CONSUMER PREFERENCES FOR COMMON DRY BEANS

IN LUSAKA, ZAMBIA

By

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DECLARATION

I, Mabvuto F. Zulu declare that this dissertation:

a) Represents my own work;
b) Has not previously been submitted for a degree at this or any other University; and
c) Does not incorporate any published work or material from another dissertation.

Signed…….

Date…….

APPROVAL

This dissertation of Mabvuto .F. Zulu has been approved as partial fulfillment of the requirements for the award of the degree of Master of Science in Agricultural Economics by the University of Zambia.

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ABSTRACT

Development of improved beans varieties that meet consumer choice has been one of the focus areas of many researchers in the Sub-Saharan Africa. In Zambia, various research institutions such as the University of Zambia (UNZA), Zambia Agriculture Research Institute (ZARI) and private institutions have implemented various projects that aim at producing improved beans varieties/land races. These research efforts have resulted in the release of different beans varieties with varying characteristics in terms of grain size, color, cooking time and gravy quality etc. These characteristics are important and may affect consumer perception and choice for beans. However, despite the important role that these characteristics may have on consumer choice for beans, little information is available about Zambian consumers and choice for beans characteristics. Therefore, the objective of this study was to analyze the effects of common dry bean grain characteristics on consumer choice.

Data for the study was obtained from the Grain Legume Innovation Lab project that implemented a survey in 2015 on 844 respondents in the seven constituencies of Lusaka district. Conditional logistic regression model was used to analyze stated preference data from a discrete choice experiment module of the survey.

The results reveal that color, cooking time and gravy quality are important characteristics which significantly affect consumer choice of common dry beans. For example, it was observed that consumers have a strong and significant preference for purple bean variety followed by a mixed yellow bean type. Compared to fast cooking beans, an individual's utility would reduce if given a slow cooking bean variety. Furthermore, an individual's utility would reduce if given a bean variety with poor gravity quality. Despite having positive signs, the coefficients for grain size were insignificant entailing that bean grain size is not important to a consumer. It is therefore recommended that policies targeting varietal beans improvement efforts in Zambia should categorically state the inclusion and consideration of most preferred beans attributes.

Key Words: Consumer, attributes, preferences, choice experiment, conditional logit

DEDICATION

This dissertation is dedicated to my wife Yvonne Makayi Zulu and my sons Taonga Zulu, Chawana Zulu and Wandile Zulu for their unwavering support and the sacrifices they have made to enable me achieve the very best and to my parents Mr Chrispin Zulu and Zelipa Sakala Zulu for encouragement and support provided throughout my masters studies.

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ACRONYMS

CIAT	International Center for Tropical Agriculture
COO	Country Of Origin
FAO	Food Agriculture Organisation
GRZ	Government Republic of Zambia
SSA	Sub-Saharan Africa
STATA	Statistics and Data
VIF	Variance Inflation Factor
WHO	World Health Organisation
WTA	Willingness To Accept
WTP	Willingness To Pay
UNZA	University of Zambia
ZARI	Zambia Agriculture Research Institute

CHAPTER 1

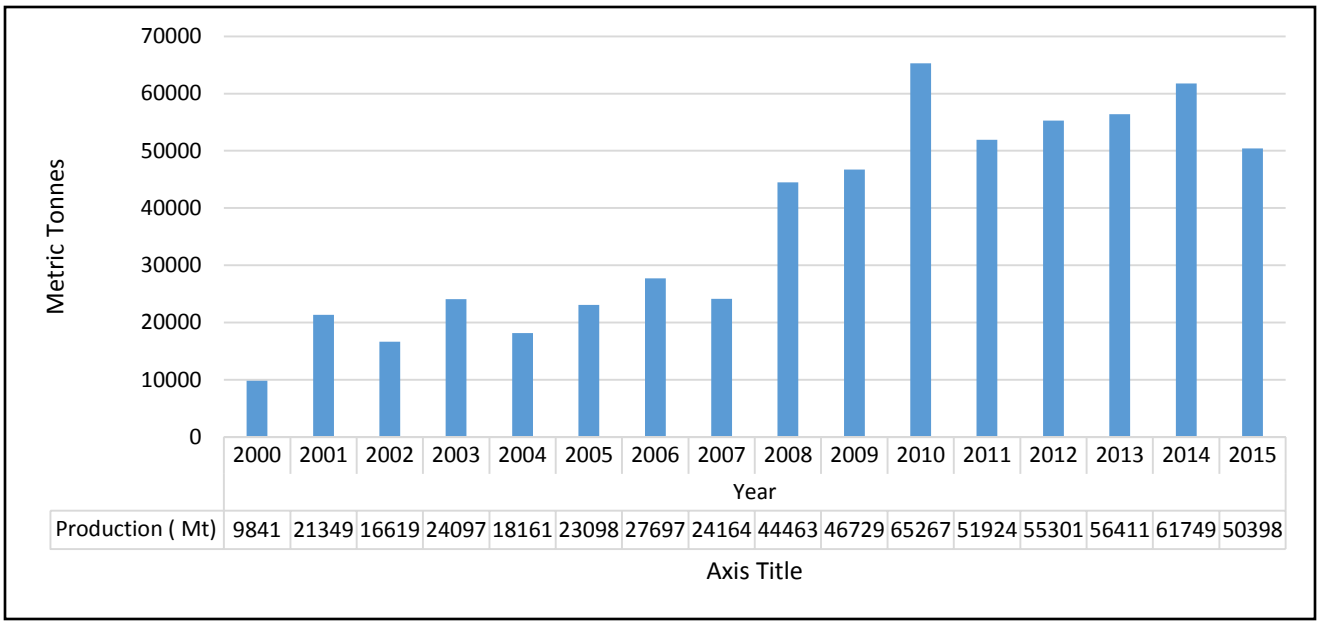
INTRODUCTION

1.1 Background

Common beans (*Phaseolus vulgaris* L.*)* are one of the most important grain legumes in most countries of sub-Saharan Africa (SSA). Grain legumes are widely consumed pulses in most parts of SSA as beans have been found to play an important role in the nutrition of both urban and rural households. Beans are a rich source of protein, carbohydrates, dietary fiber, vitamins, and minerals. Carbohydrates such as maize can thus be used as complements in improving human nutrition (Broughton *et al*., 2003). According to Mishili *et al*., (2009) beans have high concentration of soluble fibers thereby offering health benefits to the consumer. In eastern and southern Africa, beans is recognized as the second most important source of human dietary protein and third most important source of calories (Pachico, 1993). Beans have been regarded as a poor man's meat because they are a cheap source of protein (Leterm *et al*., 2002).

In addition to being nutrition enhancers, beans have been regarded as a good cash crop. Thus, smallholder farmers have an opportunity to add beans to their farm enterprises. According to Birachi (2012), beans are important to smallholder farmers as they are cash earners in addition to being high protein providers. In Tanzania for example, common beans are said to be by far the most important pulse crop both as a source of dietary protein and calories and as a source of farm income (Hillocks *et al.*, 2006).

Currently, Zambia's beans production has been on the lower side. According to the agriculture statistics of Zambia, mixed beans production for the year 2014/15 was estimated to be around 50,398 metric tons representing an 18.38 percentage reduction from the 2013/14 farming seasons (GRZ， 2016). Figure 1 below shows trends in Zambian's bean production from the years 2000 to 2015.



Source: CSO, 2015

Figure 1: Trends Of Beans Production In Zambia

As can be seen in Figure 1, beans production has been fluctuating in the range of 50,000 and 65,000 metric tons between 2010 and 2015 respectively. Despite beans being a crop grown country wide, most of it is grown in Northern Province and about 82% of bean producers are the small holder farmers (Chalwe, 2011). Northern Province alone produced 31,898 metric tons of dry beans while Muchinga Province produced 9,277 metric tons in 2013/14 crop marketing season （CSO，2014）. A much bigger proportion of the beans produced is either retained or consumed by farmers as only 18 percent of it reaches the market (Sitko *et al.*, 2011).

Urban areas provide a market for beans due to an increase in consumption resulting from the increased population. According to the 2010 census of population and housing, Lusaka has a population growth rate of 4.9 % thereby providing a ready market for beans as the increased population is expected to increase demand （Mwansa ，2013）. Thus, smallholder farmers are projected to benefit from urban markets such as Lusaka as beans marketing is profitable if produce is sold outside production districts (Samboko, 2011).

In many SSA countries, beans is considered as a complete crop as it is consumed at various stages. According to Buruchara (2011), beans in many African countries is

consumed as green leaves, as fresh pods and as dry grains. However, the critical economic and most consumed part of the bean plant is the dry seed. In SSA, beans is prepared and consumed in different ways. In Uganda for example, beans is eaten with cassava meal (David，1999), while in South Africa beans is liked as a composite with samp (dehulled maize grain) popularly known as *Umngqusho* among the South African black communities (Mkanda，2007). In Zambia, beans is mainly eaten together with *nsima* (maize meal) while other people like it with rice. Hence, beans contributes greatly to the food and nutrition security in many households and has therefore received attention in terms of research in many SSA.

Beans consumption has been observed to vary in many SSA. In Zambia, per capita beans consumption stands at 10 kg, while that for eastern Africa is 50-60 kg (Hichaambwa *et al.,* 2009; ISAR, 2011). While beans come in different characteristics such as grain size, colour, cooking time and gravy quality, there is need to understand the effect of such characteristics on consumer choice. This study has been necessitated by the lack of evidence regarding characteristics of beans which drive consumer choice of different beans varieties/landraces in Zambia. This study, in particular implemented a choice experiment approach for eliciting the drivers of consumer choice for common dry bean varieties/landraces in Lusaka. This is because understanding the technology on how to increase beans yields, how to grow beans which is tolerant to drought and diseases is not enough in the development of the beans value chain. A number of studies have been conducted to gain a much more understanding of what consumers want (Kormawa *et al*., 2000; Langyintuo *et al.*,2003; Langyintuo *et al.,* 2004; Mishili, *et al*.,2009). Therefore, there is need to study and identify characteristics of beans which influence consumer choice in Zambia.

1.2 Statement of the Problem

In Zambia, various research institutions such as the University of Zambia (UNZA), Zambia Agriculture Research Institute (ZARI) and private institutions have implemented various projects aimed at producing improved beans varieties/land races, Birachi (2012) reports research efforts on beans and key varieties released in Zambia.

Released varieties include *Lwangeni, Kalambo, Chambeshi, Lyambai, Kabulangeti, Lukupa, Kababala, Solwezi*, and *Serenje.* Other varieties that have been offloaded on the Zambian markets include *Lunga, Kalungu, Kabale, Sadzu, Lungwebungu, Kapisha* and *Mbereshi* (ZARI， 2017). The released varieties of beans come in various characteristics such as grain size, color, cooking time, cooking quality and gravy quality etc. These characteristics may affect consumer perception, choice and overall, consumption levels of different beans varieties. While beans characteristics have great potential to affect consumer choice, it is observed that the crop has received little attention in terms of policy thrust and research. Much of the research on beans has either been on agronomic practices or on the supply side. While production and other agronomic practices of beans in other countries such as Tanzania have been studied (Hillocks *et al*., 2006), consumer preferences in the rapidly growing urban markets are almost undocumented (Mishili *et al*., 2009). This is a similar case in Zambia where much documentation on beans has been on yield improvement, disease tolerance, soil management and other agronomic properties. Some studies on beans have also focused on market participation (Chalwe 2011) while others on value accruing to the bean supply chain participants (Mwansa, 2013). However, as stated above, beans come in different characteristics such as size, shape, colour, taste, cooking time, cooking quality and gravy quality, etc. and SSA markets have continued to provide beans with different characteristics. Identifying key characteristics affecting choice for beans is important because breeders and other players in the beans value chain would be informed on what attributes to focus on. Nevertheless, there is lack of empirical evidence on the most preferred beans attributes in Zambia as no such study has been conducted. Therefore, there was need to document characteristics of beans driving consumer choice.

1.3 Objective

This study sought to identify and analyze the effect that bean characteristics have on consumer choice for common dry beans in Lusaka.

