CONSUMER PREFERENCE FOR COMMON BEAN ATTRIBUTES IN DAR ES SALAAM, TANZANIA

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ABSTRACT

Consumers' preferences for food products are always based on observable and non-observable attributes. Common beans which are globally important for income generation as well as food and nutrition security, appeal to consumers in different ways. One important distinction of this nature is with respect to colour, size, cooking time and gravy quality. When multiple common beans' varieties with varying attribute levels are exposed, consumers normally select multiple varieties on the same occasion while rejecting some of the offerings. However, studies that have explicitly assessed factors underlying such a decision making have generally been rare and confined to demographic and socio-economic factors only. Factors such as societal and cultural have been ignored in the previous studies. Ignoring these factors can distort the measured effects and contribute to the failure of interventions aimed at altering food preferences. This study incorporated the factors ignored in the previous studies along with demographic and socio-economic factors to understand better consumers' preferences for the common bean in Dar es Salaam, Tanzania. The rationale was to identify means to support actors in the bean value chain to improve their businesses and wellbeing. Discrete Choice Experiment (DCE) was employed in order to elicit individual preference and uncover how individuals selected common beans with varying attributes levels using a random sample of 732 respondents. Four different attributes including colour (4 levels), grain size (3 levels), cooking time (2 levels) and gravy quality (2 levels) were studied. Data analysis involved the use of descriptive statistics and Poisson Regression Model (PRM). Results from descriptive statistics showed that common beans with yellow colour, small grain size, good gravy and shorter cooking time were the most preferred. However, common bean with mottled red colour, poor gravy and longer cooking time were the least preferred. Results from PRM

showed that the probability of choosing two common beans types was the highest, although for some consumers, the number of choices ranged from zero to eight. The observed wide range of consumers' choice of beans reflect the diversity of consumer preferences which are partly influenced by their food habits and other factors including demographic, cultural orientation and economic factors like levels of income and occupation. The study recommends that breeding and market development efforts should primarily focus on both most preferred type of common beans and unique preferences of consumers whose choices are predominantly within a narrow range of common beans. Meeting the varied demand of consumers means increasing the range of choices that appeal to consumers.

DECLARATION

I, **Ezekiel Swema**, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

_____ _____

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DEDICATION

This dissertation is dedicated to my parents Mr. and Mrs. Swema.

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LIST OF ABBREVIATIONS AND ACRONOMY

AERC	African Economic Research Conssortium
BVCP	Bean Value Chain Project
DCE	Discrete Choice Experiment
EAs	Enumeration Areas
FAOSTAT	Food and Agricultural Organization Statistical databases
i.e.	That is
ME	Marginal effects
NBS	National Bureau of Statistics
PRM	Poisson regression model
PSUs	Primary Sampling Units
SFSE	Shared Facility for Specialization and Elective
SSA	Sub-Saharan Africa
SSUs	Secondary Sampling Units
SUA	Sokoine University of Agriculture
WTP	Willingness to Pay

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Billions of people across the world consume legumes. Common bean (*Phaseolus vulgaris L.*) is an important component of the traditional cropping system in developing countries, especially in Sub-Saharan African (SSA) (Akibonde and Maredia, 2011). More than 101 million smallholder farmers in SSA grow at least one tropical legume (Abate, 2012). The global production of all food legumes has increased at the rate of more than 1% per annum since 1980 (Nedumaran *et al*., 2013). Between 1994 and 2010 the average growth rate of common bean production in SSA was estimated to be about 4% per annum although this growth was mainly attributed to an increase in acreage and not crop productivity (Nedumaran *et al*., 2015). With respect to consumption, the common bean has been reported to exhibit an upward trend in all regions of the world except in Central and East Asia (Nedumaran *et al.*, 2015). Sub Saharan Africa is the second largest consumer of common bean after Latin America and Caribbean region, although its per capita consumption remained constant in the past three decades (FAOSTAT, 2016).

Common bean is regarded as a subsidiary-crop[1] to be relied upon during lean seasons as it is drought resistant and well adapted to the semi-arid regions of the tropics (Akibonde and Maredia, 2011). In Tanzania beans are regarded as important for food and nutrition security as well as income generation (Imungi and Potter, 1983; Leterme, 2002; Hella *et al*., 2013). Tanzania is ranked 7th among top producers of common bean worldwide although production is dominated by smallholder farmers who consume part of the produce and sell the surplus (Ronner and Giller, 2013). Smallholder farmers in Tanzania

1 These are low value food crops including legumes and tubers, often used to supplement the diet in times of a shortfall of food or during hunger.

have limited entrepreneurial skills and poor access to information about market requirements (Mishili *et al*., 2011). This information asymmetry limits these farmers from fully benefitting from increased production because they cannot bargain effectively when they market their produce and locate lucrative outlets for their produce.

Over the past three decades, researchers have identified different technologies such as improved seeds for increasing productivity and production of tropical legumes including common bean (Abate and Orr, 2012; Ronner and Giller, 2013; Nedumaran *et al*., 2015). These supply side interventions have rarely been accompanied by similar interventions to identify the most desired attributes of bean varieties, although it is known that attributes embedded in the various varieties of legumes are important in shaping consumer preferences. Abate and Orr (2012) reveal that even if the supply of beans has increased, absence of direct link between farmers and buyers limits communication within the value chain and growth in domestic demand, especially in urban areas. Therefore, providing demand-side information is essential for farmers and breeders to tailor their production and breeding plans to meet consumers' needs, respectively.

The study investigated the relationship between common beans' attributes and consumer preference, as an attempt to support food legumes development initiative and in so doing to improve smallholder farmers' income, food and nutrition security and to reduce poverty levels. Improved knowledge about consumer preference will not only enhance value generation along the chain but also engender an environment that supports the adoption of practices that produce the highest benefits for smallholder farmers and society as a whole.

1.2 Problem Statement and Justification of the Study

The bean market in Tanzania offers various types of beans that differ by colour, shape, size, cooking time and digestibility (Mishili *et al*., 2011). These characteristics have been reported to affect consumers' preferences for common beans. Katungi *et al*. (2011) reported that wealthier households in Kenya preferred low flatulence and large grain size of common beans while poor households were indifferent to size. A study conducted in Tanzania show that low income earners in Dar es Salaam preferred common bean variety locally known as *Soya-kablanketi* because of its short cooking time compared to other varieties (Mishili *et al*., 2011). However, Mundua (2010) found negative relationship between income and willingness to pay for different bean varieties in Uganda, where large grain size and white color were the preferred bean attributes. A similar study in Kenya reported that women were more conversant with bean attributes than men and made decision about the type of bean to be eaten at home (Gitonga, 2015).

Recently, there has been a continued debate with respect to roles the demographic and socio-economic characteristics play in shaping decision-making regarding food preferences. Literature reveals that decision-making about food preferences and choice are not confined to demographic and socio-economic factors only. Riet *et al*. (2011) reveals that knowledge from psychology, dietetic and nutritional disciplines is equally important in shaping consumer's food preference. Chadwick *et al*. (2013) argues that eating habits are partly a reflection of cultural and societal factors that are reinforced through social interactions, community taboos and tastes and preferences. Glanz *et al.* (1998), for example, reported that most individuals prefer to eat foods that are familiar to them and resist acquiring new preferences. According to Parraga (1990) factors influencing food choice decisions are interactive, encompassing societal, cultural and other individual-specific factors. If these factors are studied together, the measured effect of consumer

decision making about food could be revealed. Regardless of their importance in shaping consumer preferences, cultural and societal factors have been ignored in the previous studies. Ignoring these factors can distort the measured effect of the studied factors (i.e. demographic and socio-economic factors) and contribute to failure of interventions aimed at altering food preferences.

This study incorporates cultural and societal aspects ignored in the previous studies along with demographic and socio-economic aspects in order to get a better understanding of consumer preference for common bean in Dar es Salaam. Filling this gap would support entrepreneurs and other stakeholders seeking to do business or improve their business in the common bean sub sector. This endeavour would also help to identify opportunities to facilitate the development of the value chain and enhance income and reduce poverty.

According to NBS (2013), Dar es Salaam stands out as the largest city that accommodates a population exceeding 4 million people which is equivalent to about 10% of the national population. With rapid urbanisation, economic growth and increasing but unequal distribution of income and changing demographics, the city creates unique market opportunities for producers and merchants of common beans.

1.3 Study Objectives

1.3.1 Overall objective

The overall objective of this study was to investigate the relationship between common bean types and consumer preference as an attempt to support food legumes development initiative with an end objective of improving the well-being of smallholder farmers.

1.3.2 Specific objective of the study

i. To identify common bean types chosen by consumers.
ii. To rank common bean types preferred by consumers.
iii. To analyse the demographic, socio-economic, cultural and societal factors influencing the number of common bean types preferred by consumers.

1.4 Research Questions

i. What common bean types chosen by consumers?
ii. What common bean types most and least ranked by consumers?
iii. What are the demographic, socio-economic, cultural and societal factors influencing the number of common bean preferred by consumers?

1.5 Hypothesis

i. Demographic, socio-economic, cultural and societal factors have no significant influence on the number of common bean preferred by consumers.

1.6 Organization of the Dissertation

This dissertation consists of five chapters. The first chapter presents the background to the study, problem statement and justification along with research objectives, questions and the hypothesis tested. The second chapter presents a literature review focusing on a theoretical framework, analytical methods and empirical evidence. This chapter is the basis for the identification of knowledge gap and the choice of most adequate theoretical and analytical models used in this study. Chapter three is methodology presenting the conceptual framework, theoretical model, research design, sampling design and analytical techniques. Chapter four presents the results and discussion while chapter five presents conclusions, limitations of the study and recommendation of policy relevance along with areas for future studies.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Theoretical Framework

The traditional demand theory considers optimising behaviour in which consumer choice is restricted to consumption bundles that satisfy a budget constraint. In this context, the factors considered in the utility function are quantity and price. However, variation in attributes of goods is important when evaluating the utility. Unlike traditional demand theory, Lancaster (1966) developed an attribute based demand theory which assumes that a consumer derives utility from attributes of goods rather than the good itself. The theory aims to maximize the overall utility an individual derives from consuming a particular good with unique attributes. The theory provides a basis for a better understanding of the overall utility consumers obtain from common bean based on common beans attributes such as colour, grain size, cooking time and gravy quality. Following the Lancaster's approach, different methods have been developed and applied to measure individuals' preference for goods. These approaches are broadly categorized as revealed and stated preference as explained in section 2.2.

2.2 Methods for Valuing Non-Traded Goods

The economic value of attributes of commodities that are not traded cannot be revealed in the market. Revealed and stated preference methods are the innovative methods developed by economist to assign monetary value to non-traded goods. Where market of a good do not exist stated preference method employs a survey in which a hypothetical market for the good valued is created. Hanley *et al*. (1998) reveals that, stated preference method potentially relies on respondents making choices over hypothetical scenarios. That is, respondents are asked to choose the best alternative from among a set of hypothetical

scenarios, which are completely described by a set of attributes generated from an experimental setting. Conversely, revealed preference techniques use observations on actual choice made by people at the market place to measure preference. The primary advantage of the revealed preference method is the reliance on actual choice as it avoids the potential problems associated with hypothetical responses such as strategic responses or a failure to properly consider behavioural constraints (Louviere *et al*., 2000). By relying on observable scenarios, revealed preference is limited to observable state of the world. According to Hanley *et al*. (1998) and Louviere *et al*. (2010) the strength of revealed preference techniques is also its primary weakness. Therefore, a revealed preference technique is not appropriate for quantifying preferences for attributes where no variation exists or for which the attributes cannot be observed. For the purpose of this work stated preference is therefore appropriate to capture information about preference for common beans' attributes.

2.3 Choice Experiment Approach

Among a set of stated preference methods the, choice experiment[2] has frequently been used by economist and researchers (Train, 1993; Hensher and Bradley, 1993; Hanley *et al*., 1998). The approaches arise from conjoint analysis, but differ in the choice task to be completed. Unlike conjoint analysis, which requires respondents to rank among several commodity attributes, choice experiment ask individuals to choose among set of alternative bundles of commodity attributes, which makes it consistent with random utility theory (Train, 1993). Additionally, consumers focus on a trade-off between commodity attributes, which mimics the real purchase situation. Attribute levels are usually assigned on the basis of past studies or preliminary pilots (Bennett and Blamey, 2001; Van der pol and Cairns, 2001).

