	
D1044 Price (too expensive)	
D1055 Risk of social embarrassment (flatulence factor)	
D1066 Preparation inconvenience (Takes too long to prepare)	
D1077 Someone (spouse, child, self, etc.) in my household doesn‘t like beans products so we all avoid them	
D1088 Never been a part of my household ‘s meal options and never considered it	
D1099 Don‘t know how to prepare it	
D1010 Don‘t believe beans products are healthy for me and/or my family	
D1211 The products are rarely available on the market	
D1212 The market where the products are found is far	
Other (Specify):	

D9. How would you respond to the following statements about persuading you to eat beans - based processed products?

Would you buy beans-based processed products if:

Change Event

D241 you found out that people you respect (athletes, celebrities, etc.) love eating bean=based processed products

D242 you found out that they are highly nutritious

D243 you found out that beans-based processed products are extremely rich in protein

D244 you understood that they were a much more economical source of protein than animal source

D245 bean-based processed products had faster cooking time than unprocessed beans

D246 you found out that they have very good health benefits (e.g., reduce cholesterol, inflammation, blood pressure, etc.)

D247 eating beans-based processed products reduced your risk of getting cancer

D248 eating beans-based processed products enhanced your social status

D249 there was no social embarrassment risk associated with eating beans-based processed products

D2410 you found out that consuming beans-based processed products improved your ability to absorb iron, vital for health of reproductive-age women

D2411 Improved options in how bean-based processed products may be included in the diet

D2412 your income increased

D2413 your learnt how to prepare it

don't know (1) **Never (2)** **Probably (3)** **Definitely (4)**

MODULE E: CONSUMER PERCEPTIONS AND ATTITUDES TOWARDS BEANS-BASED PROCESSED PRODUCTS

Instructions: The subsequent statements describe your attitudes towards bean-based processed products *variety—(Specify* ***(Please indicate your agreeableness on a five-point scale where:*** *1 = representing strongly disagree and 5 representing strongly agree. Please tick the appropriate box*

E1.Please indicate your agreeableness about the following statements

		Level of agreeableness ***Scale :*** *1= Strongly disagree2=Disagree3= Neutral 4= Agree5= Strongly Agree*			
Statement	*Bean flour*	*Pre-cooked dehydrated beans*	*Pre-cooked hydrated beans*	*Pre-cooked frozen beans*	*Baked / Canned Beans*

1. *I would have loved to purchase but I do not have money to purchase it*					
2. *I'm willing to buy … because its benefits outweigh the cost*					
3. *When I take …. I have only one to TWO meals in a day instead of three*					
4. *…. are nutritious foods*					
5. *People who consume …. are good looking.*					
6. *I am ready to buy ….. for complementary feeding for my baby*					
7. *I believe that …. can make my weaned child to look healthy and happy*					
8. *……. is well packaged products*					
9. *I will be willing to substitute other Products with …… if it becomes available to me?*					
10. *…… are foods for the children and lactating mothers*					
11. *…….can improve on the health status of formerly emaciated people*					
12. *I trust that……. is safe foods (i.e. do not result into diseases like diarrhea when taken)*					

MODULE F: ACCESS TO INFRASTRUCTURE

Enumerator: Distance should be recorded in meters (km)

1. What is the distance to the nearest **supermarket (self-service store)**? _____?
2. What is the distance to the nearest output **local market** _____?
3. What is the distance to the nearest **mom and pop shop** _____?
4. What is the distance to the nearest **kiosk** _____?
5. What is the distance to the nearest **health center** _____?
6. What is the distance to the nearest primary/secondary **school** _____?
7. What is the distance to the nearest commercial **bank** _____?
8. What is the distance to the nearest **mobile money agent** _____?

MODULE G: Household well-being and dwelling

G1. How well-off do you consider **your household** in comparison to other **residents of this estate/neighborhood**?

(1=much better off, 2=better off, 3=same, 4=worse off, 5=much worse off) 6= Prefer not to say

G2. How much does your household income fluctuate from one month to the other?

(*1=not at all, 2=a bit, 3=a lot,*) (*if 1, skip to G5*)

G3. How much does the income fluctuation have a **negative** effect on your **household well-being**?

(1=High, 2=Medium, 3=Low, 4=No impact 5= Prefer not to say)

G4. How much does the income fluctuation have a **negative** effect on **food consumption** of your household?

(1=High, 2=Medium, 3=Low, 4=No impact 5= Prefer not to say)

G5. Which of the following best describes your housing situation?