1.4 Hypothesis

Bean attributes i.e. color, grain size, cooking time and gravy quality have a significant effect on the choice of beans

1.5 Significance of the Study

The role that consumers play in the bean marketing and bean value chain development cannot be ignored. If bean breeding efforts through the promotion of improved beans varieties are going to meet intended results in Zambia, then it is imperative that the common dry bean characteristics most preferred by consumers are understood and documented. Bean breeders, in their efforts to producing new bean varieties need consumer information if they are to produce saleable varieties. On the other hand, farmers and bean traders need to produce and supply the market with beans varieties that yield high utility of consumers respectively. If this kind of information is not available, bean breeders will continue to operate in a vacuum and they will continue to breed beans which is not attractive to the consumers. Furthermore, if beans preference information is not available, trade would continue operating in an un-informed market environment. As the government of the republic of Zambia is promoting more and more uptake of protein rich pulses such as common bean among households, it is important to establish the characteristics of beans that will get more people to eat beans.

This study is therefore important as it sought to understand choice drivers for beans in Lusaka, Zambia. The study contributes to the research fraternity by adding to the information gap about consumer preferences for beans which currently exist. Findings of this study will inform researchers and bean breeders on the bean attributes which need focusing on when developing new bean varieties. Furthermore, farmers and traders will also have information thereby supplying the markets with varieties most preferred by consumers.

1.5 Structure of the Report

The remainder of the report is organized as follows. Chapter Two highlights a review of studies relevant to this study. Chapter Three addresses the methodology, discussing in detail the conceptual framework and theoretical model. Chapter Four provides a detailed discussion of the results, while conclusions and policy implications are presented in chapter Five.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter begins with a synthesis of various studies that have been conducted on consumer appreciation of a product attributes. This is followed by a discussion on how grain legume (beans and cowpeas) attributes affect pricing and choice.

2.2 Consumer Appreciation of Food Attributes

In trying to assign monetary values to the commodity characteristics which cannot be directly traded on a market, many researchers have used economic valuation, where the money values have a particular and precise meaning, (David 2002). In experimental designs, consumers evaluate product characteristics or attributes based on hypothetical trade-offs between price and quality attributes of the product. Based on Lancaster，(1966, a consumer's choice for a product is determined by a product's attributes and not by a product as a whole hence the use of Willingness To Pay (WTP) and Willingness To Accept (WTA) by many researchers to assess consumer's preference for non-marketed goods. As observed by Owusu *et al.,*(2012), consumers' perception towards a product influence a premium which consumers are willing to pay for a product's attributes.

Much has been documented on consumer preference and willingness to pay for a product attributes and not a product as a whole. For example, Owusu *et al.,* (2012) found that product attributes such as freshness and cleanness have positive effects on consumers' WTP premiums for organic water melon while product size was found to have a negative influence on consumers' WTP premiums for organic lettuce. Fiamohe *et al*., (2014) report that rice consumers in Togo are willing to pay for cleanness and whiteness of rice. Dobbs *et al.,* (2014) conducted a willingness to pay for beef among Tennessee consumers. It was found that consumers prefer grain-fed, flavored beef and willing to pay high premium for beef steaks produced within Tennessee. Further, it was

observed that consumers who value freshness, safety, and natural products are willing to pay more for Tennessee ground beef.

Nutritional information is seen to influence consumer's perception of a product thereby affecting premiums which they are willing to pay for. For example, Xue *et al.,* (2009) observed that **c**onsumers' awareness about the nutritional value and benefits of nutrients in a food product influence their perception of the product. In their study they also revealed that nutrition knowledge of a product play a critical role in determining consumers' preferences and willingness to pay. Oparinde *et al*., (2015) examined consumer choice of two beans varieties i.e Red Iron Bean and White Iron Bean in Rwanda. In the absence of nutrition information, they found that the red iron bean variety fetched a high premium compared to the white iron bean variety. However, when nutrition information about the red iron bean variety was provided, they observed a significant increase in the premium consumers were willing to pay.

Attitudes towards product labelling has been found to explain consumer preference for a particular product. For example, Wu *et al*., (2017) studied consumer preferences for pork attributes such as traceability, information certification and origin labelling in China's Jiangsu Province. They found that consumers are willing to pay a high premium for government certification of traceability and information authenticity. It was also found that consumers are willing to pay for pork which has local farming labelling. Lim *et al*., (2014) record that a product label showing country of origin (COO) affects consumer preference. They note that willingness to pay for country-of-origin labelled imported beef steak is associated with consumers' perceptions of the risk and food-safety associated with imported beef. Findings revealed consumers' high preference for COO labelling and it proved more important than the product price. Yeh *et al*., (2016) investigated the relative importance of food label information and price among Taiwanese consumers. They found that consumers preferred sweet-pepper with a label showing the country of origin.

Social influence was seen to influence consumer's willingness to pay for a product's attributes. For example, Gracia *et al*., (2012) analyzed the effect of social component of local food and how it affects premiums consumers are willing to pay. Apart from the

country of origin labeling, it was found that consumers are willing to pay a premium for local food products than imported ones. Using contingent choice experiment to estimate the preferences of respondents for beef steak attributes, Abidoye *et al*., (2011) found that consumers were willing to pay premiums for wanting to support local farmers. Hand *et al*., (2010) also found that consumers' attitude towards provision of support to local based farmers influenced premiums which consumers are willing to pay for local foods.

2.3 The role of Consumers in Agrifood Value Chains and Marketing

While the focus of this study is on consumer preferences of common dry beans attributes, it is also imperative to understand the role that consumers play in the agrifood value chains and marketing. Although consumer value lies at the centre of value chain development and management principles, a number of value chain developing projects have overlooked the consumer perspectives Adhikari *et al*., (2012). The lack of a consumer perspective in chain development creates a vacuum which could negatively impact such efforts. For example, value chain development efforts that overlook consumer value-based perspective have resulted in problems such as oversupply or lack of response to market needs (Boehlje 1999). Therefore, the role of consumers in value chain development such as that for beans cannot be downplayed. However, the thrust of consumer behaviour in value chain management and marketing is diverse.

The complexity of consumer behaviour leads to changes in many facets of marketing as consumer preference changes. For example, a response as a result of change in income levels leads to changes in many other things such as lifestyle decisions and food safety concerns (Lohr， 2001). Thus it is imperative that such information regarding changes in consumer demand is channelled to the traders and bean breeders. Furthermore, the behaviour of consumers towards a commodity could have an impact on commodity prices, consumption levels, access to markets, etc. In many countries, consumer habits lead to increase in food consumption. Consumers in Senegal markets for example show high preferences for imported rice compared to the locally grown Demont *et al*. (2015).

Therefore, agrifood value chains that are more responsive to consumers are more effective and more competitive (Trienekens, 2011). It is also demonstrated that value chains that are responsive to consumers have the ability to generate more income Adhikari *et al*, (2012). However, with the focus of this paper being on consumer choice for beans attributes, it is imperative to understand what consumers prefer as the consumer has the potential of affecting beans marketing and beans value chain development.

2.4 Grain Characteristics affecting Demand and Consumption of Beans and Cowpeas in sub-Saharan Africa

Unlike in Zambia, much of the sub Saharan Africa has a lot of documented literature on factors affecting choice of beans consumed. This section aims at showing some existing evidence on factors affecting the choice of beans consumed.

Grain legume characteristics have been found to play a major role on consumer choice. While a number of studies reviewed have been on the traders' view point, it is the consumers' perception of grain legumes that command demand or premiums for beans which they are willing to pay for. Various studies on consumer preferences for pulses, particularly beans and cowpeas have been carried out in SSA using different approaches including choice experiment and hedonic approaches. While many studies reviewed have been on cowpeas, findings are to some extent comparable with beans as beans and cowpeas fall in the same category of pulses. For example, Faye *et al*., (2006) used the hedonic pricing analysis of markets in Senegal and found that larger cowpea grains are most preferred. Further, they observed that preference for grain color and skin texture for cowpeas varied across markets. Langyintuo *et al*., (2004) performed a number of studies in different countries on consumer preferences for cowpeas. They observed in Cameroon and Northern Ghanaian markets that consumers prefer large cowpea grain. Grain eye color was also recorded as an important grain quality attribute that consumers are willing to pay a premium for. In Cameroon, northern Ghana, northern Nigeria and Senegal, cowpea consumers place value on large cowpea grains and dislike damaged cowpea grain Langyintuo *et al*., (2013). Mishili *et al*., (2009) performed an inter country comparison of consumer perception of quality characteristic

along the cowpea value chain in Nigeria, Ghana and Mali. They found that cowpea consumers in Nigeria, Ghana and Mali are willing to pay a premium for large cowpea grains. Furthermore, using hedonic modeling, Mishili *et al*., (2009) found on the Tanzanian markets that the average cooking time of the three common bean varieties ranged from 1 hour and 15 minutes to 1 hour and 29 minutes. Among the three varieties, the Yellow bean variety had the lowest average cooking time. However, it had a higher average cooking variant compared to the *Kabulangeti* variety. The *Kabulangeti* variety had an average cooking time of 1 hour and 22 minutes with a relatively narrow cooking time variant relatively. It was concluded that beans consumers in Dar es Salaam markets preferred *Kabulangeti* because of its low average cooking time and narrow average cooking variant. They also observed and recorded that coefficients for bean grain size, despite having the positive signs were not statistically significant entailing that size of bean grain doesn't matter to consumers.

Kormawa *et al*., (2000) records that Nigerian consumers prefer brown coloured cowpeas to white coloured grains. In addition to preferences, they further recorded four major drivers of cowpea consumption. These include income level of consumers, taste of the product, market price of cowpea and of its close substitutes, and population density of towns.

A 2007 Research conducted by CIAT and its partners on consumer preferences for beans in Malawi revealed interesting findings. It was observed that choice of beans is strongly influenced by grain colour. Cooking time and taste of the different beans varieties studied was observed to also influence consumer choice. Furthermore, whilst the price of beans in Malawi is influenced by the principles of demand and supply, the research found that cooking time and grain colour were also associated with price. In addition, Scott and Maiden (1998) records that farmers in Malawi prefer good flavored and fast cooking beans and these attributes were found to affect choice of dry bean varieties for production and consumption.

As can be seen from the literature above, beans attributes play a critical role in influencing choice and premiums which consumers are willing to pay for. Much has

been documented in a number of SSA countries and it is easy to demonstrate how bean characteristics affect price and choice. In the case of Zambia, little documentation exists on consumer choice for common dry beans. In an effort to understand consumer preference for beans attributes in Zambia, Sichilima *et al*., (2016) used hedonic price modelling to show the effect that different bean attributes have on premiums which consumers are willing to pay for. The study established that medium sized grain is an important characteristic which affects the pricing of common bean in urban Lusaka markets. The study also learnt that bean color such as yellow and white was significant in influencing bean pricing. Thus, color plays a critical role in the pricing of the bean grain. Although informative, the study is limited as it uses a trader's perspective to study beans attributes which consumers are willing to pay a premium for. Thus, discrete choice experiment which allows researchers to estimate the effects of good attributes on preferences Louviere *et al.*, (2008) is paramount as it adds consumer perception to the current knowledge. This study also complements Sichilima *et al*.,(2016) by presenting an empirical assessment of the consumers' choice drivers of beans

2.5 Summary and Conclusion

The literature reviewed has demonstrated that beans characteristics such as color, grain size and cooking time significantly influence consumer preference for beans. Despite good attempts at documenting literature on beans, there exists an information gap to be filled as most of the previous studies on beans are either on agronomic or supply side factors with little to no publications on consumer preferences. However, results on agronomic findings alone do not provide a complete picture when assessing a technology like an improved bean variety (Onyango, 2010). Analysis and understanding of consumer perceptions and preferences are important to enable appreciation of technologies like improved beans varieties Odendo *et al*., (2006). Thus understanding of consumer preferences of beans is important Ojiem *et al*., (2006). Despite this evidence, which is mostly based on cases in SSA, there is not much empirical literature on the characteristics of beans that determine consumer choice in Zambia. Furthermore, most of the studies reviewed used hedonic pricing model to

understand the characteristics of grain legumes which affect consumer choice for beans. This study proposed the use of Choice Experiment Modelling to elicit consumer preference for beans direct from the consumer themselves.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter discusses the methods used to determine the factors influencing consumer choice for beans. First, the conceptual framework is presented. This is followed by information on the data and data sources. Lastly, as this study used secondary data, information on the discrete choice experiment module of the data set is presented.