2 Also known as Discrete Choice Experiment (DCE)

Although cost attribute plays an important and distinct role in the discrete choice experiments, it is appropriate when a study intends to capture consumers' willingness to pay (WTP). Bennett and Blamey (2001) reveals that, inclusion of cost attribute makes it possible to indirectly obtain the respondent's WTP for either a good or its attributes. Despite the fact that cost component is a special feature to make DCE appropriate, it is perceived as a quantitative attribute and only important in estimation of consumer's willingness to pay (Van der pol and Cairns, 2001). In DCE cost component can take different forms, these including options such as consumer price, salary or donation. Because this study does not intend to understand consumers' WTP, the conversional DCE is used and hence does not include the cost component of common beans.

2.4 Empirical Evidence

2.4.1 Consumer behaviour and preference over food attributes

Consumer behaviour and preference for common beans is crucial especially when consumers are exposed to choices entailing unique combinations of beans' attributes. Common beans are heterogeneous in attributes and appeal to consumers in different ways (Katungi *et al*., 2010). A consumer preference literature investigates whether there is a link between individual factors and preference for common beans' attributes. The individual factors to be studied include cultural and societal factors, demographic factors as well as socio economic individual factors. The most recent studies on consumer preferences in Tanzania include Korir *et al*. (2005) and Fivawo and Msolla (2011). These studies reported the significance of socio-cultural factors on consumers' preferences for common beans and they found variation in consumers' preference for bean colour and across zones. According to their findings consumers from southern, central and western zones of Tanzania preferred common beans with yellow colour whereas consumers from northern and eastern zones preferred common beans with grey (soya) and mottled colour. The implication is

that availability and accessibility of common beans with the corresponding colour in these zones create a stagnant eating habit in favour of varieties of the same colour. Earlier studies by Sztainer *et al*. (1999) and Makweba and Xu (2009) in Tanzania found that personal consumption background related to upbringing and forced/imposed foods during the early stages of growth could result in someone avoiding entirely some foods during late stages of growth.

Like any other food stuff, preferences for common bean vary across consumer demographic and socio economic factors. Mishili *et al*. (2011) investigated the influence of consumers' income and cooking time for common beans and found that consumers with low income preferred common bean with low cooking time to save on the cost of fuel. Similar findings were observed by Katungi *et al*. (2011) in Kenya where low income households preferred common beans with low cooking time because they normally have inadequate resources to afford the cost associated with the extended cooking time. With regards to sex of an individual Katungi *et al*. (2015) found that, African women who are the ones undertaking most of the household chores, including food preparation, derive high values in terms of serving time for work from less cooking time of common beans than male consumers.

Several studies have evaluated consumers' characteristics and their preferences for common beans with varying grain size. For example, Wortmann (1998) found that large sized seeds were the most preferred type of beans in Africa followed by medium sized seeds. This preference was dominant among poorer consumers who relied on low priced food and seed, although small grains were also accepted. Gitonga (2015) reported that families with large members tend to prefer common beans with large grain size. This finding is supported by Saba *et al*. (2015) who found the larger the bean size the higher the

hydration and swelling capacity when cooked. Therefore, common bean with large size expand/swell more when cooked than those with small size. This means it takes fewer kilograms of large sized common beans to make a meal for a large family compared to small sized beans.

Appearance of common beans' gravy has been identified to influence consumers' preference. Asp (1999) and Gitonga (2015) reveal that beans that produce thick gravy when cooked are more preferred. Consumers' preference for food is likely to be limited to specific attributes for people who are employed and those with high education level. Although consumers are exposed to multiple food attributes, good food taste/flavour is the only attribute found to influence their preference and eating habit. Ferrara and Ward (2007) reveal that employed consumers and those with high education satisfy their food appetite from good taste.

Food preference is reported to vary widely between adult and young consumers (Cohen and Babey, 2012; Horvath *et al*., 2005). A study by Cohen and Babey (2012) reported that old consumers are more likely to be conscious of healthy eating than young people and are likely to prefer foods with low fat content. Eating habit for young consumer is normally driven by pleasantness but not contents of foods (Horvath *et al*. 2005). With regard to marital status, unmarried consumers are linked to inconsistency eating pattern when compared with married consumers. According to Ferrara and Ward (2007) unmarried consumers have a tendency of eating away from home, hence dictated with attributes of foods available at the eating place(s).

2.4.2 Willingness to pay and ranking of commodities

Consumer preference can be understood through their stated willingness to spend money for various types of common bean. In the context of common bean types, consumer

willingness to spend money can inform policy maker and breeders on which types of common bean are preferred over the other. According to Grunert *et al*. (2009) information on consumer willingness to spend money on a commodity is vital for checking the expected profitability for new product development, product improvement, product differentiation, and line extensions. Also, Shafter and Zhang (1995) signify that consumer willingness to spend money on a commodity is critical for promotional activities. Moreover, Anderson *et al*. (1993) and Miller *et al*. (2011) indicate that the correct measurement of consumer willingness to spend money on a product is crucial for shaping competitive strategies and implementing value audits. Further, knowledge of consumer willingness to spend money on a commodity is instrumental for the estimation of demand and the formation of optimal pricing schedules (Wertenbroch and Skiera, 2002).

2.4.3 Modelling consumer preference

A number of studies have been undertaken to identify factors affecting consumer preference. Farah *et al*. (2011) used binary logistic regression model to assess determinants of preference for rice attributes and consumption decision and concluded that household income, household size, family choice and gender variables were the main factors underlying rice consumption decisions. Hedonic pricing method was used by Mundua (2010) and Katungi *et al*. (2011) to study factors affecting consumer preference for cowpea and common beans, respectively. Despite the fact that Mundua conducted the study in Uganda and Katungi in Kenya similar results were found as adult consumers were identified to have higher disposable income which enabled them to afford different types of beans/cowpeas.

Ogundele (2014) applied multinomial logistic regression to examine factors driving consumers' preference for locally produced rice in Nigeria. The study identified socio-

economic factors as major drivers underlying consumer preference for local rice. The socio-economic factors studied considered were income, education, age, marital status and sex of a households' heads. Apart from these socio-economic variables other factors such as frequency of purchase and price were incorporated in the study and found to have a significant influence on consumers' preference for rice.

Although, Poisson regression model has been widely applied in disciplines such as transport economics, political economics and medical sciences, there have been limited applications to studies on individuals' preferences and foods' choices. For example, Ferrara and Ward (2007) used Poisson regression model to study factors influencing consumers' preference for beef cuts and examine the probabilities associated with the expected number of choices. The results indicated that the number of cuts purchased was significantly influenced by family size as well as education level and occupation of the main decision maker.

2.5 Knowledge Gap

A review of the literature indicates that factors that have been considered in studying consumer preference fall under individual demographic and socio economic characteristics. Studies that have explicitly included individual-specific societal and cultural factors which are deemed important in shaping consumer preference have generally been rare. Vartanian *et al*. (2008) and Riet *et al*. (2011) reveal that decision-making about food preferences and choices is not confined to demographic and socio-economic factors only because eating habits are partly a reflection of cultural and societal factors (Chadwick *et al*., 2013). This study is however incorporating cultural and societal aspects that were ignored in the previous studies along with demographic and socio-

economic aspects to get a better understanding of factors underlying consumers' preference for common bean in Dar es Salaam.

CHAPTER THREE

3.0 METHODOLOGY

3.1 The conceptual Framework

The relationship between consumer characteristics and preference for common bean types with varying attributes is clarified in the framework presented in fig. 1. The framework suggests that consumer preference for common bean type with specific attributes is not only influenced by the demographic and socio-economic characteristics of individuals as traditionally studied but also societal and cultural factors. The framework is derived from the new demand theory which asserts that consumer stated preference for common beans arises from the attributes that are embedded in common beans and is a derived demand (Lancaster, 1966).

Starting with the demographic factors, sex of a consumer influences preference over common bean with specific attributes. It is expected that female consumers who are responsible not only for food preparation at home but also performing other activities will state higher preference for fast cooking common beans types so that they can spare sometime for other home activities (Katungi *et al*., 2011; 2015; Mishili *et al*., 2011). Households with large household's size are expected to indicate their preference for common beans types with large grain size. The reason for this expectation is that large sized common beans expands more when cooked than small grain sized beans hence small quantity of the larger sized beans will be required to make a meal for a large family than when small grain sized beans are used (Gitonga, 2015).

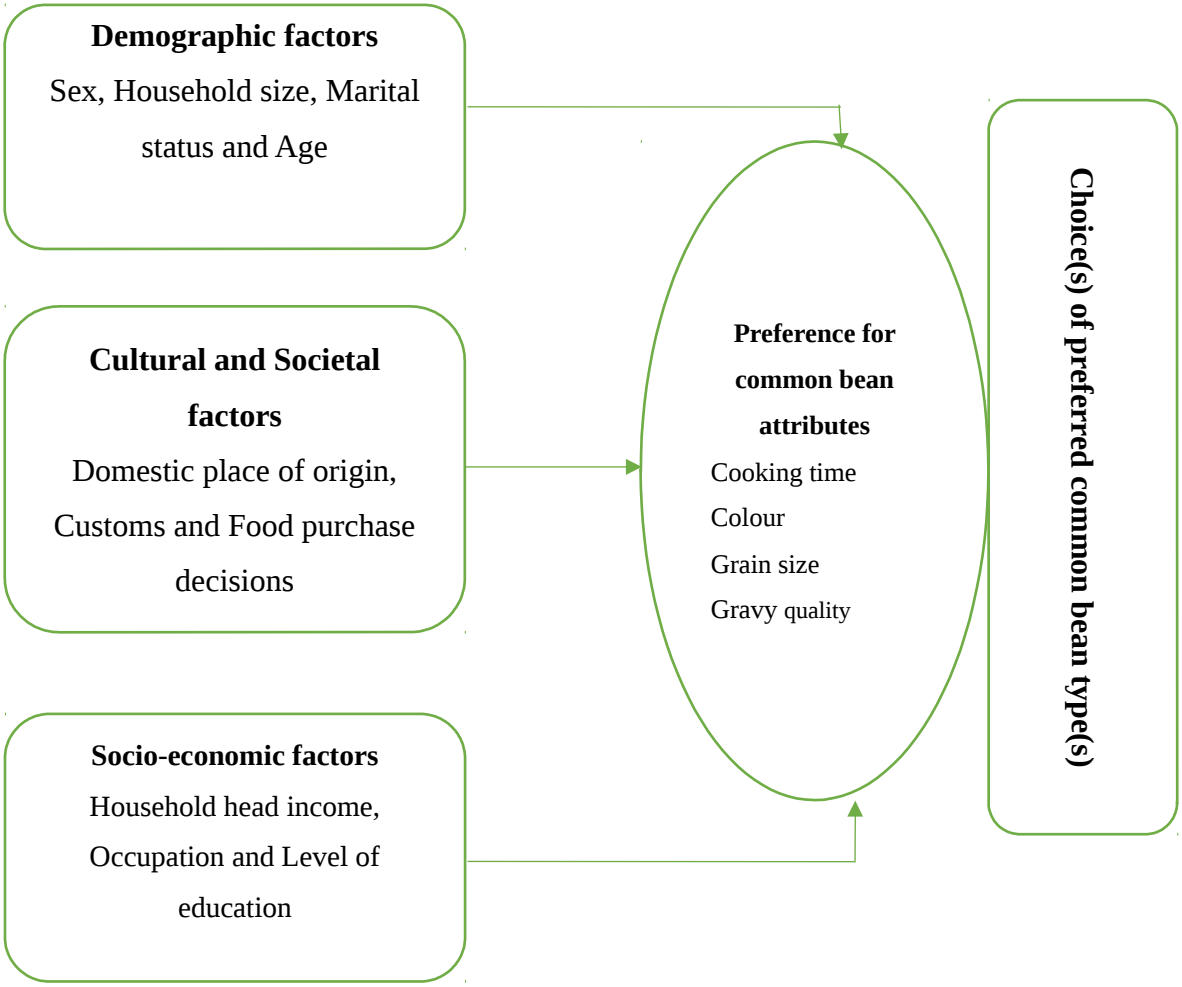


Figure 1: The conceptual framework of the study

Most consumers that are unmarried or young or male consumers in urban areas tend to eat away from home and are dictated with attributes of foods available at the eating point. Thus, they are less likely to consume common beans. Evidence shows that consumption frequency of food away from home decreases with age and is likely to be higher among men than women (Mwana, 2013). Unmarried consumers seem to have higher frequency eating away from home than married consumers. Most of unmarried consumers in urban areas buy food from vendors to save on cost and time of preparing foods, experience new taste and food types and get away from monotonous diet.