1=Own my house/flat…2=Rent House/Flat….3=Living with someone (relative/friend)…4=Others (Please Specify)

G6. Roof top material (outer covering):

1=Tile, 2= Corrugated iron sheet, 3=Concrete; 4= Plastic sheeting, 5=Grass thatched, 777=other, specify

G7. The main Floor material:

***2**=Concrete/cement, **3**=Tile/brick, 4=wood, 6=Arranged stones, **1**=Earth/mud/Cow dung, 777=other, specify*

G8. How many habitable rooms are there in this dwelling/residential house? (Do not count bathrooms, hallways, garage, toilet, cellar, and kitchen)

G9. What is the **main type** of toilet that your household mostly **uses**? *1=Flush toilet, 2= Ventilated improved pit latrine (VIP); 3=Traditional Pit latrine 4=Bush /field, 5=Pour flush; 6=ECOSAN toilet 777=other, specify*

G10. Which of these kitchen appliances do you have in your kitchen or have access to in your house? (Check all that apply)

1=Electric stove…2=Gas stove…3=Charcoal brazier…4=Pressure cooker….5=Microwave…6=Refrigerator….

G11. What is the **main source** of cooking fuel for your household?

1=Electricity 2=Gas (gas) 3=Kerosene 4=Charcoal 5=Firewood 6=Agricultural crop residue 7=Biogas 8=Solar power 777=other, specify

G13. Does the household own a functional Television? *0=No 1=Yes*

G14. Do you have easy access to clean water and electricity? (1=yes 0= No

G15. Does any member of your household own a radio? *0=No 1=Yes*

G16.Is there anyone in your household who owns a mobile phone? 0=No. 1=Yes? _____

G17. All things considered, how satisfied are you with your life as a whole these days?

1=Very Dissatisfied…2=Dissatisfied….3=.Satisfied….4=Very Satisfied

(Guidelines for enumerator: We are now going to focus on your food consumption decisions in the next section of this conversation. We will begin from the general and work to the particular choices and decisions you make with respect to beans and bean products

H. MODULE H. FOOD CONSUMPTION DECISIONS

H1. Which of the following people typically influence food-purchasing decisions in your household? (Select all that apply)

1=Self….2=.Spouse…..3=Parent or Other Relatives…4=Children…..5=House Help…..6=Friends……7=Other (Please Specify)

H2. In the past 7 days, indicate which of the following people have contributed to food preparation in your household. (Select all that apply)

1=Self…..2=Spouse…..3=Parent or Other Relative….4=Children….5=House Help…..6=Friends…..7=Other (Please specify)

H3. How frequently do you or any member eat major meals (breakfast, lunch or dinner) at home?

- D31 Breakfast (1=Never,2= Seldom (A few times/year), 3=Often (Once or twice/month), 4=Frequent (Once or more/week),5=Daily
- D32 Lunch…(1=Never, 2=Seldom (A few times/year), 3=Often (Once or twice/month), 4=Frequent (Once or more/week),5=Daily
- D33 Dinner …(1=Never, 2=Seldom (A few times/year),3= Often (Once or twice/month), 4=Frequent (Once or more/week), 5=Daily

H4. Please select a diet in which the household most commonly follow (select all that apply):

1. Omnivore (I eat everything)
2. Vegetarian (I don't eat meat)
3. Vegan (I don't eat meat, dairy, or eggs)
4. Pescatarian (I don't eat meat but I eat fish)
5. Celiac (gluten free)
6. Diabetic
7. Gluten-sensitive
8. Other specialized diet (specify)
9. Prefer not to say (9)

H5. How much does your household spend on all food purchases in a typical month? (ZMK)

1= below 500

2= 501-1000

3= 1001-2000

4= 2001-3000

5= 3001-4000

6=4001-5000

7= Above 5001

H6. What proportion of your total monthly household income is spent on all food expenditure? (PERCENTAGE)

1= less than 20%

2= 21 to 40%

3= 41-60%

4=61-80%

5=81-99

6= 100

H7. How much do you spend on food purchases?

H8. What proportion of your household food expenditure is spent on food consumed away from home in a typical month? (PERCENTAGE)

1= less than 20%

2= 21 to 40%

3= 41-60%

4=61-80%

5=81-99

6= 100

H9. If you do not purchase all the food consumed in your household in a typical month, please indicate the sources of the food you do not purchase in a typical month.