3.2 Conceptual Framework

The current study used the discrete choice experiment approach to determine the bean characteristics which affect consumer choice for a particular bean type. The choice experiment is among the widely used hypothetical stated preference methods. It is considered to be the most appropriate one for valuing the importance of multiple characteristics consumers evaluate when deciding whether or not to buy a bean variety. This is because the choice experiment method allows for estimation not only of the value of the bean variety as a whole, but also of the implicit values of characteristics (Hanley *et al*., 2001). This approach has a theoretical grounding in Lancaster's attribute theory of consumer choice (Lancaster, 1966), and an econometric basis in models of random utility (Hauseman & McFadden, 1984).

Lancaster (1966) proposed that consumers derive utility not from goods themselves but from the attributes they provide. Consider a consumer's choice of a new bean variety, and assume that utility depends on choices made from a set C, which includes all the possible alternatives of different bean varieties. This list of all alternatives that are

available to the consumer is referred to as the choice set. The consumer is assumed to have a utility function of the form

$$U_{ij} = U(Z_{ij}) \tag{1}$$

where for any consumer *i*, a given level of utility will be associated with any alternative bean variety *j*. Utility derived from any of the bean variety alternatives depends on the attributes of the variety.

The random utility model is the theoretical basis for integrating choice behaviour with economic valuation in the choice experiment method. In this model, the utility of a choice is comprised of a systematic (explainable or deterministic) component, V_{ij} , and an error (unexplainable or random) component, e_{ij} , which is independent of the deterministic part and follows a predetermined distribution.

$$U_{ij} = V_{ij} + e_{ij} \tag{2}$$

The systematic component can be explained as a function of characteristics of the bean variety as explained above, in (1). That is:

$$U_{ij} = V(Z_{ij}) + e_i \tag{3}$$

Given that there is an error part in the utility function, predictions cannot be made with certainty and analysis becomes one of probabilistic choice. Consequently, choices made between alternative bean varieties will be a function of the probability that the utility associated with a particular bean variety (j) is higher than that for other alternative varieties. That is to say, the probability that consumer i will choose bean variety j over all other options h is given by

$$P_{ij} = \Pr ob\{V_{ij} + e_{ij} > V_{ih} + e_{ih}; \forall j \neq h, \forall \in C\} \quad (4)$$

The parameters for the relationship can be introduced by assuming that the relationship between utility and attributes and characteristics follows a linear path in the parameters and variables function, and by assuming that the error terms are identically and independently distributed with a Weibull distribution (Greene, 2008). These assumptions ensure that the probability of any particular alternative *j* being chosen can be expressed in terms of a logistic distribution. This specification is known as the conditional logistic model (Greene, 2008), and it takes the general form

$$P_{ij} = \frac{e^{V_j}}{\sum_{h \in C} e^{V_{ih}}} \quad (5)$$

The probability of choosing a given bean variety is determined by the indirect utility function which is assumed to be linear and additive. It takes the form as shown below;

$$V = \beta_1 colour + \beta_2 size + \beta_3 cookingtime + \beta_4 gravyquality + \varepsilon \quad (6)$$

where V is the utility derived from a given bean variety, ε refers to the error.

The vectors of coefficients β_1 to β_4 are attached to the vector of attributes (Z).

The conditional indirect utility function generally estimated is

$$V_{ij} = \beta + \beta_1 Z_1 + \beta_2 Z_2 + ... + \beta_n Z_n \quad (7)$$

where β is the alternative specific constant (ASC), that captures the effects in utility from any attributes not included in choice specific attributes. The number of bean variety attributes considered is n. The vectors of coefficients β_1 to β_n are attached to the vector of attributes (Z).

3.3 Data and Data Sources

This study used secondary data from a survey of households in the Lusaka district conducted in 2015 by the Dry Legume Innovation Lab project under the Feed the Future Innovation Lab for Collaborative Research on Grain Legumes. The data was collected in the seven constituencies of Lusaka district. Provision of basic information on bean consumption and understanding of the characteristics of bean consumers were some of the objectives of the survey.

3.3.1 The Choice Experiment Design

This study used choice experiment data which was designed by the Grain Legume Innovation Lab project. Experimental design is an important tool in choice modeling as it provides a framework for running the choice experiment (Awino, 2013). The factors of an experimental design are the columns. The columns or variables have two or more discrete levels which are arranged in such a way that the effects of different factors can be studied in a single experiment (Awino, 2013). The rows correspond to the product attribute alternatives (bean attribute alternatives) and a block of several rows define a set referred to as a choice set. Rows or alternatives are hypothetical bean profiles resulting from combining different attribute levels. The response or choice is the dependent variable (McFadden, 1974; Louviere and Woodworth, 1983; Kuhfeld, 2005). Once the choice experiment has been designed, the respondent need to understand it in order to provide quality data.

The project from which the current study adopted the secondary data from developed the experimental design based on four bean grain attributes with their corresponding levels. The attributes which were determined included colour, grain size, cooking time and gravy quality. Colour had four levels (mottoled red, yellow, mixed yellow and purple), size had three levels (large, medium and small), two levels for cooking time (fast and slow) and two levels for gravy quality (good and poor). Table 1 below shows the attributes with the corresponding levels.

Table 1: Attributes and Levels used in the Choice Experiment

Bean Attribute	Attribute Levels	# of levels
Color	Yellow, Purple, Mottled Red, Mixed Yellow	4
Size	Large, Medium, Small	3
Cooking Time	Fast, Small	2
Gravy Quality	Good, Poor	2

Source: Bean Legume Innovation Lab Project, 2015

The combinations derived from the full set of attributes as shown above yield a full factorial design comprising of too many alternatives to be presented to a respondent. For example, from the attribute levels mentioned above, using a full factorial design results in (4 x 3 x 2 x2), entailing forty eight (48) attribute combinations or alternatives to be presented to the respondent. These may be too many for a respondent to evaluate as they make a choice. As interviews take longer than expected and as respondents are asked to make too many choices, data quality issues usually arise (Awino, 2013). Therefore, it is usually advisable to block the choice sets so that the subjects see just a subset of the design at a time.

In order to curtail the complexity of data collection as a result of having too many choices for a respond to choose from, a fractional factorial design is usually encouraged

(Kuhfeld, 2005) as it allows the researcher to make inferences for all profiles (WHO, 2012). Thus, the project used a fractional factorial design where the 48 alternatives/combinations were blocked into six (6) resulting into eight (8) choice sets. This design ensured that there were six alternatives per choice set and each respondent randomly picked one alternative per choice set. However, the respondents had a "NO" option of not selecting any of the alternatives in a given choice set. The choice sets were developed in STATA using the attribute levels as mentioned above. Table 2 below shows one example of the choice set that was used in the choice experiment survey. Other profiles or choice sets have been presented in Appendix 1

Table 2 : Example of a Choice Set

Bean Attributes	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Color	Yellow	Purple	Mixed	Mottled Red	Yellow	Mottled Red
Size	Medium	Medium	Medium	Medium	Small	Small
Cooking Time	Fast	Slow	Fast	Slow	Slow	Fast
Gravy Quality	Poor	Good	Poor	Good	Good	Poor

Source: Bean Legume Innovation Lab Project, 2015

3.3.2 Checking for the Properties of the Experimental Design

As choice experiment surveys are based on hypothetical scenarios where respondents are presented with a number of alternatives to choose from, a number of biases usually occur. Furthermore, it has also been seen in the previous studies and from literature that choice experiment surveys are prone to multicollinearity (WHO, 2010). As a result of these biases, every study undertaking a choice experiment approach is required to work at minimizing such biases. Some of the biases are usually minimized during data collection and this ensures that the data which is collected is of high quality.

Orthogonality, level balance and minimum overlap are some of the aspects of a good experimental design that a researcher needs to pay particular attention to during a choice experiment method.

i) Orthogonality

The experimental design used an orthogonal fractional factorial design. Orthogonality is one aspect which many researchers in the area of choice experiment have used to ensure a good and efficient experimental design (Awino, 2013). Orthogonality characterize a good fractional factorial design (WHO, 2012) and is the opposite of multicollinearity. Furthermore, orthogonal design refers to the relationship between factors and other factors and it ensures that estimates across factors are independent (Bliemer and Rose, 2010; Espinosa-Goded *et al*., 2010). Since orthogonality is the opposite of multicollinearity, a test to check for the presence of it in the data was performed. A Pearson pairwise correlation matrix was generated in STATA. According to Gujarati (2007), if the pair-wise correlation is in excess of 0.8, then the data has a serious problem of multicollinearity. The results of the Pearson pairwise correlation matrix as shown in the results section and Appendix 3 showed no presence of multicollinearity.

A second test to check for the presence of multicollinearity was the Variance Inflation Factor (VIF). VIF shows how the variance of an estimator is inflated as a result of the existence of multicollinearity. With increased multicollinearity, the VIF approaches infinity and in the absence of it, VIF will be equal to 1 (Gujarati, 2007). This was calculated as shown below:

$$VIFi = \frac{1}{1 - Ri2}$$

Where VIF refers to the variance inflation factor and R refers to the artificial regression with the ith independent variable as a dependent variable. A VIF of less than 5 indicates absence of multicollinearity. VIF results have been presented in the results section and Appendix 2.

ii) Level Balance

The second aspect for consideration in experimental design is level balance. Level balance defines a good experimental design (WHO, 2010). Level balance requires that all the levels of each attribute to appear with equal frequency across profiles giving each level an equal chance of being selected. The project from which the data set was obtained ensured that the attribute levels in the choice sets were well balanced as shown Table 3 below.

Table 3 : Level Balance

Attribute	Level	Number of Appearance
Colour	Purple	12
	Yellow	12
	Mixed Yellow	12

	Mottled Red	12
	Large	16
Size	Medium	16
	Small	16
Cooking time	Fast	24
	Slow	24
Gravy Quality	Good	24
	Poor	24

Source: Bean Legume Innovation Lab Project, 2015

iii) Minimum overlap

This aspect of the experimental design requires that a repeated attribute level within a choice set be minimized. Minimum overlap provides maximum information as respondents make trade-offs during the choice experiment exercise (WHO, 2010). Information usually is not available about an attribute if an attribute takes the same level in each of the choice sets. The project from which the data set was derived from ensured that there were few overlaps within the choice sets.

iv) Choice Experiment Exercise

Data collection is one of the critical components of a well conducted choice experiment survey. This is because enumerators present hypothetical scenarios from which the respondents are required to make a choice from. Enumerators are required to show high

levels of data collection techniques or skills to ensure that the choice experiment survey is presented in the same way to all the respondents in order to avoid biases. In the choice experiment module, enumerators presented bean samples with varying characteristics to the respondents. Colour was discrete and respondents were able to differentiated the different bean types presented to them. Different grain sizes were presented for the respondents to differentiate between large, medium and small. Fast cooking time for a bean type was defined in terms of beans able to cook in less than 1hour 3ominutes while slow was a bean type cooking in more than 1hour 30minutes. Gravy quality was defined in terms of the flow of the soup before any ingredient was added to the beans which is cooking. Poor gravy quality was defined as a soup able to easily flow (thin) while good gravy quality was the soup with slow flowing ability (thick). These definitions were mentioned and clarified to the respondents before the actual choice experiment exercise. Different combinations or alternatives of the attribute levels were presented to the respondent and asked whether they would purchase a bean type with characteristics presented to them. The choice was: YES, I will purchase it; NO, I will not purchase it. The enumerator presented each of the choice tasks to the respondent. The choice tasks were blocked so that each respondent saw only a segment of the full choice tasks. Each respondent was asked to pick only one out of six alternatives from a choice set. The six alternatives collectively formed a choice set and a respondent was given a total of eight choice sets in the choice experiment exercise.

3.3.3 Summary and Conclusion

Based on the facts presented above about the experimental design which the Bean Legume Innovation Lab project employed and upon seeing that the properties of a good experimental design were adhered to and that the actual data collection process was adequate, the current study adopted the data set and proceeded with the analysis.