With respect to the socio-economic factors, consumer's preference for food is limited to specific attribute for people who are employed and those with high level of education. Although they are exposed to multiple foods appearance of gravy is a single attribute that dictates their preference and eating habit. Evidence from studies on consumption of common beans reveals that employed consumers and those with high level of education tend to interact with people having different eating behaviour (Gitonga, 2015). They become exposed to different common bean types and hence their preference hinges on the taste and appearance of gravy. Consumers with low income are expected to prefer common bean that are fast cooking. Fast cooking types of common beans will lead to energy serving, which is beneficial to consumers especially those with low income (Mishili *et al*., 2011; Mwana, 2013).

With respect to cultural and societal factors, preferences for common bean among consumers with diverse background are likely to be associated with specific cultural and societal factors. Preference for beans' colour is expected to vary across geographical zones reflecting local habits. Consumers originating from southern, central and western zones of Tanzania tend to prefer yellow coloured beans, while consumers from eastern and northern zones prefer beans with grey colour and mottled beans (Korir *et al*., 2005; Fivawo and Msolla, 2011). Beans that are consumed at home are likely to be influenced by whether the purchase decision is jointly made by household's members or heads of the households. Sekhampu (2012) reveals that married households' heads have additional persons to help with food choice decisions, thus ensuring increased efficiency in food purchase and consumption than unmarried heads.

Generally, the presence of preferred attributes in a choice set consisting of common bean type with varying attributes is expected to influence the ultimate choices of that bean type that consumers may choose. Common bean types with more than one attribute are preferred by consumers are likely to be chosen.

3.2 Theoretical Model

The study employs the new demand theory which asserts that goods as such, are not the immediate objects of preference or utility, but have associated characteristics which are directly relevant to consumers (Lancaster, 1966). If the consumer is required to make independent choices among various common bean types, the choice to be made reflect the level of satisfaction or utility which is unobservable. This utility is derived from the attributes' embedded in the chosen common bean type which vary across individuals depending on their demographic, socio-economic, cultural and societal characteristics.

The utility function is specified as,

$$U_{ij} = f\left(Att_j, S_i\right) + \varepsilon_i \quad \text{……..……..…..} \quad (1)$$

Where, U_{ij} is the utility of the i^{th} individual derived from j^{th} type of common beans, Att_j is the j^{th} specific attributes embedded in, S_i represents individual specific characteristics and ε_i is the stochastic error for the i^{th} individual. However, the random utility model (equation 1) is appropriate when individuals are able to rank the choices based on perceived satisfaction derived from each type of common bean (Louviere *et al*., 2010). If an individual is not required to rank the possible choices, the random utility model (equation 1) is replaced by the latent model specified in equation 2. The attributes component in equation 1 is left out in equation 2 because individuals are exposed to specific type of common bean at a time.

$$y_i^{¿} = f(S_i) + v_i \quad \text{……..……... (2)}$$

Where, $y_i^{¿}$ reflects the perceived net benefits from a given common bean type, S_i reflects individual specific characteristics and v_i is the stochastic error for the i^{th} individual.

Then, i^{th} individual in equation 2 will choose a specific common bean type based on the perceived net expected benefits derived from such type. The choice decisions rule is expressed in equation 3.

$$\left.\begin{array}{l} y_i^{¿} > 0 \; specific\; common\; bean\; type\; is\; selected\; by\; i^{th}\; individual \\ y_i^{¿} \le 0 \; s\; pecific\; common\; bean\; type\; is\; rejected\; by\; i^{th}\; individual \end{array}\right| \quad \text{…….. (3)}$$

If the perceived net expected benefits are greater than zero, the specific common bean type is selected and if the perceived net expected benefits are less or equal to zero the specific common bean type is rejected.

3.3 Research Design

The work is based on discrete choice experiment conducted by the Bean Value Chain Project (BVCP) under the Legume Innovation Lab. Data were collected from Dar es Salaam that was purposefully selected to represent bean consumers in Tanzania because it is the major market for common beans and business centre (market share about 26%). Moreover, Dar es Salaam has diverse population to account for variation in social, ethnic and economic background of bean consumers.

3.3.1 Description of the Study Area

The study was conducted in Dar es Salaam City and covered Kinondoni, Ilala and Temeke districts. The city is located along the Indian Ocean coast and covers a total area of 139.3 km^2. Dar es Salaam is the commercial city of the country and it is one of the fastest growing cities in Africa. It has a population of 4 364 541 (NBS, 2014), where the population growth is fuelled partly by an influx of unemployed youth from rural areas and on average 16% of the city population are migrants from other regions of Tanzania.

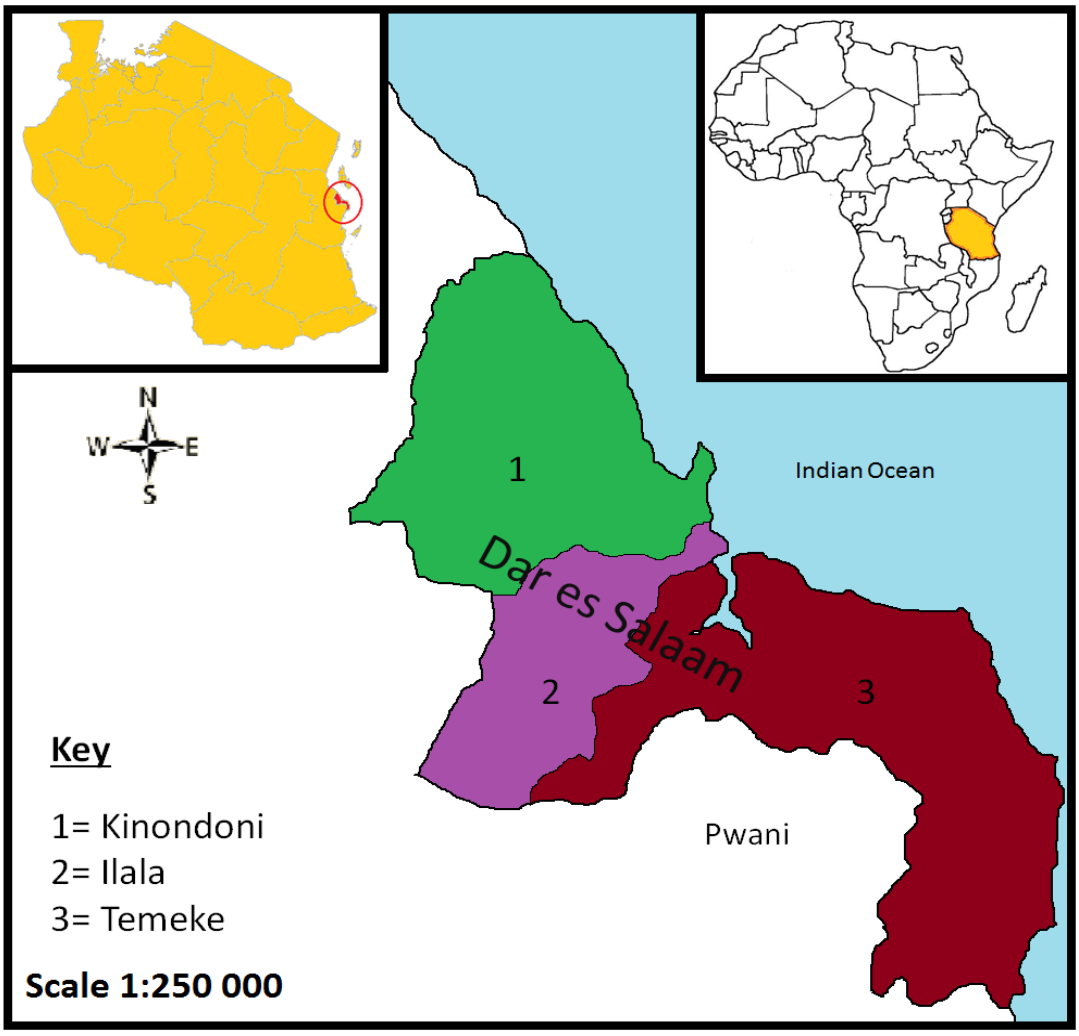


Figure 2: Map of a study site: Dar es Salaam city, Tanzania

3.3.2 Sampling Procedure

A three-stage sampling design was employed in this survey. The first stage involved stratification of the enumeration areas (EAs) within Dar es Salaam City into high, middle and low income residences to ensure fair representation of such consumers' categories**.** The second stage entailed a proportionate sampling of 100 EAs from the three strata. The third stage involved a random selection of eight households from each of the 100 EAs resulting into a sample of 732 households.

3.4 Data Collection and Approach used

3.4.1 Primary data

The primary data used were collected by the Bean Value Chain Project in collaboration with National Bureau of Statistics (NBS). A household survey was conducted in May 2015 in three districts of Dar es Salaam region. A household survey was accompanied with a Discrete Choice Experiment to gather information on a household and respondent specific factor that could influence consumers' preferences for common beans' types. The choice task was first comprehensively introduced to the respondent to make sure the task of buying of common beans with specific attributes were properly understood. A pilot test before the actual choice experiment confirmed the respondent understanding of the choice task.

3.4.2 Discrete choice experiment

The DCE was employed in order to elicit individual preference and uncover how individuals selected common beans types by asking them to state their choice over different hypothetical attributes combinations. Four different common beans' attributes were identified to include colour, grain size, cooking time and gravy quality. The colour attribute involved four colours namely pure grey colour locally known as *soya-supa*, grey colour locally known as *soya-kawaida*, yellow colour locally known as *njano* and mottled-red colour (Plate 1). The grain size attribute involved three classes of size namely small,

medium and large. The cooking time attribute involved common beans that cook fast and those that cook slowly. Finally, the gravy quality attribute was specified in two levels namely poor and good gravy quality. The experiment, generally intended to capture trade-offs among the attributes in the common bean product. So, colour, size, cooking time and gravy levels were traded to produce the preference.

Following the given four attributes with their levels, its combination (4 x 3 x 2 x 2) gives the rise of 48 common bean types. From the 48 common bean types, 6 unique choice sets were created each containing 8 different types of common bean. The total sample of respondent was divided into 6 sub-samples and each was subjected to only one of the 6 choice sets (Appendix 2).

The implementations of this choice experiment deviated from the conversional choice experiment in the sense that, consumers were exposed to each of the common beans types allocated to their sub-group and were required to indicate whether they would choose each of them. Although each type of common beans was tested independently, consumers were given the budget of 14 000 Tshs to allocate on the chosen types of common beans as means to determine the most preferred options.

Plate 1: Common beans' colours involved in choice experiment

3.5 Analytical Techniques

3.5.1 Descriptive statistics

For the first specific objective, determining what common bean types were chosen by majority of respondents and which ones were chosen by least number of respondents in each of the 6 choice sets was crucial. Let n_s be the sample size related to choice set S where $(s=1,2,\ldots.6)$; n_{js} be the number of individuals selecting a specific type of common bean from set S . Then

$f_{js}=\frac{n_{js}}{n_s}*100$ represents the percentage of respondents choosing common bean j from set s .

Therefore, for each choice set (s) , the elements $j's$ (for $j=1,2,\ldots.8$ and that the $j's$ are different from one choice set to another) were listed in descending order based on f_{js} . The common beans types that listed first from each choice set was chosen to construct a pattern of most chosen common bean types. Similarly, a pattern of least chosen

common beans was constructed by choosing those types that listed last from each choice set.

In order to address the second specific objective, we conducted a ranking of common beans types in order to identify those which are most and least preferred. The essences were to measure respondent’s willingness to pay for the chosen types of common bean in objective one. So, the ranking procedure was based on mean/median budget shares respondents allocated on the chosen common bean types. Thus, for each choice set the common beans were ranked from the most to least preferred.