1=Your own home gardens or farm…..2=Friends and family…..3=NGO, Church or other charitable organization….4=Government…..5= other (specify)

Any questions. Thank you for your participation

End of interview

Record GPS

Appendix 6:
Principle component analysis results

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	4.08477	2.36061	0.1945	0.1945
Comp2	1.72416	.240005	0.0821	0.2766
Comp3	1.48416	.290121	0.0707	0.3473
Comp4	1.19404	.0292073	0.0569	0.4041
Comp5	1.16483	.0656704	0.0555	0.4596
Comp6	1.09916	.0556813	0.0523	0.5120
Comp7	1.04348	.0958401	0.0497	0.5616
Comp8	.947639	.0176658	0.0451	0.6068
Comp9	.929974	.0411968	0.0443	0.6511
Comp10	.888777	.0372897	0.0423	0.6934
Comp11	.851487	.059101	0.0405	0.7339
Comp12	.792386	.063949	0.0377	0.7717
Comp13	.728437	.0584251	0.0347	0.8063
Comp14	.670012	.0873159	0.0319	0.8383
Comp15	.582696	.007697	0.0277	0.8660
Comp16	.574999	.0796386	0.0274	0.8934
Comp17	.49536	.0073951	0.0236	0.9170
Comp18	.487965	.0355304	0.0232	0.9402
Comp19	.452435	.0321403	0.0215	0.9618
Comp20	.420295	.0373587	0.0200	0.9818
Comp21	.382936	.	0.0182	1.0000

Appendix 7
Factor analysis results

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	10.23772	3.07826	0.3075	0.3075
Factor2	7.15946	3.57564	0.2150	0.5225
Factor3	3.58382	0.60028	0.1076	0.6301
Factor4	2.98355	0.69259	0.0896	0.7197
Factor5	2.29095	0.57872	0.0688	0.7885
Factor6	1.71223	0.43624	0.0514	0.8399
Factor7	1.27599	0.19326	0.0383	0.8782
Factor8	1.08273	0.15288	0.0325	0.9107
Factor9	0.92985	0.27332	0.0279	0.9387
Factor10	0.65653	0.05687	0.0197	0.9584
Factor11	0.59966	0.01790	0.0180	0.9764
Factor12	0.58176	0.19389	0.0175	0.9939
Factor13	0.38787	0.06728	0.0116	1.0055
Factor14	0.32059	0.03690	0.0096	1.0151
Factor15	0.28369	0.04088	0.0085	1.0237
Factor16	0.24281	0.03337	0.0073	1.0310
Factor17	0.20944	0.01900	0.0063	1.0372
Factor18	0.19044	0.01215	0.0057	1.0430
Factor19	0.17829	0.03545	0.0054	1.0483
Factor20	0.14285	0.01998	0.0043	1.0526

Factor21	0.12286	0.03315	0.0037	1.0563
Factor22	0.08971	0.02602	0.0027	1.0590
Factor23	0.06370	0.00801	0.0019	1.0609
Factor24	0.05568	0.03697	0.0017	1.0626
Factor25	0.01871	0.01158	0.0006	1.0631
Factor26	0.00713	0.00784	0.0002	1.0634
Factor27	-0.00071	0.01219	-0.0000	1.0633
Factor28	-0.01290	0.01633	-0.0004	1.0629
Factor29	-0.02924	0.01150	-0.0009	1.0621
Factor30	-0.04074	0.00107	-0.0012	1.0608
Factor31	-0.04181	0.00671	-0.0013	1.0596
Factor32	-0.04852	0.00866	-0.0015	1.0581
Factor33	-0.05718	0.00417	-0.0017	1.0564
Factor34	-0.06135	0.01314	-0.0018	1.0546
Factor35	-0.07448	0.01115	-0.0022	1.0523
Factor36	-0.08563	0.00564	-0.0026	1.0498
Factor37	-0.09127	0.00904	-0.0027	1.0470
Factor38	-0.10031	0.00213	-0.0030	1.0440
Factor39	-0.10244	0.00697	-0.0031	1.0409
Factor40	-0.10942	0.01554	-0.0033	1.0376
Factor41	-0.12496	0.00806	-0.0038	1.0339
Factor42	-0.13302	0.00608	-0.0040	1.0299
Factor43	-0.13909	0.00511	-0.0042	1.0257
Factor44	-0.14420	0.00582	-0.0043	1.0214

Factor45	-0.15002	0.00921	-0.0045	1.0169
Factor46	-0.15923	0.03306	-0.0048	1.0121
Factor47	-0.19228	0.01848	-0.0058	1.0063
Factor48	-0.21076	.	-0.0063	1.0000

LR test: independent vs. saturated: chi2(1128)= 1.3e+04 Prob>chi2 = 0.0000