3.4 Analytical Framework for the Effect of Grain Characteristics on Bean Varietal Choice

3.4.1 The Conditional Logistic Model

Different tools that have been used to analyze discrete choice variables include the multinomial logit (MNL), conditional logit (CL), and nested logit (NL) Models. This study used the conditional logistic (CL) model as the required analysis was based on the regression with the left hand side having 1 for the selected bean alternative and 0 for the bean alternative that was not selected, (Hauber *et al*., 2016). Conditional logit gives good results when data is stacked, with each alternative within a choice set on a different row (WHO, 2010). Furthermore, conditional logit allows a researcher to analyze the characteristics in the alternatives and not the characteristics of the individual selecting the alternative (WHO, 2010). In addition, conditional logit model was found to be consistent with random utility theory (McFadden, 1974) and since conditional logit relates the probability of choice among two or more alternatives to the characteristics of the attribute levels defining those alternatives, it was imperative that this model be used (Hauber *et al*,. 2016). The estimated parameters of the conditional logistic model provided information about the direction and significance of the beans attributes. The probability of choosing a given beans variety is determined by the indirect utility function which is assumed to be linear and additive. It takes the form as shown below:

$$V = \beta_1 yellow + \beta_2 purple + \beta_3 mixedyellow + \beta_4 small + \beta_5 medium + \beta_6 slow + \beta_7 poor + \varepsilon$$

Where V is the utility derived from a given bean variety, β_{ij} is the explanatory variable and ε_{ij} is the error term. The explanatory variables included in the conditional logistic model are described in Table 3.

Color of grain legumes was included in the model as beans comes in different colours, (Mishili *et al*., 2009). Sensory evaluation is one of the methods used for evaluating and determining product acceptability by consumers (Mkanda, 2007). Color has been observed to be associated with characteristics such as aroma, taste and texture (Meenakshi *et al.*, 2012). As such, color was included in the model and it was expected to have either a positive or negative effect on the choice of a beans variety. Color of grain legumes was also found to be one of the factors affecting the pricing of beans (Sichilima *et al*., 2016), hence it is important to consider it when trying to asses consumer preferences for common dry beans. Color had four levels, as shown in Table 3 and entered the model as a dummy variable

Size of grain legumes was included and entered the model as a dummy variable. Beans size is classified in different sizes and these include small (more than 900 seeds per kg), medium (between 600 to 900 seeds per kg) and large (less than 600 seeds per kg) (FAO (2004). Some consumers prefer beans of medium and large sized as it is believed to cook well (Berrios et al., 1999). Other studies have found larger gain legumes to positively affect premiums which consumers are willing to pay for (Langyintuo *et al.,* 2003; Mishili *et al.,* 2009). Sichilima *et al.,* (2016) found that traders considered large grain size to be an important attribute affecting pricing of beans. Furthermore, it was found that consumers least preferred small seeded beans (Mkanda, 2007).

Another important attribute of beans which was included is cooking time and entered the model as a dummy variable. Cooking time is seen as an important attribute as it affects the cost of cooking energy and preparation time (Mkanda, 2007). Mishili *et. al*., (2009) found on the Tanzanian markets that consumers prefer a beans variety which has a low average cooking time. Cooking time had two levels as shown in Table 3. Cooking time was expected to positively affect choice of beans consumption looking at

the escalating electricity tariffs in Zambia and due to high prices of charcoal, a commonly used energy for cooking in many households.

Bean gravy quality was also included to find out if cooking quality had any effect on the choice of common dry bean. Gravy quality is associated with the softness of cooked beans and is an important attribute which needs assessment on its effect on preferences for beans. Mkanda, (2007) found that softness of cooked beans was one of the attributes that lead to consumer's high preference for a given beans variety. Gravy quality entered as a dummy variable and had two levels as shown in Table 4 below.

The levels of the different bean attributes were hypothesized to have either a positive or negative relationship with the probability of consumer's choice because consumer taste differs from one individual to the other.

Table 4 : Description of Variables used in the Conditional Logit Model

Variable	Description	Levels	Expected Sign
Color	Color was categorized into four based on common beans colors found on Zambian markets. These included Yellow, purple, Mottled Red and mixed yellow.	Yellow (1=yes, 0=otherwise)	+/-
		Purple(1=yes, 0=otherwise)	+/-
		Mottled Red(1=yes, 0=otherwise)	+/-
		Mixed Yellow(1=yes, 0=otherwise)	+/-

Grain size	Grain size was categorized into three i.e. small, medium and large.	Small(1=yes, 0=otherwise) Medium(1=yes, 0=otherwise) Large(1=yes, 0=otherwise)	+/- +/- +/-
Cooking time	Cooking time referred to the time taken for beans to reach palatable level. It was categorized into fast and slow	Slow(1=yes, 0=otherwise) Fast(1=yes, 0=otherwise)	+/- +/-
Gravy quality	This referred to the cooking quality of beans which leads into a thick soup when beans has been cooked to palatable level. It was categorized into poor and good.	Poor(1=yes, 0=otherwise) Good(1=yes, 0=otherwise)	+/- +/-

Source: Bean Legume Innovation Lab Project

3.5 Data Analysis

Descriptive statistics were performed to show the socio-demographic characterization of the respondents. The socio-demographic data was organized in excel and exported into STATA 13 where the individual characteristics were analyzed.

Microsoft excel was again used to organize the choice experiment data in a format that is compatible with the conditional logit model. The choice experiment data was exported into STATA 13 and analyzed using conditional logit model to examine bean characteristics which determine consumer choice for beans. In running the model, all the levels of the bean characteristics were entered as dummy variables while dropping one for every characteristic. This was done so to avoid the dummy variable trap which occurs if all dummy variables are entered in the model. The dropped variables acted as bases to which reference was made when interpreting the results. Variable for Mottled red was dropped from color levels, variable for large from size levels, variable for fast from cooking time and variable for good from gravy quality levels.

While analyzing discrete choice experiment output for bean attributes, it is important to look at how the probability of choosing a given bean variety changes as properties of levels are altered. As indicated in the theoretical framework, the logit probability of choosing alternative i rather than alternative j is given by:

$$P_i = \frac{e^{\beta^i x_i}}{\sum e^{\beta^i x_j}} \qquad (1)$$

Where x is a vector of attribute coefficients.

The above equation was used to calculate marginal effects of attributes by simply calculating the difference in variable levels. In this study, it was hypothesized that statistically significant bean attribute levels changed by 0.5. For example, color intensity was hypothesized to have been increased by 0.5 units. Elasticity's or marginal

effects as a result of these changes were calculated using STATA version 13. As an illustration, a manual formula that follows shows the steps for manual calculation of margins.

$$P_{purple=1} - P_{purple=0.5} = \frac{e^{\beta_1 * 1}}{e^{\beta_1 * 0.5} + e^{\beta_1 * 1}} - \frac{e^{\beta_1 * 0.5}}{e^{\beta_1 * 0.5} + e^{\beta_1 * 1}} \quad 2$$

$$= \frac{e^{0.879_1 * 1}}{e^{0.879_1 * 0.5} + e^{0.879_1 * 1}} - \frac{e^{0.879_1 * 0.5}}{e^{0.879_1 * 0.5} + e^{0.879_1 * 1}} \quad 3$$

$$= 0.216$$

$$= 0.216/0.879 * 100$$

$$= 24.57\%$$

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter begins with a description of the various socio-demographic characteristics of beans consumers involved in the study. This is followed by results and discussions on the empirical analysis of the conditional logit model. Empirical findings on preferences for beans and marginal effects when beans attribute levels have been altered are also presented.

4.2 Descriptive Statistics

A detailed description of the socio-demographic characterization of the respondents is shown in Table 5 below.

Table 5: Socio-Demographic Characteristics of Respondents

	Constituency							
	Kabwata	**Kanyama**	**Lusaka - Central**	**Mandevu**	**Matero**	**Munali**	**Chawama**	**Total**
Gender of Respondent (%)								
Male	23.3	11.8	18.1	20	14.4	22.4	14.7	17.7
Female	76.7	88.2	81.9	80	85.6	77.6	85.3	82.3
Marital Status of Respondent (%)								
Married	60.9	74.7	62.9	77.8	66.5	56.1	73.5	67.5
Divorced	4.4	7.8	7.2	2.7	9.6	13.2	11.8	8.1
Single	27.7	12.3	23.7	13.9	16.1	25	5.9	17.8
Widowed	7	5.2	6.2	5.6	7.8	5.7	8.8	6.6
Education level of Respondent (%)								
College	49.1	8.4	58.8	27.8	16.5	27.8	14.7	29
Secondary	27.6	47.7	27.8	41.6	42.2	44.3	38.3	38.5
Technical	7.8	3.2	3.1	5.6	2.6	4.3	2.9	4.2
Primary	13.8	38.1	8.2	25	36.1	21.2	38.2	25.8
None	1.7	2.6	2.1	0	2.6	2.4	5.9	2.5
Age of respondent								
Mean Age	32.9	33.5	38.4	34.4	35.1	35.6	35.6	35
Minimum Age	16	19	20	18	18	15	18	15
Maximum Age	82	67	78	66	81	86	72	86
Standard Deviation	11.4	9.1	11.8	11.8	11.6	12.7	12	11.6

Household Size								
Mean Household Size	4.9	5	5	4.7	5	4.8	5.5	5
Standard Deviation	2	2.1	2.3	2.5	2.1	2.1	2	2.1
Minimum household size	1	1	1	1	1	1	3	1
Maximum household size	>10	>10	>10	>10	>10	>10	>10	>10
Economic Status of a Household (%)								
Middle Class	63.8	32.9	48.5	48.5	46.8	44.3	44.1	47
Poor	9.4	38.8	10.3	18.3	29.5	25	23.5	22.1
Rich	3.5	0	5.1	0	2.6	1.9	5.9	2.7
Upper Middle Class	3.5	3.3	8.3	9.2	3.5	9	8.8	6.5
Working class	19.8	25	27.8	24	17.6	19.8	17.7	21.7

Source: Author's Own Calculation

The overall sample size was 882 and out of this sample, 82.3% of the responds were females while 17.7% were males. With regards marital status of the respondents, results showed that 67.5% of the respondents were married and 8.1% divorced while 17.8% were single. Furthermore, 6.6% of the respondents were widowed. Results in the constituencies showed that Munali constituency had the highest percentage (13.2%) of divorced respondents while Mandevu had the lowest percentage (2.7%).

For education level, results from the study showed that 29% of the respondents reached college level, 38.5% secondary level while 4% reached tertiary level. Further, 25.8% reached primary school level where as 2.5% did not attend any school. However, it is worth noting that Lusaka Central constituency had the highest (58.8%) percentage of respondents that reached college level followed by Kabwata constituency at 49.1% and Kanyama had the least (8.4%) of respondents that reached college level. Furthermore, results showed that Chawama had the highest (5.9%) percentage of respondents that did not attain any education.

Further, the age of the respondents ranged from 15 years to 86 years while the mean age of the respondent was 35 years. The results further showed that the mean age for respondents in Kabwata constituency was lower when compared with other constituencies. Lusaka Central was found to have the highest (38.4) mean age of respondents.

Furthermore, results showed that the number of people in each household ranged from 1 to slightly more than 10 members and the average size of the household was 5.1 for the total sample. On the other hand, Munali constituency had the highest (5.5) average household size while Mandveu had the lowest household size at 4.7 members.

For household economic status, about 2.7% of the respondents classified themselves as rich, 47% as middle class while 21.7% classified themselves as working class. Further 6.5% and 22.1% of respondents classified themselves as upper middle class and poor respectively. When constituency comparisons were made, it was seen that Chawama constituency had the highest percentage (5.9%) of respondents that classified themselves as rich while Mandevu and Kanyama had no respondents that classified themselves as rich. Furthermore, Kanyama constituency had more (38.8%) poor respondents compared to Kabwata constituency which had only 9.5% poor respondents.

4.3 Descriptive Statistics of Bean Consumption Decisions

Table 6 below shows results of how respondents ranked the importance of beans, meat, cereals and tubers with respect to household food security. Considering that this was a household survey, this information is vital to understand how different households rank food items in relation to household food security. As shown in the table, beans ranked second (47.7%) from cereals (54.6%). This finding reveals that beans play a critical role in the choice of food items in a household. This finding can be attributed to the relative long shelf life that beans possess and the nutrient content.