3.5.2 Poisson Regression Model (PRM)

A Poisson regression model was used to analyse factors influencing number of common bean types made by the consumer in six different choice sets. The analysis shows the range of choice among consumers given their stated preferences/choices of common beans types. Equation 4 presents the Poisson probability function, with Y being the corresponding random variable, the probability of choosing common bean type within a given choice set. For each choice set, there are 8 different common beans types. The range of selecting these types in each choice set is conditioned from not selecting any type to selection of all 8 types of common beans, hence presenting a non-negative integer condition of Poisson model.

$$\Pr(Y = y_i \mid X_i) = \frac{e^{-\lambda_i}\lambda_i^{y_i}}{y_i!} \quad \text{..........} (4)$$

$$\begin{bmatrix} y_i = 0 \rightarrow \textit{No common bean type chosen by } i^{th} \textit{ individual} \\ y_i = 8 \rightarrow \textit{All types of common bean are chosen by } i^{th} \textit{ individual} \end{bmatrix}$$

λ_i represents the expected number of common beans' type chosen by individual i . Suppose we let expected number of choice λ_i (and therefore the variance) depend on a vector of explanatory variables X . A simple liner model is given as:

$$\lambda_i = \mu(x) = e^{x_i^{'}\beta} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5) \quad .$$

Because the Poisson mean on the left hand side represents an expected count and must be non-negative, a simple linear model shown in Equation (5) was modelled by applying logarithm in both side to get a linear model as;

$$\log ¿ (¿¿ \lambda i) = X_i^{'}\beta \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(6)}$$

Since for poison distribution the mean equals to the variance, this gives rise to equation 7.

$$E[y_i / x_i] = Var[y_i / x_i] = \lambda_i = e^{x_i^{'}\beta} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(7)}$$

The $y_i^{'}$ are independently distributed as Poisson random variables with mean λ_i for each individual. So, the Poisson regression model may be written as:

$$Log_e(\lambda_i) = \underset{\sim}{X_i^{'}}\underset{\sim}{\beta} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(8)}$$

Where λ_i is the response variable indicating the expected number of common bean type chosen by i^{th} consumer, X_i is a vector of independent variables influencing the number of common beans' varieties chosen by the i^{th} consumer and β represents a vector of parameters to be estimated. The description of all types in the model (8) and their expected signs are listed in Table 1 followed by reasons behind the expectations.

Table 1: Description and Expected signs of variable in Poisson regression model

Variables	Description	
Dependent Variable		
Expected number of choice	Expected number of common bean type chosen by an individual from a set of 8 types (λ_i)	
Independent variables		**Expected Signs**
Sex of the household head	A dummy variable assigned a value of 1 if a household head is Female and 0 if Male (D_1)	+/-
Household size	Number of individuals living in a particular household (X_1)	+
Marital Status	A dummy variable assigned a value of 1 if a household head is Married and 0 otherwise (D_2)	-
Age of a household head	A dummy variable assigned a value of 1 if age of a household head is >35 years and 0 if age ≤ 35 (D_3)	+
Income of a household head	A household head income per month in USD (X_2)	+
Occupation of head of household	A dummy variable assigned a value of 1 if a household head is employed and 0 if not employed (D_4)	+/-
Education of head of household	A dummy variable assigned a value of 1 if a household head has secondary education and more and 0 if primary education and none(D_5)	+
Household head domestic place of origin	A dummy variable assigned a value of 1 if a household head is comes from region potential for bean production and 0 if Otherwise (D_6)	+
Food purchasing decision of a household	A dummy variable assigned a value of 1 if food purchasing decision is made by household head and 0 if made by all member of household (D_8)	-

Starting from demographic factors, Sex of the household head is expected to have a negative sign. The mean number of common bean types chosen by female headed households is expected to be lower than that of male headed household. Female-headed households are likely to stick to their favourite choice(s) of specific common bean, hence reluctant to go for other alternative. Families with large household size are expected to be more flexible in their choice of common beans' types and exhibit higher counts than households with relatively smaller household size. With large families, the households head might be interested in several common beans' types to satisfy the varied preferences of households' members in terms of colour, grain size, and quality of gravy. A negative sign is expected for marital status variable. The mean number of common beans' types chosen by married consumers is expected to be lower than that of unmarried consumers. Married consumers have tendencies of developing habits of eating at home, the tendency limits their chances of being flexible in their eating behaviour include choice of common bean varieties. Single/unmarried consumers are expected to possess a habit of eating away from home; hence their eating point dictates the types of common bean types they eat. Age of a household head is expected to be associated with a negative sign. As age of household's head increases the mean number of common beans' types to be chosen decreases. Adult individuals are limited in their choice as they already created behaviour of eating specific foods and are unwilling to try new types as they are concerned about their health. Unlike adults, young individuals are more willing to try different foods and they may be more flexible when choosing common beans' types.

With regards to the socio-economic factors, household heads' income is expected to have a positive effect on the counts of common beans' types. The higher the household's head income the higher the mean number of common beans' types chosen. Higher income allows household's heads to afford the cost of different types of common beans within

their choice domain. Occupation of the household head is expected to have a positive sign. The mean number of common beans' type for employed individual is expected to be higher compared to unemployed individual. Employed individuals do mix and interact with people with different eating habits and are more likely to be flexible when choosing common beans' types than unemployed people. Education is expected to have positive effect on the outcome variable. Individuals with high level of education are expected to choose different type than individuals with lower level of education. Individuals with high level of education are also likely to have better knowledge about food attributes and benefits of different food type than uneducated ones.

With respect to the cultural and societal factors, an individual's place of origin influences positively consumer flexibility in choice of common bean type. Individuals who come from regions which are potential in bean production are more likely to choose many varieties if they are provided with than those who come from regions which are non-potential in beans production. Regions potential in production of beans are more likely to produce varieties than those with less potentiality. Flexibility in choosing common bean at a family level is likely to increase if the decision is jointly made by households' members. Food purchase decision by head of household alone limits the choice flexibility because his/her choice will rely on own preference.

3.5.3 Variable estimations and diagnostic tests

Marginal effects or impact effects

Marginal effects provide a way of measuring the effect of each explanatory variable on the dependent variable. The marginal effect of one explanatory variable is the expected instantaneous rate of change in the dependent variable as a function of the change in that covariate while keeping other covariates constant. For PRM from equation (6).

$$\frac{\partial E(Y_i / X_i)}{\partial X_{ij}} = \beta_j e^{x_i' \beta} = \beta_j E(y_i / x_i) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(9)}$$

Therefore the marginal effect of the change in regressor $x_{i,j}$ depends not only on β_j , but also on all other estimated coefficients and on all other values. Because the derivative in equation (9) is with respect to a small change, it is not appropriate to apply for the effect of a change in a dummy variable, or change of state. The appropriate marginal effect for the dummy variable, say, *d*, would be;

$$Marginal\,Effect = Prob\left[Y=1 \mid x_{(d)}, d=1\right] - Prob\left[Y=1 \mid x_{(d)}, d=0\right] \quad \text{.. (10)}$$

Where $x_{(d)}$ denotes the means of all the other variables in the model.

The results from the model were assured for validity of Poisson distribution assumptions and goodness of fit. Pseudo R squared was used to check for the model fitness. A conditional moment test was used to test for over dispersion in the model (the major assumptions in Poisson distribution i.e. mean should be equal to variance). An over dispersion test starts from the hypothesis in equation 10.

$$\left.\begin{array}{c} H_0 : Var[y_i] = E[y_i] \\ H_1 : Var[y_i] = E[y_i] + \alpha\rho(E[y_i]) \end{array}\right| \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(11)}$$

Simple comparisons based procedure for testing the hypothesis (equation 10) is carried out by comparing the values for mean and variance of the expected number of choices. If the expected variance happens to be greater than the expected mean, over dispersion in the model is confirmed. If it happens that the expected variance are equal to expected mean or the expected mean are greater than expected variance with small variations (less than 0.5) the model is confirmed not have over dispersion.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Choices of Common Bean Types

The first objective intended to determine what common bean types are chosen by majority of consumers and which ones were chosen by least number of consumers in each of the 6 choice sets. Behind the chosen common bean types, the interest was to determine if there was any communality across choice sets in specific attributes. That is if there are dominating attributes across the 6 choice sets. This will allow to say the common bean type chosen by majority of consumer have what specific attributes and those chosen by least number of consumers have what specific attributes in common.

If the stated preferences for common bean types are derived from its embedded attributes, then a better understanding of what common bean types are most and least chosen by majority of consumers will contribute in the design of policies and breeding programs in the common bean sub sector. Moreover, understanding of the dominant attributes in the list of most and least chosen common beans' types will also provide a room to study in details what make the attributes to be selected or not selected.

4.1.1 Most and least chosen common beans types

On the basis of the available data and design of the choice experiment a list of most and least chosen common bean types are presented in Tables 2 and 3 respectively. According to Table 2, common bean type with grey colour, large grain size, fast cooking and whose gravy quality is good was chosen by majority of consumers in the first choice set. The most chosen common bean type in second choice set was that with yellow color, medium grain size which cooked slow and produced good gravy attributes. Common bean type

embedded with attributes yellow colour, large grain size, that cook fast but with poor gravy quality was chosen most in third choice set. Common bean type with attributes mottled-red colour, large grain size but cooked slowly and produced poor gravy was most chosen in the choice set four. In the choice set five the most chosen common bean type was that with attributes yellow colour, large grain size that cooked fast and produced good gravy. In the last choice set (choice set six) the common bean type most chosen was that with attributes yellow colour, small grain size that cooked slowly and produced good gravy.

Table 2: Most chosen common beans' types

Choice Set*	Common bean type	N	Absolute Frequency	Percentage
1	Grey, Large, Fast, Good	119	84	70.6
2	Yellow, Medium, Slow, good	123	61	49.6
3	Yellow, Large, Fast, Poor	124	70	56.5
4	Mottled-red, Large, Slow, Poor	130	57	43.9
5	Yellow, Large, Fast, Good	112	69	61.6
6	Yellow, Small, Slow, Good	124	78	62.9

**Sets of common bean types exposed to consumers. Each set comprised of 8 common bean types. The common bean types that shown are those selected by majority of consumers in each choice set.*

According to Table 3, the common bean type with attributes pure grey colour, small grain size, fast cooking and poor gravy quality was chosen by least number of consumer in choice set one. Common beans type with attributes mottled red color, medium grain size, slow cooking and with poor gravy quality were least chosen in the second choice set. Common bean type with attributes pure grey colour, medium grain size which coked slowly and produced poor gravy was chosen by least number of consumers in the third choice set. That common bean type with attributes grey colour, small grain size, slow cooking and good gravy was the chosen by least number of consumers in choice set four. In the choice set five the least chosen type of common bean was that with attributes grey

colour, large grain size, slow cooking and poor gravy quality. In the choice set six common bean type with attribute pure grey colour, small grain size, slow cooking and produced poor gravy was the least chosen type.