Table 6 : Importance of Beans, Meat, Cereals and Tubers to Household Food Security

Rank	Cereals (%)	Beans (%)	Meat (%)	Tubers (%)
Critical	54.56	47.66	43.89	17.81
Moderate critical	18.08	26.01	27.27	20.63
Fairly critical	14.15	15.58	17.4	25.94
Fair effect	8.02	6.07	7.05	18.59
Moderate effect	3.3	1.87	3.92	9.53
Least effect	1.89	2.8	0.47	7.5

Source: Author's Own Calculation

As the results above showed that beans was second in terms of the importance to the household food security, a further descriptive analysis was performed to compare the two food items i.e cereals and beans in the constituencies. Table 7 below shows the findings.

Table 7 : Importance of Beans and Cereals to Household Food Security in Constituencies

Constituency	Importance of Cereals to Food Security						Importance of Beans to Food Security					
	Critical	Moderate Critical	Fairy Critical	Fair effect	Moderate effect	Least Effect	Critical	Moderate Critical	Fairy Critical	Fair Effect	Moderate effect	Least Effect
Chawama	3.97	3.29	2.5	2.99	9.38	9.09	3.71	5.05	4.96	0	0	2.13
Kabwata	13.6	11.18	16.67	10.45	12.5	13.64	11.14	10.09	21.3	14.2	15.79	19.15
Kanyama	18.83	13.16	19.17	25.37	6.25	4.55	15.1	22.94	16.31	18.37	10.53	17.02
Lusaka_Central	10.88	13.82	12.5	7.46	0	13.64	15.35	10.09	4.96	8.16	5.26	2.13
Mandevu	3.14	4.61	6.67	0	9.38	4.55	3.47	4.59	3.6	2	10.53	6.38
Matero	26.15	30.26	14.17	35.82	43.75	13.64	24.75	22.94	30.5	40.8	52.63	19.15
Munali	23.43	23.68	28.33	17.91	18.75	40.91	26.49	24.31	18.4	16.3	5.26	34.04

Source: Author's Own Calculation

Comparisons in the constituencies showed that beans in Lusaka Central, Mandevu and Munali was rated as critical in contribution to household food security. As can be seen in Table 7 above, in Lusaka Central Constituency beans rated 15.35% and cereals rated 10.88%. while in Mandevu constituency, beans rated 3.47% and cereals rated 3.14%. Further, in Munali beans rated 26.49% and 23.43% for cereals. However, it is worth noting that where cereals rated the highest, the difference with beans was marginal.

4.4 Descriptive statistics of Frequently Consumed Bean Varieties/Types

Table 8 below reveals the varieties/type of beans frequently consumed by the sampled Lusaka residents. Frequency of bean consumption was defined as consumption of beans in a week once or more. Results show that while 97.1% of respondents consume dry beans, bean consumption was seen to vary across bean varieties/types and constituencies. Six bean types commonly consumed included purple (Kabulangeti), yellow (Lusaka), mottled red (Solwezi), mixed yellow (white and yellow), white and mottled brown. Respondents were asked to provide information on the frequency of consumption of the above varieties.

Table 8 : Bean Varieties and Frequency of Consumption

Bean Type	Market/Local Name	Constituencies							Total
		Chawama	Kabwata	Kanyama	Lusaka Central	Mandevu	Matero	Munali	
Purple	Kabulangeti	13	35.48	9.68	6.45	0	29.03	19.35	46.97
Mixed Yellow	White and Yellow	0	20	10	20	10	20	20	34.48
Mottled Red	Solwezi	12	25	12	0	0	5	0	29.63
Yellow	Lusaka	0	11.1	0	22.2	0	33.3	33.3	26.47
White	Plain White	0	0	0	33.3	33	30	0	13.64
Mottled Brown	Butter	0	0	0	13	0		0	5.26

Source: Author's Own Calculation

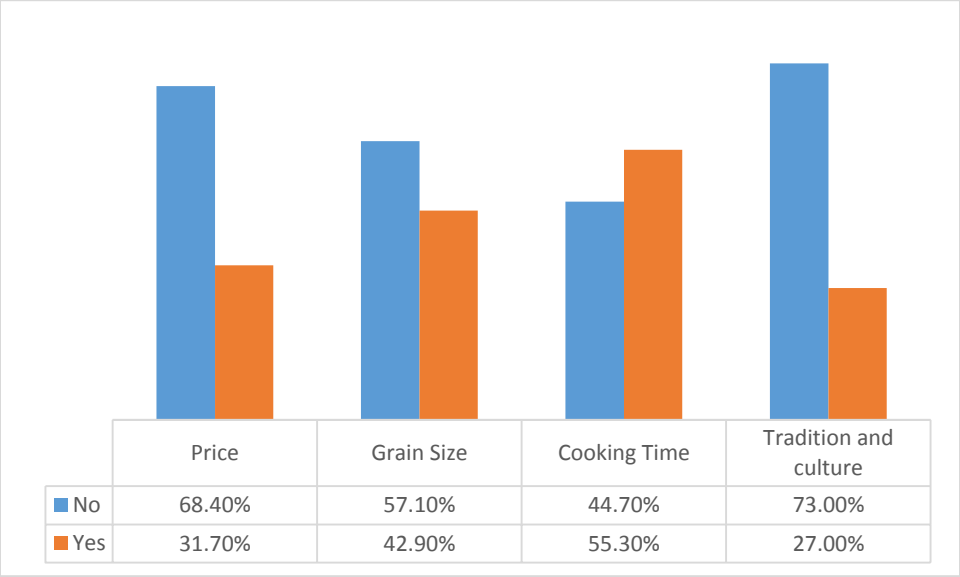
Results as shown in Table 8 reveal that purple dry beans is the most frequently consumed (46.97%) variety or bean type followed by mixed yellow (34.48%) and mottled red (29.63%). Mottled brown bean variety was the least frequent consumed (5.26%).

Results in the constituencies showed that Kabwata and Chawama highly (35.48% and 13% respectively) consumed Kabulangeti. Respondents in Kanyama constituency consumed more (12%) of Solwezi beans, Lusaka Central and Mandevu frequently consumed white beans by 33.3% and 33% respectively. Further, Matero and Munali constituencies frequently consumed Lusaka beans (33.3% and 33.3% respectively).

Based on the most frequently consumed bean variety, purple, a further analysis was done to assess the mode of consumption. Results show that 53.3% consume it as a main dish, 34.6% as side dish while 70% consume it as a complement to main dish. Only 9.1% of respondents consume purple dry beans as an ingredient.

4.5 Factors Influencing Decision to Buy Frequently Consumed (Kablangeti) Beans

Respondents were asked to indicate the factors which influence their decision to purchase dry beans. Factors were grouped into four categories and these included price, grain size, cooking time and tradition/culture. Descriptive statistics were used to show percentages in which respondents fall in. Based on the most frequently consumed purple beans, results, as shown in Figure 2 indicate that cooking time (55.3%) largely influences the decision to purchase dry beans followed by grain size (42.9%). About 31.7% of the respondents see price as the main influencer while tradition/culture was the least influencer at 27%.



Source: Author's Own Calculation

Figure 2 : Factors Influencing Decision To Buy Purple (Kabulangeti) Beans

Constituent comparisons on the factors influencing decision to buy purple dry beans were done and Table 9 below shows the results. As can be seen in Table 9 respondents in Kanyama, Lusaka Central and Munali constituencies consider price as the main factor in influencing decision to buy pruple dry beans. Only Kabwata and Chawama constituencies consider tradition and culture as the man factor which influence decision to buy purple dry beans.

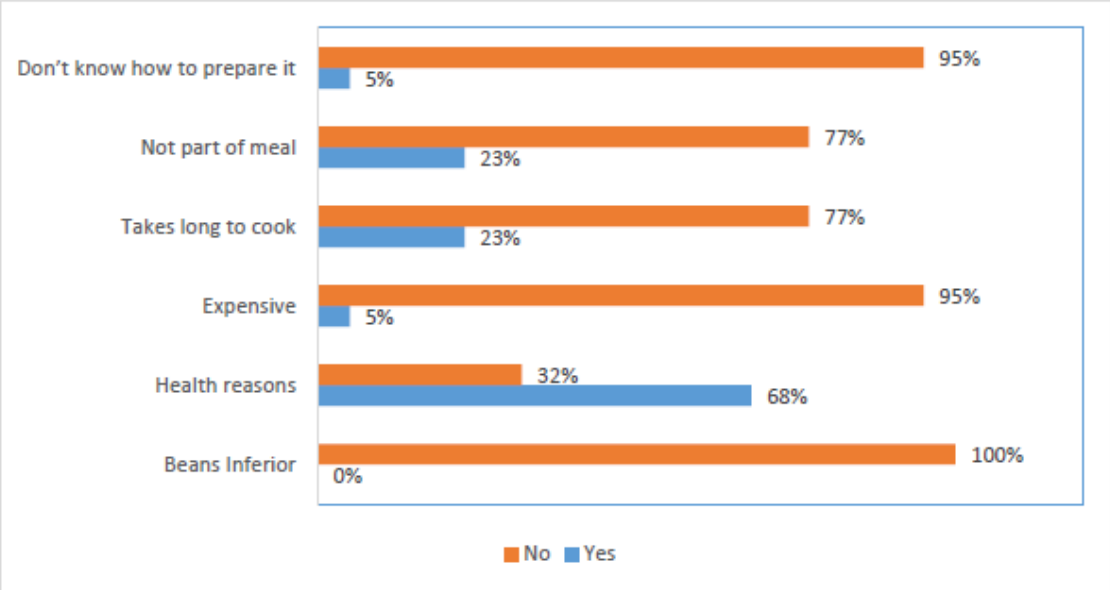
Table 9 : Factors Influencing Decision to buy Purple (Kabulangeti) Beans in Constituencies

	Constituencies						
Factor	**Chawama**	**Kabwata**	**Kanyama**	**Lusaka Central**	**Mandevu**	**Matero**	**Munali**
Price	2	18.37	12.24	10.2	4	18.4	34.7
Grain Size	0	21.15	3.85	9.6	9.6	32.7	23.1
Cooking Time	1.5	23.1	6.2	6.2	7.7	29.3	26.15
Tradition and Culture	2.2	28.9	11.1	8.9	6.7	8.9	33.3

Source: Author's Own Calculation

4.5 Reasons for not consuming beans

Figure 3 below show results explaining the reasons for not consuming beans. Of the respondents that do not consume beans, 22.7% do not consume it because it takes long to cook while 68.2% do not eat beans because of health reasons. About 4.6% of respondents perceive beans as expensive and thus, do not consume it. It is interesting to note that no consumer that doesn't eat beans regarded it as an inferior good.



Source: Author's Own Calculation

Figure 3 : Reasons For Not Consuming Beans

4.6 Choices when exposed to different bean attribute levels

Tables 10 to 13 show results when respondents were exposed to different combinations/alternatives of bean attributes. Each respondent had a choice to choose one alternative from a given choice set. A no option was also allowed. Analysis of the results provide interesting findings of how different consumers perceive different attribute combinations. Picking choice sets 1 and 2 for example, it was revealed that color, cooking time and gravy quality play key roles on individual's choice for beans.

For example, alternative 2 of choice set 1 shows that 38% of the respondents prefer a bean variety which is purple, medium size, cooks slow but with good gravy quality. Alternative five from the same choice set shows that 27% of respondents prefer a medium sized mottled red beans variety which cooks slow but with good gravy quality. From choice set 2 and alternative 3, results show that 34% of respondents prefer small sized purple beans which cooks fast and with good gravy quality. Analysis of the frequencies indicate that color, cooking time and gravy quality are important attributes that influence consumers choice for bean attributes. Consumers are indifferent to grain size as can be seen from the frequencies. Furthermore, it can also be seen that consumers would rather compromise cooking time but not gravy quality.

Table 10 : Choice Sets 1&2 - Choices When Exposed to Different Combinations

Choice	Alternative				Frequency	Percentage
1	Yellow	Medium	Fast	Poor	50	17%
	Purple	Medium	Slow	Good	111	38%
	Mixed Yellow	Medium	Fast	Poor	11	4%
	Mottled red	Medium	Slow	Good	64	22%
	Yellow	Small	Slow	Good	45	15%
	Mottled red	Small	Fast	Poor	10	3%
	Total				291	
	Alternative				**Frequency**	**Percentage**
2	Yellow	Large	Slow	Good	72	21%
	Mottled red	Large	Slow	Good	36	10%
	Purple	Small	Fast	Good	120	34%
	Mottled red	Large	Fast	Poor	16	5%
	Purple	Large	Fast	Good	93	27%
	Mottled red	Medium	Fast	Poor	11	3%
	Total				348	

Source: Author's Own Calculation

Table 11 : Choice Sets 3&4 - Choices When Exposed to Different Combinations

Choice	Alternative				Frequency	Percentage
3	Mottled red	Small	Fast	Good	47	15%
	Mottled red	Small	Slow	Good	53	17%
	Mixed Yellow	Small	Slow	Poor	15	5%
	Mixed Yellow	Small	Fast	Good	123	39%
	Purple	Medium	Slow	Poor	34	11%
	Mixed Yellow	Small	Slow	Good	43	14%
	Total				315	
Choice	**Alternative**				**Frequency**	**Percentage**
4	Mixed Yellow	Medium	Slow	Good	59	23%
	Mottled red	Small	Slow	Poor	12	5%
	Purple	Large	Slow	Good	99	38%
	Yellow	Medium	Slow	Poor	19	7%
	Yellow	Large	Slow	Poor	15	6%
	Mottled red	Medium	Fast	Good	54	21%
	Total				258	

Source: Author's Own Calculation

Table 12 : Choice Sets 5&6 - Choices When Exposed to Different Combinations

Choice Number	Alternative				Frequency	Percentage
5	Mixed Yellow	Large	Fast	Poor	31	21%
	Purple	Small	Fast	Poor	11	7%
	Yellow	Small	Fast	Poor	11	7%
	Mixed Yellow	Small	Fast	Poor	34	23%
	Mixed Yellow	Medium	Fast	Good	53	35%
	Mixed Yellow	Large	Slow	Poor	10	7%
	Total				150	
	Alternative				**Frequency**	**Percentage**
6	Mixed Yellow	Large	Fast	Good	87	47%
	Purple	Large	Fast	Poor	30	16%
	Purple	Medium	Fast	Poor	25	14%
	Yellow	Large	Fast	Good	7	4%
	Yellow	Large	Fast	Poor	17	9%
	Mottled red	medium	Slow	Poor	19	10%
	Total				185	

Source: Author's Own Calculation

Table 13 : Choice Sets 7&8 - Choices When Exposed to Different Combinations

Choice Number	Alternative				Frequency	Percentage
7	Purple	Small	Slow	Poor	53	20%
	Mottled red	Large	Fast	Good	45	17%
	Yellow	Large	Fast	Good	87	32%
	Mottled red	Large	Slow	Poor	16	6%
	Yellow	Small	Fast	Good	59	22%
	Mixed Yellow	Medium	Slow	Poor	8	3%
	Total				268	
8	**Alternative**				**Frequency**	**Percentage**
	Purple	Medium	Fast	Good	89	28%
	Yellow	Medium	Fast	Good	73	23%
	Yellow	Medium	Slow	Good	26	8%
	Mixed Yellow	Large	Slow	Good	20	6%
	Purple	Small	Slow	Good	100	32%
	Yellow	Small	Slow	Poor	7	2%
	Total				315	

Source: Author's Own Calculation

4.7 Econometric analysis of Consumer preferences for Bean Attributes

4.7.1 Tests for Multicollinearity

i) Correlation matrix

The correlation matrix as shown in Appendix 3 revealed that no variables had a pair-wise correlation above 0.4. Since the threshold is 0.8 and that all variables had a pairwise correlation of less than 0.4, the data was free of multicollinearity

ii) Variance Inflation Factor (VIF)

In this study, the mean VIF was 1.32 and each of the independent variables also had VIF of between 1.01 and 1.52 as shown in Appendix 2. Since all the VIF for the independent variables were < 5, this indicated zero multicollinearity.

4.8 Empirical Estimation

Table 14 below shows the econometric estimation of the preferences for beans attributes.

Results of the conditional logistic model reveal that coefficients of color variables i.e. mixed yellow, yellow and purple were highly significant and carried positive signs. For example, when compared to mottled red beans, mixed yellow, yellow and purple bean type commanded a strong and positive preference. However, despite having positive effects on the likelihood of choice, there was significant variations in the strengths of probabilities. For example, a bean variety with purple color is highly preferred (0.879) to yellow (0.249) and mixed yellow (0.399) respectively. A mixed yellow bean type is highly preferred (0.399) relative to yellow (0.249) when compared to mottled red beans. In terms of utility, when compared to purple, a consumer's utility would

increase by 0.879, 0.399 and 0.249 utils if given a bean type which is purple, mixed yellow or yellow respectively. The data showed that all the colour attributes of beans were highly significant and commanded positive preference.

Table 14 : Parameter Estimates for Preferences for Bean Attributes:

Variables	**Survey**					
	Coefficient	**Standard Error**	**Significant Level**	**Standard Error**	**95% Confidence Interval**	
Grain color (base=mottled red)						
Yellow	0.249	0.074	**	0.074	0.103	0.393
Purple	0.879	0.067	***	0.067	0.746	1.012
White and Yellow	0.399	0.074	***	0.074	0.253	0.545
Grain size(base=large)						
Small	0.046	0.066		0.066	-0.084	0.176
Medium	0.64	0.068		0.068	-0.07	0.199
Cooking time(base=fast)						
Slow	-0.252	0.053	***	0.053	-0.356	-0.149
Gravy Quality(base=good)						
Poor	-1.161	0.059	***	0.059	-1.276	-1.046
Number of observations	12712					
Prob > chi2	0					
Pseudo R2	0.1005					

Significance levels: $p \leq 1\%$ =***, $p \leq 5\%$ = **, $p \leq 10\%$ = *

Source: Author's Own Calculation

The effect of cooking time on choice for beans was also assessed. When compared with the fast cooking bean variety, it was revealed that coefficient for cooking time variable, slow, was highly significant and had a negative sign. Using fast cooking variable as

reference, it was found that an individual's utility would reduce by 0.253 if given a beans variety which takes long to cook. This finding is consistent with the finding by Katungi et. al (2011) which also indicated that varietal adaptation should strive at reducing the cooking time of bean grain. This finding can be attributed to the bearing which cooking time has on the cost associated with bean preparation. As the bean seed is hard to cook, the shorter the cooking time, the more a bean variety is preferred. A fast cooking bean variety would thus be highly preferred to the slow cooking one as households thrive at reducing the cost of energy used for cooking. Lusaka district is predominantly urban with high dependency on electricity as the major source of energy. Furthermore, low density areas even when most of them are connected to the national electricity grid have an alternative source of energy for cooking i.e. charcoal. In both cases, energy for cooking is expensive, therefore, these results potentially explain why consumers will prefer common dry beans with lower average cooking time.

Gravy quality was also assessed and was found to play a critical and significant role in the preference for beans. Compared to beans with good gravy quality, results revealed that consumers' utility would significantly reduce by 1.161 if given a beans variety with poor gravy quality. This finding reveals the value that consumers attach to good gravy quality. Gravy quality is associated with cooking quality, thus a beans with poor gravy quality can be said to poses poor cooking quality characteristics. This explains the results in both total survey and constituency level data where respondents have a negative and significant preference for a poor gravy quality beans.

Grain size attribute was also assessed. Even though carrying positive signs, the coefficients for bean grain size of the total survey data were found to be insignificant at all significance levels

The analysis further went to show how the preferences in the constituency. As the sample was drawn from different constituencies of Lusaka district, it was imperative to compare how consumers in the respective constituencies prefer beans attributes. Table 15 shows results of consumer preferences for beans attributes in constituencies. While

total survey data as explained in the previous section showed interesting findings, results of the individual constituencies showed varied findings. For example, in Chawama constituency, respondents preferred purple and mixed yellow beans as shown by the significance levels. In Lusaka Central and Mandevu constituencies, respondents preferred purple beans variety while in Kanyama, respondents preferred all colour attributes.

Furthermore, it was noted that purple bean variety was highly preferred in both the total survey and constituent data. It can be concluded that a purple bean variety has a high and positive impact on the choices that consumers make on beans compared to other bean varieties. This finding affirms the descriptive findings on the most frequently consumed bean type where it was shown that respondents most preferred purple bean variety, as shown in the previous section. Thus, color plays a significant role in the choice that individuals make for beans. This finding is consistent with studies done by Mishili et al (2009). Sichilima *et. al* (2016), though using hedonic modeling framework also observed that color played a significant role on the price for beans which Lusaka consumers are willing to pay.

Table 15 : Table Showing Parameter Estimates for Attributes Preferences in Constituencies

Variables	Chawama Constituency			Kabwata Constituency			Kanyama Constituency			Lusaka Central Constituency			Mandevu Constituency			Matero Constituency			Munali Constituency		
	Coef	Std. error	Sig. level	Coef	Robust std.err	Sig. level	Coef	Std. error	Sig. level	Coef	Std. error	Sig. level	Coef	Std. error	Sig. level	Coef	Std. error	Sig. level	Coef	Std. Error.	Sig. level
Grain color (base=mottled red)																					
Yellow	0.538	0.33		0.507	0.218	*	0.406	0.197	*	0.052	0.222		0.205	0.368		0.176	0.135		0.155	0.148	
Purple	0.929	0.32	**	1.078	0.198	***	1.161	0.18	***	0.633	0.195	**	1.058	0.335	**	0.801	0.124	***	0.754	0.137	***
White and Yellow	0.623	0.33	*	0.345	0.223		0.315	0.194	*	0.252	0.213		0.452	0.368		0.484	0.136	***	0.264	0.152	*
Grain size(base=large)																					
Small	-0.201	0.301		-0.394	0.205	*	0.102	0.173		0.293	0.205		-0.39	0.325		-0.031	0.123		0.307	0.131	*
Medium	-0.197	0.296		-0.13	0.214		0.086	0.184		0.478	0.195	*	-0.503	0.334		0.056	0.125		0.118	0.139	
Cooking time(base=fast)																					
Slow	-0.25	0.237		-0.406	0.155	**	-0.465	0.139	**	0.078	0.155		-0.325	0.265		-0.214	0.096	*	-0.202	0.108	*
Gravy Quality(1=yes:																					
Poor	-1.041	0.25	***	-1.14	0.173	***	-1.292	0.157	***	-1.2	0.172	***	-1.052	0.284	***	-1.12	0.107	***	-1.222	0.12	***
Number of observations	641			1449			1937			1458			546			3728			3120		
Prob > chi2	0			0			0			0			0			0			0		
Pseudo R2	0.0868			0.1148			0.1339			0.0934			0.1133			0.0923			0.1023		

Significance levels: $p \leq 1\% = ***$, $p \leq 5\% = **$, $p \leq 10\% = *$

Source: Author's Own Calculation

Results of the total survey data were similar with those found in Matero, Munali, Kabwata and Kanyama constituencies where slow cooking time had a significant and negative effect on choice. Even though having negative sign, results for Mandevu and Chawama constituencies were insignificant. Furthermore, Lusaka Central constituency recorded a positive and insignificant effect of slow cooking beans variety on choice. This entails that cooking time doesn't matter among the respondents of Lusaka Central constituency. As Lusaka Central constituency is affluent relative to other Lusaka district constituencies, it can be concluded that respondents in this constituency have the ability and capacity to use pressure cookers in beans preparation, hence, the insignificant effect that cooking time have on choice for beans. Nevertheless, survey data showed a significant effect on the choices that consumers make on which bean variety to consume.

Small grain sized beans was found to have a positive and significant (at 10% significant level) in Munali constituency while in Kabwata constituency, the coefficient was negative and significant at 10% significant level. The coefficient for medium grain sized beans in Lusaka Central constituency was positive and significant at 10% significant level. Nevertheless, these findings reveal that bean grain size is not as important as color, cooking time and gravy quality. Survey data showed that bean grain size is insignificant and has no influence or impact on the choice consumers make over which bean variety to choose. This finding is similar to Fulgence et. al (2009) that indicated that none of the coefficients for the grain size were statistically significant but carried expected positive signs.

4.9 Marginal Effects

Marginal effects were run to understand how the preference changes with a change in the characteristic of an attribute level. For example, what happens to the preference if colour intensity is altered or when the cooking time is reduced by a certain amount of time. Table 16 below shows interesting results on marginal effects. As can be seen from the table, if color intensity is increased by 0.5 units, the probability of being selected improves by almost 25% (yellow=24.9%, purple=24.57% and mixed yellow=25%) for all color levels. Interesting results were seen for the levels for cooking time and gravy quality. A 0.5 unit change for cooking time, or 0.5 unit reduction in cooking time saw an improvement of the probability of being selected by 74%. A 0.1 unit improvement in gravy quality saw an improvement in the likelihood of being selected by 41.34%. When compared with color, these results confirm the importance of cooking time and gravy quality on the choice for a bean variety. Thus, even though coefficients for color, purple in particular had a big probability of being selected, marginal effects revealed otherwise. Gravy quality is the most preferred attribute followed by cooking time while color intensity is the least.