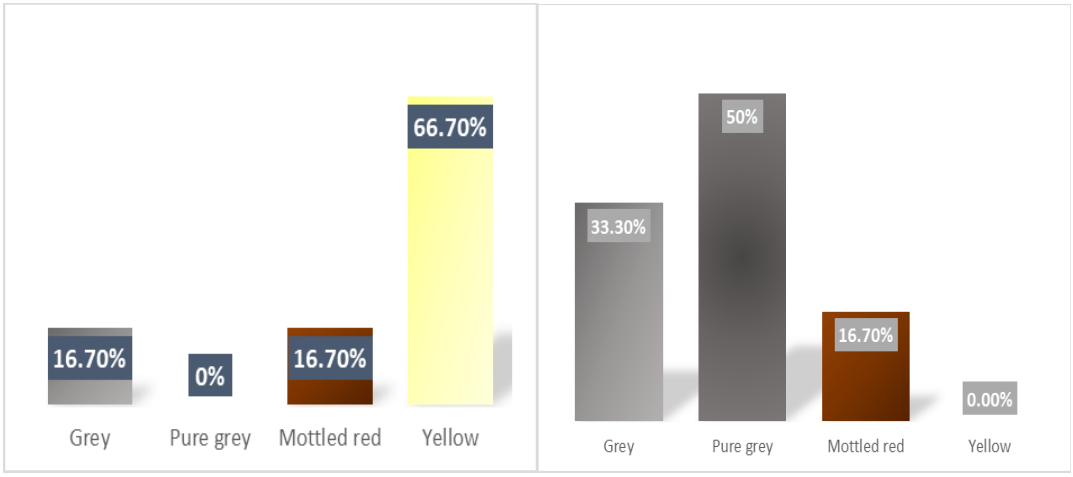
Table 3: Least chosen common beans' types

Choice Set*	Common bean types	N	Absolute Frequency	Percentage
1	Pure grey, Small, Fast, Poor	119	0	0
2	Mottled red, Medium, Slow, Poor	123	13	10.6
3	Pure grey, Medium, Slow, Poor	124	8	6.5
4	Grey, Small, Slow, Good	130	14	10.8
5	Grey, Large, Slow, Poor	112	24	21.4
6	Pure grey, Small, Slow, Poor	124	2	1.6

**Sets of common bean types exposed to consumers. Each set comprised of 8 common bean types. The common bean types that shown are those selected by least number of consumers in each choice set.*

4.1.2 Dominant attributes in the list of most and least chosen common bean types

The common bean attributes such as yellow colour, large size and good gravy quality appeared to dominate the list of most chosen common bean types by consumers in Dar es Salaam. Evidence from several studies concurs with this observation (Mishili *et al*., 2011; Katungi *et al*., 2011; Gitonga, 2015). Common beans with yellow colour are preferred because are associated with lowest cooking time (about 75 minutes) compared to beans with other colours (Maryange *et al*., 2010; Mishili *et al*., 2011). Similarly, the majority of low income consumers prefer fast cooking beans to save on cooking fuel (Katungi *et al*., 2011). Therefore, the results potentially explain why majority of consumers will choose common beans with yellow colour which is associated with fast cooking attribute. In comparison with other colours involved in the choice experiment. Yellow colour was dominant in the list of most chosen common bean types as indicated in Fig. 3a.



3a. Common bean colour most chosen 3b. Common bean colour least chosen

Figure 3: Most and least chosen common bean colour

Evidence from literature suggests that large sized grains expand more when cooked than the small sized grains of common beans (Wortmann *et al*., 1998; Gitonga, 2015). Saba *et al*. (2015) studied on swelling capacity of common bean, they found that common bean with large size expand/swell more when cooked than those with small size. Therefore, it makes sense that fewer amount of common bean with large grain size would be required to make a meal compared to when the common bean small grain size. This is however the reason why common bean with large grain size are chosen most by consumers compared to common bean with small grain size.

In terms of gravy quality common bean with good gravy quality were observed to dominate the list of most preferred common beans' types. Several studies have identified good gravy to influence food preference (Wortmann, 1998; Asp, 1999; Cohen and Babey, 2012; Chadwich *et al.*, 2013).

From to Table 4, we observed that common bean attributes such as pure grey colour, small size and poor gravy quality observed to be chosen by least number of consumers.

According to Mugenyi (2012) and Ronner and Giller (2013) common beans with pure grey colour are associated with higher compared to beans with other colours. These type of beans are mainly sold in supermarkets were majority of consumer with low and medium income not obvious doing their purchases. The domination of pure grey colour compared to other colour of common beans involved in the DCE is as shown in Figure. 3b.

4.2 Ranking of Chosen Type of Common Bean

Having knowing how much money consumer allocate on a given types of common bean, a ranking procedure is crucial in order to determine the order of consumer preference for common bean types selected in different choice sets. According to this study, consumers were given a fixed budget to allocate on the type of common bean that were selected in the first step of the experiment (objective one).

Three preference behaviors were observed during the experiment. First, some consumers allocated full amount of the budget to only one type of common bean chosen among others. Second, some consumers allocated the budget share with varying amount to all selected type of common bean. Third, some opted not to allocate the budget to either of the chosen type of common bean. Distribution of expenditure shares was checked if it was normal. Shapiro-Wilk test was used to check for normality. It was observed that, most of the expenditure shares across choice sets were not normal (Appendix 3). Therefore, ranking was done using median expenditure shares instead of mean expenditure shares (Appendix 4).

Results for most and least ranked common bean types for each choice set are presented in Table 4 and Table 5 respectively. From the list of most ranked common bean types in six

different choice sets (Table 4), at least 50% of the median budget share were allocated to the common bean type in choice sets 2, 3 and 5. This is an indication that, consumers in Dar es Salaam are willing to put more money on specific common bean with specified attributes. However, specific common bean types ranked highest in choice sets 1, 4 and 5 are observed to be allocated less than fifty percent of the median budget share. Generally, common bean types with attributes such as yellow colour, fast cooking and good gravy are observed to be the most appealing to consumers. However, consumers were indifferent between medium and small sized common bean types. Common bean types with large grain size (one of the attribute level involved in a choice experiment) did not appear in the top ranked common bean types.

Table 4: Most ranked common bean types in six different choice sets based on median budget shares

Choice set	Common bean type	N	Count	Count percentage	Mean	sd	Median
		12		72.5			
1	Yellow, Medium, Fast, Good	0	87		0.48	0.31	0.43
		12		34.2			
2	Yellow, Small, Fast, Poor	0	41		0.58	0.30	0.64
		12		59.2			
3	Yellow, Medium, Slow, Good	0	71		0.54	0.31	0.50
		12		42.1			
4	Grey, Small, Fast, Good	6	53		0.39	0.25	0.43
		10		67.0			
5	Yellow, Medium, Fast, Poor	3	69		0.43	0.36	0.29
6	Yellow, Small, Fast, Good	118	92	78.0	0.54	0.35	0.57

In order to meet demand from a wide range of consumers who are willing to put money on specific types of common bean, an effective breeding program goal should focus on breeding common bean types with specified attributes. Development of new products that satisfy growers' and traders' demands does not guarantee success in the marketplace. As in all economic sectors, many new products fail in the agribusiness sector (Spetsidis and Schamel, 2002). In this regard, the necessity to heed to the wishes of consumers during the early stages of product development has been identified as a vital factor for businesses in order to be competitive and profitable (Van Kleef *et al*., 2005). It is especially important for marketing when abundant choices are available to increasingly sophisticated and demanding consumers (Craig and Hart, 1992; Spetsidis and Schamel, 2002). Results in Table 4 also present a remarkable percentage of consumers who are willing to put money on specific types of common bean in different choice sets. According to this study, 72.5 % of 120 consumers exposed in choice set 1 were willing to put more money on a common bean type which has yellow colour, medium grain size, fast cooking and whose gravy quality is good. Other specific types of common bean consumers were willing to allocate money are as seen in Table 4.

From the list of least ranked common bean types in six different choice sets (Table 5), consumers allocated approximately zero median budget shares on specific common bean types in choice sets 3, 4 and 5. This is an indication that, the specific common bean types are not very important in the bean market in Dar es Salaam. Notwithstanding, the specific common bean type in this list are characterized with attributes such as grey colour and poor gravy quality.

Table 5: Least ranked common bean types in six different choice sets based on median budget shares

Choice set	Common bean type	N	Count	Count percentage	Mean	sd	Median
1	Mottled red, Small, Fast, Poor	120	12	10.0	0.25	0.20	0.25
2	Grey, Large, Fast, Poor	120	13	10.8	0.26	0.26	0.14
3	Grey, Medium, Fast, Poor	120	12	10.0	0.15	0.20	0
4	Grey, Large, Slow, Poor	126	10	7.9	0.10	0.20	0
5	Mottled red, Medium, Slow, Poor	103	27	26.2	0.07	0.12	0
6	Grey, Medium, Fast, Good	118	46	38.9	0.24	0.31	0.14

4.2 Range of Choice(s) of Common Beans' Types

4.2.1 Probabilities associated with counts of common beans' types selected by consumers

In order to explore the current and future demand of different common bean types, a clear understanding on how consumers are flexible in choosing those beans is crucial. This message is important for both sellers and breeders of common bean in a bean sub sector. In this study, eight common bean types were presented to a consumer and asked to state if the bean would be chosen or rejected. At the end of the experiment the number of selected bean type ranged from 0 (no bean selected) to 8 (all beans selected). Consumers were considered being flexible in choices if they choose at least two types and not flexible if they stick to the choice of only one type. If consumer choose nothing from the given common bean types, he or she was considered not having a habit of eating beans.

Results in Figure. 4 present how consumers are diverse in choice of common bean types. They ranged from choosing nothing to all eight type of common bean that were provided during the experiment. However, the results showed that after the choice of two common bean types, probability of choice decreases as the number of choices increase. In a set of eight common bean types, majority of consumers were flexible in choosing two types of common bean, however chances of choosing all eight types were observed to be minimal.

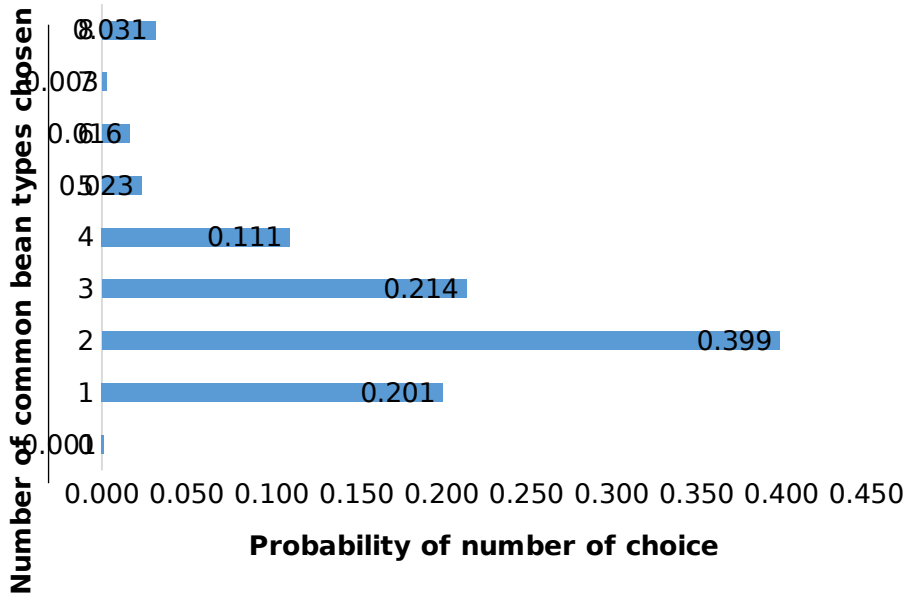


Figure 4: Average Probability of choosing zero, one or more common beans types

The number of choices of common bean types were ranked corresponding to probability of choice as presented in Table 6. A ranking results revealed that majority of consumers confined in choosing one type of common bean to four types of common bean. The probability of consumers to stick on choice of only one type observed to be 20%, meaning they are not flexible in their choice. Also, the sum of probabilities of choosing more than one type of common bean observed to be 79%. This is to mean that majority of consumers who were involved in this study are flexible in their choices with high proximity of trading off between two to four different types of common bean. Factors affecting this type of behaviour are discussed in section 4.2.2.

Table 6: Ranking number of choice of common bean by probability

Number of common bean types chosen	Rank	Probability of number of common bean type chosen	CDF
0	9	0.00	0.00
1	3	0.20	0.20
2	1	0.40	0.60
3	2	0.21	0.81
4	4	0.11	0.92
5	6	0.02	0.94
6	7	0.02	0.96
7	8	0.00	0.96
8	5	0.03	1.00
Total		**1**	

4.2.2 Factors affecting mean number of choice of common beans' types

Before studying the factors affecting the mean number of choice of common bean types it is important to see how data used in this study are distributed. Although the study includes consumers from the Dar es Salaam region, participants represented a wide range of characteristics such as demographic, socio-economic, cultural and societal aspects (Table 7). Household size ranged between 1 member to 11 members, age ranged between 16 and 92 years and total household income ranged from Tshs 3000 per month to Tshs 250 000 per month. With regards to the habit of consuming beans, a majority of respondent observed to possess habit of eating beans.