Table 16 : Marginal Effects or Elasticity's when Attribute Levels are altered

Variable	Scenario	Coefficient	Standard Error	95% confidence Interval	
Yellow	0.5	0.062 (24.9%)	0.018	0.026 (25%)	0.098 (24.9%)
Purple	0.5	0.216 (24.57%)	0.016	0.185 (24.8%)	0.248 (24.5%)
Mixed Yellow	0.5	0.099 -25%	0.018	0.063 (24.9%)	0.135 (24.7%)
Slow	-0.5	-0.187 -74%	0.038	-0.262 (69.1%)	-0.112(75.2%)
Poor	-0.1	-0.480 (41.34%)	0.02	-0.519(40.7%)	0.440 (42%)

Source: Author's Own Calculation

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter begins with the conclusions of the study where the study's objectives and key findings are summarized. Proposed recommendation based on the key findings is also presented. The chapter concludes by highlighting areas where future research related to this study could be undertaken.

5.2 Conclusions

Attributes of grain legumes are known to affect premiums which consumers are willing to pay and also affect choice of a particular bean variety. The main objective of this study was to identify and analyze the impact that bean attributes have on consumer choice for common dry beans in Lusaka. To achieve this objective, this study used data obtained by Pulse Value Chain Initiative project that implemented the survey in 2015. The sample size for this study was 844 consumers of Lusaka district and the stated sample was used to identify and analyze attributes which drive consumer choice for beans. The study used the conditional logistic regression model in analyzing the choice experiment data in order to identify and analyze the impact that bean attributes have on consumer choice for common dry beans in Lusaka. Furthermore, the marginal effects to show the elasticity of demand when attribute levels are altered was performed.

Interesting findings about consumer preference for beans, in Zambia, Lusaka in particular have been revealed by the current study. For example, it has been established that color such as purple, yellow and mixed yellow are important characteristics which affect the choice for common dry beans.

The results showed that colour plays an important role in the preferences which consumers make given a particular bean type. It was also observed from the study that cooking time significantly influenced the choice for beans. A slow cooking bean variety is less preferred by the consumers as it was observed from the results. Further, it was revealed that gravy quality affected consumer preference when a consumer was given a bean variety with poor gravy quality. This reveals the negative preference that consumers have over poor gravy quality bean variety. Furthermore, analysis of the marginal effects brought about as a result of change in attribute levels revealed that a change in color intensity resulted a positive direction of the preference for a given bean type. Reduction in cooking time and an improvement in gravy quality of a bean type was also seen to increase consumer preference for a given bean type

5.3 Recommendations

The study finds that bean attributes affect preference for a particular bean type. Results showed that gravy quality, cooking time and grain color are the most important characteristics of a bean type/variety which affect consumer preference.

Agriculture Research Institutes such as Zambia Agriculture Research Institute (ZARI) and training institutions such as the University of Zambia (UNZA) have been putting efforts in place to develop new and improved bean varieties. Bean breeding efforts have the objective of developing marketable and preferred bean varieties with resistance to major biotic and abiotic stresses (ZARI). Since one of the specific objectives of the breeding efforts is to release preferred and acceptable bean varieties by the community/consumers, the findings of this study shed light on consumer preferences which breeders need to take into consideration while developing new and improved bean varieties. Thus bean breeders should pay particular attention on gravy quality, cooking time and grain color in their efforts of improving improved bean varieties.

5.4 Future Research

The study uses Lusaka's respondents to elicit consumer preferences for beans. Lusaka is currently being considered as the largest urban market for agricultural produce. Future studies need to consider other urban markets so as to come up with a nationwide picture of how different consumers perceive bean attributes. It is also important for future studies to consider rural consumers in an effort to segmenting markets. Furthermore, future research should consider incorporating qualitative data collection techniques as a way of triangulating the quantitative piece.

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APPENDICES

Appendix 1: Choice sets used in the Choice Experiment survey

Appendix 1.1: Choice set 1

Attributes	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**
Color	Yellow	Purple	Mixed	Mottled Red	Yellow	Mottled Red
Size	Medium	Medium	Medium	Medium	Small	Small
Cooking Time	Fast	Slow	Fast	Slow	Slow	Fast
Gravy Quality	Poor	Good	Poor	Good	Good	Poor

Appendix 1.2: Choice set 2

Attributes	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**
Color	Yellow	Mottled Red	Purple	Mottled Red	Purple	Mottled Red
Size	Large	Large	Small	Large	Large	Medium
Cooking Time	Slow	Slow	Fast	Fast	Fast	Fast
Gravy Quality	Good	Good	Good	Poor	Good	Poor

Appendix 1.3: Choice set 3

Attributes	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**

Color	Mottled Red	Mottled Red	Mixed Yellow	Mixed Yellow	Purple	Mixed Yellow
Size	Small	Small	Small	Small	Medium	Small
Cooking Time	Fast	Slow	Slow	Fast	Slow	Slow
Gravy Quality	Good	Good	Poor	Good	Poor	Good

Appendix 1.4: Choice set

Attributes	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**
Color	Mixed Yellow	Mottled Red	Purple	Yellow	Yellow	Mottled Red
Size	Medium	Small	Large	Medium	Large	Medium
Cooking Time	Slow	Slow	Slow	Slow	Slow	Fast
Gravy Quality	Good	Poor	Good	Poor	Poor	Good

Appendix 1.5: Choice set 5

Attributes	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**
Color	Mixed Yellow	Purple	Yellow	Mixed Yellow	Mixed Yellow	Mixed Yellow
Size	Large	Small	Small	Small	Medium	Large
Cooking Time	Fast	Fast	Fast	Fast	Fast	Slow
Gravy Quality	Poor	Poor	Poor	Poor	Good	Poor

Appendix 1.6: Choice set 6

Attributes	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**
Color	Mixed Yellow	Purple	Purple	Yellow	Yellow	Mottled Red
Size	Large	Large	Medium	Large	Large	Medium
Cooking Time	Fast	Fast	Fast	Fast	Fast	Slow
Gravy Quality	Good	Poor	Poor	Good	Poor	Poor

Appendix 1.7: Choice set 7

Attributes	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**
Color	Purple	Mottled Red	Yellow	Mottled Red	Yellow	Mixed Yellow
Size	Small	Large	Large	Large	Small	Medium
Cooking Time	Slow	Slow	Fast	Slow	Fast	Slow
Gravy Quality	Poor	Good	Good	Poor	Good	Poor

Appendix 1.8: Choice set 8

Attributes	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Color	Purple	Yellow	Purple	Mixed Yellow	Purple	Yellow
Size	Medium	Medium	Medium	Large	Small	Small
Cooking Time	Fast	Fast	Slow	Slow	Slow	Slow
Gravy Quality	Good	Good	Good	Poor	Good	Poor

Appendix 2: Variance Inflation Factors (VIF) for the Independent Variables

Variable	VIF	SORT	Tolerance	R - squared
Yellow	1.52	1.23	0.6564	0.3436
Purple	1.48	1.22	0.6739	0.3261
Mixed Yellow	1.5	1.22	0.6667	0.3333
Small	1.35	1.16	0.742	0.258
Medium	1.35	1.16	0.742	0.258
Slow	1.01	1.16	0.9946	0.0054
Poor	1.01	1.16	0.9946	0.0054

Mean VIF = 1.32

Appendix 3: Correlation Matrix

	Mixed Yellow	Purple	Yellow	Mottled red	Small	Medium	Large	Slow	Fast	Poor	Good
Mixed Yellow	1										
Purple	- 0.3148	1									
Yellow	- 0.3519	-0.3323	1								
Mottled red	- 0.3333	-0.3148	-0.3519	1							
Small	- 0.0000	0.035	-0.0331	-0.0000	1						
Medium	- 0.0000	0.035	-0.0331	-0.0000	-0.05	1					
Large	- 0.0000	-0.0701	0.0663	-0.0000	-0.05	-0.05	1				
Slow	- 0.0241	-0.0269	-0.0215	0.0241	0.0295	0.0295	-0.059	1			
Fast	- 0.0241	0.0269	0.0215	-0.0241	-0.0295	-0.0295	0.059	-1	1		
Poor	- 0.0241	-0.0269	-0.0215	0.0241	0.0295	0.0295	-0.059	-0.0017	0.0017	1	
Good	- 0.0241	0.0269	0.0215	-0.0241	-0.0295	-0.0295	0.059	0.0017	-0.0017	-1	1

Appendix 4: Household Questionnaire

BEAN CONSUMPTION SURVEY: A CHOICE EXPERIMENT APPROACH

THIS SURVEY IS BEING CONDUCTED BY THE BEAN VALUE CHAIN RESEARCH NETWORK, A COLLABORATIVE RESEARCH INITITATIVE COMPRISING LILONGWE UNIVERSITY OF AGRICULTURE AND NATURAL RESOURCES, SOKOINE UNIVERSITY OF AGRICULTURE, UNIVERSITY OF ZAMBIA AND KANSAS STATE UNIVERSITY WITH FUNDING FROM THE LEGUME INNOVATION LABORATORY, A USAID-FUNDED INITIATIVE

THIS INFORMATION IS STRICTLY CONFIDENTIAL AND IS USED FOR STATISTICAL PURPOSES ONLY

City/Town & Country	**Lusaka, Zambia (automatically inputted into survey)**

A1. In which province is your hometown?	

Lusaka	**Central**	**Western**	**Northern**	**Southern**
Eastern	**Luapula**	**Muchinga**	**Copperbelt**	**North-Western**

Provinces:

A16. Enumerator Area

Interview Date:	**(automatically inputted into survey)**	**Interview Location**	Home	Work	Other

M1. Respondent's Gender (X):	**Male**			**Female**	

INTRODUCTION BY ENUMERATOR

E.1 ***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 play in their food options. We would also like to know how the attributes of certain foods influence consumption decisions. Your responses will help inform how plant breeders and the upstream production chain makes 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.

C1. 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 on which you would like further clarification? {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)?

A. MODULE A: HOUSEHOLD ROSTER

A1. How many people, <u>including yourself</u>, live permanently in this household?	

A2. How many of the people permanently living in your household are 18 years or older?	

A3. For all household members <u>under 18 years</u>, please indicate the number in each of the following age categories.					
Under 5 Years		5-12 Years		13-17 Years	

A4. Which of the following best describes your marital status	Single/Never Married		Married/Cohabiting		Divorced/Separated		Widowed	

A5. What is your highest level of education current or completed	None		Primary		Secondary		Technical/Vocational		College/University	

A6. How old are you (in years?)	

A7. Please select the employment type that best describes your situation.									
Salaried (Full-time)		Salaried (Part-time)		Self-employed (Full-time)		**Self-employed (Part-time)**		**Unemployed**	
A8. If you indicated being married/cohabiting, could you please which of the following best describes your spouse's situation?									
Salaried (Full-time)		Salaried (Part-time)		Self-employed (Full-time)		**Self-employed (Part-time)**		**Unemployed**	

A9. Which of these kitchen appliances do you have in your kitchen or have access to in your house? (Check all that apply)													
Electric stove		Gas stove		Charcoal brazier		Pressure cooker		Microwave		Refrigerator		Washing Machine	

A10. Which of the following best describes your housing situation?					
Own my house/flat		Rent House/Flat		Living with someone (relative/friend)	Others (Please Specify)

A11. Taking all things together, which of the following would you use to describe your current situation?	Very Unhappy	Unhappy	Happy	Very Happy

A12. All things considered, how satisfied are you with your life as a whole these days?	Very Dissatisfied	Dissatisfied	Satisfied	Very Satisfied

A13. Please indicate which of the following <u>you</u> <u>would use</u> to describe your own <u>economic</u> <u>condition</u>.	Poor	Working Class	Middle Class	Upper Middle Class	Rich

E.4 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.