Table 7: Summary statistics of Variable included in a Poisson regression model

Continuous Variables	Number of respondents	Median	Std Dev	Min	Max
Household size	732	4	2.25	1	11
Age of the household head (Years)	732	33	13.35	16	92
Income of a household head (Tshs)	732	4375	11 489.14	300 0	250 000
Categorical Variables	**Percentage (n=732)**				
Sex of household head					
Male	13.3				
Female	86.7				
Marital Status					
Single	23				
Married	77				
Occupation of head of household					
Employed	35.8				
Unemployed	64.2				
Education of a household head					
No formal education	8.7				
Primary	58.1				
Secondary	22.7				
Certificate/Diploma	2.5				
Higher education	8.1				
Household head domestic place of origin					
Central Zone	7.2				
Eastern	62.0				
Northern	10.7				
Southern	14.9				
Western	5.2				
Custom of head of household					
Habit of eating beans	95.5				
Otherwise	4.5				
Household food purchase decision					
Household head	62.2				
All family members	37.8				

The Poisson regression model was used to determine factors affecting the mean number of common beans' types chosen by consumers. Results were tested for model goodness of fit and Poisson distribution assumption. Pseudo R-squared was 0.16 indicating modest level of fitness (Appendix 1). According to Louviere *et al.* (2000) the pseudo R-squared should be greater than 0.1 to have a stable or meaningful model whereas a value between 0.2 and 0.4 is considered as an extremely good fit. Poisson regression model is rejected when there

is over-dispersion in the dependent variable (i.e. variance>mean). Table 8 indicates non-presence of over-dispersion since mean of the dependent variable (number of choices) is slightly greater than variance. According to (Cameron and Trivedi, 1986) if the mean is greater than variance with a small variation (¿0.5), the means are said to be roughly equal to the variance. For this reason, the distribution of the dependent variable was observed to comply with the Poisson distribution assumption.

Table 8: Detection of over-dispersion

Number of common bean types chosen by individuals	
Number observations	732
Mean	2.569672
Std. Deviation	1.487498
Variance	2.212649

Table 8 presents results of factors affecting the mean number of common bean type chosen by consumers. Variables related to demographic characteristics such as sex of a household head and household size have a significant influence on the number of common beans' types chosen whereas marital status and age of household head didn't have a significant influence (Appendix 1). On number of choice made, common bean type chosen by male-headed households is 18.2% higher than for female counterparts, *ceteris paribus*. As expected, this is an indication that male headed household are more flexible in their choice of common bean types as compared to female headed households. Male headed households do not care so much about attributes embedded in beans than female counterparts (Mundua, 2010 and Gitonga, 2015). Increase in household's size by 1% increases the number of choice of common beans' types by about 4.3%. Large household size have previously been associated with increased number of choice of food variety with multiple attributes to satisfy the preferences of family members in terms of variety, convenience and quality (Ferrara and Wald, 2007).

Table 9: Factors affecting number of common bean types chosen: Poisson regression results (Marginal Effects)

Variable	(dy/dx)	Std. Err.	z	P-Value
Demographic factors				
Sex of the household head	0.1827	0.0419	4.35	0.000***
Household size	0.0437	0.0049	8.83	0.000***
Marital status	-0.0423	0.0236	-1.8	0.072
Age of a household head	-0.0192	0.0239	-0.8	0.422
Socio-economic factors				
Income of a household head	1.86E-07	0	9.39	0.000***
Occupation of head of household	0.2703	0.0198	13.69	0.000***
Education of a household head	0.4130	0.0927	4.45	0.000***
Cultural and Societal factors				
Household head domestic place of origin				
Central zone	-0.1838	0.0366	-5.02	0.000***
Northern zone	-0.7385	0.0790	-9.34	0.000***
Southern zone	-0.1714	0.0358	-4.78	0.000***
Western zone	-	-	-	-
Custom of head of household	0.4696	0.1031	4.55	0.000***
Household food purchase decision	0.1103	0.0237	4.66	0.000***
*Significance levels is denoted by *** for 1%*				

Socio-economic variables including income of a household head, occupation and level of education showed a significant influence on number of choice of common beans' types. Although household's head income indicates highest level of significant influence on the number of common bean type chosen, its influence on choice of these combination was observed to be relatively small. The results also show a positive relationship between income and income and mean number of choice of types of common bean. However, its

influence observed to be minimal. Previous studies indicated that individuals with high level of income are deemed able to try out specific food with multiple attributes assuming different attributes implicitly refer to different quality levels (Farah *et al*., 2011 and Ogundele, 2014). Being employed increases the number of choices of common bean types by about 27%, *ceteris paribus*. This finding is similar to that of Ferrara and Wald (2007) that reveal there is high possibility of employed individuals to interact with people and acquiring new knowledge on various types of food and food habit than unemployed people. An additional year of formal learning is likely to increases the number of choice of common beans' type by about 41.3% when other factors are held constant. This finding validate the previous studies that found higher levels of awareness on healthy eating among educated than uneducated people (Parraga, 1990 and Leterme, 2002). More education is also associated with curiosity and ability to search and try new food products with different but desired attributes (Vartanian *et al*., 2008 and Riet *et al*., 2011).

With respect to societal/cultural variables such as household head domestic place of origin, the habit of eating beans and making joint food purchase decisions were found to significantly influence the number of choices made at 1% level. For the household domestic place of origin, the mean number of common bean type chosen by consumers from central, eastern, north and southern zones of Tanzania were 18%, 73%, 37% and 17% lower than the benchmark category, the western zone; respectively. This is to mean that, consumers originated from the specific regions are more flexible in their choice of common bean if compared to those from western zone of Tanzania. The habit of eating beans increased the number of choice of common beans' types by 46.9%, *ceteris paribus*. It is more likely for an individual with the habit of eating a particular food to try the same food with different attributes (Puoane *et al*., 2006 and Morsello *et al*., 2015). Moreover, joint decision making when purchasing the beans increased the number of choice of

common beans' types. According to Gillespie and Johnson-Askew (2009) in a household, personal food knowledge, skills and other human resources contributes to the food and eating alternatives available at home.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The results related to first specific objective reveals that, common bean with yellow colour that cooked fast and with large grain size dominated the list of common beans' types that were chosen by majority of respondent. The common bean with pure grey colour, small grained size and poor gravy dominated the list of those chosen by least number of respondent. These findings seek to inform stakeholders and actors with respect to common beans' types that are most and least chosen by consumers in the market. The information is essential for breeders and sellers of common beans to become certain about consumers' desire and what to produce and sell.

The results related to the second specific objective confirmed what was observed in objective one. Individual ranking results of chosen common bean types show that, common bean attributes highly embedded in a list of most ranked common bean types are yellow colour, fast cooking and good gravy attributes. However, common bean attributes levels highly embedded in a list of least ranked common bean types are grey colour and poor gravy quality.

The findings related to the third specific objective show that consumers are flexible in the choice of common beans' types. That is, consumers are not stick to the choice of only one type of common bean, however they prefer several types mostly ranging from 2 to 4 common bean types. This is an indication that, considerable efforts to provide common beans' types with the preferred attributes' embedded, is the best way to influence demand for common bean in Tanzania. More importantly the significant influence of cultural and

societal factors which were ignored in the previous studies is an indication that, these factors are important in shaping preference for number of common beans' types.

5.2 Recommendations

Based on the major findings the following recommendations are made towards improving food legumes development initiative and improving the well-being of smallholder farmers.

5.2.1 Recommendation for policy implications

1. Relevant institutions should ensure that there is a matching between produced common beans' types and consumer preference. This will create a preference oriented markets which is beneficial for breeders, farmers, sellers and consumers.
2. Since Feed the Future Legume Innovation Lab shows the willingness to join the Government and its partner in the design and implementation of new strategy and programs for common bean to play its role as an engine for economic growth, job creation, and food security, there is a need of working with the institute for the provision of new common bean types that are demanded in the market. Working together with development partners (NGOs, traders' organisation, farmers' organization and the private sector) would also facilitate the spread of new varieties that are desired by consumers.
3. Since majority of Tanzanian consume common beans and they are flexible in choices of varieties, breeding programme should ensure production of several common bean varieties and not stick on production of usual varieties available in the market. This may create an opportunity for breeders and traders of common beans to produce and sell new products that have the actual demand. The opportunity will not only increase the income of these stakeholders but customer satisfaction as well.

4. The study does not discourage production of common bean types observed to be ranked least, rather recommend its production that will meet the demand of few consumers preferring specific varieties.

5.2.2 Recommendation for further studies

It is important to note that the preceding results and the conclusion of the study must be considered with some limitations of the study. One relates to the selection of the attributes for common bean. The attributes considered in this study were colour of a common beans, grain size, time expected for common beans to be cooked and quality of gravy that common beans could produce. However, it is most likely that there are other attributes of common bean that are important to consumers beyond what was considered in this study. Future studies may include other attributes or modify the attributes levels that are included in this study.

The study also observed how eating behaviour can be shaped by societal and cultural aspects. The only societal and cultural variables captured in this study include consumer eating habit, household food purchase decision and individual domestic place of origin. There are other cultural and societal variables like belief, value, religion and norms which were not considered in this study but likely to influence consumers' preference for common beans. Further studies focusing on this area should incorporate the remaining societal and cultural variables by finding the appropriate proxies that are suitable to assess their effects.

REFERENCES

Abate, T. (ed.) (2012). *Four seasons of learning and engaging smallholder farmers*. *Progress of Phase I*. Nairobi, Kenya: International Crops Research Institute for the Semi-Arid Tropics.

Abate, T. and Orr, A. (2012). Research and development for tropical legumes: Towards a knowledge-based strategy. *Journal of SAT Agricultural Research*, 10: 1-12.

Akibode, S. and Maredia, M. (2011). *Global and regional trends in production. Trade and Consumption of Food Legume Crops*. Report Submitted to SPIA. March 27, 2011.

Anderson, J. C., Jain, D. and Chintagunta, P. K. (1993). Understanding customer value in business markets: Methods of customer value assessment. *Journal of Business-to-Business Marketing*, 1(1): 3-30.

Asp, E. H. (1999). Factors affecting Food Decision Made by Individual Consumers. *Journal of Food Policy*, 24(2-3): 287-94.

Bennett, J. and Blamey, R. K. (2001). *The Choice Modelling Approach to Environmental Valuation*. Edward Elgar Publishing Limited, United Kingdom. 288pp.

Cameron, C. and Trivedi, P. (1986). Econometric Models Based on Count Data: Comparisons and Applications of Some Estimations and Tests. *Journal of Applied Econometrics*, 9: 29-54.

Chadwick, P. M., Crawford, C. and Ly, L. (2013). Human food choice and nutritional intervention. *Nutrition Bulletin*, 38 (1): 36-42.

Cohen, D. A. and Babey, S. H. (2012). Contextual Influences on eating behaviors: Heuristic Processing and Dietary Choices. *Obesity Rev*, 13(9): 766-779.

Craig, A. and Hart, S. (1992). Where to now in new product devel-opment research? *Eur. J. Mark.*, 26(11): 2–49.

FAOSTAT (2016). Food and Agriculture Organization: Country Agricultural statistical report at [http:// faostat3.fao.org/ browse/ Q/QC/E] site visited on 23/06/2016.

Farah, A., Zainalabidin, Manfrud, M. and Ismail, A. L. (2011). The influence of socio-demographic factors and product attributes on attitudes towards purchasing special rice among Malaysian consumers. *International Food Research Journal,* 18(3): 1135-1142.

Ferrara, O. and Ward, R. (2007). *Evidence of Changes in Consumer Preference Among Beef Cuts Varieties*: *An Application of Poisson Regressions*. Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meetings, Portland, July 29 August 1, 2007. 3-13pp.

Fivawo, N. C. and Msolla, S. N. (2011). The diversity of Common Bean Landraces in Tanzania. *Tanzania Journal of Natural and Applied Sciences* (*TaJONAS*), 2(1): 337-351.

Gillespie, A. M. H and Johnson-Askew, W. L. (2009). Changing family Food and Eating Practices: The Family Food Decision-Making System. *Annals of Behavioral Medicine,* 38: 123-300.

Gitonga, H. (2015). Analysis of Consumer preference in Product Attributes: A case of common beans in Kiambu County Kenya. Unpublished Dissertation for Award of MSc Degree at Kenyatta University, Nairobi. Kenya. 53-90pp.