B. MODULE B. FOOD CONSUMPTION DECISIONS

B1. Which of the following people typically influence food-purchasing decisions in your household? (Select all that apply)						
Self	Spouse	Parent or Other Relatives	Children	House Help	Friends	Other (Please Specify)
B2. In the past 7 days, indicate which of the following people have contributed to food preparation in your household. (Select all that apply)						
Self	Spouse	Parent or Other Relative	Children	House Help	Friends	Other (Please specify)

B3. How frequently do you eat major meals (breakfast, lunch or dinner) outside the home?											
B31	Breakfast	Never		Seldom (A few times/year)		Often (Once or twice/month)		Frequent (Once or more/week)		Daily	
B32	Lunch	Never		Seldom (A few times/year)		Often (Once or twice/month)		Frequent (Once or more/week)		Daily	
B33	Dinner	Never		Seldom (A few times/year)		Often (Once or twice/month)		Frequent (Once or more/week)		Daily	

B4. How much does your household spend on all food purchases in a typical month?	**$**
B5. What proportion of your total monthly household income is spent on all food expenditure?	**%**
B6. What proportion of your household food expenditure would you typically spend on food eaten away from home in a typical month?	**%**
B7. What proportion of your household food expenditure is spent on food consumed at home in a typical month?	**%**

B8. 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.	**You own home gardens or farm**	**Friends and family**	**NGO, Church or other charitable organization**	**Government**

B9. Do you eat beans and/or bean products?		**YES**		**NO**

B10. If yes, where do you eat beans and/or bean products?		**At home**		**Outside of the home**

B11. Please rank the importance of the following food categories to your household's food nutrition security. (1 = Critical to our food security, i.e., will always buy it; 6 = Have least effect on our food security, i.e., can afford to forgo it)

	Food Product	**Rank**
B101	Legumes (Dry Beans and Pulses)	
B102	Fish and Seafood	
B103	Fruits and Vegetables	
B104	Cereals (Maize, rice millet, sorghum, bread)	
B95	Roots and Tubers (Cassava, sweet potato, Irish potato, yams, etc.)	
B97	Animal products (Meat, milk, eggs, etc.)	

B12. In a typical month, what amount of your household food expenditure would you spend on each of the following food product?

Food Product		**Amount**	**Food Product**		**Amount**
B111	Legumes (Dry Beans and Pulses)	$	B115	Roots and Tubers (Cassava, sweet potato, Irish potato, yams, etc.)	$
B112	Fish and Seafood	$	B116	Animal products (Meat, milk, eggs, etc.)	$
B113	Fruits and Vegetables	$	B117	Other foods (oil, salt, etc.)	$
B114	Cereals (Maize, rice, millet, sorghum, bread)	$		**Total (must equal no more than household food expenditure)**	$

NOTE: If you consume beans but do not purchase them (e.g., beans are sourced from your family garden), then input $1 as the amount.

NOTE: If the expenditure on legumes is 0% (i.e., B111=0), skip to Question B20.

E.5 For the rest of our conversation, I am going to focus on your household's consumption of beans and bean products.

B13. How frequently does your household consume each of the following beans and bean products? (Response codes below)					
Variety/Product		**Frequency Code**	**Variety/Product**		**Frequency Code**
B121	Dry beans, purple		B127	Dry beans, mottled brown	
B122	Dry beans, yellow		B128	Dry beans, white with brown spot	
B123	Dry beans, mottled red		B129	Bean flour	
B124	Dry beans, mixed yellow		B1210	Baked beans	
B125	Dry beans, white		B1211	Canned whole beans	
B126	Dry beans, red		B1212	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 omit food product option in the subsequent tables (B12, B13, B14, B15, B17)

B14. Over the past 30 days, please estimate the quantity of bean products purchased or consumed in your household.							
Variety/Product		**Quantity**	**Unit**	**Variety/Product**		**Quantity**	**Unit**
B141	Dry beans, purple			B147	Dry beans, mottled brown		
B142	Dry beans, yellow			B148	Dry beans, white with brown spot		
B143	Dry beans, mottled red			B149	Bean flour		
B144	Dry beans, mixed yellow			B1410	Baked beans		
B145	Dry beans, white			B1411	Canned whole beans		
B146	Dry beans, red			B1412	Other processed bean products (Specify below)		

Code	**B90**	**B50**	**B25**	**B10**	**T20**	**T10**	**T5**	**P**	**KG**	**GR**
Unit	**90 Kg Bag**	**50 kg Bag**	**25 kg bag**	**10 kg bag**	**20 Litre tin**	**10 Litre tin**	**5 Litre tin**	**Piece**	**Kg**	**gram**

Code	LT	ML	BP	HP	PL	CU	GAL	BK	BD	MD
Unit	Litre	Millilitre	BP	Heap	Plate	Cup	Gallon	Bucket	Bundle	Meda

B15. Over the past 30 days, please estimate your expenditure on bean products purchased or consumed in your household. (in local currency)					
Variety/Product		Expenditure	Variety/Product		Expenditure
B131	Dry beans, purple	$	B137	Dry beans, mottled brown	$
B132	Dry beans, yellow	$	B138	Dry beans, white with brown spot	$
B133	Dry beans, mottled red	$	B139	Bean flour	$
B134	Dry beans, mixed yellow	$	B1310	Baked beans	$
B135	Dry beans, white	$	B1311	Canned whole beans	$
B136	Dry beans, red	$	B1312	Other processed bean products (Specify below)	$

B16. Please indicate (X) your typical source of beans and bean products. Select the source used most often for each product.						
Product/Variety		Own Farm	Gift	Donations from Church, NGOs, Gov't	Open Market	Supermarket
B161	Dry beans, purple					
B162	Dry beans, yellow					
B163	Dry beans, mottled red					
B164	Dry beans, mixed yellow					
B165	Dry beans, white					
B166	Dry beans, red					
B167	Dry beans, mottled brown					
B168	Dry beans, white with brown spot					
B169	Bean flour					
B1610	Baked beans					
B1611	Canned whole beans					
B1612	Other processed beans (Specify)					

B17. Please indicate the typical roles of the different types of beans and bean products in your household meals. Select all that apply.					
	Product/Variety	**Main Dish**	**Complement to Main Dish (e.g., stew/soup)**	**Side Dish**	**Ingredient**
B171	Dry beans, purple				
B172	Dry beans, yellow				
B173	Dry beans, mottled red				
B174	Dry beans, mixed yellow				
B175	Dry beans, white				
B176	Dry beans, red				
B177	Dry beans, mottled brown				
B178	Dry beans, white with brown spot				
B179	Bean flour				
B1710	Baked beans				
B1711	Canned whole beans				
B1712	Other processed beans (Specify)				

E.6 Let us now turn our attention to the characteristics of beans that influence your purchasing and/consumption decisions.

B18. 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	**Price**	**Grain Size**	**Gravy Quality**	**Cooking Time**	**Tradition/Culture (Part of my/our diet)**
B191	Dry beans, purple					
B192	Dry beans, yellow					
B193	Dry beans, mottled red					
B194	Dry beans, mixed yellow					
B195	Dry beans, white					
B196	Dry beans, red					
B197	Dry beans, mottled brown					
B198	Dry beans, white with brown spot					
B199	Bean flour					
B1910	Baked beans					
B1911	Canned whole beans					
B1912	Other processed beans (Specify)					

B19. Please indicate which of the following food groups you would pair with beans and bean products in your household.		
Food Group	**Yes**	**No**

B201	Cereal (maize, rice, millet, sorghum, etc.)		
B202	Cereal products (bread, etc.)		
B203	Plantains and Bananas		
B204	Roots and Tubers (cassava, sweet potato, Irish potato, yams, etc.)		
B205	Groundnuts		
B206	Meat (beef, chicken, pork, etc.)		
B207	Fish (fresh, dry, tinned, etc.)		

E.7 Skip the next session and go to the experiment for respondents indicating they are bean and/or bean product consumers. NOTE: If the expenditure on legumes is greater than 0% (i.e., B111>0), skip to Module D.

E.8 The following few questions are for those who do not currently consume any beans in their households.

B20. Why don't you eat beans and/or bean products? (Select all that apply).		
Reason		**Check (X)**
B221	It is an inferior food product in my community (e.g., only poor people eat beans)	
B222	Health reasons (allergies, stomach aches)	
B223	Religion, faith or cultural taboo	
B224	Price (too expensive)	
B225	Risk of social embarrassment (flatulence factor)	
B226	Preparation inconvenience (Takes too long to prepare)	
B227	Someone (spouse, child, self, etc.) in my household doesn't like beans so we all avoid them	
B228	Never been a part of my household's meal options and never considered it	
B229	Don't know how to prepare it	
B2210	Don't believe beans are healthy for me and/or my family	
	Other (Specify):	

B21. How would you respond to the following statements about persuading you to eat beans and/or bean products?					
Change Event		**Unsure**	**Never**	**Probably**	**Definitely**
B241	If you found out that people you respect (athletes, celebrities, etc.) love eating beans and bean products				
B242	If you found out that beans are highly nutritious				
B243	If you found out that beans are extremely rich in protein				
B244	If you understood that beans were a much more economical source of protein than animal source				
B245	If bean had faster cooking time				
B246	If you found out that beans has very good health benefits (e.g., reduce "bad" LDL cholesterol, inflammation, blood pressure, etc.)				
B247	If eating beans reduced your risk of getting cancer				
B248	If eating beans enhanced your social status				
B249	If there was no social embarrassment risk associated with eating beans				
B2410	If you found out that consuming beans improved your ability to absorb iron, vital for health of reproductive-age women				
B2411	Improved options in how beans and bean products may be included in the diet				
B2412	If your income increased by 10%				
B2413	If your income increased by 30%				

E.9 Those who do not currently consume any beans and/or bean products have completed the survey at this point. Thank them for their time and responses. The interview is now completed.

MODULE C: Income Effect on Bean Consumption

E.10 In this section, we are going to explore the effect of changes in your income on your consumption of beans and bean products.

B22. Please indicate the extent to which the quantity of beans and bean products consumed in your household would likely change under each of the following income scenarios. Select the one that seems most feasible and reasonable to you.		
Statement		***Response***
B2511	Current annual income increased by 5%	
B2512	Current annual income increased by 10%	
B2513	Current annual income increased by 20%	
B2514	Current annual income increased by 50%	

Response	**No change**	**Less than the change in income**	**Same change in income**	**More than the change in income**
	0	**1**	**2**	**3**

MODULE D: CHOICE EXPERIMENT

Four different dry bean attributes – color, size, cooking time and the gravy quality – have been determined to influence consumers' dry bean preferences. Color has four levels (***Purple, Yellow, Mottled Red, Mixed Yellow)***, size has three levels (***small, medium*** and ***large***), two levels of cooking time (***slow*** and ***fast***), and two levels of gravy quality (***poor*** and ***good***). We are going to present you with different combinations of these attributes and levels for you to choose whether you would purchase dry beans with these characteristics. Your choices in each situation are as follows: **YES, I will purchase it; NO, I will not purchase it.**

The enumerator presents each of the choice tasks to the respondent. The choice tasks are blocked so that each respondent sees only a segment of the full choice tasks. Taken together, the total number of blocks ensures all the choice tasks are covered by the respondents so we have a complete balanced experiment. As they complete the choice tasks, the program develops a table similar to the one below with the choices to which they indicate "YES". Once they complete the choice tasks, we move to Module D.

MODULE E: CHOICE RANKING

The enumerator now gives the respondent a small cash note and begin the final section of the survey.

Now, this is the final step in the survey. I am going to give you a small amount of money. I will also present you with the choices you have made from the options that were presented. I want you to "spend" your money on the different choices you made **until you have exhausted it**. The money can **only be spent** on the bean choices selected. You can choose to spend it all on a single choice or distribute it among all your choices based on how you feel about the different combinations. So, let us do the allocations.

	Choice Descriptions	Amount
D1	**Color/Variety, Size, Cooking Time, Gravy Quality**	
D2	*If answered "Yes" to being willing to purchase the bean with the certain attributes stated in the DCE for Decision (Module C), then the bean's attributes will automatic populate this cell (e.g., Yellow, large, slow, poor) If answered "No", then this cell will be left blank.*	
D3		
D4		
D5		
D6		
	Total	@sum

E.11 Those who currently consume any beans and/or bean products have completed the survey at this point. Thank them for their time and responses. The interview is now completed.