Glanz, K., Basil, M. and Maibach, E. (1998). Why American eat what they do: taste, nutrition, cost, convenience, and weight control concern as influences on food consumption. *Journal of American Dietetic Association,* 10: 1118-1126.

Grunert, K. G., Juhl, H. J., Esbjerg, L., Jensen, B. B., Bech-Larsen, T., Brunsø, K. and Madsen, C. Ø. (2009). Comparing methods for measuring consumer willingness to pay for a basic and an improved ready-made soup product. *Food Quality and Preference,* 20(8): 607-619.

Hanley, N., Wright, R. E. and Adamowicz, V. (1998). "Using choice experiments to value the environment". *Journal of Environmental and Resource Economics,* 11(3-4): 413–428.

Hella, J. P., Chilongo, T., Mbwag, A. M., Bokosi, J., Kabambe, V., Riches, C. and Massawe, C. L. (2013). Participatory Market-Led Cowpea Breeding in Sub-Saharan Africa: Evidence Pathway from Malawi and Tanzania. *Merit Research Journal of Agricultural Science and Soil Science,* 1(2): 011-018.

Hensher, D. A. and Bradley, M. (1993). "Using stated response choice data to enrich revealed preference discrete choice models". *Marketing Letters,* 4(2): 139–151.

Horváth, Á., Lajos, A., Szira, Z. and Varga, E. (2005). The Manifestation of Health consciousness in Food Preference and Consumption among Young People According to an Empiric Study. *Gazdálkodás,* 49(12): 98-112.

Imungi, J. K. and Potter, N. N. (1983). "Nutrient Contents of Raw and Cooked Cowpea leaves". *Journal of Food Science*, 48: 299-350.

Katungi, E., Farrow, A, Mutuoki, T., Gebeyehu, S., Karanja, D., Alamayehu, F., Sperling, L., Beebe, B., Rubyogo, J. C. and Buruchara, R. (2010). Improving common

bean productivity: An analysis of socioeconomic factor in Ethiopia and Eastern Kenya. International de Agricultural Tropical. Cali, Colombia. 10pp.

Katungi, E., Louise, S., David, K., Farrow, A. and Beebe, S. (2011). Relative Importance of Common Bean Attributes and Variety Demand in the Drought Areas of Kenya. *Journal of Development and Agricultural Economics,* 3(8): 411-422.

Katungi, E., Kikulwe, E. and Emongor, R. (2015). Analysis of farmers' valuation of common bean attributes and preference heterogeneity under environmental stresses of Kenya. *African Journal of Agricultural Research*, 10(30): 2889-2901.

Korir, M. K., Odhiambo, M. O., Iruria, D. M., Kipsat, J. and Serem, A. K. (2005). Bean Varietal Preference in East African Markets and its Implications to Breeding. *African Crop Science Conference Proceedings*, 7: 803-805pp.

Lancaster, K. (1966). Change and Innovation in the Technology of Consumption. *The American Economic Review,* 56: 14-23.

Leterme, P. (2002). Recommendations by Health Organizations for Pulse Consumption. *British Journal of Nutrition*, 3: 888.

Louviere, J. J., Flynn, N. T. and Carson, R. T. (2010). Discrete Choice Experiments Are Not Conjoint analysis. *Journal of Choice Modeling,* 3(3): 57-72.

Louviere, J. J., Hensher, D. A. and Swait, J. D. (2000). A stated choice method: analysis and applications. *Cambridge University* (In Press). 30pp.

Makweba, J. R. and Xu, Q. (2009). Supply Chain Management and Challenges Facing Food Industry Sector in Tanzania. *Journal of International Business Management,* 4(12): 70 – 80.

Maryange, M., Nchimbi-Msolla, Sawargaonkar, S., Hudge, B. and Thanki, H. (2010). Screening of 30 Advanced Common Bean Lines for Short Cooking Time Using Different Methods. *Electronic Journal of Plant Breeding*, 1(4): 505-511.

Miller, K. M., Hofstetter, R., Krohmer, H. and Zhang, Z. J. (2011). How should consumers' willingness to pay be measured? An empirical comparison of state-of-the-art approaches. *Journal of Marketing Research*, 48(1): 172-184.

Mishili, J. F., Temu, A. A., Fulton, J. and Lowenberg-DeBoer, J. (2011). "Consumer preference as drivers of the common beans trade in Tanzania: A Marketing Perspective" *Journal of International food and Agribusiness Marketing*, 23(2): 110-127.

Morsello, C., Yagüe, B., Beltreschi, L., van Vliet, N., Adams, C., Schor, T., Quiceno-Mesa, M. P. and Cruz, D. (2015). Cultural attitudes are stronger predictors of bush meat consumption and preference than economic factors among urban Amazonians from Brazil and Colombia. *Ecology and Society,* 20(4): 21.

Mugenyi, F. (2012). Organic kidney Beans: Potential for certified producers in Tanzania. *Trade for development Centre. BTC (Belgian Development Agency*) (In press). 29pp.

Mundua, J. (2010). Estimation of Consumer Preference for Cowpea Varieties in Kumi and Soroti District, Uganda. Unpublished Dissertation for Award of MSc Degree at Makerere University, Kampala, Uganda. 102pp.

Mwana, K. E. (2013). Consumer attitude, knowledge and use of nutrition information in relation to energy dense foods: A case study of Dar es Salaam, Tanzania.

Unpublished Dissertation for Award of MSc Degree at University of Gent, Gent, Belgium. 95pp.

NBS (2013). The 2012 Population and Housing Census. 1pp. [www.nbs.go.tz] site visited on 21/07/2017.

NBS (2014). Basic Demographic and Socio-economic profile, 2012 Population and Housing Census. *National Bureau of Statistics*. 46pp.

Nedumaran, S., Abinaya, P., Jyosthnaa, P., Shraavya, B., Parthasarathy, R. and Bantilan, C. (2015). Grain Legumes Production, Consumption and Trade Trends in Developing Countries. Working Paper Series, No 60. ICRISAT Research program, Markets, Institution and Policies. Patancheru 502 324, Telangana, India: *International Crop Research Institute for the Semi-Arid Tropics.* 64 pp.

Nedumaran, S., Abinaya, P., Shraavya, B., Parthasarathy, R. and Bantilan, C. (2013). Grain Legumes Production, Consumption and Trade Trends in Developing Countries-An Assessment and Synthesis. Series paper Number 3. *ICRISAT Research program, Markets, Institution and Policies. India*.

Ogundele, O. (2014). “Factors influencing consumers’ preference for local rice in Nigeria” *African Journal of Marketing Management*, 6(4): 49-55pp.

Parraga, I. (1990). “Determinants of Food Consumption” *Journal of the American Dietetic Association,* 90(5): 661.

Puoane, T., Matwa, P., Bradley, H. and Hughes, G. (2006). *Human Ecology Special Issue* 14: 89-93.

Riet, J., Sijtsema, S. J., Dagevos, H. and G-H De (2011). “The Importance of Habits in eating behavior. An overview and Recommendation for future research” *Appetite*, 57(3): 585-596.

Ronner, E. and Giller, K. E. (2013). Background Information on Agronomy, Farming System and Ongoing projects on grain legumes in Tanzania. 33pp. [www.N2Africa.org] site visited on 24/07/2017.

Saba, I., Sofi, P. A., Kandoliya, U. K. and Baba, Z. A. (2015). Natural Variation for Seed Physical, and Culinary Traits in Common bean (*Phaseolus Vulgaris* L.). *Current Botany*, 6: 1-8.

Sekhampu, T. J. (2012). Socio-Economic Determinants of Household Food Expenditure in a Low Income Township is South Africa. *Mediterranean Journal of Social Sciences*, 3(3): 99.

Shaffer, G. and Zhang, J. Z. (1995). Competitive coupon targeting. *Marketing Sci.*, 14: 395–416.

Spetsidis, N. M. and Schamel, G. (2002). A consumer-based approachtowards new product development through biotechnologyin the agro-food sector. In: Santaniello, S., Evenson, R. E., Zilberman, D. (eds) *Market Development for Genetically Modified Foods*. CABI Publishing, Oxon. pp. 63–79.

Sztainer, N., Story, M., Perry, C. and Casey, M. (1999). Factors influencing food choices of adolescent. *Journal of the American Dietetic Association*, 99(8): 927 – 937.

Train, K. (1993). *Qualitative Choice Analysis: Theory Econometrics, and an Application to Automobile Demand*, 3 editions, The MIT Press, Cambridge, Massachusetts. 252 pp.

Van der pol, M. and Cairns, J. (2001). Estimating time preference for health using discrete choice experiments. *Social Science and Medicine*, 52(9): 1459-1470.

Van Kleef, E., Van Trijp, H. C. M. and Luning, P. (2005) Consumer research in the early stages of new product development: acritical review of methods and techniques. *Food Quality Preference,* 16(3): 181–201.

Vartanian, L. R., Herman, C. P. and Wansink, B. (2008). Are We Aware of the External Factors that Influence Our Food Intake? *Health Psychology,* 27: 533-538.

Wertenbroch, K. and Skiera, B. (2002). Measuring consumers' willingness to pay at the point of purchase. *Journal of Marketing Research,* 39(2): 228-241.

Wortmann, C. S. (1998). Atlas of common bean (*Phaseolus Vulgaris* L.) production in Africa, CIAT. 297pp.

APPENDICES

Appendix 1: Poisson regression results for factors affecting number of common bean attributes combinations chosen

Dependent variable = Number of common bean attributes combination chosen				
Independent Variables	**Coef.**	**Std. Err**	**z**	**P>|z|**
Sex of the household head	0.3884805	0.076869	5.05	0.000***
Household size	0.1078141	0.011969	9.01	0.000***
Marital status	-0.1021671	0.055661	-1.84	0.066
Age of a household head	-0.0472009	0.058476	-0.81	0.42
Income of a household head	-4.59E-07	4.76E-08	-9.65	0.000***
Occupation of head of household	0.7223685	0.052861	13.67	0.000***
Education of a household head	0.7354762	0.121657	6.05	0.000***
Household head domestic place of origin				
Central Zone	-0.5709824	0.144596	-3.95	0.000***
Eastern Zone	-1.41543	0.110546	-12.8	0.000***
Northern Zone	-1.537143	0.131113	11.72	0.000***
Southern Zone	-0.4984364	0.122992	-4.05	0.000***
Western zone	-	-	-	-
Custom of head of household	-0.7885702	0.122132	-6.46	0.000***
Household food purchase	0.2808082	0.061362	4.58	0.000***
_Cons	-3.430149	0.195049	-17.59	-
Significance levels are denoted by *** for 1%, ** for 5%				
Number of Obs = 732 LR chi2(16) = 1226.34 Prob>chi2 = 0.000 Log likelihood = -3218.1122 Pseudo R2 = 0.1600				

Appendix 2: Description of common bean attributes combination

Choice Version	Attributes Combinations	Rank	Frequency	Percentage
1	Soya-Kawaida, Large, Fast, Good	1	84	70.59
	Njano, Medium, Fast, Good	2	76	63.87
	Soya-supa, Small, Slow, Good	3	38	31.93
	Mottled red, Large, Slow, Good	4	37	31.09
	Njano, Large, Slow, Poor	5	22	18.49
	Mottled red, Small, Fast, Poor	6	18	15.13
	Soya-supa, Large, Fast, Poor	7	5	4.2
	Soya-supa, Small, Fast, Poor	8	0	0
2	Njano, Medium, Slow, good	1	61	49.59
	Soya-Supa, Large, Fast, Good	2	56	45.53
	Mottled_red, Small, Fast, Good	3	48	39.02
	Njano, Large, Fast, Poor	4	46	37.4
	Soya-supa, Medium, Slow, Good	5	41	33.33
	Soya-kawaida, Large, Slow, Good	6	31	25.2
	Soya-kawaida, Medium, Fast, Poor	7	24	19.51
	Mottled_red, Medium, Slow, Poor	8	13	10.57
3	Njano, Large, Fast, Poor	1	70	56.47
	Mottled-red, Small, Slow, Good	2	66	53.23
	Soya-kawaida, Small, Fast, Good	3	45	36.29
	Njano, Small, Slow, Poor	4	43	34.68
	Mottled_red, Medium, Fast, Poor	5	42	33.87
	Mottled_red, Large, Slow, Poor	6	37	29.84
	Soya-supa, Medium, Slow, Good	7	16	12.9
	Soya-supa, Medium, Slow, Poor	8	8	6.45
4	Mottled-red, Large, Slow, Poor	1	57	43.85
	Njano, Small, Fast, Poor	2	57	43.85
	Njano, Small, Fast, good	3	50	38.46
	Soya-supa, Large, Fast, Good	4	43	33.08
	Soya-supa, Small, Slow, Poor	5	34	26.15
	Mottled_red, Small, Fast, Good	6	21	16.15
	Soya-kawaida, Medium, Fast, Poor	7	20	15.38
	Soya-kawaida, Slow, Slow, Good	8	14	10.77
5	Njano, Large, Fast, Good	1	69	61.61
	Soya-Supa, Medium, Slow, Good	2	59	52.68
	Mottled_red, Small, Slow, Good	3	59	52.68
	Soya-kawaida, Small, Fast, Good	4	57	50.89
	Mottled_red, Medium, Fast, Poor	5	51	45.54
	Soya-supa, Small, Fast, Poor	6	31	27.68
	Njano, Small, Slow, Poor	7	30	26.79
	Soya-kawaida, Large, Slow, Poor	8	24	21.43

6	Njano, Small, Slow, Good	1	68	62.9
	Njano, Medium, Fast, Poor	2	78	54.84
	Mottled_red, Medium, Slow, Poor	3	59	47.58
	Soya-kawaida, Medium, Fast, Good	4	40	32.26
	Soya-kawaida, Medium, Slow, Good	5	38	30.65
	Njano, Medium, Slow, Poor	6	13	10.48
	Mottled_red, Large, Fast, Poor	7	9	7.26
	Soya-Supa, Small, Slow, Poor	8	2	1.61

Appendix 3: Checking for Normality

Through results from the Shapiro-Wilk test for normal data, the p-value shows that for most of expenditure shares there is no sufficient evidence to reject the null hypothesis that shares of expenditures are not normally distributed.

XChoice set 1: Shapiro-Wilk test for normal data					
Variable	**Obs**	**W**	**V**	**z**	**Prob>z**
share1	49	0.93371	3.068	2.388	0.00847
share2	91	0.96218	2.887	2.34	0.00965
share3	4	0.95306	0.541	-0.629	0.73525
share4	87	0.97593	1.77	1.257	0.10438
share5	12	0.84359	2.613	1.872	0.03062
share6	3	0.75	3.732	.	-0.00005
share7	3	0.75	3.732	.	-0.00005
share8	31	0.86995	4.236	2.991	0.00139
Choice set 2: Shapiro-Wilk test for normal data					
Variable	**Obs**	**W**	**V**	**z**	**Prob>z**
share1	38	0.9817	0.696	-0.761	0.77682
share2	41	0.96009	1.608	1.001	0.1584
share3	2	.	.	.	.
share4	7	0.80136	2.609	1.725	0.04225
share5	61	0.92101	4.351	3.172	0.00076
share6	13	0.85366	2.577	1.855	0.03181
share7	70	0.98659	0.825	-0.417	0.66178
share8	23	0.93803	1.621	0.982	0.16299
Choice set 3: Shapiro-Wilk test for normal data					
Variable	**Obs**	**W**	**V**	**z**	**Prob>z**
share1	71	0.97459	1.582	0.998	0.1591
share2	13	0.93529	1.14	0.256	0.39883
share3	36	0.937	2.297	1.739	0.04099
share4	42	0.98387	0.662	-0.871	0.80807
share5	6	0.85623	1.781	0.928	0.1766
share6	12	0.8966	1.728	1.065	0.14336
share7	66	0.96446	2.086	1.593	0.05555
share 8	.	.	.	.	.
Choice set 4: Shapiro-Wilk test for normal data					
Variable	**Obs**	**W**	**V**	**z**	**Prob>z**
share1	23	0.90259	2.548	1.902	0.02859
share2	53	0.9717	1.394	0.71	0.23877
share3	51	0.95505	2.147	1.632	0.05136
share4	23	0.96637	0.88	-0.261	0.60285
share5	28	0.95903	1.237	0.438	0.33067
share6	10	0.72884	4.179	2.883	0.00197
share7	81	0.96139	2.677	2.159	0.01541

share8	46	0.9763	1.044	0.091	0.46359
Choice set 5: Shapiro-Wilk test for normal data					
Variable	**Obs**	**W**	**V**	**z**	**Prob>z**
share1	45	0.85387	6.328	3.91	0.00005
share2	69	0.96565	2.09	1.601	0.05464
share3	69	0.92158	4.771	3.395	0.00034
share4	33	0.7359	9.016	4.574	0
share5	27	0.64317	10.49	4.828	0
share6	47	0.85576	6.462	3.965	0.00004
share7	27	0.76828	6.812	3.941	0.00004
share8	59	0.91482	4.569	3.271	0.00054
Choice set 6: Shapiro-Wilk test for normal data					
Variable	**Obs**	**W**	**V**	**z**	**Prob>z**
share1	26	0.96568	0.981	-0.038	0.5153
share2	55	0.99313	0.349	-2.26	0.9881
share3	92	0.98825	0.905	-0.221	0.58728
share4	41	0.78809	8.537	4.52	0
share5	16	0.84172	3.207	2.315	0.01032
share6	4	0.87184	1.478	0.51	0.30496
share7	5	0.77083	2.705	1.686	0.04588
share8	46	0.8852	5.057	3.44	0.00029

Appendix 4: Expenditure shares on common bean types ranked based on median expenditure in six different choice sets

XChoice set 1									
bean type	**specific attributes**	**N**	**count**	**count percentage**	**mean**	**sd**	**median**	**min**	**max**
type 3	Soya-kawaida, Medium, Slow, Poor	120	4	3.3333333	0.580357	0.311862	0.535714	0.25	1
type 4	Njano, Medium, Fast, Good	120	87	72.5	0.483169	3062646	0.428571	0	1
type 2	Soya-kawaida, Large, Fast, Good	120	91	75.833333	0.417739	0.321569	0.357143	0	1
type 1	Soya-supa, Small, Slow, Good	120	49	40.833333	0.368805	0.285263	0.285714	0	1
type 8	Mottled red, Large, Slow, Good	120	31	25.833333	0.331797	0.273295	0.285714	0	1
type 5	Mottled red, Small, Fast, Poor	120	12	10	0.24881	0.197898	0.25	0	0.785714
type 6	Soya-supa, Large, Fast, Poor	120	3	2.5	0.047619	0.082479	0	0	0.142857
type 7	Njano, Large, Slow, Poor	120	3	2.5	0.047619	0.082479	0	0	0.142857
Choice set 2									
bean type	**specific attributes**	**N**	**count**	**count percentage**	**mean**	**sd**	**median**	**min**	**max**
type 2	Njano, Small, Fast, Poor	120	41	34.166667	0.583972	0.302948	0.642857	0	1
type 3	Mottled_red, Small, Slow, Poor	120	2	1.6666667	0.535714	0.454569	0.535714	0.214286	0.857143
type 1	Njano, Small, Fast, Poor	120	38	31.666667	0.485902	0.367752	0.5	0	1
type 7	Soya-supa, Small, Fast, Good	120	70	58.333333	0.542653	0.331225	0.5	0	1
type 8	Soya-kawaida, Small, Slow, Good	120	23	19.166667	0.490683	0.282699	0.5	0	1
type 5	Mottled_red, Medium, Fast, Good	120	61	50.833333	0.294028	0.214251	0.285714	0	1
type 4	Soya-supa, Medium, Slow, Poor	120	7	5.8333333	0.27551	0.360528	0.142857	0	1
type 6	Soya-kawaida, Large, Fast, Poor	120	13	10.833333	0.26044	0.262973	0.142857	0	0.714286
Choice set 3									
bean type	**specific attributes**	**N**	**count**	**count percentage**	**mean**	**sd**	**median**	**min**	**max**
type 1	Njano, Medium, Slow, Good	120	71	59.166667	0.535111	0.311843	0.5	0	1
type	Soya-supa,	120	66	55	0.560173	0.324669	0.5	0	1

7	Large, Fast, Good								
type 4	Soya-kawaida, Large, Slow, Good	120	42	35	0.464626	0.339358	0.45	0	1
type 3	Mottled_red, Small, Fast, Good	120	36	30	0.326984	0.276305	0.285714	0	1
type 5	Mottled_red, Large, Slow, Poor	120	6	5	0.158333	0.124164	0.225	0	0.25
type 2	Njano, Large, Fast, Poor	120	13	10.833333	0.385714	0.453332	0	0	1
type 6	Soya-kawaida, Medium, Fast, Poor	120	12	10	0.14881	0.200205	0	0	0.5
type 8	Soya-supa, Small, Slow, Poor	120	4	3.3333333	0	0	0	0	0
Choice set 4									
bean type	**specific attributes**	**N**	**count**	**count percentage**	**mean**	**sd**	**median**	**min**	**max**
type 2	Soya-kawaida, Small, Fast, Good	126	53	42.063492	0.387197	0.253919	0.428571	0	1
type 5	Soya-supa, Small, Fast, Poor	126	28	22.222222	0.415816	0.312896	0.428571	0	1
type 7	Njano, Large, Fast, Good	126	81	64.285714	0.451984	0.241872	0.428571	0	1
type 8	Soya-supa, Medium, Slow, Good	126	46	36.507937	0.388354	0.249505	0.375	0	1
type 3	Mottled_red, Small, Slow, Good	126	51	40.47619	0.297619	0.207314	0.285714	0	1
type 4	Njano, Small, Slow, Poor	126	23	18.253968	0.468944	0.435457	0.285714	0	1
type 1	Mottled_red, Medium, Fast, Poor	126	23	18.253968	0.236025	0.204806	0.214286	0	0.571429
type 6	Soya-kawaida, Large, Slow, Poor	126	10	7.9365079	0.096786	0.204183	0	0	0.5
Choice set 5									
bean type	**specific attributes**	**N**	**count**	**count percentage**	**mean**	**sd**	**median**	**min**	**max**
type 2	Njano, Medium, Fast, Poor	103	69	66.990291	0.426093	0.363421	0.28777	0	1
type 3	Njano, Small, Slow, Good	103	69	66.990291	0.339212	0.33614	0.214286	0	1
type 8	Soya-supa, Medium, Fast, Good	103	59	57.281553	0.264593	0.273757	0.214286	0	1
type 1	Soya-kawaida, Medium, Slow, Good	103	45	43.68932	0.244689	0.28785	0.178571	0	1
type 4	Soya-supa, Large, Slow,	103	33	32.038835	0.226524	0.344994	0.142857	0	1

	Poor								
type 6	Mottled_red, Large, Fast, Good	103	47	45.631068	0.21577	0.246728	0.142857	0	1
type 5	Soya-kawaida, Small, Fast, Poor	103	27	26.213592	0.148352	0.264008	0	0	1
type 7	Mottled_red, Medium, Slow, Poor	103	27	26.213592	0.072222	0.12127	0	0	0.5
Choice set 6									
bean type	**specific attributes**	**N**	**count**	**count percentage**	**mean**	**sd**	**median**	**min**	**max**
type 3	Njano, Small, Fast, Good	118	92	77.966102	0.536258	0.346305	0.571429	0	1
type 2	Soya-supa, Large, Slow, Good	118	55	46.610169	0.55	0.350777	0.5	0	1
type 1	Soya-supa, Medium, Fast, Poor	118	26	22.033898	0.408791	0.341188	0.428571	0	1
type 5	Mottled_red, Large, Fast, Poor	118	16	13.559322	0.315625	0.322282	0.271429	0	1
type 4	Mottled_red, Medium, Slow, Poor	118	41	34.745763	0.162718	0.201142	0.142857	0	1
type 8	Soya-kawaida, Medium, Fast, Good	118	46	38.983051	0.241304	0.310179	0.142857	0	1
type 6	Njano, Medium, Slow, Poor	118	4	3.3898305	0.232143	0.336928	0.107143	0	0.714286
type 7	Soya-kawaida, Small, Slow, Poor	118	5	4.2372881	0.007143	0.015972	0	0	0.035714